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RESCISSION OF ANY PRIOR DISCLAIMERS AND REQUEST TO REVISIT ART

Applicant	:	Matthew Bell
App. No	:	To be determined
Filed	:	On even date herewith
For	:	LENS SYSTEM
Examiner	:	To be determined
Art Unit	:	To be determined
Conf #	:	To be determined

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

The claims of the present application are different and possibly broader in scope than the claims pursued in the parent application(s). To the extent any prior amendments or characterizations of the scope of any claim or referenced art could be construed as a disclaimer of any subject matter supported by the present disclosure, Applicant hereby rescinds and retracts such disclaimer. Accordingly, the references previously considered in the parent application(s) may need to be re-visited.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

Dated: April 16, 2012

/Russell M. Jeide/
Russell M. Jeide
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Volkswagen v. Longhorn - IPR2025-00925

Electronic Patent Application Fee Transmittal	
Application Number:	
Filing Date:	
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Filer:	Russell M. Jeide/Christina Alvarez (RMJ)
Attorney Docket Number:	KM2326.007D1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	380	380
Utility Search Fee	1111	1	620	620
Utility Examination Fee	1311	1	250	250
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1250**

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Electronic Acknowledgement Receipt

EFS ID:	12554689
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Russell M. Jeide/Robin Leu
Filer Authorized By:	Russell M. Jeide
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Application Data Sheet	ADS_KM2326-007D1.pdf	895350 59557378ffb6e1ec217c921c1c8d154903a101f0a	no	4
Warnings:					
Information:					
2		Spec_KM2326-007D1.pdf	574870 ba2a5c868beade39a4bcbc5841c59680aac460fa	yes	14
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Specification		1	10	
	Claims		11	13	
	Abstract		14	14	
Warnings:					
Information:					
3	Drawings-only black and white line drawings	Drawings_KM2326-007D1.pdf	55671 19dced5aef9b7fa5badf11a6caf34bab372b821f	no	4
Warnings:					
Information:					
4	Oath or Declaration filed	Declaration_KM2326-007D1.pdf	51933 42186eb24763e9399d30ed8821c5bee1764aaf0f	no	1
Warnings:					
Information:					
5	Miscellaneous Incoming Letter	Request_to_Revisit_Art.pdf	33986 c72aaaeaf71a76589b486c1a42492ad43c2b8994	no	1
Warnings:					
Information:					
6	Fee Worksheet (SB06)	fee-info.pdf	33027 5db7e1021f062149badbb80e4a080e307fae917d	no	2
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		Total Files Size (in bytes):	1644837		

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

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New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	KM2326.007D1
	Application Number	
Title of Invention	LENS SYSTEM	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1 [Remove]

Applicant Authority ◉ Inventor ○ Legal Representative under 35 U.S.C. 117 ○ Party of Interest under 35 U.S.C. 118

Prefix	Given Name	Middle Name	Family Name	Suffix
	Matthew		Bell	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Palo Alto	State/Province	CA	Country of Residence i	US

Citizenship under 37 CFR 1.41(b) i: US

Mailing Address of Applicant:

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Address 2			
City	Palo Alto	State/Province	CA
Postal Code	94306	Country i	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. [Add]

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	20995		
Email Address	efiling@kmob.com	[Add Email]	[Remove Email]

Application Information:

Title of the Invention	LENS SYSTEM		
Attorney Docket Number	KM2326.007D1	Small Entity Status Claimed	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		Sub Class (if any)	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	4	Suggested Figure for Publication (if any)	

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	KM2326.007D1
	Application Number	
Title of Invention	LENS SYSTEM	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S. C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	20995		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Division of	12/269849	2008-11-12
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
12/269849	non provisional of	60/987315	2007-11-12

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

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Application Number	Country [i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
			◉ Yes ○ No

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	KM2326.007D1
	Application Number	
Title of Invention	LENS SYSTEM	

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1 Remove

If the Assignee is an Organization check here. ☒			
Organization Name	Intellectual Ventures Holding 67 LLC		
Mailing Address Information:			
Address 1	7251 W. Lake Mead Blvd., Suite 300		
Address 2			
City	Las Vegas	**State/Province**	NV
Country [i]	US	Postal Code	89128
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button. Add

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Russell M. Jeide/			Date (YYYY-MM-DD)	2012-04-16
First Name	Russell	Last Name	Jeide	Registration Number	54198

This collection of information is required by 37 CFR 1.76. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

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7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

LENS SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a divisional of U.S. Application Serial No. 12/269,849, filed November 12, 2008, entitled “LENS SYSTEM,” which claims the benefit of U.S. Provisional Patent Application Serial No. 60/987,315, filed Nov. 12, 2007 and entitled "FRAGMENTED LENS SYSTEM," each of which are hereby expressly incorporated by reference in their entireties.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention generally relates to interactive display systems. More specifically, the present invention relates to a lens system as might be used by an illuminator in an interactive display system.

Description of the Related Art

If a computer vision system uses a two-dimensional camera input and background subtraction, a random or semi-random dot pattern allows the system to more reliably detect objects that are at a different distance from a background. If the pattern is too regular, however, the object may disappear relative to the background when at a particular distance. This is a result of too many parts of a texture looking alike. Determinations as to the position of objects (or a more accurate indication thereof) therefore suffer. As a result, users may attempt to interact with an object (e.g., grab an object) that is not where the interactive display system otherwise indicates the object to presently be located. There is, therefore, a need for a system that may create lighting patterns useful to computer vision systems and to allow for more accurate tracking and determination of object positions in space.

SUMMARY OF THE INVENTION

In a first claimed embodiment, a system for projecting a pattern of light is disclosed. The system includes a light source (an illuminator) including multiple emitters of light. The emitters are arranged in a pattern. The system further includes

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a cluster of lenses located in front of the light source. The cluster of lenses focuses and projects light from the emitters in numerous directions. The focused and projected light forms a pattern of light. A camera detects the pattern of light on an object illuminated by the emitters. A computing device executes instructions stored in memory to determine a location of the object in space utilizing at least the detected pattern of light on the object

In a variation of the aforementioned embodiment, the system may include a cluster of infrared light emitting diodes (LEDs). The light emitting diodes generate infrared light that is detectable by the camera but not by the eye of a human observer interacting with the object. The system may alternatively (or additionally) include a condenser lens located between the light source and the cluster of lenses. The condenser lens concentrates light from the light source to the cluster of lens.

A second claimed embodiment of the present invention is for a method for projecting a pattern of infrared light. Through this claimed method, light is emitted from a light source (an illuminator) including multiple emitters arranged in a pattern. A cluster of lenses focuses and projects the emitted light, the cluster of lenses located in front of the light source. The focused and projected light forms a pattern of light. That pattern is detected on an object illuminated by the emitters. As a result, the location of an object in space may be determined utilizing at least the detected pattern of light on the object. The location of the object may be determined by a computing device executing instructions stored in memory (e.g., a program).

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an exemplary lens system including a lighting source, an optional condenser lens, and lens cluster.

FIG. 2 illustrates a number of semi-random light configurations for the lighting source of FIG. 1.

FIG. 3 illustrates the assembly of a lens cluster like that of FIG. 1.

FIG. 4 illustrates a cross-sectional illustration of light as created by an LED in an illuminator light source.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

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The presently disclosed lens system may create an invisible light pattern that is useful to computer vision systems. If a computer vision system utilizes a pattern matching algorithm to identify position and distance of objects from a camera, the random or semi-random dot pattern generated by the present system allows the computer to uniquely identify each patch of the pattern projected by the illuminator. As a result, the computer may determine the position and distance of an object by identifying the illumination pattern on the object. The computer may make this determination by executing instructions corresponding to a computer program stored in memory. Results of these determinations may then be rendered on a display device, which may include user manipulation of an object on the display.

In a system where a computer vision system utilizes a stereo camera and a stereopsis algorithm to match features between two or more camera images, the vision system will attempt to find matches between texture patches in the different images. The disparity between these patches gives an indication of depth. The compared texture patches often lie along the same horizontal line in the two images. The presently disclosed lens system allows for patterned illumination that better ensures that all objects have texture thereby ensuring good performance by the stereo algorithm. This is especially true with respect to the axis along which the vision algorithm matches texture patches, is very important. The detected pattern may be aperiodic along one or more dimensions in this regard.

In this context, an embodiment of the presently disclosed invention provides for a lens system that may be used in conjunction with an illuminator to create an invisible random, semi-random, partially random, or repeating pattern useful to a computer vision system like those disclosed in U.S. Pat. No. 7,259,747 and U.S. patent application Ser. No. 12/100,737 (subsequently referred to as the '747 patent and '737 application, respectively). The system includes a lighting source composed of a pattern of light emitters, an optional condenser lens or similar hardware to focus emitted light onto a common area (namely a lens cluster), and a lens cluster containing multiple lenses. Each lens of the lens cluster may be of a similar focal

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length and/or designed to displace an image of the emitter pattern by a particular distance.

FIG. 1 illustrates the aforementioned exemplary lens system 100 including a lighting source 110 (such as an illuminator), an optional condenser lens 120, and lens cluster 130. Light emitted from lighting source 110 is re-aimed by condenser lens 120 so that the light is directed towards the center of lens cluster 130. Lens cluster 130 then focuses and projects light from the emitters in numerous directions. The focused and projected light forms a pattern of light, which may be detected by a camera so that a computing device may determine a location of an object in space utilizing at least the detected pattern of light on the object. This determination may involve the execution of instructions corresponding to a program stored in memory.

Lighting source 110 may be akin to the lamp of the '747 patent. A lamp (like lamp 2 of FIG. 1 of the '747 patent) may illuminate a person(s) or other object(s). The lighting source 110 of the present application may also may be comparable to the light source of component 10 in FIG. 2 of the '747 patent. Lighting source 110 may also be configured in a manner similar to those illustrated in FIGS. 3 and 4 of the '747 patent.

Light source 110 includes any number of emitters as are further discussed in the context of FIG. 2. Each emitter may be mounted such that it emits light in a cone perpendicular to the surface of lighting source 110. If each emitter emits light in a cone, the center of the cone may be aimed at the center of lens cluster 130. Aiming may involve an optional intermediate lens (like condenser lens 120). The angle of the cone of light produced by the emitters may be chosen such that the cone will completely cover the surface of lens cluster 130. In an embodiment omitting a condenser lens, the lighting source 110 may focus light onto lens cluster 130 on its own. For example, each emitter at the lighting source 110 may be individually be angled with respect to the lens cluster 130.

Optional condenser lens 120 redirects light from each of the emitters in light source 110. Condenser lens 120 may be substituted with hardware or some other component similarly capable of concentrating and/or redirecting light. Condenser

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lens 120 reduces wasted light by redirecting the emitters' light toward the center of the lens cluster 130 thereby seeking to ensure that as much emitted light as possible passes through lens cluster 130. Implementations of condenser lens 130 may include a convex lens, a plano-convex lens, a Fresnel lens, a set of micro-lenses, one or more prisms, or a prismatic film.

The focal length of the lenses in lens cluster 130 may be similar to the distance between lens cluster 130 and lighting source 110. A focal length of this nature helps ensure that light emitters at lighting source 110 are in focus or substantially in focus when an illuminator including lighting source 110 is pointed at a distant object. The position of the lighting source 110, optional condenser lens 120, and lens cluster 130 in system 100 may be adjusted to allow for an emitted light pattern to be focused at a variety of distances.

Lens cluster 130 takes the light from each emitter and focuses that light onto a number of points. Each lens in the lens cluster 130 may be used to focus the light of each emitter from illuminator light source 110 onto a different point. The theoretical number of points that may be created by shining the lighting source 110 through the lens cluster 130 is equal to the number of emitters in the lighting source multiplied by the number of lenses in the lens cluster 130. For example, a lighting source 110 with 200 LEDs and a lens cluster 130 with 36 lenses can create up to 7200 distinct points of light. An illuminator, lamp, or projector utilizing the present lens system 100 may create a high resolution texture that is useful to a computer vision system.

All the lenses in the lens cluster 130 may have a similar focal length. This similarity in length may better ensure that the pattern is focused together onto an object illuminated by the light source 110 (e.g., a pattern illuminator). Lenses may have somewhat different focal lengths so at least some of the pattern is in focus at different distances. In some instances, a semi-random or random pattern may be desirable to the functioning of the computer vision system. In such an instance, the lenses within the lens cluster 130 may displace the focused image by different distances to the side.

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FIG. 2 illustrates a number of semi-random light configurations (210-230) for lighting source 110 of FIG. 1. The light configuration patterns may likewise be used to create a desired random or semi-random pattern as referenced above. In the patterns 220-230 illustrated in FIG. 2, each black `dot` is representative of an emission of light (i.e., a light emitter). It should be noted that the black `dots` are merely exemplary for the purpose of FIG. 2. The black `dots` need not necessarily emit `black light` or focused `dots` of light although various types of light, frequencies, and patterns within the pattern (e.g., dots versus squares versus asymmetric blobs) may be emitted from light source 110 and any constituent light emitters.

In that regard, potential light sources for emission of light are inclusive of light emitting diodes, laser diodes, incandescent bulbs, metal halide lamps, sodium vapor lamps, organic light emitting diodes (OLEDs), and pixels of a liquid crystal display (LCD) screen. The emitter(s) at light source 110 may be a backlit slide or backlit pattern of holes. In an embodiment like that of FIG. 1, each emitter (i.e., each dot) `aims` the light along a cone toward the lens cluster 130 or intermediate and optional condenser lens 120.

The pattern of illuminators may be randomized to varying degrees. For example, pattern 210 illustrates a rectangular grid of emitters with some removed at random. Pattern 220 illustrates a rotated grid of emitters with the columns shifted random amounts and random emitters removed. Pattern 230 consists of a randomly positioned, tight packing of emitters with a random set of emitters removed. The density of emitters on the light source varies across a variety of spatial scales. This variation in emitter density helps ensure that the emitters at light source 110 will create a pattern that varies in brightness even at distances where the emitted pattern is not entirely in focus.

The light source 110 of FIG. 1 and the pattern embodiments illustrated in FIG. 2 (210-230) are generally rectangular in shape. This rectangular configuration of the light source 110 in conjunction with a design of the lens cluster 130 helps create a pattern that roughly covers an otherwise rectangular area. The use of

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rectangular light sources 110 and constituent patterns facilitates clustering of illuminators thereby covering broad areas without significant overlap. Nevertheless, other shapes may be used with respect to illuminator patterns and light source 110 configurations and overlap of patterns may be desirable and incurred.

The light source 110 may also be positioned on a motorized mount. Through such a mounting, the light source 110 may move or rotate thus creating further variation and control as to emitted light patterns and focus of the same at varying distances. Emitters in the patterns (210-230) may be turned on or off via an electronic control system thereby allowing the pattern emitted from the light source 110 to vary. The emitter pattern, too, may be regular (e.g., with no variance in layout or pattern) but the pattern of emitters that are in an `on state` at any given time may be random.

As initially noted above, different frequencies of light may be emitted from light source 110 with respect to emitting light in a particular pattern such as those illustrated in FIG. 2. Near-infrared, far-infrared, visible, and ultraviolet light are just some of the various light frequencies that may be emitted subject to a particular choice of light emitter. A number of different frequencies of light may be emitted from a single pattern (e.g., one `dot` may emit light at a near-infrared frequency while another `dot` emits light at an ultraviolet frequency). The light source 110 may be strobed in conjunction with the camera(s) of a corresponding computer vision system thereby allowing the presence and effects of ambient light to be reduced.

The pattern, frequency, strobing, and other manipulations of emitted light may be particularly useful with respect to operating a vision system like that disclosed in the '737 application. In a system like that disclosed in the '737 application, an interactive video display system allows a physical object to interact with a virtual object. A light source delivers a pattern of invisible light to a three-dimensional space occupied by the physical object and a camera detects invisible light scattered by the physical object. A computer system analyzes information generated by the camera, maps the position of the physical object in the three-dimensional space, and generates a responsive image that includes the virtual

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object, which is then rendered on a display. Utilizing the present lens system to project a pattern of invisible light may improve the accuracy and utility of such a vision system.

FIG. 3 illustrates the assembly of a lens cluster like lens cluster 130 in FIG. 1. In element 310, a lens is illustrated that has had several square columns removed. These removed square pieces are then reassembled into a lens cluster (like that of FIG. 1) as shown in element 320. The varying angles and displacements of these squares have ensured some randomness in the focal points of the lenses in the cluster. In FIG. 3, the rough spatial positioning of the squares (shown with the corresponding pieces numbered 1 to 13) has been preserved. While this positioning is not necessary, this arrangement does provide the advantage of helping ensure that copies of each emitter that are projected as bright dots by the lens cluster are not too far apart. Further, this arrangement helps create a roughly rectangular shape to the overall pattern.

As is also evident in FIG. 3, there are multiple sizes of squares in the diagram (e.g., square [1] versus square [8]). While not necessary, this difference in size helps the computer vision system to process a variety of illumination levels. If the square is larger, the dots produced by the pattern will be brighter. By mixing large and small squares, the pattern becomes a mix of dense dimmer dots and sparse brighter dots. The computer vision system may then see some texture from the illuminator in conditions with high ambient illumination while having high resolution texture when the ambient illumination is low.

The lens cluster need not be constructed in this method. The lens cluster may be constructed of regular lenses, Fresnel lenses, or a mix of lenses. The lenses may or may not have a square cross-sectional shape. The lenses may or may not be different sizes. Although FIG. 3 shows a lens being cut apart to construct the lens cluster, it may be fabricated by casting from a mold, machining, or another technique. The `pieces` of the lens from which the lenses in the cluster are derived may or may not overlap.

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If the lenses in the lens cluster focus light onto different points, the emitter may not need to be completely random. For example, if there are a small number of bright emitters in a grid pattern and a large number of lenses in the lens cluster, the light produced by the illuminator can still be semi-random. Repetition would show up over very large length scales.

FIG. 4 illustrates a cross-sectional illustration of light as created by an LED in an illuminator light source. It should be noted that the dimensions of FIG. 4 are not to scale. In a real-world scenario, the object and focal plane are typically further away from a lens cluster. As such, FIG. 4 should be considered exemplary for the purpose of aiding understanding of the present disclosure.

In FIG. 4, light is emitted in a cone from an LED in the infrared LED cluster 110, which corresponds to lighting source 110 of FIG. 1. The light path is redirected toward the center of the lens cluster by the condenser lens 120, which likewise corresponds to the optional condenser lens of FIG. 1. When the light cone hits the lens cluster 130 (which corresponds to cluster 130 of FIG. 1), different parts of the LED light are focused onto different locations on a distant plane. This causes several bright spots to be created from the light of a single LED. When all the light from all the LEDs is tracked, the result is a dense overlapping pattern of focused light beams creating a discernable pattern that may be detected by a camera(s) and processed by a corresponding computing device.

The use of infrared light (or other types of non-visible or substantially invisible light) may prove useful in that it may be invisible (or nearly invisible) to the human eye of an observer interacting with an illuminated object. In this way, the illuminated object is not obscured by an illumination pattern nor or does the overall appearance of the object appear to have been altered. Notwithstanding, a computing device coupled to a camera may detect the pattern in order to track the object and interactions with the same with an increased degree of accuracy.

While the present invention has been described in connection with a series of exemplary embodiments, these descriptions are not intended to limit the scope of the invention to the particular forms set forth herein. To the contrary, the present

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descriptions are intended to cover such alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims and otherwise appreciated by one of ordinary skill in the art.

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WHAT IS CLAIMED IS:

1. A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern;

a cluster of lenses located in front of the light source, the cluster of lenses configured to focus and project light from the emitters in a plurality of directions, the focused and projected light forming a pattern of light;

a camera configured to detect the pattern of light on an object illuminated by at least a portion of the pattern of light; and

a computing device configured to execute instructions stored in memory to determine a location of the object in space based on at least the detected pattern of light on the object.

2. The system of claim 1, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is detectable by the camera but not by an eye of a human observer interacting with the object.

3. The system of claim 1, further comprising a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens concentrates light from the light source to the cluster of lens.

4. The system of claim 1, wherein the cluster of lens includes a Fresnel lens.

5. The system of claim 1, wherein the emitters are arranged in an irregular pattern.

6. The system of claim 1, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

7. The system of claim 1, wherein the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

8. A method for projecting a pattern of infrared light, the method comprising:

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emitting light from a light source including a plurality of emitters, the plurality of emitters arranged in a pattern;

focusing the emitted light in a plurality of directions using a cluster of lenses located in front of the light source, the focused light forming a pattern of light;

detecting the pattern of light on an object illuminated by at least a portion of the pattern of light; and

determining a location of the object in space based on at least the detected pattern of light on the object, wherein the location of the object is determined by a computing device executing instructions stored in memory.

9. The method of claim 8, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is not detectable by an eye of a human observer interacting with the object.

10. The method of claim 8, further comprising a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens concentrates light from the light source to the cluster of lens.

11. The method of claim 8, wherein the cluster of lens includes a Fresnel lens.

12. The method of claim 8, wherein the emitters are arranged in an irregular pattern.

13. The method of claim 8, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

14. The method of claim 8, wherein the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

15. A tangible computer readable medium having instructions stored thereon, the instructions configured for execution by a computing system having one or more hardware processors in order to perform operations comprising:

instructing a light source to emit light from a plurality of emitters arranged in a pattern, wherein the emitted light is focused in a plurality of

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directions by a cluster of lenses located in front of the light source in order to form a pattern of light;

detecting the pattern of light on an object illuminated by at least a portion of the pattern of light; and

determining a location of the object in space based on at least the detected pattern of light on the object.

16. The tangible computer readable medium of claim 15, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is not detectable by an eye of a human observer interacting with the object.

17. The tangible computer readable medium of claim 15, wherein the condenser lens concentrates light from the light source to the cluster of lens.

18. The tangible computer readable medium of claim 15, wherein the emitters are arranged in an irregular pattern.

19. The tangible computer readable medium of claim 15, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

20. The tangible computer readable medium of claim 15, wherein the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

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ABSTRACT OF THE DISCLOSURE

A fragmented lens system for creating an invisible light pattern useful to computer vision systems is disclosed. Random or semi-random dot patterns generated by the present system allow a computer to uniquely identify each patch of a pattern projected by a corresponding illuminator or light source. The computer may determine the position and distance of an object by identifying the illumination pattern on the object.

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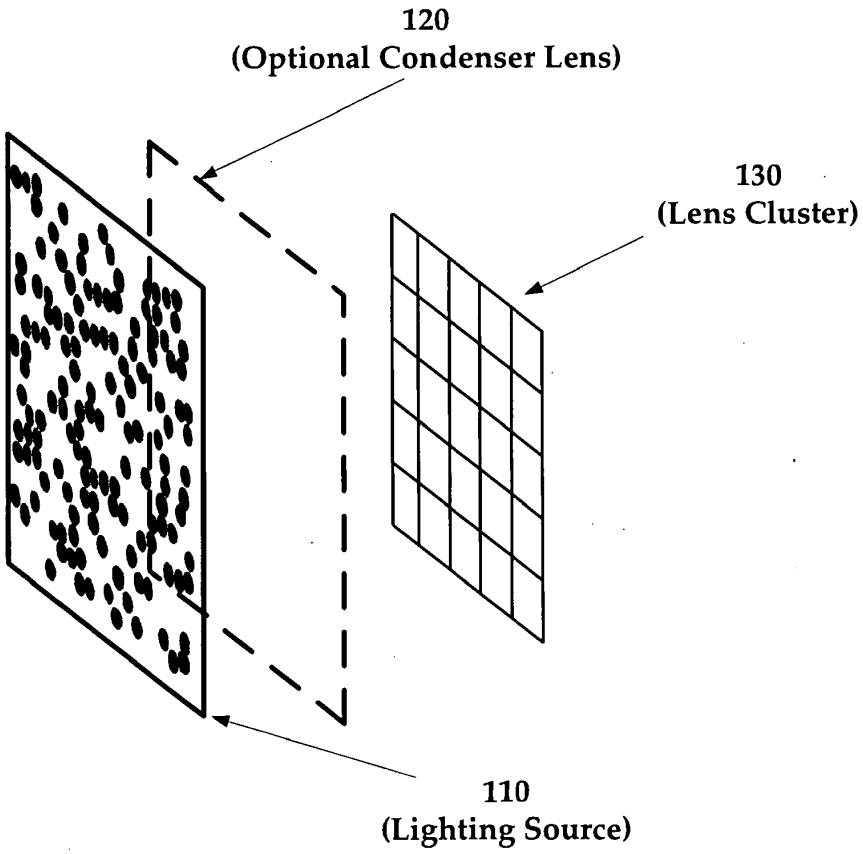
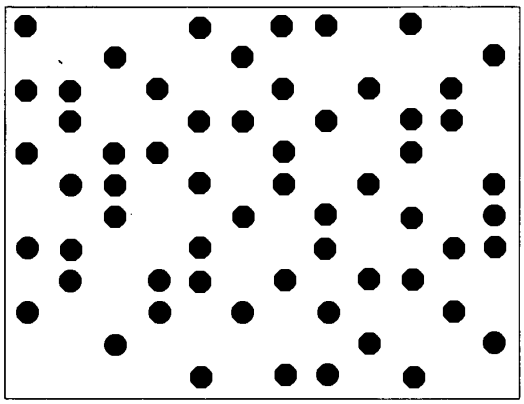
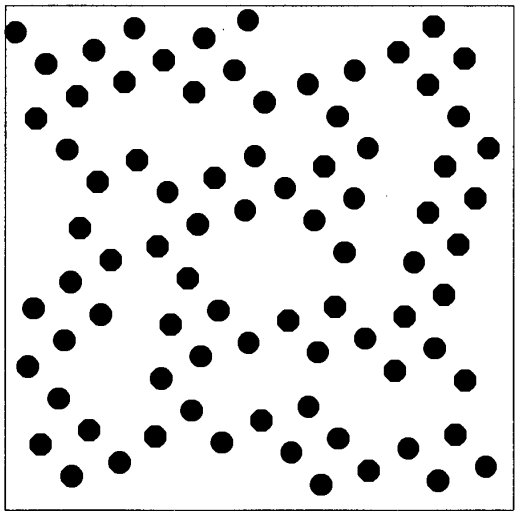


FIGURE 1

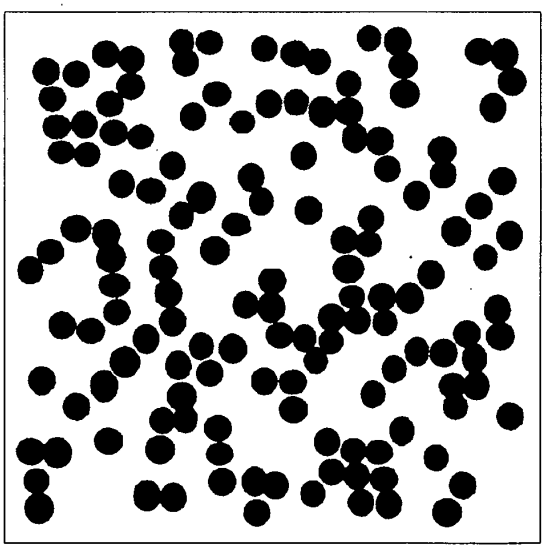
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220

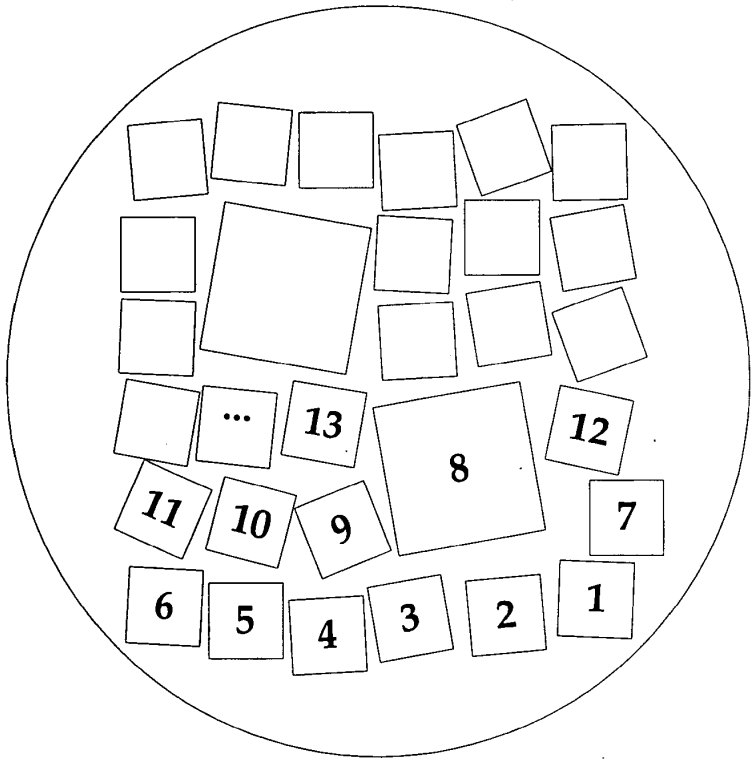


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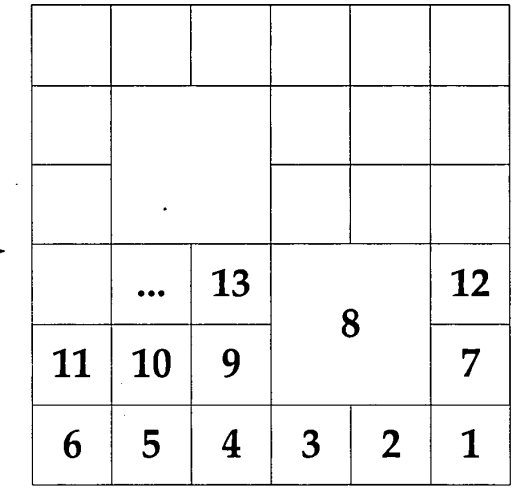
FIGURE 2

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FIGURE 3



310
(Original Lens)



320
(Cluster of Displaced Lens Fragments)

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LAG-VW00000027

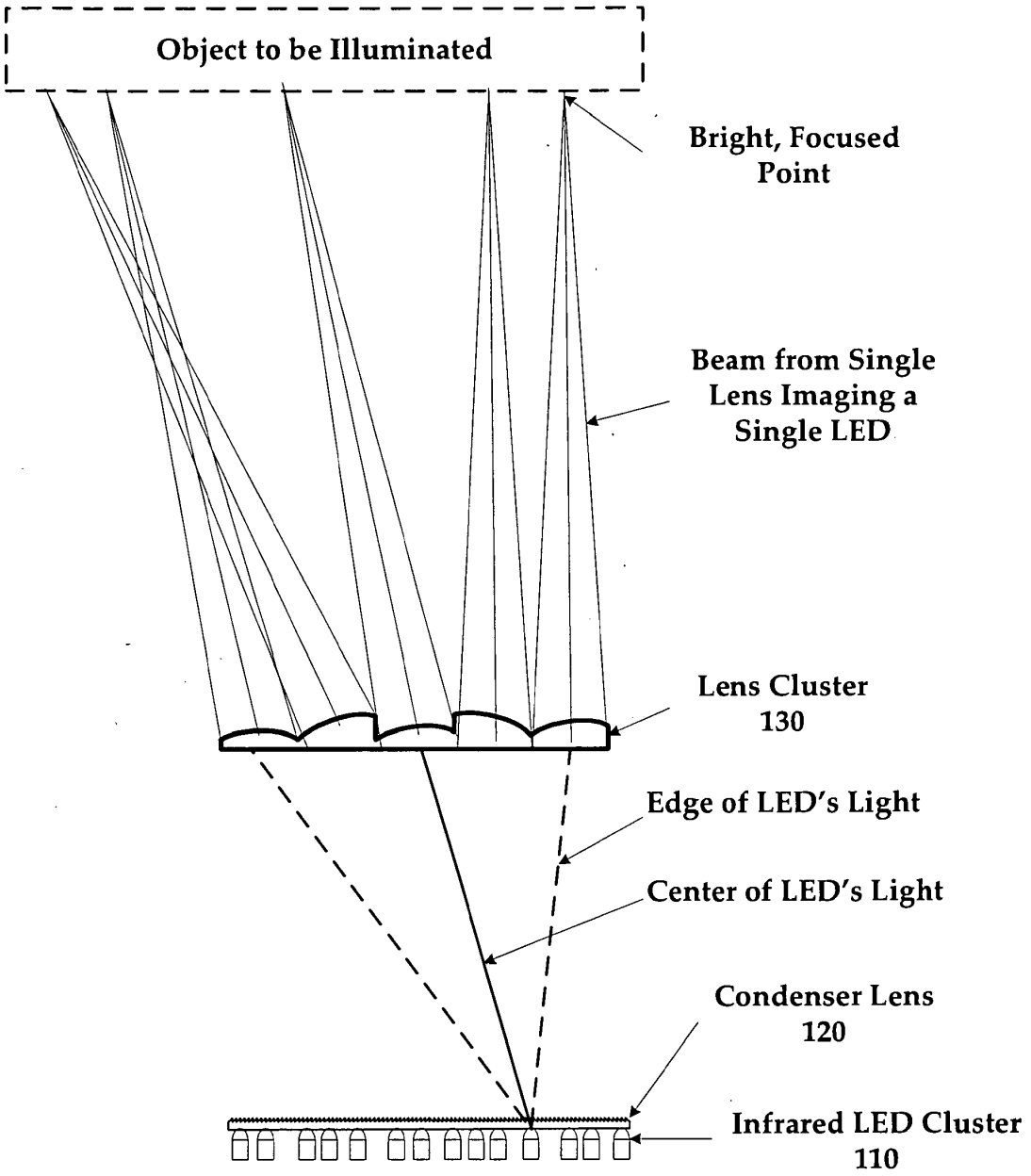

Object to be Illuminated
Bright, Focused Point
Beam from Single Lens Imaging a Single LED
Lens Cluster 130
Edge of LED's Light
Center of LED's Light
Condenser Lens 120
Infrared LED Cluster 110

FIGURE 4

DECLARATION FOR UTILITY OR DESIGN APPLICATION UNDER 37 CFR 1.63

Docket No.: KM2326.007A

Title: LENS SYSTEM

Inventors: Matthew Bell

Please Direct All Correspondence to Customer Number 20,995

This Declaration is directed to the invention that:

Was filed as Serial No. 12/269,849, filed on November 12, 2008

As a below named inventor:

I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is described and claimed and for which a patent is sought;

I have reviewed and understand the contents of the above-identified application, including the claims, and any amendment filed herewith or identified above;

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56;

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful, false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of **first** inventor: Matthew Bell

Signature: Matt Bell Date: 6/24/09

Citizenship: United States of America

Mailing Address: 4245 Los Palos Avenue, Palo Alto, CA 94306

Residence Address: (if different than above) _____

Send Correspondence To:
KNOBBE, MARTENS, OLSON & BEAR, LLP
Customer No. 20,995

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061509

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Volkswagen v. Longhorn - IPR2025-00925

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/448,321

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	380
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	620
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	250
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 60 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 250 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	1250

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE($)	ADDITIONAL FEE($)		RATE($)	ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/448,321	04/16/2012	2875	1250	KM2326.007D1	20	3

CONFIRMATION NO. 3370

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

FILING RECEIPT

OC00000053957430

Date Mailed: 05/02/2012

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Matthew Bell, Palo Alto, CA;

Assignment For Published Patent Application

INTELLECTUAL VENTURES HOLDING 67 LLC, Las Vegas, NV

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a DIV of 12/269,849 11/12/2008 PAT 8159682 *
which claims benefit of 60/987,315 11/12/2007
(*)Data provided by applicant is not consistent with PTO records.

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)

If Required, Foreign Filing License Granted: 04/26/2012

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/448,321**

Projected Publication Date: 08/09/2012

Non-Publication Request: No

Early Publication Request: No

Title

LENS SYSTEM

Preliminary Class

362

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Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

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Title 37, Code of Federal Regulations, 5.11 & 5.15

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PTO/SB/80 (01-06)
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I hereby appoint:

☑ Practitioners associated with the Customer Number: 20,995

OR

☐ Practitioner(s) named below (If more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 20,995

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
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Telephone		Email	

Assignee Name and Address:

Intellectual Ventures Holding 67 LLC
7251 W. Lake Mead Blvd., Suite 300
Las Vegas, Nevada 89128

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record
The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	4-16-09
Name	Joe Kosiara	Telephone	
Title	Authorized Person for Intellectual Ventures Holding 67 LLC		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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ON BEHALF OF A LEGAL ENTITY
37 C.F.R. 3.73(b)(2)(ii)

I, Joe Kosiara (whose title is supplied below), hereby declare that I am authorized to sign the Power of Attorney to Prosecute Applications Before the USPTO on behalf of Intellectual Ventures Holding 67 LLC.

Joe Kosiara
Authorized Person for Intellectual Ventures Holding 67 LLC

4-16-09
Date

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041409

Volkswagen Exhibit 1037, Page 35 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt

EFS ID:	13185399
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Don Neil Caceres Pua/Nino Lopez
Filer Authorized By:	Don Neil Caceres Pua
Attorney Docket Number:	KM2326.007D1
Receipt Date:	05-JUL-2012
Filing Date:	16-APR-2012
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73(b).	KM2326-007D1_373.pdf	61952 8201ef55f648426637f9cce1ab8460c7197c6714	no	2

Warnings:	
Information:	

2	Power of Attorney	KM2326-007D1_POA.pdf	95340 0b86491b50f17ce67209b776201caa8bd970206b	no	2
Warnings:					
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			Total Files Size (in bytes):	157292	

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National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Docket No.: KM2326.007D1 **Customer No. 20995**

STATEMENT UNDER 37 CFR § 3.73(b)
ESTABLISHMENT OF ASSIGNEE

Applicant	:	Matthew Bell
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Unknown
Group Art Unit	:	2875

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This document is being filed with a copy of a Power of Attorney signed by the Assignee. This Statement sets forth the chain of title of the above-identified application.

Intellectual Ventures Holding 67 LLC, a Nevada limited liability company, is the Assignee of the entire right, title, and interest of the above-referenced application by virtue of:

A chain of title, in reverse order, from the inventor(s) to the current Assignee as shown by the following recorded assignments:

1. Assignment from Dhando Investments, Inc. to Intellectual Ventures Holding 67 LLC recorded in the United States Patent and Trademark Office on June 25, 2012, at Reel 028439, and Frame 0249.
2. Assignment from Reactrix (Assignment for the Benefit of Creditors), LLC to Dhando Investments, Inc. recorded in the United States Patent and Trademark Office on September 25, 2009, at Reel 023287, and Frame 0628.
3. Confirmatory Assignment of Reactrix Systems, Inc. to Reactrix (Assignment for the Benefit of Creditors), LLC recorded in the United States Patent and Trademark Office on June 12, 2009, at Reel 022823, and Frame 0255.
4. Assignment from Matthew Bell to Reactrix Systems, Inc. recorded in the United States Patent and Trademark Office on April 09, 2010, at Reel 024214, and Frame 0121.

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5. Assignment from Matthew Bell to Reactrix Systems, Inc. recorded in the United States Patent and Trademark Office on December 03, 2009, at Reel 023599, and Frame 0341

The undersigned is an agent of Customer Number 20995 and is authorized to act on behalf of the Assignee. Please recognize or change the correspondence address for the above-identified application to **Customer No. 20995.**

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 7/5/12

By: _____

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13257702

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1

CONFIRMATION NO. 3370

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
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POA ACCEPTANCE LETTER

OC000000055268639

Date Mailed: 07/12/2012

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 07/05/2012.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/atesfai/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	8,081,822 (KM2326.002A)	12-20-2011	Bell	
	2	8,098,277 (KM2326.009A)	01-17-2012	Bell	
	3	8,159,682 (KM2326.007A)	04-17-2012	Bell	
	4	2009/0179733	07-16-2009	Hattori et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T^1
	5	JP 10-207619	08-07-1998	Toshiba Corp.		X
	6	JP 11-057216	03-02-1999	Sony Corp.		X-Abstract

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T^1
	7	Office Action in U.S. Application No. 12/269,849 (KM2326.007A), dated November 12, 2010	
	8	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated December 20, 2010	
	9	Final Office Action in U.S. Application No. 12/269,849 (KM2326.007A), dated May 12, 2011	
	10	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated July 6, 2011	
	11	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated July 14, 2011	
	12	Office Action in U.S. Application No. 12/269,849 (KM2326.007A), dated August 18, 2011	
	13	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated October 14, 2011	
	14	Notice of Allowance in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated December 2, 2011	

13615161

Examiner Signature	Date Considered
***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

T^1 - Place a check mark in this area when an English language Translation is attached.

PATENT ABSTRACTS OF JAPAN

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(43)Date of publication of application : **07.08.1998**

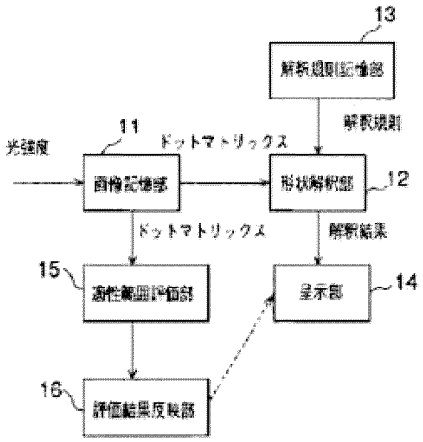
(51)Int.Cl. G06F 3/033
G06F 3/14
G06F 3/16
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G09G 5/08

(21)Application number : **09-009773**
(22)Date of filing : **22.01.1997**

(71)Applicant : **TOSHIBA CORP**
(72)Inventor : **DOI MIWAKO**
MORISHITA AKIRA
UMEKI NAOKO
NUMAZAKI SHUNICHI

(54) **USER INTERFACE DEVICE AND OPERATION RANGE INDICATING METHOD**

(57)Abstract:
PROBLEM TO BE SOLVED: To lighten the burden on a user by deciding whether or not an body as an object of image processing is within a proper image-processable range and displaying specific visual information and/or visual information when it is decided that the body is not within the proper range.
SOLUTION: A proper range evaluation part 15 inputs a two-dimensional image stored in an image storage part 11 as a dot matrix, evaluates whether the object body is within the proper range (whether the object body is too close to or far away from a photodetection part or projects from the left or right, etc.), and generates feedback information corresponding to the evaluation result. An evaluation result reflection part 16 sends an indication on the basis of the feedback information so as to make a display device and/or voice reproducing device give presentation (e.g. cursor movement, a change in cursor shape, or a display of a message upon occasion) on which the evaluation result is reflected. Consequently, the burden on the user can be reduced.



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(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

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	3/14	３３０		3/14	３３０Ａ
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Ｇ０９Ｇ	5/00	５５０	Ｇ０９Ｇ	5/00	５５０Ｃ
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審査請求　未請求　請求項の数11　ＯＬ　（全 11 頁）

(21)出願番号　特願平9－9773

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(74)代理人　弁理士　鈴江　武彦　（外６名）

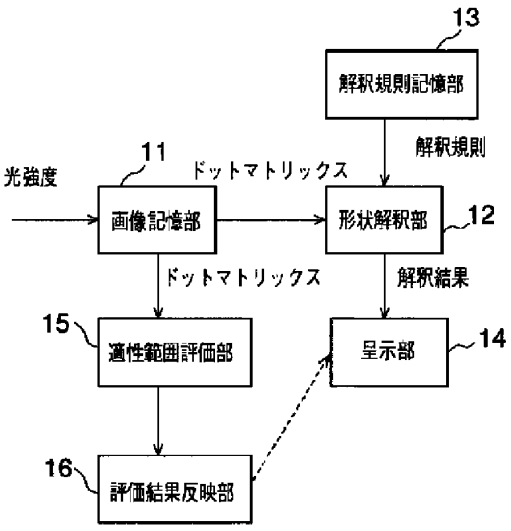
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(54)【発明の名称】　ユーザインタフェース装置及び操作範囲呈示方法

(57)【要約】

【課題】　画像処理により入力を行なうユーザインタフェース装置において、ユーザの操作上の負担を軽減したより使い易いユーザインタフェース装置及び操作範囲呈示方法を提供すること。

【解決手段】　画像処理により入力を行なうユーザインタフェース装置において、画像処理対象の物体が画像処理可能な適正範囲にあるか否かを判定する手段と、適正範囲にないと判定された場合、所定の視覚的情報および聴覚的情報の少なくとも一方を呈示する手段とを備えたことを特徴とする。例えば、適正範囲から遠方にはずれている場合、カーソルを小さくおよび／または薄く表示し、近傍にずれている場合、カーソルを大きく表示し、左方にはずれている場合、カーソルの左方の端を歪ませて表示し、右方にはずれていると判定された場合、カーソルの右方の端を歪ませて表示する。



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【特許請求の範囲】

【請求項１】画像処理により入力を行なうユーザインタフェース装置において、
画像処理対象の物体が画像処理可能な適正範囲にあるか否かを判定する手段と、
適正範囲にないと判定された場合、所定の視覚的情報および聴覚的情報の少なくとも一方を呈示する手段とを備えたことを特徴とするユーザインタフェース装置。

【請求項２】画像処理により入力を行なうユーザインタフェース装置において、
画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定する手段と、
適正範囲にないと判定された場合、表示画面に表示するカーソルの表示状態を所定の状態に変化させて、画像処理対象の物体が適正範囲からどの方向にはずれているかを通知する手段とを備えたことを特徴とするユーザインタフェース装置。

【請求項３】画像処理対象の物体が適正範囲から遠方にはずれていると判定された場合、カーソルを小さくおよび／または薄く表示することを特徴とする請求項２に記載のユーザインタフェース装置。

【請求項４】画像処理対象の物体が適正範囲から近傍にずれていると判定された場合、カーソルを大きく表示することを特徴とする請求項２に記載のユーザインタフェース装置。

【請求項５】画像処理対象の物体が適正範囲から左方にはずれていると判定された場合、、カーソルの左方の端を歪ませて表示することを特徴とする請求項２に記載のユーザインタフェース装置。

【請求項６】画像処理対象の物体が適正範囲から右方にはずれていると判定された場合、カーソルの右方の端を歪ませて表示することを特徴とする請求項２に記載のユーザインタフェース装置。

【請求項７】適正範囲にないと判定された場合、音声を用いて画像処理対象の物体が適正範囲からどの方向にはずれているかを通知する手段をさらに備えたことを特徴とする請求項２ないし６のいずれか１項に記載のユーザインタフェース装置。

【請求項８】画像処理により入力を行なうユーザインタフェース装置において、
画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定する手段と、
適正範囲にないと判定された場合、音声により画像処理対象の物体が適正範囲からどの方向にはずれているかを通知する手段とを備えたことを特徴とするユーザインタフェース装置。

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【請求項９】対象物体の画像処理により入力を行なうユーザインタフェース装置における対象物体の操作範囲呈示方法であって、
画像処理対象の物体が画像処理可能な適正範囲にあるか否かを判定し、
適正範囲にないと判定された場合、所定の視覚的情報および聴覚的情報の少なくとも一方を呈示することを特徴とする操作範囲呈示方法。

【請求項１０】対象物体の画像処理により入力を行なうユーザインタフェース装置における対象物体の操作範囲呈示方法であって、
画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定し、
適正範囲にないと判定された場合、表示画面に表示するカーソルの表示状態を所定の状態に変化させて、画像処理対象の物体が適正範囲からどの方向にはずれているかを通知することを特徴とする操作範囲呈示方法。

【請求項１１】対象物体の画像処理により入力を行なうユーザインタフェース装置における対象物体の操作範囲呈示方法であって、
画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定し、
適正範囲にないと判定された場合、音声により画像処理対象の物体が適正範囲からどの方向にはずれているかを通知することを特徴とする操作範囲呈示方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、画像処理により入力を行なうユーザインタフェース装置及び画像処理の対象物体に対する操作範囲呈示方法に関する。

【０００２】

【従来の技術】コンピュータの入力デバイスとして、マウスが圧倒的に使われている。しかし、マウスで操作できることは、カーソルの移動と、メニューの選択などであり、あくまでも２次元のポインティングデバイスとしての役目に過ぎない。マウスで扱えるのは、２次元の情報であり、３次元空間の中の物体など奥行きがあるものを選択することは難しい。また、アニメーションを作成する場合、キャラクタの動きをつけるのに、マウスのような入力デバイスでは、自然な動きをつけることが難しい。

【０００３】３次元空間でのポインティングの難点を補うために、ボールを所望の方向に押したり回したりして６軸方向の情報を入力する装置や、いわゆるデータグローブやデータスーツ、サイバーグローブといった手などにはめて使用する装置が開発されている。しかし、これら装置は操作性の悪さ等のために、当初の期待程、普及していないのが現実である。

【０００４】これに対し、最近、ユーザは特殊な装置を扱うことなく、手振りや身振りでユーザの意図する情報を入力できる直接指示型の入力装置が開発されている。例えば、光を照射し、ユーザの手による反射光を受光し、これを画像化して特徴量抽出や形状認識処理を行ない、手の形状に応じた制御を実行したり、手の移動量に応じた分のカーソル移動や３次元モデルにおける視点の変更を行なったりするものがある。

【０００５】あるいは、ユーザの手の動きをビデオ撮影し、ビデオ映像を解析することにより、上記と同様の処理を行なうものがある。このような装置によって、ユーザは特殊な装置を装着などすることなく、簡易にジェスチャで入力を行なうことができる。

【０００６】

【発明が解決しようとする課題】しかし、この種の装置では、物体検出のための受光装置は固定的に設置されるため、ユーザの手などを正常に検出可能な範囲が限定される。したがって、ユーザの手などの位置によっては、その形状や動きを正確に検出することができず、ユーザが所望する制御等を実現できない問題があった。また、ユーザは３次元空間中での上記検出可能範囲を直ちに認識することは困難であることから、経験によって上記検出可能範囲内での操作を体得せざるを得ず、ユーザに操作上の負担を強いる問題があった。

【０００７】本発明は、上記事情を考慮してなされたもので、画像処理により入力を行なうユーザインタフェース装置において、ユーザの操作上の負担を軽減したより使い易いユーザインタフェース装置及び操作範囲呈示方法を提供することを目的とする。

【０００８】

【課題を解決するための手段】本発明は、画像処理により入力を行なうユーザインタフェース装置において、画像処理対象の物体が画像処理可能な適正範囲にあるか否かを判定する手段と、適正範囲にないと判定された場合、所定の視覚的情報および聴覚的情報の少なくとも一方を呈示する手段とを備えたことを特徴とする。

【０００９】本発明によれば、ユーザの手などの対象物体が適正範囲からはずれた場合、例えば表示装置や音声再生装置を用いてその旨を通知するので、ユーザは容易に３次元空間中での適正範囲を認識することができ、容易に適正範囲でジェスチャ等を行なって所望の指示等を入力することができる。

【００１０】また、本発明は、画像処理により入力を行なうユーザインタフェース装置において、画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定する手段と、適正範囲にないと判定された場合、表示画面に表示するカーソルの表示状態を所定の状態に変化させて、画像処理対象の物体が適正範囲からどの方向にはずれているかを通知する手段とを備えたことを特徴とする。

【００１１】本発明によれば、ユーザの手などの対象物体が適正範囲からはずれた場合、表示画面に表示するカーソルの表示状態を所定の状態に変化させて、画像処理対象の物体が適正範囲からどの方向にはずれているかを通知するので、ユーザは視覚的に適正範囲から対象物体がはずれている方向を認識し、容易かつ即座に対象物体の位置を修正することができ、この結果、容易に３次元空間中での適正範囲を認識することができ、容易に適正範囲でジェスチャ等を行なって所望の指示等を入力することができる。

【００１２】好ましくは、画像処理対象の物体が適正範囲から遠方にはずれていると判定された場合、カーソルを小さくおよび／または薄く表示することを特徴とする。好ましくは、画像処理対象の物体が適正範囲から近傍にずれていると判定された場合、カーソルを大きく表示することを特徴とする。

【００１３】好ましくは、画像処理対象の物体が適正範囲から左方にはずれていると判定された場合、カーソルの左方の端を歪ませて表示することを特徴とする。好ましくは、画像処理対象の物体が適正範囲から右方にはずれていると判定された場合、カーソルの右方の端を歪ませて表示することを特徴とする。

【００１４】好ましくは、適正範囲にないと判定された場合、音声を用いて画像処理対象の物体が適正範囲からどの方向にはずれているかを通知する手段をさらに備えたことを特徴とする。

【００１５】また、本発明は、画像処理により入力を行なうユーザインタフェース装置において、画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定する手段と、適正範囲にないと判定された場合、音声により画像処理対象の物体が適正範囲からどの方向にはずれているかを通知する手段とを備えたことを特徴とする。

【００１６】本発明によれば、ユーザの手などの対象物体が適正範囲からはずれた場合、音声を用いて画像処理対象の物体が適正範囲からどの方向にはずれているかを通知するので、ユーザは聴覚的に適正範囲から対象物体がはずれている方向を認識し、容易かつ即座に対象物体の位置を修正することができ、この結果、容易に３次元空間中での適正範囲を認識することができ、容易に適正範囲でジェスチャ等を行なって所望の指示等を入力することができる。

【００１７】また、本発明は、対象物体の画像処理により入力を行なうユーザインタフェース装置における対象物体の操作範囲呈示方法であって、画像処理対象の物体が画像処理可能な適正範囲にあるか否かを判定し、適正範囲にないと判定された場合、所定の視覚的情報および聴覚的情報の少なくとも一方を呈示することを特徴とす

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る。

【００１８】また、本発明は、対象物体の画像処理により入力を行なうユーザインタフェース装置における対象物体の操作範囲呈示方法であって、画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定し、適正範囲にないと判定された場合、表示画面に表示するカーソルの表示状態を所定の状態に変化させて、画像処理対象の物体が適正範囲からどの方向にはずれているかを通知することを特徴とする。

【００１９】また、本発明は、対象物体の画像処理により入力を行なうユーザインタフェース装置における対象物体の操作範囲呈示方法であって、画像処理対象の物体が画像処理可能な適正範囲にあるか否かおよび適正範囲にない場合に画像処理対象の物体が適正範囲からどの方向にはずれているかを判定し、適正範囲にないと判定された場合、音声により画像処理対象の物体が適正範囲からどの方向にはずれているかを通知することを特徴とする。

【００２０】なお、以上の各装置に係る発明は、方法に係る説明としても成立する。また、上記の発明は、相当する手順あるいは手段をコンピュータに実行させるためのプログラムを記録した機械読取り可能な媒体としても成立する。

【００２１】

【発明の実施の形態】以下、図面を参照しながら発明の実施の形態を説明する。図１は、本発明の一実施形態に係るユーザインタフェース装置の構成例を示す図である。また、図２に、本実施形態のユーザインタフェース装置の動作手順例を示す。

【００２２】本ユーザインタフェース装置は、例えば、グラフィックユーザインタフェースを持つ計算機に適用すると好適なものである。すなわち、表示画面上にカーソル、スライダーバー、スクロールバー、プルダウンメニュー、ボックス、リンク、アプリケーションなどのアイコンが表示され、ユーザが入力デバイスによりカーソルの移動、アイコンの選択、アプリケーションの起動などの指示を入力するようなシステムであって、入力デバイスがマウスのような専用器具を必要とせずユーザの手などの物体を画像処理することにより入力を受けるものであるシステムに適用するものである。

【００２３】本ユーザインタフェース装置は、入力機能部分と、フィードバック機能部分とに大別される。入力機能部分は、公知のものを利用することが可能で、光を発光し、ユーザの手などの対象物体による反射光を画像として捉えることにより（あるいは背景の光の対象物体による反射光を画像として捉えることにより）、その形状、動き、距離情報などを検出し、その形状等に応じた所定の制御（例えば入出力装置に関する制御あるいはアプリケーションソフトの起動など）を行なうもので、ユーザは手のモーションなどにより意図する入力を行なうことができる機能を提供するものである。本実施形態では、画像記憶部１１、形状解釈部１２、解釈規則記憶部１３、呈示部１４からなるものとする。

【００２４】フィードバック機能部分は、本発明に係る部分で、ユーザの手などの画像検出対象物体が適正な検出範囲にあるか否かを評価し、評価結果をユーザに呈示するものである。本実施形態では、画像記憶部１１、適性範囲評価部１５、評価結果反映部１６からなるものとする。

【００２５】まず、両機能部分に共通の画像記憶部１１と図示しない画像入力装置について説明する。画像記憶部１１は、図示しない画像入力装置から所定時間毎（例えば１／３０秒毎、１／６０秒毎、１／１００秒毎など）に出力される画像検出対象物体の２次元画像を逐次記憶する（ステップＳ１）。

【００２６】図示しない画像入力装置は、例えば、ＬＥＤなどの発光素子により近赤外線などの光を対象物体に照射する発光部と、対象物体からの反射光を２次元アレイ状に配列された受光素子で受光する受光部とを有するものである。なお、通常、発光部が発光しているときに受光した光の量と、発光部が発光していないときに受光した光の量の差をとることによって、バックグラウンドの補正を行ない、発光部からの光の対象物体による反射光の成分だけを取り出す。なお、画像入力装置は、発光部を持たず、ＣＣＤカメラなどの受光部のみ持つものであっても良い。

【００２７】例えば、画像入力装置の前にユーザの手を持ってきた場合、その手からの反射光画像が得られる。このとき、反射光画像の各画素値は、物体の性質（光を鏡面反射する、散乱する、吸収する、など）、物体面の向き、物体の距離、などに影響されるが、物体全体が一様に光を散乱する物体である場合、その反射光量は物体までの距離と密接な関係を持つ。手などはこのような性質を持つため、手を差し出した場合の反射光画面は、手の距離、手の傾き（部分的に距離が異なる）、などを反映する。したがって、これらの情報を抽出することによって、様々な情報の入力・生成が可能になる。

【００２８】次に、入力機能部分について説明する。形状解釈部１２は、画像記憶部１１に記憶された２次元画像を、Ｎ×Ｎ（例えば６４×６４）のドットマトリクスとして逐次取込む（ステップＳ２）。各画素は階調（例えば８ビット＝２５６階調）を持つものとする。図３（ａ）に、対象物体を手としたドットマトリクスの一例を示す。

【００２９】次に、形状解釈部１２は、ドットマトリクスから所定の特徴量を抽出し、解釈規則記憶部１３に記憶された解釈規則をもとに、形状解釈する（ステップＳ３）。そして、適合する解釈規則に応じた指示を解釈結

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果として出力する（ステップＳ４，Ｓ５）。もし適合する解釈規則がなければ、必要に応じてドットマトリクスからの所定の特徴量の抽出の仕方を変更して（例えばドットマトリクスのしきい値処理を行なう場合、そのしきい値を変更する）、再度マッチング処理をやり直すようにしても良い。最終的に適合する解釈規則がなければ（ステップＳ４）、入力はなかったものとする。

【００３０】解釈規則記憶部１３は、形状解釈のための解釈規則を記憶する。例えば、ユーザの手の形状などの特徴量に応じた指示内容が解釈規則として記憶されている。指示内容には、アイコンの選択、アプリケーションの起動、カーソル移動等がある。カーソル移動の場合には、手の移動方向・距離に応じたカーソルの移動量も指示される。例えば、人差し指のみを立てた状態をカーソル移動に対応させ（この場合、例えば人差し指の先端の移動距離・方向がカーソルの移動距離・方向に対応づけられる）、人差し指のみを立てた状態で、親指を動かした動作を、カーソルの位置するアイコンの選択に対応させ、人差し指のみを立てた状態で、手のひらを反転させる動作を、カーソルの位置するアイコンに対応するアプリケーションの起動に対応させるなどの規則が考えられる。

【００３１】形状解釈部１２による形状解釈におけるドットマトリクスから特徴量の抽出の代表例は、距離情報の抽出と、領域抽出である。物体が一様で均質な散乱面を持つ物体であれば、反射光画像は距離画像とみなすことができる。したがって、受光部から見込んだ物体の立体形状を抽出することができる。物体が手であれば、手のひらの傾きなどが検出できる。手のひらの傾きは部分的な距離の違いとして現れる。また、手を移動させたときに画素値が変われば、距離が移動したと見ることができる。また、背景のように遠い物体からの反射光はほとんどないため、反射光画像からあるしきい値以上の領域を切り出すという処理で、物体の形状を簡単に切り出すことができる。例えば、物体が手であれば、そのシルエット像を切り出すのは極めて容易である。距離画像を用いる場合でも、一度しきい値によって領域抽出をしておいてから、その領域内の距離情報を用いる、という場合が多い。

【００３２】ドットマトリクスから抽出した特徴量と解釈規則とのマッチングの手法には種々のものがある。例えば、画像からベクトルを抽出するベクトル化、形状モデルにもとづいた形状の変形状態の抽出、走査線上の距離値にもとづいたスペクトル解析などである。

【００３３】もし適合する形状がなければ、例えばしきい値を変更するなどして、再度マッチング処理をやり直すようにしても良い。最終的に適合する形状がなければ、入力はなかったものと見なす。

【００３４】呈示部１４は、形状解釈部１２による解釈結果がユーザに視覚的な情報の呈示を指示するものである場合、表示装置にて形状解釈部１２による解釈結果を反映した呈示を行なう。例えば、カーソルを移動させ、カーソルの形状を変更させ、あるいは必要に応じてメッセージを呈示する。なお、メッセージの呈示には、音声再生装置が使用または併用されることもある。

【００３５】次に、フィードバック機能部分について説明する。適性範囲評価部１５は、画像記憶部１１に記憶された２次元画像を、図３（ａ）のようなドットマトリックスとして取込み（ステップＳ２）、対象物体が適性範囲にあるか否かを評価し、評価結果に応じたフィードバック情報を生成する（ステップＳ６～Ｓ１６）。

【００３６】評価結果反映部１６は、フィードバック情報をもとに、評価結果を反映した呈示を表示装置および／または音声再生装置にて行なうよう指示を出す（ステップＳ１７）。

【００３７】まず、適性範囲評価部１５について詳しく説明する。対象物体が適性範囲にある場合には、例えば図３（ａ）のような適当なドットマトリックスが得られ、ユーザの手などによる所望の入力が可能である。しかし、対象物体が適性範囲にある場合、より具体的には、対象物体が受光部に対して近すぎる場合、遠すぎる場合、左からはみ出している場合、右からはみ出している場合には、ユーザが所望する指示等は入力できない。

【００３８】そこで、適性範囲評価部１５は、ドットマトリックスを解析して、対象物体が適性範囲にあるか（ステップＳ６）、あるいは近すぎるか（ステップＳ８）、遠すぎるか（ステップＳ１０）、左からはみ出しているか（ステップＳ１２）、右からはみ出しているか（ステップＳ１４）を評価する。そして、対象物体が適性範囲にある場合、ユーザフィードバック情報＝ＮＵＬＬ（またはＮＵＬＬを示すコード；例えば０）とし（ステップＳ７）、近すぎる場合、ユーザフィードバック情報＝近（または近を示すコード；例えば１）とし（ステップＳ９）、遠すぎる場合、ユーザフィードバック情報＝遠（または遠を示すコード；例えば２）とし（ステップＳ１１）、左からはみ出している場合、ユーザフィードバック情報＝左（または左を示すコード；例えば３）とし（ステップＳ１３）、右からはみ出している場合、ユーザフィードバック情報＝右（または右を示すコード；例えば４）とし（ステップＳ１５）、それ以外の場合、ユーザフィードバック情報＝不適とする（ステップＳ１６）。

【００３９】図４に、この評価手順の一例を示す。また、図３（ａ）、図７（ａ）、図８（ａ）、図９（ａ）、図１０（ａ）にそれぞれ、対象物体が適性範囲にある場合のドットマトリックス例、近すぎる場合のドットマトリックス例、遠すぎる場合のドットマトリックス例、左からはみ出している場合のドットマトリックス例、右からはみ出している場合のドットマトリックス例を示す。

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【００４０】対象物体が適性範囲にあるか否かの判定には、種々の方法が考えられるが、この例では、対象物体の画像の面積ｓ、対象物体の画像中の至近点の距離ｄ、対象物体の画像形状における垂直線の長さｌを使用するものとする。対象物体の画像の面積ｓは、ドットマトリックスにおける対象物体に対応する画素の個数またはその全画素に占める割合により表すことができる。また、対象物体の画像中の至近点の距離ｄは、ドットマトリックスにおける対象物体に対応する画素の濃度の最大値の逆数または画素の取り得る最高濃度－該濃度の最大値で表すことができる。対象物体の画像形状のにおける垂直線の長さｌは、図５に示すようにドットマトリックスにおける対象物体の画像の外形において画素が垂直に連続する最大個数により表すことができる。

【００４１】そして、面積ｓの下限値ｒと上限値α、画像中の至近点の距離ｄの下限値βと上限値δ、画像形状における垂直線の長さｌの上限値εを設定しておく。もし、ｒ≦面積ｓ≦α　かつ　β≦至近点の距離ｄ≦δ　かつ　垂直線の長さｌ≦εならば（ステップＳ２１）、範囲は適正とする（ステップＳ２２）。

【００４２】もし、面積ｓ＞α　かつ　至近点の距離ｄ＜βならば（ステップＳ２３）、近すぎるとする（ステップＳ２４）。もし、面積ｓ＜ｒ　かつ至近点の距離ｄ＞δならば（ステップＳ２５）、遠すぎるとする（ステップＳ２６）。

【００４３】もし、垂直線の長さｌ＞ε　かつ垂直線位置は右ならば（ステップＳ２７）、右からはみ出しているとする（ステップＳ２８）。もし、垂直線の長さｌ＞ε　かつ　垂直線位置は左ならば（ステップＳ２９）、左からはみ出しているとする（ステップＳ３０）。

【００４４】それ以外の場合には、範囲が不適とする（ステップＳ３１）。次に、評価結果反映部１６について詳しく説明する。図６に、この処理手順の一例を示す。この処理では、評価結果反映部１６は、適性範囲評価部１５から評価結果として与えられるユーザフィードバック情報にもとづいて、表示画面上に表示されているカーソルの形状を変形させることにより、評価結果を通知する。

【００４５】もし、ユーザフィードバック情報＝ＮＵＬＬならば（ステップＳ４１）、カーソルの形状は変更しない（ステップＳ４２）。この状態の一例を図３（ｂ）に示す。

【００４６】もし、ユーザフィードバック情報＝近ならば（ステップＳ４３）、例えば図７（ａ）に示すようにカーソルを大きくさせる（ステップＳ４４）。もし、ユーザフィードバック情報＝遠ならば（ステップＳ４５）、例えば図８（ａ）に示すようにカーソルを小さく薄くさせる（ステップＳ４６）。

【００４７】もし、ユーザフィードバック情報＝左ならば（ステップＳ４７）、例えば図９（ａ）に示すようにカーソルの左端を変形させる（ステップＳ４８）。もし、ユーザフィードバック情報＝右ならば（ステップＳ４９）、例えば図１０（ａ）に示すようにカーソルの左端を変形させる（ステップＳ５０）。

【００４８】もし、ユーザフィードバック情報＝不適ならば、エラーメッセージを表示する（ステップＳ５１）。図１１に、この処理手順の他の例を示す。この処理では、評価結果反映部１６は、適性範囲評価部１５から評価結果として与えられるユーザフィードバック情報にもとづいて、音声再生装置にて評価結果を音声で通知する。

【００４９】もし、ユーザフィードバック情報＝ＮＵＬＬならば（ステップＳ６１）、なにも呈示しない、あるいはカーソルが移動する音を呈示する（ステップＳ６２）。もし、ユーザフィードバック情報＝近ならば（ステップＳ６３）、例えば「近すぎるよ」などの音声を出力させる（ステップＳ６４）。

【００５０】もし、ユーザフィードバック情報＝遠ならば（ステップＳ６５）、例えば「遠すぎるよ」などの音声を出力させる（ステップＳ６６）。もし、ユーザフィードバック情報＝左ならば（ステップＳ６７）、例えば「左にはみ出しているよ」などの音声を出力させる（ステップＳ６８）。

【００５１】もし、ユーザフィードバック情報＝右ならば（ステップＳ６９）、例えば「右にはみ出しているよ」などの音声を出力させる（ステップＳ７０）。もし、ユーザフィードバック情報＝不適ならば、エラーメッセージを音声で呈示する（ステップＳ７１）。

【００５２】なお、図６の処理と図１１の処理を併用し、画像と音声で通知するようにしても良い。あるいは、画像で通知する機能と音声で通知する機能を容易しておき、ユーザーが個別に機能のオン／オフを設定できるようにしても良い。

【００５３】以上のように、本実施形態によれば、ユーザの手などの対象物体が適正範囲からはずれた場合、その旨を通知するので、ユーザは容易に３次元空間中での適正範囲を認識することができ、容易に適正範囲でジェスチャ等を行なって所望の指示等を入力することができる。

【００５４】なお、図２の手順では、入力機能部分の処理とフィードバック機能部分の処理は独立的に実行するものであったが、手順を修正して、入力機能部分の処理に先だってフィードバック機能部分の処理を行ない、対象物体が適正範囲にあると判定された場合にのみ入力機能部分の処理を実行するようにしても良い。

【００５５】また、以上の各機能は、ソフトウェアとしても実現可能である。また、上記した各手順あるいは手段をコンピュータに実行させるためのプログラムを記録した機械読取り可能な媒体として実施することもできる。本発明は、上述した実施の形態に限定されるもので

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はなく、その技術的範囲において種々変形して実施することができる。

【００５６】

【発明の効果】本発明によれば、ユーザの手などの対象物体が適正範囲からはずれた場合、その旨を通知するので、ユーザは容易に３次元空間中での適正範囲を認識することができ、容易に適正範囲でジェスチャ等を行なって所望の指示等を入力することができる。

【図面の簡単な説明】

【図１】本発明の実施の形態に係るユーザインタフェース装置の構成例を示す図

【図２】本実施形態の処理手順の一例を示すフローチャート

【図３】対象物体が適性範囲にある場合のドットマトリクスの一例とその場合の画面表示例を示す図

【図４】対象物体が適性範囲にあるかどうかの評価手順の一例を示すフローチャート

【図５】対象物体の画像形状における垂直線の長さｌを説明するための図

＊【図６】評価結果反映手順の一例を示すフローチャート

【図７】対象物体が近すぎる場合のドットマトリクスの一例とその場合の画面表示例を示す図

【図８】対象物体が遠すぎる場合の適性範囲にあるドットマトリクスの一例とその場合の画面表示例を示す図

【図９】対象物体が左からはみ出している場合のドットマトリクスの一例とその場合の画面表示例を示す図

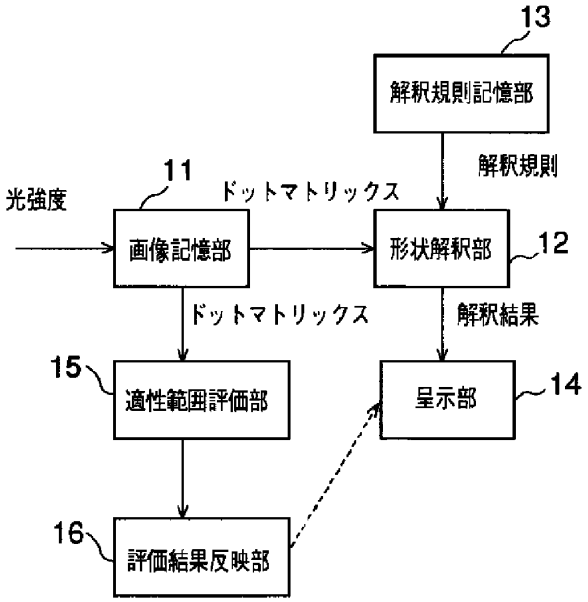
【図１０】対象物体が右からはみ出している場合のドットマトリクスの一例とその場合の画面表示例を示す図

【図１１】評価結果反映手順の他の例を示すフローチャート

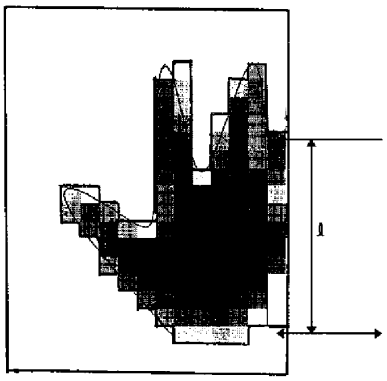
【符号の説明】

１１…画像記憶部
１２…形状解釈部
１３…解釈規則記憶部
１４…呈示部
１５…適性範囲評価部
１６…評価結果反映部

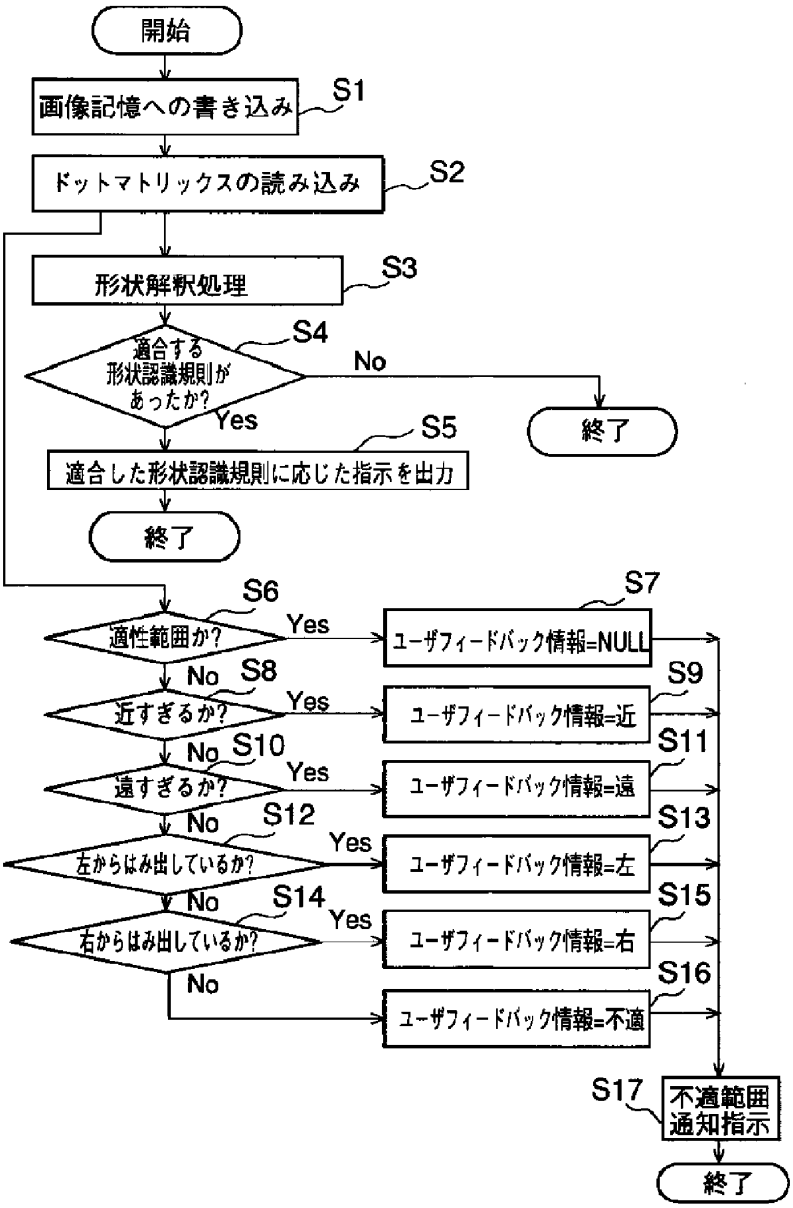
【図１】



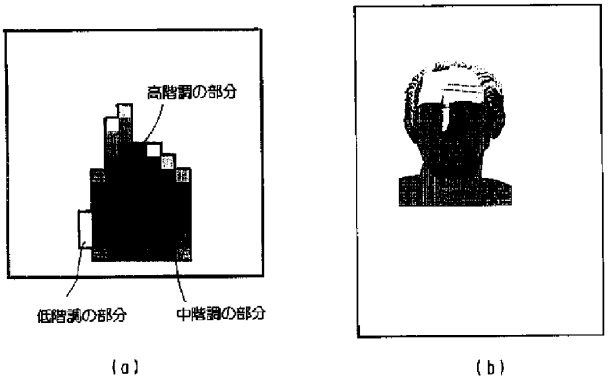
【図５】



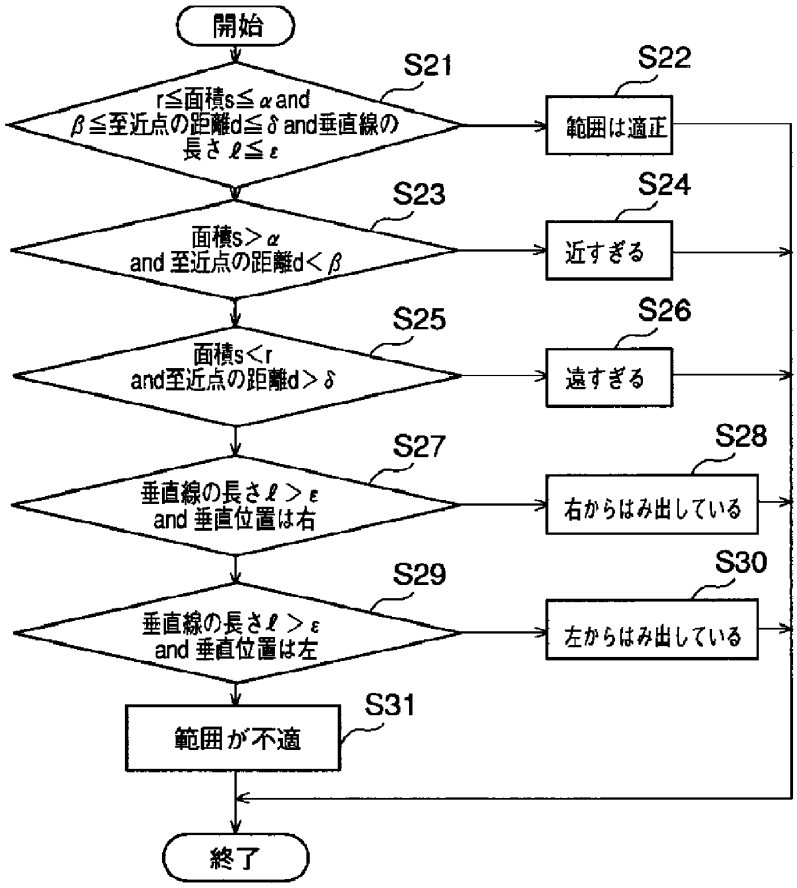
【図２】


開始
画像記憶への書き込み
S1
ドットマトリックスの読み込み
S2
形状解釈処理
S3
適合する形状認識規則があったか?
S4
No
Yes
終了
適合した形状認識規則に応じた指示を出力
S5
終了
適性範囲か?
S6
Yes
ユーザフィードバック情報=NULL
S7
No
近すぎるか?
S8
Yes
ユーザフィードバック情報=近
S9
No
遠すぎるか?
S10
Yes
ユーザフィードバック情報=遠
S11
No
左からはみ出しているか?
S12
Yes
ユーザフィードバック情報=左
S13
No
右からはみ出しているか?
S14
Yes
ユーザフィードバック情報=右
S15
No
ユーザフィードバック情報=不適
S16
S17
不適範囲通知指示
終了

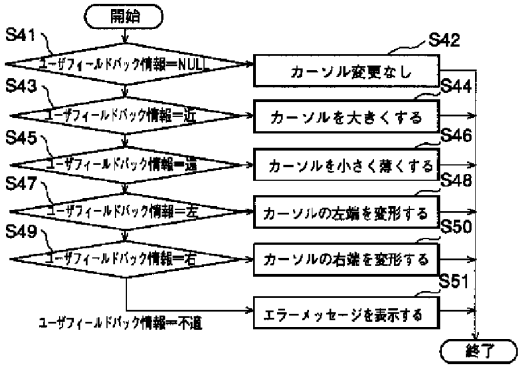
【図３】


高階調の部分
低階調の部分
中階調の部分
(a)
(b)

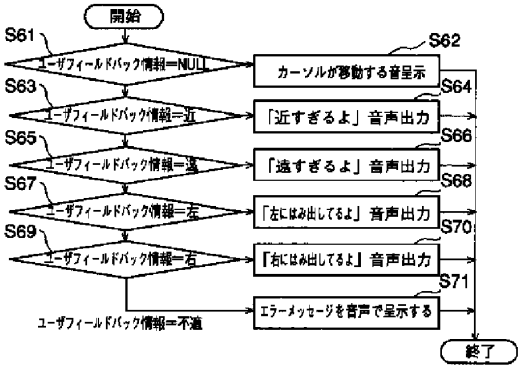
【図４】


開始
S21
r≦面積s≦αand
β≦至近点の距離d≦δand垂直線の
長さℓ≦ε
S22
範囲は適正
S23
面積s＞α
and 至近点の距離d＜β
S24
近すぎる
S25
面積s＜r
and至近点の距離d＞δ
S26
遠すぎる
S27
垂直線の長さℓ＞ε
and 垂直位置は右
S28
右からはみ出している
S29
垂直線の長さℓ＞ε
and 垂直位置は左
S30
左からはみ出している
S31
範囲が不適
終了

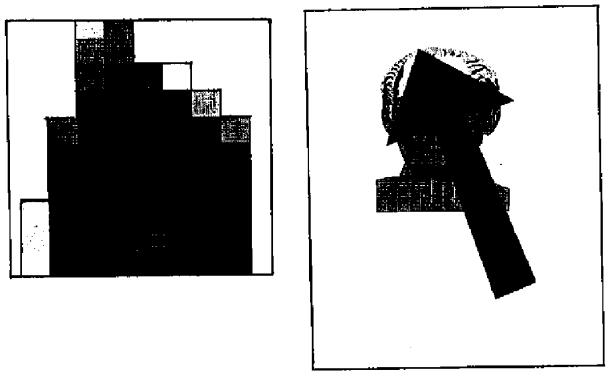
【図６】



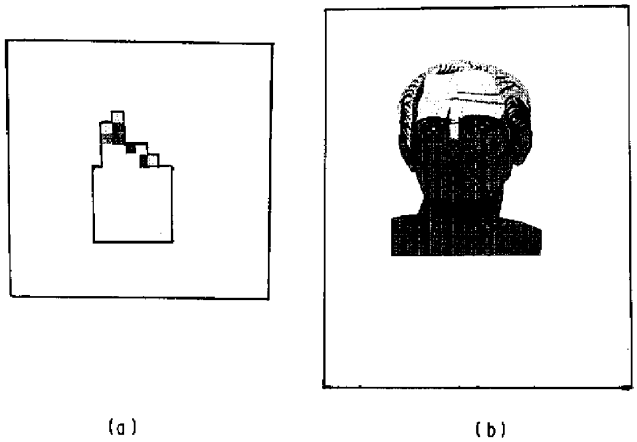
【図１１】



【図７】

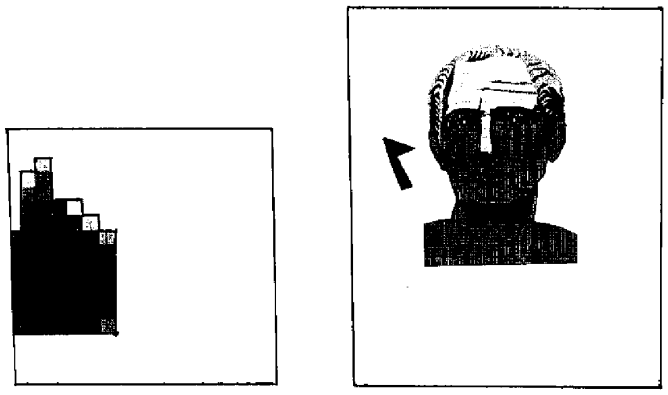


【図８】

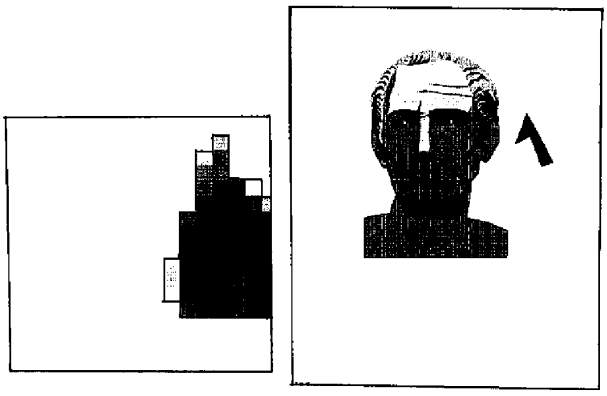


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【図９】



【図１０】



フロントページの続き

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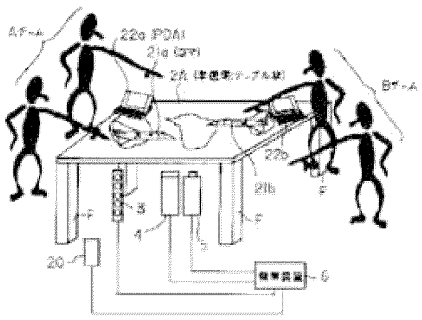
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(71)Applicant : **SONY CORP**
(72)Inventor : **REKIMOTO JIYUNICHI**
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(54) **GAME DEVICE**

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a game device which can create a realistic match-type game.
SOLUTION: This device displays the entire image of a game on a semitransparent surface 2A, and, when the ID pattern of a portable information terminal 22a placed in the display position of an element 21a on the semitransparent surface 2A coincides with the ID pattern of the element 21a, sends individual information such as is displayed only on the portable information terminal 22a, from a control device 6 via a transmitting/receiving part 20. Such a semitransparent surface 2A can be enlarged relatively easily because of its structure.



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Ｇ０６Ｆ　3/033	３５０	Ｇ０６Ｆ　3/033	３５０Ｇ

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(71)出願人　000002185
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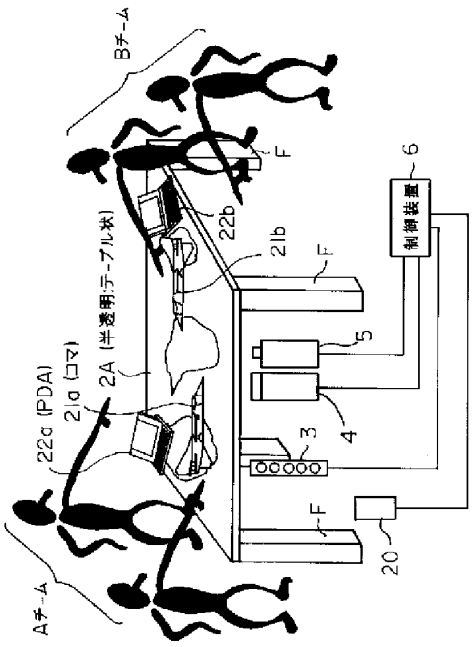
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(54)【発明の名称】　ゲーム装置

(57)【要約】
【課題】臨場感ある対戦型ゲームを実現することができるゲーム装置の提供。
【解決手段】半透明面２Ａ上にゲームの全体画像を表示すると共に、半透明面２Ａ上のコマ２１ａの表示位置に置かれた携帯情報端末２２ａのＩＤパターンが、このコマ２１ａのＩＤパターンと一致した場合は、制御装置６から送受信部２０を介して携帯情報端末２２ａにおいてのみ表示されるような個別情報を送信する。このような半透明面２Ａは、その構造上、比較的容易に大型化することが可能である。



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【特許請求の範囲】
【請求項１】　半透明面と、
上記半透明面側の方向から入射する所定の波長帯域の光又は電磁波のみを像として捉える撮像手段と、
上記撮像手段が受像すべき所定の波長帯域の光又は電磁波を上記半透明面に対して輻射する輻射手段と、
上記撮像手段から入力された撮像信号に基づいて、上記半透明面に対して与えられた入力情報が反映される検出用画像情報を生成し、この検出用画像情報に基づいて画像入力情報を検出する画像入力情報検出手段と、
個体を識別可能な識別情報を有すると共に、ゲームに関する操作に応じた操作情報を出力可能な外部操作装置と、通信を行うことのできる通信手段と、
上記撮像手段が撮像すべき光又は電磁波の波長帯域を含まない可視光による画像を上記半透明面に対して投影表示可能に設けられる投影表示手段と、
上記通信手段を介して入力された上記外部操作装置からの操作情報、又は上記画像入力情報検出手段からの画像入力情報に基づいて、少なくとも、所定の規則に従ったゲーム用画像を投影表示させるための上記投影表示手段に対する表示制御を含む所要の制御処理を実行可能な制御処理手段とを備え、
上記制御処理手段は、上記画像入力情報又は上記操作情報として与えられる上記識別情報を認識可能に構成されると共に、識別情報に基づいて、上記外部操作装置ごとに対応して生成した個別情報を、その個別情報が対応する外部操作装置にてのみ受信入力可能なように送信するための、上記通信手段に対する制御を実行可能に構成されていることを特徴とするゲーム装置。
【請求項２】　上記識別情報は、外部操作装置ごとに固有の図柄とされ、
上記制御処理手段は、上記画像入力情報内において得られる上記図柄の画像に基づいて、上記識別情報をその位置情報と共に認識可能に構成されていることを特徴とする請求項１に記載のゲーム装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、インタラクティブな入出力が可能な表示システムを利用して対戦型ゲームを行うことができるゲーム装置に関するものである。
【０００２】
【従来の技術】例えばコンピュータ装置などを利用したゲーム装置では、様々なプログラムやアプリケーションなどのもとで各種ゲームを実行できるようにされる。このようなゲームは、一般にユーザがコンピュータ装置のモニタ画面を見ながらマウスやキーボードあるいは専用のジョイスティック等の入力装置を操作することによって楽しむことができるようになっている。
【０００３】
【発明が解決しようとする課題】ところで、上記したようなコンピュータ装置等を利用したゲーム装置において、例えば複数のユーザが参加できる対戦型ゲームを実行する場合は、ジョイスティックなどの入力装置を複数用意することで、複数のユーザが参加することが可能とされる。しかしながら、この場合は一般にゲーム画像を表示するモニタ画面が一つしかないため、このモニタ画面には共通のゲーム画像しか表示することができず、例えば対戦するチーム単位の個別情報を表示するといったことはできなかった。

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【０００４】また、近年インターネット等の通信ネットワークの普及に伴って、通信ネットワークを介して接続された複数のコンピュータ装置を利用して複数のユーザが参加するゲームなども提案されている。このような通信ネットワークを介して接続された複数のコンピュータ装置間で対戦型ゲームを実行した場合は、例えばチームごとの個別情報を各コンピュータ装置のモニタ画面上に表示させることが可能となる。
【０００５】しかしながら、この場合は各コンピュータ装置のモニタ画面は比較的小さいモニタ装置によって構成され、このようなモニタ画面上にゲームを進行していく上で必要な全てのゲーム画像を表示することになるため、このようにして行われるゲームは臨場感に欠けるものであった。
【０００６】また、例えばゲームの臨場感を高めるため、チームごとの個別情報を表示するモニタ装置と共に比較的大画面のモニタ装置を用意し、この大画面のモニタ装置に共通のゲーム画像を表示するといったことも考えられるが、大画面のモニタ装置を用意するためにはコストがかかると共に、設置するためのスペースなどが必要になるといった問題点があった。
【０００７】そこで本発明は、特に対戦型ゲームを実行する際に、チームごとの個別情報を表示することができると共に、全体のゲーム画像を比較的大画面で表示することができるゲーム装置を比較的簡易な構成により提供することを目的とする。
【０００８】
【課題を解決するための手段】本発明は上記した課題を考慮して、半透明面と、この半透明面側の方向から入射する所定の波長帯域の光又は電磁波のみを像として捉える撮像手段と、この撮像手段が受像すべき所定の波長帯域の光又は電磁波を半透明面に対して輻射する輻射手段と、撮像手段から入力された撮像信号に基づいて、半透明面に対して与えられた入力情報が反映される検出用画像情報を生成し、この検出用画像情報に基づいて画像入力情報を検出する画像入力情報検出手段と、個体を識別可能な識別情報を有すると共にゲームに関する操作に応じた操作情報を出力可能な外部操作装置と通信を行うことのできる通信手段と、撮像手段が撮像すべき光又は電磁波の波長帯域を含まない可視光による画像を半透明面に対して投影表示可能に設けられる投影表示手段と、通

信手段を介して入力された外部操作装置からの操作情報、又は画像入力情報検出手段からの画像入力情報に基づいて、少なくとも、所定の規則に従ったゲーム用画像を投影表示させるための投影表示手段に対する表示制御を含む所要の制御処理を実行可能な制御処理手段とを備え、制御処理手段は、画像入力情報又は操作情報として与えられる識別情報を認識可能に構成されると共に、識別情報に基づいて、外部操作装置ごとに対応して生成した個別情報を、その個別情報が対応する外部操作装置にてのみ受信入力可能なように送信するための、通信手段に対する制御を実行可能に構成されている。

【０００９】上記構成においては、例えば半透明面に近づいた物理的対象によって撮像手段に入射する光又は電磁波の状態が変化するのであるが、本発明ではこのような光又は電磁波の状態変化を画像情報として捉えることになる。そして、このようにして得られる操作情報に応じて外部操作装置に対して所要の情報信号を送信することが可能とされる。そして、半透明面に対して投影表示手段から画像を投影表示することによって半透明面を情報入力パネル兼表示パネルとして機能させることができる。また、この半透明面は、例えば単に半透明性を有するプレート状の材を用いれば良いことから、その材質の選定によっては容易に大型化を実現することができる。

【００１０】

【発明の実施の形態】先ず、図１及び図２を参照して、本発明の実施の形態の基本的な構成について説明する。本発明のゲーム装置は、これより説明する基本的な構成をもとに実現されるものである。

【００１１】図１は、本発明の実施の形態としてのゲーム装置の基本的構成を概念的に示している。本実施の形態としてのゲーム装置１は、半透明面２、赤外線発光ダイオード素子（ＬＥＤ：Light Emitted Diode）パネル３、ＣＣＤ(Charge Coupled Device) カメラ４、プロジェクタ５、及び制御装置６を備えて構成される。赤外線ＬＥＤパネル３、ＣＣＤカメラ４、及びプロジェクタ５は半透明面２の背面側に対して設けられる。

【００１２】半透明面２は、例えば透明なガラス板に対してトレーシングペーパーのような見え方をする半透明膜を貼り合わせる、あるいは磨りガラスのような半透明の性質を有するものを利用するなどして形成され、後述するようなユーザの操作によって入力情報が与えられる操作パネルと、入力情報に応じた各種応答表示が行われる表示パネルとの両者の機能を併せ持つものとされる。

【００１３】赤外線ＬＥＤパネル３は、例えばパネル面に対して多数の赤外線ＬＥＤが集合的に配列されることによって構成され、上記赤外線ＬＥＤから発光出力される赤外線光が半透明面の背面全体に対して照射されるように設けられる。上記赤外線ＬＥＤは制御装置６によって定常的に赤外線を発光するように駆動される。なお、赤外線ＬＥＤパネル３としては、発光出力される赤外線光が半透明面２全体に対して照射されるのに充分な数の赤外線ＬＥＤが設けられればよい。また、後述するように、初期の赤外線画像に対する現在の赤外線画像の差分に基づいて半透明面２側から反射してくる画像情報を得るようにされることから、半透明面２全体に対して照射される赤外線光量が一律であるべき必要もない。従って赤外線ＬＥＤパネル３のサイズは、半透明面２よりもはるかに小さいもので済ませることができる。

【００１４】ＣＣＤカメラ４は、撮像素子としてＣＣＤを用いたカメラ装置であり、この場合には、半透明面２に映る画像光として赤外線光の成分のみを撮像することにより、半透明面２に対して行われた操作を画像情報として認識するために設けられる。このため、ＣＣＤカメラ４の光学系の部分に対しては、赤外線領域の波長帯域のみを透過する赤外線透過フィルタ４ａが設けられる。また、ＣＣＤカメラ４により撮影される構図として半透明面２全体が含まれるようにその配置位置が設定される。

【００１５】プロジェクタ５は、制御装置６から供給される画像情報に基づいて、可視光による画像光を半透明面２の背面に対して投影表示する。例えばユーザは、半透明面２に投影表示されたプロジェクタ５の画像を、半透明面２の前面側から観察することができる。ここで、プロジェクタ５の光学系には赤外線領域の波長を遮断する赤外線遮断フィルタ５ａが設けられているが、これにより、半透明面２に投影表示される画像光には赤外線が含まれなくなるため、プロジェクタ５の投影画像は、ＣＣＤカメラ４からは不可視となる。

【００１６】制御装置６は、例えばマイクロコンピュータを備えて構成され、ＣＣＤカメラ４から供給される撮像信号から画像情報（映像データ）を得て、更にこの画像情報をもとに入力情報を得る。そして、この入力情報に基づいて、例えばプロジェクタ５により半透明面２に表示させる画像に関する表示制御を実行する他、各種所要の制御処理を行う。また、赤外線ＬＥＤパネル３の赤外線ＬＥＤの発光駆動を行う。なお、上記赤外線ＬＥＤパネル３、ＣＣＤカメラ４及びプロジェクタ５の配置位置は、それぞれが果たすべき役割が充分機能することを考慮して設定されればよい。

【００１７】図２は、上記制御装置６の内部構成例を示すブロック図である。この図に示す制御装置６において、ＬＥＤ駆動部１０は、赤外線ＬＥＤパネル３に設けられた複数の赤外線ＬＥＤを発光駆動するための回路部位である。

【００１８】画像入力部１１は、ＣＣＤカメラ４から供給された撮像信号について所要の信号処理を施すことによって映像信号を生成して入力画像処理部１２に供給する。つまり、画像入力部１１では、半透明面２側からＣＣＤカメラ４を介して入射してきた赤外線光を映像情報として出力する。

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【００１９】入力画像処理部１２では、例えば画像入力部１１から供給された映像信号をデジタル信号による映像信号データに変換する。入力画像処理部１２においては、この映像信号データに基づいて得られる「画像情報（例えばフレーム単位の映像データ）」を利用して所要の解析処理等を実行することで、半透明面２に対して行われた操作等に基づく入力情報を得るようにされる。ここで画像情報に基づいて得られる入力情報としては、例えば、半透明面２に対して操作を行っている操作体の画像上の位置（座標）や画像の信号レベルなどが用いられる。この入力情報はデータベース駆動部１４に伝送される。また、上記映像信号データは、画像合成部１７に対しても供給可能とされている。

【００２０】しきい値制御部１３は、入力画像処理部１２にて実行される入力情報に関する処理に必要なしきい値を設定して入力画像処理部１２に伝送する。上記入力画像処理部１２では、しきい値制御部１３において設定されるしきい値を利用して画像情報について解析を行うなど所要の処理を実行することで逐次必要とされる入力情報を識別する。また、本実施の形態では後述するようにして入力画像データのフレーム差分を算出することにより、現在の半透明面２の画像状態（検出画像情報）を得るようにされるが、フレーム差分演算に利用する基準値（基準画像入力レベル）等の情報も、後述するようにして、しきい値制御部１３に格納されるものとする。

【００２１】データベース駆動部１４は、入力画像処理部１２により得られた入力情報を取り込み、この入力情報に基づいて適宜所要の処理を実行する。この際、データベース駆動部１４が実行すべき制御処理に必要なプログラムデータはデータベースメモリ１５に格納されており、データベース駆動部１４は、データベースメモリ１５に格納されたプログラムデータに基づいて所要の制御処理を実行することになる。

【００２２】画像生成部１６は、データベース駆動部１４の制御によって、必要な画像データ（デジタル信号による映像信号データ）を生成して画像合成部１７に出力する。画像合成部１７においては、必要があれば上記画像生成部１６から供給された映像信号データに対して、入力画像処理部１２から供給された映像信号データを合成してＲＧＢ信号生成部１８に対して出力する。ＲＧＢ信号生成部１８では、上記画像合成部１７から供給された映像信号データについて、例えばアナログによるＲＧＢ信号に変換してプロジェクタ５に対して出力する。これにより、プロジェクタ５からは、半透明面２に対して行われる操作に応答した映像による画像光が半透明面２に対して照射出力されることになる。

【００２３】次に、上記構成による本実施の形態のゲーム装置１における入力情報の検出方法について説明する。前述のように、図１に示す半透明面２全体に対しては、その背面から赤外線ＬＥＤパネル３により赤外線光

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が照射されるのであるが、この赤外線光は半透明面２が半透明性を有することから、全ての赤外線光が半透明面２を通過するのではなく、幾分かの赤外線光がその半透明性の作用によって反射されることになる。そして、本実施の形態においては半透明面２に対して何も操作が行われていないとされる状態のもとで、半透明面２にて反射される赤外線光をＣＣＤカメラ４により撮像して得られる映像信号データの初期レベルを「基準入力画像レベル」として記憶する。この基準入力画像レベルは、入力された映像信号データに基づいて例えば１フレームにおける画素ごとの信号レベルを検出することにより行うようにすればよい。この検出処理は、入力画像処理部１２により行われるものとされる。このようにして検出された基準入力画像レベルの情報はしきい値検出部１３に伝送され、ここで保持されることになる。

【００２４】上記基準入力画像レベルの検出処理は、例えば図３のフローチャートに示すものとなる。この図に示すように、先ず入力画像処理部１２では、ステップＳ１０１において、ＣＣＤカメラ４から画像入力部１１を介して供給された映像信号から得られる１フレーム分の画像データに基づいて、上述のようにして画素ごとに信号レベルを検出し、この検出結果を基準入力画像レベルＬｉｎｔとして得る。なお、具体的には画素ごとの輝度信号成分のレベルを検出してこれを基準入力画像レベルＬｉｎｔとすることが考えられる。入力画像処理部１２は、続くステップＳ１０２において、上記基準入力画像レベルＬｉｎｔをしきい値制御部１３に伝送して記憶させるように処理を実行する。

【００２５】なお、基準入力画像レベルＬｉｎｔを検出してしきい値制御部１３に記憶させる処理（上記図３に示す処理動作）は、例えば当該ゲーム装置１の電源オン時などに実行させたり、あるいは何らかのユーザの指示によって必要なときに基準入力画像レベルＬｉｎｔを更新させるように構成することが考えられる。

【００２６】上記のようにして基準入力画像レベルＬｉｎｔの情報が保持された状態のもとで、入力情報として扱われる画像情報は次のようにして得るようにされる。図４は、入力情報のもととなる画像情報（以下、この「画像情報」については特に「検出画像情報」という）を得るための入力画像処理部１２の処理動作を示すフローチャートである。この場合、入力画像処理部１２は、先ずステップＳ２０１において現在の入力画像レベルＬｐｒｓを検出する処理を実行する。ここでいう入力画像レベルＬｐｒｓは、現在においてＣＣＤカメラ４により撮像された、赤外線光に基づく半透明面２の画像についてのフレーム単位のデータであり、このフレーム単位の画像データにおける画素ごとの信号レベルを検出して得られる情報である。続いて、入力画像処理部１２はステップＳ２０２において、基準入力画像レベルＬｉｎｔと上記現在の入力画像レベルＬｐｒｓの差分を演算する

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（Ｌ＝Ｌｐｒｓ－Ｌｉｎｔ）ことによって差分入力画像レベルＬを算出する。具体的には、基準入力画像レベルＬｉｎｔと上記入力画像レベルＬｐｒｓとして得られたデータ値を、同一位置の画素ごとに差分を求めることによって差分入力画像レベルＬを得るようにされる。従って、差分入力画像レベルＬとしては、常に基準入力画像レベルＬｉｎｔに対する現在の入力画像レベルＬｐｒｓとの信号レベル差が画素ごとに得られることになる。そして、入力画像処理部１２は、ステップＳ２０３に進み、上記差分入力画像レベルＬに基づいて、現在の検出画像情報（フレーム単位で画素ごとのレベル情報を有する形式の映像データ）を生成するようにされる。

【００２７】上記のごとき検出画像情報の検出動作を、実際のユーザの半透明面２の前面側での動きと共に説明する。例えばユーザは、半透明面２の前面側において赤外線を反射可能な何らかの物体を利用して半透明面２の前面側において操作を行うようにするのであるが、ここでは、説明の簡単のためにユーザ自身の指や身体を用いることとする。ここで、例えば図１に示すように半透明面２の前面側においてユーザが半透明面２から遠く離れた距離にいるときには、例えば半透明面２を通過してユーザの身体に反射するとされる赤外線光量は少ないことから、そのほとんどが半透明面２の前面から背面を通過して戻ることはない。このとき、上述した基準入力画像レベルＬｉｎｔと上記現在の入力画像レベルＬｐｒｓとは同等であり、入力画像処理部１２では、差分入力画像レベルＬとしてほぼ０であると検出することになる。つまり、差分入力画像レベルＬに基づいて生成される検出画像情報としては、初期状態と同様の変化の無いとされる状態が得られることになる。

【００２８】ここで、例えば上記の状態からユーザが徐々に半透明面２に対して近づいていったとすると、半透明面２を通過してユーザの身体に反射する赤外線光のうち、半透明面２を通過して背面側に到達する光量が次第に増加していくことになる。この状態を、入力画像処理部１２からみた場合には、ユーザの身体に対応する画像部分の基準入力画像レベルＬｉｎｔに対する現在の入力画像レベルＬｐｒｓのレベルが徐々に増加していく状態として捉えられる。これに応じて、検出画像情報としては算出される差分入力画像レベルＬに応じて、半透明面２に接近するユーザの姿が徐々に捉えられていくことになる。そして、半透明面２に対して例えばユーザの体が非常に接近した状態（しきい値の設定にもよるが例えば半透明面２から３０ｃｍ以内）では、その人体に反射した赤外線光がほとんど半透明面２を通過して背面側に到達することになるので、その身体形状がより鮮明な状態の検出画像情報が生成されることになる。

【００２９】また、ここでユーザがその身体を半透明面２からある程度距離を置いた状態で、例えば自身の指を手前にかざして半透明面２の非常に近い位置にあるようにしたとする。この場合、半透明面２に近接するユーザの指は他の身体部分よりも多くの赤外線光を反射するため、入力画像処理部１２において得られる画像情報としては、ユーザの指にあたる位置の画像領域のレベルが強く、その背景となる部分においてユーザの身体部分にあたる位置の画像領域のレベルは半透明面２からの距離に応じて弱くなることになる。そして、例えばこの状態のもとで、しきい値制御部１３にて設定された所定のしきい値と検出画像情報とを比較すれば、容易にユーザの指にあたる部分のみの画像を背景から分離させることが可能であり、同様にしきい値の設定によっては、半透明面２から離れた距離にあるユーザの身体部分のみを抽出した画像情報を得ることも可能である。このようなしきい値は、前述のように実際に必要とされる条件に応じた値がしきい値制御部１３において設定されるものである。

【００３０】このようにして、半透明面２の前面側の状態を検出する構成を採ることにより、この半透明面２を例えばインタラクティブなインターフェイスのための操作パネルとして機能させる場合には次のような利点が得られる。先ず、本実施の形態では半透明面２側からの赤外線の反射光量によって得られる画像に基づいて入力情報を得ることになるので、入力情報を与えるための物理的対象としては、特に特殊なポインティングデバイスを必要とせず、１つには、赤外線を反射する物体であればその種類は問わないことになる。つまり、操作体としては、上述のように人体全体もしくはその一部や、その他の何らかの物体を問題なく使用することができる。また、例えば黒色は赤外線光を反射せずに吸収する作用があることなど利用し、後述するようにして、例えば黒色による特定パターンの図柄を半透明面２に対して与えることで、この図柄のパターンを特定の意義を有する入力情報（ＩＤ情報）として扱うようにすることも可能となる。さらには、ＣＣＤカメラ４により赤外線光の光量変化が撮像さえされればこれを入力情報として扱えることになるので、入力情報として例えば赤外線を発光させるポインティングデバイスなどを用いて、積極的に半透明面２に対して赤外線光を与えるような方法を採ることも可能である。

【００３１】また、例えばタッチパネルなどでは操作パネル面に対して指などの操作体を接触させる必要があるが、本実施の形態の場合には操作体の位置や動きは赤外線光の反射として検出されればよいことから、半透明面２に操作体を接触させる必要性はなく、その前面の空間において操作を行うような方法を採ることができる。更に、本実施の形態では、半透明面２側からの赤外線の反射光により得られる画像に基づいて入力情報を得るために、画像認識さえ可能であれば複数の操作体（即ち入力情報）を同時に認識することが可能である。

【００３２】また、上述したように赤外線の反射光量は、操作体の半透明面２に対する距離に応じて変化する

ために、例えば操作体の半透明面２からの距離を入力情報として利用することも考えられる。

【００３３】更に、半透明面２は前述のように例えば透明のガラス板などに対してトレーシングペーパーのような半透明の薄膜を組み合わせたり、磨りガラスのようなものを利用するなどの簡略な手段により構成可能とされ、特にパネル構造として表示のための駆動回路などを設ける必要がないので、低コストで容易に大型化を実現することができ、この点で大型化が困難なタッチパネルなどとは大きく異なる。

【００３４】そして、半透明面２は画像表示パネルとしての機能も有することから、例えば後述するように操作対象となるメニュー画面のようなものを表示させた上で、ユーザがこのメニュー画面に対して指などにより操作を行えるようにするなどの直接的な操作を実現することも容易に可能となる。このように、本実施の形態としてのゲーム装置１では、その入力情報を入力するのに多くの可能性が得られるために、これまでには無かったようなインタラクティブな入出力環境を容易に構築することができる。

【００３５】これまでの説明による構成を踏まえて、半透明面２に対して行われた操作により得られた入力情報に応答した本実施の形態のゲーム装置１の動作として、ユーザがメニュー操作を行う場合を例に挙げ、これについて図５及び図６を参照して説明する。

【００３６】図５には、ユーザがゲーム装置１を利用してメニュー操作を行う場合が示されており、ここでは半透明面２を前面側からみた状態が示されている。例えばこの図に示すように、ユーザが半透明面２の前面に近づいたとすると、先ず、ゲーム装置１の制御装置６では、このときに得られる検出画像情報に基づいてユーザが近づいた半透明面２上の位置を認識する。そして、半透明面２上においてユーザが近づいたと認識された位置に対応させて、図のようにメニュー画面Ｍを表示するように表示制御を行う。このメニュー画面Ｍは当然のこととしてプロジェクタ５から半透明面２に対して投影された画像である。

【００３７】そして、ユーザ自身が位置している付近の半透明面２上にメニュー画面Ｍが表示された状態のもとで、例えばユーザは自身の指を用いて、メニュー画面Ｍにおいて操作項目が表示されている任意の領域を指さすように指定したとする。このとき、ユーザの指先は、半透明面２上から３ｃｍ～３０ｃｍ程度の範囲内の距離にあるようにされる。

【００３８】これにより、例えばメニュー画面Ｍにおいては、ユーザが指し示した操作項目の領域が選択されたことを示す何らかの指示表示（例えば選択領域に対するカーソルの配置表示や所定の形態による強調表示など）が行われることになる。この強調表示のための表示制御は、検出画像情報に基づいてユーザの指が指し示している領域の座標を検出することにより実現される。ここでは、上記のようにして指示表示が開始された状態から所定時間（例えば数秒程度）経過したときにエンター操作が行われたとみなすこととする。そして、ユーザがエンター操作を行った、つまり、特定の操作項目が強調表示された状態を所定時間以上維持させたとすると、指定された操作項目に従った所要の制御動作を実行することになる。例えば、指定された操作項目に従って、他の階層のメニュー画面を表示させたり、当該ゲーム装置１に対して所望の動作を実行させたりすることになる。あるいは、当該ゲーム装置１が何らかの外部機器を制御可能に構成されており、メニュー画面がその外部機器の動作についての操作制御を行うためのものであるとすれば、指定された操作項目に従って外部機器の動作を制御することになる。なお、ユーザが半透明面２の前面から離れていき、ユーザと半透明面２との間にある程度以上の距離があいた場合には、それまで表示されていたメニュー画面Ｍは自動的に消去されるものとされる。

【００３９】ここで、図６のフローチャートに、上記図５に示した利用例に対応して実行される制御装置６の処理動作を示す。この図に示す処理動作は、主として制御装置６内の入力画像処理部１２が検出画像情報に基づいて入力情報を認識すると共に、データベース駆動部１４がデータベースメモリ１５に格納されたプログラムに従って、上記入力情報に基づいて適宜処理動作を実行することにより実現されるものである。

【００４０】この図に示すルーチンにおいては、先ずステップＳ３０１において現在の検出画像情報から入力情報として「接近体」が検出されるか否かについて判別を行う。ここで、「接近体」とは半透明面２に対して所定の距離範囲まで接近した何らかの検出対象（図５ではユーザ自身の身体とされている）をいうものとされる。この「接近体」の検出は、例えば入力画像処理部１２が検出画像情報と接近体の検出用に設定されたしきい値（しきい値制御部１３により設定される）を比較して、例えば検出画像情報のある領域においてこのしきい値以上の値が得られた場合には「接近体有り」と検出し、しきい値以上の値が得られる領域がない場合には、「接近体無し」と検出することになる。上記接近体検出用のしきい値は、例えば通常、人体（ユーザ）が半透明面２にある程度（例えば数十ｃｍ）近づいたときに検出画像情報として得られる人体部分の画像レベルに基づいて設定されればよい。

【００４１】上記ステップＳ３０１において接近体が検出されなかった場合にはステップＳ３０８に進んで、ここで現在メニュー画面Ｍが表示中であるか否かについて判別が行われ、ここでメニュー画面Ｍが表示されていない場合には元のルーチンに戻る（即ち再度ステップＳ３０１の処理に移行する）が、メニュー画面Ｍが表示中の状態である場合にはステップＳ３０９に進み、メニュー

画面Ｍを消去するための制御処理を実行する。このメニュー画面Ｍの消去処理は、例えばデータベース駆動部１４が画像生成部１６に対するメニュー画面Ｍの画像データの生成処理を停止することで実現される。

【００４２】これに対して、ステップＳ３０１において接近体が検出された場合には、ステップＳ３０２に進んで、半透明面２上における上記接近体の位置を検出することが行われる。この処理は、例えば検出画像情報における接近体の部分が占有する領域の座標を検出することで可能となる。この場合、検出すべき座標としては接近体の領域の所定の一地点であっても、所定規則に従って求められる複数地点であっても構わなく実際の使用環境等に応じて任意に設定されればよい。

【００４３】続くステップＳ３０３においては、上記ステップＳ３０２にて検出された接近体の位置に応じた半透明面２の領域に対してメニュー画面Ｍを表示させるための制御を実行する。この制御処理は、例えばデータベース駆動部１４がデータベースメモリ１５に格納されているメニュー画面表示用のプログラムに基づいて、画像生成部１６において所要の種類のメニュー画面の画像データが作成されるように制御を行うことになる。

【００４４】この際、データベース駆動部１４は、ステップＳ３０２にて検出された接近体の位置に対応する表示領域に対して、例えばメニュー画面の画像データをマッピングするようにして、表示用画像データを作成する。この結果、最終的にプロジェクタ５から投影される画像としては、半透明面２におけるユーザが近づいた位置に対してメニュー画面Ｍが表示されたものとなる。

【００４５】上記ステップＳ３０３の処理が実行された後は、ステップＳ３０４において、現在表示中のメニュー画面Ｍの操作項目とされる表示領域内において、「操作体」が検出されたか否かについて判別が行われる。ここで、「操作体」とは半透明面２の前面において至近距離（しきい値の設定にもよるが３ｃｍ～３０ｃｍ程度）にある物体（検出対象）のことをいうものとされる。つまり、図５においてはメニュー画面Ｍを指し示す指が対象となる。そして、この「操作体」の検出処理は、先ず、操作体検出用としてしきい値制御部１３において設定されたしきい値と、検出画像情報の画像レベルとを比較することにより、操作体の有無を検出することが行われる。このとき設定されるしきい値としては、半透明面２の前面において至近距離にある物体を背景から分離して検出する必要上、前述した接近体検出用のしきい値よりも大きい値が設定される。そして、例えばしきい値と比較した結果、操作体が検出されたとすれば、その操作体が検出された検出画像情報上の座標位置を検出し、この検出位置とメニュー画面Ｍが表示されているとされる画像情報上の位置が一致しているか否かを判別することで、現在表示中のメニュー画面の表示領域内における操作体の有無を検出することになる。

【００４６】上記ステップＳ３０４においてメニュー画面Ｍの操作項目とされる表示領域内において操作体が検出されない場合とは、検出画像情報上に操作体が検出されなかった（ユーザが至近距離で半透明面２上を指し示していないような状態）か、或いは、検出画像情報上に操作体を検出したとしても、この操作体の検出位置（座標）がメニュー画面Ｍの表示領域内に対応する画像情報上の領域に無かった（ユーザが至近距離で半透明面２上を指し示していた位置がメニュー画面Ｍの操作項目以外の領域であったような状態）ことになるが、このような場合にはステップＳ３０１に戻るようにされる。

【００４７】なお、ここで操作体が人体の手又は指に特定されるような場合には、ステップＳ３０４における操作体の検出処理として、例えば、データベースメモリ１５に対して操作時に現れる人体の手又は指の形状の情報を記憶させておき、この手又は指の形状の情報と、検出画像情報として得られた画像形状とを比較して、その一致状態をみて操作体の検出の有無を識別するように構成することが可能である。即ち、本発明では、画像情報から入力情報を検出するために、検出画像情報に得られる画像の形状に基づいても、これを何らかの意義を有する入力情報の１つとして認識可能なわけである。

【００４８】ステップＳ３０４においてメニュー画面Ｍの操作項目とされる表示領域内において操作体が検出されたと判別された場合には、ステップＳ３０５に進んで、操作体が検出された位置に対応するメニュー画面Ｍの操作項目について指示表示が行われるように制御を実行してステップＳ３０６に進む。

【００４９】ステップＳ３０６の処理はエンター操作の待機処理となる。前述のように、ここでのエンター操作は、指示表示が開始された状態から所定時間経過したときに確定されるものと規定している。そこで、ステップＳ３０６においては、ステップＳ３０４にて検出された操作体の検出状態が所定時間以上維持されるか否かについて検出を行うようにしている。この検出処理は、入力画像処理部１２において現在の検出画像の状態遷移を監視することにより行われる。そして、例えば現在の検出画像情報上から操作体が検出されなくなったり、あるいは現在の検出画像情報上における操作体の検出位置が、ステップＳ３０４にて検出されたメニュー画面Ｍの操作項目とされる表示領域内から外れたことが検出されたような場合には、ステップＳ３０６からステップＳ３０１以降の処理に戻ることになる。（この処理により、例えばユーザがこれまでとは異なるメニュー画面Ｍ上の操作項目を指し示すように、その指定位置を変更した場合には、新たに指定されたメニュー画面Ｍ上の操作項目に対して指示表示が行われたりすることになる。）

【００５０】これに対して、ステップＳ３０６において、直前のステップＳ３０４にて検出された操作体の検出状態が所定時間以上維持されたと判別された場合に

は、エンター操作が行われたものとしてステップＳ３０７に進む。ステップＳ３０７においては、メニュー画面M上において操作体が検出された位置の操作項目に応じた所要の制御処理が実行される。このステップにおける処理は、データベース駆動部１４がデータベースメモリ１５に格納されたプログラムに従って実行する。

【００５１】以下、これまで説明してきた本実施の形態とされるゲーム装置１の基本的な構成及び入力情報の検出方法を踏まえて、実際に本実施の形態のゲーム装置によって実現可能なゲームの具体例について説明する。

【００５２】図７は、本実施の形態とされるゲーム装置１を利用してゲームを行っている様子が示されている。ここでは、後述するようにして複数のユーザがチームに分かれて参加する対戦型ゲームを行っているものとされる。なお、この図において図１と同一部分については同一番号を付して説明は省略する。また、この図７において赤外線透過フィルタ４ａと赤外線遮断フィルタ５ａの図示は省略されているが、図１の場合と同様にＣＣＤカメラ４とプロジェクタ５に対して備えられているものである。

【００５３】図７において、半透明面２Ａはテーブル面として設置されている。つまり、４本のテーブル脚Ｆ，Ｆ，Ｆ，Ｆにより支持される。この場合、半透明面２の下面側に対して図示するように赤外線ＬＥＤパネル３、ＣＣＤカメラ４、プロジェクタ５（及び制御装置６）、送受信部２０が設けられる。なお、この場合には制御装置６の設置位置は特に半透明面２Ａの下面側で有る必要はなく、例えば半透明面２Ａ（テーブル）の下面側のスペースに余裕を与えることを考慮して、これ以外の位置に設置することも考えられる。

【００５４】送受信部２０は、例えば次に説明する携帯情報端末（ＰＤＡ：Personal Digital Assistants ）２２から赤外線によって送信されてくるデータ信号を受信して制御装置６に伝送したり、あるいは携帯情報端末（以下、「ＰＤＡ」という）２２に対して制御装置６から伝送されてくるデータ信号を赤外線によって送信することが可能とされる。

【００５５】ＰＤＡ２２ａ，２２ｂは、この場合にはチームごとに１つづつ与えられ、主としてゲーム進行に関する操作を行うために備えられる。このＰＤＡ２２には、ユーザがゲームを進めるための所要の入力操作を行うことができる操作部と、所用の画像を表示することができる表示部が設けられている。また、赤外線により送受信を行うことができる例えば赤外線通信機能が備えられており、ユーザがゲームを進めるための所要の入力操作を行った場合は、その操作に対応した操作情報を上記制御装置６に対して送信したり、あるいは制御装置６から送受信部２０を介して送信されてくる各種データ信号を受信して表示部に表示することが可能とされる。

【００５６】また、このＰＤＡ２２には個体識別のためのＩＤパターンが底面に貼りつけられている。このＩＤパターンは、後述するようにして制御装置６においてＰＤＡ２２ａ，２２ｂの識別のために利用されるものである。

【００５７】ここで、ＰＤＡ２２ａ，２２ｂに底面に設けられているＩＤパターンの一例を図８に示す。この図８に示すＩＤパターン３０ａは、例えば白地のＰＤＡ２２に対して、黒色の特定のパターンによる、いわゆる２次元バーコードといわれる図柄により描かれている。そして、例えば図７に示されているユーザがＰＤＡ２２ａ，２２ｂを半透明面２上においたとすると、黒色は赤外線光を反射せずに吸収する作用を有することから、制御装置６で得られる検出画像情報としては、ちょうど図８に示したようなＩＤパターン３０ａの画像となる。

【００５８】ここで、このような送受信部２０を備えた本実施の形態とされるゲーム装置１の具体的な内部構成を図９に示す。なお、この図では半透明面２Ａが省略されているが当然のこととして赤外線ＬＥＤパネル３、ＣＣＤカメラ４、及びプロジェクタ５がその背面に有るように設けられているものとされる。また、図２と同一部分には同一番号を付し説明は省略するが、本実施の形態では対戦型ゲームの処理を実行するためのゲームプログラムがデータベースメモリ１５に格納されることになる。

【００５９】送受信部２０は、ＰＤＡ２２から赤外線によって送信されてくる操作情報を受信してデータベース駆動部１４に対して供給するようにされている。そして、データベース駆動部１４は、この操作情報に基づいて半透明面２Ａに表示するコマ２１やゲームの背景画像を画像生成部１６で生成するような処理を実行させることになる。また、データベース駆動部１４からデータ信号が伝送されてきた時は、このデータ信号をＰＤＡ２２に対して送信するようにされる。

【００６０】なお、本実施に形態における送受信部２０は、赤外線によってデータ信号を送信したり、ＰＤＡ２２からの操作情報を受信する送受信部とされているが、例えば送信先であるＰＤＡ２２に電波を送受信することができる送受信部が備えられている場合は、電波によって空間伝送を行うことができる送受信部するというように適宜変更することが可能とされる。

【００６１】図７に示すような対戦型ゲームは、例えば複数のユーザが２つのチーム（ＡチームとＢチーム）に別れて対戦形式で行うゲームとされており、この対戦型ゲームを開始するにあたっては、まずゲームを行うための初期設定を行う必要がある。このため、ユーザがＰＤＡ２２に対してゲームを開始するための操作を行った場合は初期設定モードに移行することになる。

【００６２】初期設定モードにおいては、例えば先ずゲームに使用するコマ２１ａ，２１ｂをＡチーム又はＢチームに分けるためのメッセージが表示される。そして、

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ユーザが例えばＰＤＡ２２ａ，２２ｂからコマ２１ａ，２１ｂのチーム分けを行うための所定の入力操作を行うことで、制御装置６では、Ａチームとして設定されたコマ２１ａに対してＡチームに対応するグループＩＤを付与すると共に、Ｂチームとされたコマ２１ｂに対してはＢチームに対応するグループＩＤを付与して保持することになる。

【００６３】このようにして、ゲームに使用するコマ２１ａ，２１ｂに対してグループＩＤが付与されると、次に例えばゲームに使用されるＰＤＡ２２ａ，２２ｂのチーム分けを行うためのメッセージが表示される。この場合ゲーム装置では、例えば始めにＡチームに属することになるＰＤＡを設定するモードに移行するものとされ、このモード状態のもとでＡチームのユーザがメッセージに従ってＡチームが使用するＰＤＡ２２ａを、そのＰＤＡ２２ａの底面に貼りつけられているＩＤパターンを制御装置６が認識できるように半透明面２Ａ上に載置する。これにより、制御装置６はＡチームに属することになるＰＤＡ２２ａのＩＤパターンを認識して、このＩＤパターンとＡチームのグループＩＤを対応させて保持することになる。

【００６４】例えば、続いてＢチームが使用するＰＤＡを設定するモードでは、上記と同様にしてＢチームのユーザがＰＤＡ２２ｂの底面に貼りつけられているＩＤパターンを制御装置６が認識できるように半透明面２Ａ上に載置する。これにより、制御装置６はＰＤＡ２２ｂのＩＤパターンを認識してこのＩＤパターンとＢチームのグループＩＤを対応させて保持することになる。

【００６５】なお、上記したようなＰＤＡ２２ａ，２１ｂのグループＩＤの設定は、ユーザがＰＤＡ２２を半透明面２Ａ上に置くことなく、例えばＰＤＡ２２ａから所定の操作を行い、上記ＩＤパターンと同様、ＰＤＡを特定するためのＩＤコード情報を送信するようにして設定することも可能である。

【００６６】また、本実施の形態においては、ＰＤＡ２２ａ，２２ｂがチームごとに１つづつ与えられているものとして説明しているが、例えば各チームに複数のユーザが参加している場合は、各チームごとに複数のＰＤＡ２２ａ，２２ｂを設けるようにすることも可能とされる。

【００６７】このようにして初期設定が行われた後、ゲームが開始されるものとされ、例えば図７に示すような各チームのコマ２１ａ，２１ｂや背景画像といったゲーム画像が半透明面２Ａに表示されることになる。そして、各チームに別れたユーザがＰＤＡ２２を操作しながら、予め決められたルールに従ってゲームを進めていくことになる。このようなゲームの進行は、ＰＤＡ２２からの操作情報に基づいて、制御装置６が例えば半透明面２Ａに表示されるコマ２１を進めていく等の表示制御などを実行することで実現される。

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【００６８】このようにゲームが進行している途中で、例えばＡチームのユーザが個別情報（チームごとに特有のゲームに関する情報で対戦相手チームに知られてはならない情報）を得たい場合は、ＡチームのユーザがｐＤＡ２２ａを自チームのコマ２１ａの上に載置にする。この場合制御装置６は、このＰＤＡ２２ａの底面に貼りつけられているＩＤパターン３０ａの画像を入力情報として識別し、この識別した入力情報の座標位置を検出する。そしてこの検出した入力情報の座標位置に基づいて、例えばＰＤＡ２２ａの座標位置が半透明面２Ａ上に表示されるコマ２１ａの座標位置と一致すると判別し、且つ、ＰＤＡ２２ａとコマ２１ａのチームが一致すると判別した時に、例えばそのコマ２１ａに与えられている個別情報をＰＤＡ２２ａにおいてのみ受信させるように送信することで、Ａチームの個別情報がＰＤＡ２２ａの表示画面にのみ表示されることになる。

【００６９】これは例えば制御装置６から送受信部２０を介して個別情報を送信する時に、ＰＤＡ２２ａに対して送信する個別情報に送信先のＰＤＡ２２ａを特定するためのＩＤ情報を付加すればよい。これによりＰＤＡ２２ａ，２２ｂは制御装置６からの送信信号を受信することになるが、ＰＤＡ２２ａ，２２ｂは先ず送信信号に含まれるＩＤ情報を識別する。ここで、例えばＢチームのＰＤＡ２２ｂにおいては識別したＩＤ情報が自身の有するＩＤと一致しないため、以降のデータ取り込み処理が行われない。これに対して、送信信号のＩＤ情報と自身のＩＤ情報が一致したＰＤＡ２２ａにおいては、受信信号から個別情報を抽出して取り込み個別情報を提示するための表示を行うように動作することになる。

【００７０】このように本実施の形態とされるゲーム装置においては、比較的大画面として構成することができる半透明面上２Ａに全体のゲーム画像を表示すると共に、各チームごとに関する個別情報をＰＤＡ２２の表示画面上に表示させるようにしている。このためユーザは通常、比較的大画面とされる半透明面２Ａ上に表示されるゲーム画像を見ながらゲームを進行させていくことになるため、臨場感のあるゲームを楽しむことができると共に、ＰＤＡ２２ａ，２２ｂの表示画面上にチームごとの個別情報が表示されるので、相手チームにわからないようにチームごとに作戦を立てるといったことが可能になり、対戦型ゲームをより楽しく行うことができるようになる。

【００７１】次に、上記したような対戦型ゲームを実行する場合の制御装置６の処理動作例について説明する。上記したような対戦型ゲームを実行するにあたっては、先ず前述したように初期設定としてゲームに使用するコマ２１（半透明面２Ａ上にプロジェクタ５から投影表示される）及びＰＤＡ２２を各チームごとに分けることが行われるが、先ずこの時の処理動作を図１０に示すフローチャートを参照して簡単に説明する。

【００７２】この場合、制御装置６は、先ずコマ２１のグループＩＤを付与するためのモードとなり、ステップＳ４０１において、半透明面２Ａ上にゲームに使用する全てのコマ２１に付与するための処理動作を実行する。このような処理動作は、制御装置６のデータベース駆動部１４がデータベースメモリ１５に格納されているプログラムに基づいて、画像生成部１６においてコマ２１の画像データを生成することで実現されることになる。

【００７３】そしてステップＳ４０２において、半透明面２Ａ上に表示されたコマ２１に対してチームのグループＩＤを付与するための処理動作を実行することになる。この処理動作としては、まずデータベース駆動部１４がデータベースメモリ１５に格納されているプログラムに基づいて、画像生成部１６においてゲームに使用するコマ２１をＡチーム又はＢチームに分けるためのメッセージ画像を生成し、このメッセージ画像をプロジェクタ５から半透明面２Ａに対して投影表示させるような制御を実行する。そして、これに応答して送受信部２０で受信された操作情報に基づいて、例えばＡチームとされたコマ２１ａに対してＡチームのグループＩＤを付与すると共に、Ｂチームとされたコマ２１ｂに対してはＢチームのグループＩＤを付与してデータベースメモリ１５に保持させることで実現することができる。

【００７４】上記のようにしてコマ２１に対してグループＩＤを付与した後は、ＰＤＡ２２に対してグループＩＤを付与するためのモードとなり、ステップＳ４０３に移行することになる。ステップＳ４０３において、データベース駆動部１４はゲームに使用するＰＤＡ２２に対してグループＩＤを付与するための処理動作を実行することになる。この処理動作としては、データベース駆動部１４がデータベースメモリ１５に格納されているプログラムに基づいて、画像生成部１６において例えばゲームに使用されるＰＤＡのチーム分けを行うためのメッセージ画像を生成し、このメッセージ画像をプロジェクタ５から半透明面２Ａに対して投影表示させるような制御を実行する。そして、これに応答してユーザがＰＤＡ２２ａ，２２ｂをＩＤパターン３０ａを認識できるように半透明面２Ａ上に載置することで入力画像処理部１２から得られることになるＰＤＡ２２ａ，２２ｂのＩＤパターンを認識して、このＩＤパターンのＩＤ情報とグループＩＤを対応させてデータベースメモリ１５に保持することで実現される。

【００７５】なお、各チームに属することになるＰＤＡ２２ａ，２２ｂが複数ある場合でも、当該ゲーム装置１の入力画像処理部１２において検出される検出画像情報は、先に説明したような半透明面２Ａ側から赤外線の反射光により得られるため、半透明面２Ａ上に複数のＰＤＡ２２ａ，２２ｂを載置した場合でも同時に複数のＩＤパターン３０ａを認識することが可能とされる。

【００７６】上記のようにして初期設定が行われた後、本実施の形態とされる対戦型ゲームが開始され、ユーザがＰＤＡ２２ａ，２２ｂの操作を行うと、ＰＤＡ２２ａ，２２ｂから操作情報が送信されることになる。そして、制御装置６はＰＤＡ２２ａ，２２ｂから送信されてくる操作情報に基づいて、対応するコマ２１ａ，２１ｂを進めるといった表示制御を実行することになる。このような処理動作は、データベース駆動部１４がＰＤＡ２２ａ，２２ｂから操作情報に含まれているＩＤ情報を識別し、データベースメモリ１５に保持しているＩＤ情報とグループＩＤとの対応テーブルから対応するグループのコマ２１ａ，２１ｂを判別して表示を制御することで実現される。

【００７７】ここで例えばＡチームのユーザがＰＤＡ２２ａをコマ２１ａ上に載置した場合、すなわち上述したようにユーザが自チームのコマ２１に与えられている個別情報を表示させるための操作が行われた場合の制御装置６における処理動作を図１１に示すフローチャートを参照して説明する。

【００７８】この場合ステップＳ５０１において、制御装置６は検出画像情報に基づいて得られる入力情報として何らかのＩＤパターン３０ａが認識されるのを待機しており、ここでＩＤパターン３０ａが認識されたと判別されると、ステップＳ５０２に進んでステップＳ５０１において認識したＩＤパターン３０ａの検出画像情報上における位置情報ｐｏｓを検出することになる。

【００７９】ステップＳ５０２において、ＩＤパターン３０ａの位置情報ｐｏｓを検出するとステップＳ５０３に進んで、この位置情報ｐｏｓと半透明面２Ａ上に表示しているコマ２１の座標位置が一致しているかどうか判別することになる。ここで、ＩＤパターン３０ａの位置情報ｐｏｓと半透明面２Ａ上に表示しているコマ２１の座標位置が一致すると判別した場合は、ステップＳ５０４に進んで、位置情報ｐｏｓを検出したＩＤパターン３０ａによって特定されるＰＤＡ２２のグループＩＤと、このＰＤＡ２２ａが載置された位置に対応するコマ２１のグループＩＤが一致するかどうかの判別を行うことになる。

【００８０】ステップＳ５０４において、ＰＤＡ２２ａとコマ２１のグループＩＤが一致すると判別した場合は、ステップＳ５０５に進んで対応するＰＤＡ２２ａに対してコマ２１ａの固有の個別情報を送信するような制御を実行することになる。この場合、制御装置６から送信される送信信号は、例えば対応するコマ２１ａに対応する個別情報に、コマ２１ａの表示位置に置かれたＰＤＡ２２ａを示すＩＤ情報を付加して送信するようにされる。これにより前述したようにコマ２１ａの表示位置に置かれたＰＤＡのみ個別情報を受信して表示することができる。

【００８１】一方、ステップＳ５０３において、ＩＤパターン３０ａの位置情報ｐｏｓと表示するコマ２１の位

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置情報が一致しないと判別した場合、あるいはステップＳ５０４において、ＰＤＡ２２ａと、このＰＤＡ２２ａが載置された位置に対応するコマ２１のグループＩＤが一致しないと判別した場合は、コマ２１ａの個別情報を送信することなくもとのルーチンに戻ることになる。

【００８２】ところで、上述したような本実施の形態では、テーブルの下側に少なくとも赤外線ＬＥＤパネル３、ＣＣＤカメラ４、プロジェクタ５を配置してやる必要があるが、例えば床からテーブル面（半透明面２Ａ）までの高さ（距離）はさほど多く取ることができないため、ＣＣＤカメラ４やプロジェクタ５が半透明面２Ａ全体をカバーできるのに必要な直線距離を得ることが難しい場合が生じる。そこで、この場合は図１１に示すように半透明面２Ａ（テーブル面）の下側に光路を反射により変更させるミラーＭＲを配置させ、赤外線ＬＥＤパネル３、ＣＣＤカメラ４、及びプロジェクタ５などの装置はテーブルの横側に配置することが考えられる。

【００８３】なお、ミラーＭＲの代わりに、所定の光透過率と反射率が設定されたハーフミラーＭＲを用いることも考えられる。このようなハーフミラーＭＲを用いた場合には、例えば、赤外線ＬＥＤパネル３はテーブルの横側に配置せずに、テーブル下部の床面部分に設置することなどが可能となってそれだけ設置自由度が高くなる。

【００８４】ところで、本実施の形態のゲーム装置に適用される表示装置１としては、図１に示す構成において、例えば赤外線ＬＥＤパネル３の代わりにマイクロ波発生器を設け、また、ＣＣＤカメラ４の代わりにマイクロ波受信器を設けて構成することも考えられる。この場合、図２に示す制御装置６においては、ＬＥＤ駆動部１０（図１参照）の代わりに、マイクロ波発生器を駆動するためのマイクロ波駆動回路が備えられる。また、マイクロ波受信器から供給される受信マイクロ波を入力して例えば所定形式のデータに変換して出力する画像信号入力回路と、この画像信号入力回路から供給されるマイクロ波の受信データを入力して所要の処理を行うことにより、例えば検出画像情報を得ると共にこの検出画像情報に基づいて操作情報を得る入力データ処理回路が設けられる必要がある。画像信号入力回路及び入力データ処理回路は、それぞれ図２に示す画像入力部１１及び入力画像処理部１２に代わる機能回路部である。また、操作情報検出用の媒体としてマイクロ波を利用するため、ＣＣＤカメラ４に備えられた赤外線透過フィルタ４ａや、プロジェクタ５に備えられた赤外線遮断フィルタ５ａは不要となる。

【００８５】このように、それが照射された物体に反射する性質を有するマイクロ波のような媒体を操作情報の検出に利用するように構成しても、これまで説明してきた実施の形態（赤外線を操作情報の検出に利用した例）と同様にして本発明としてのゲーム装置を構成することが可能である。

【００８６】なお、上記した本発明のゲーム装置で実行可能とされるゲームは、あくまでも一例であり、これに限定されることなく他にも各種考えられるものである。また、本実施の形態においては音声出力系の説明は省略したが、各種ゲーム音声の出力を行うことは可能である。また、本実施の形態においては、半透明面２が水平に設置してある状態（テーブル状）とした場合について説明したきたが、本発明としての半透明面２の機能（表示パネル機能及び操作パネル機能）を考慮すればこれに限定されることなく、半透明面２を球面状などの曲面として形成することも可能である。

【００８７】また、本実施の形態においては、制御装置６からデータ信号を送受信部２０から赤外線を用いて送信する場合について説明したが、例えば赤外線ＬＥＤパネル３から発光出力されるＬＥＤの発光強度を変化させることによって、赤外線ＬＥＤパネル３を送信部として機能させることも可能である。

【００８８】

【発明の効果】以上、説明したように本発明は、例えば半透明面に近づいた物理的対象によって撮像手段に入射する光又は電磁波の状態が変化するのであるが、このような光又は電磁波の状態変化を画像情報として捉えることになる。そして、このようにして得られる操作情報に応じて外部操作装置に対して所要の情報信号を送信することが可能とされる。そして、半透明面に対して投影表示手段から画像を投影表示することによって、情報入力パネル兼表示パネルとして機能させるようにしている。従って、この半透明面上にゲームの全体画像を表示すると共に、外部操作装置を半透明面上に載置した際に得られるＩＤパターンの認識情報（例えばその位置情報も含む）に基づいて、外部操作装置に個別情報を送信することができるようになり、対戦型ゲームをより楽しく行うことができるようになる。

【００８９】また、上記のように情報入力パネル兼表示パネルとされる半透明面としては、例えば単に半透明性を有するプレート状の材を用いれば良いことから、例えば従来のＣＲＴ、液晶ディスプレイなどの表示デバイスやタッチパネル（タブレット）などの入力装置を組み合わせて大型化を図る場合に比べて、より簡易な構成で実現することができる。

【図面の簡単な説明】

【図１】本発明の実施の形態としてのゲーム装置の基本的な構成例を示す概念図である。

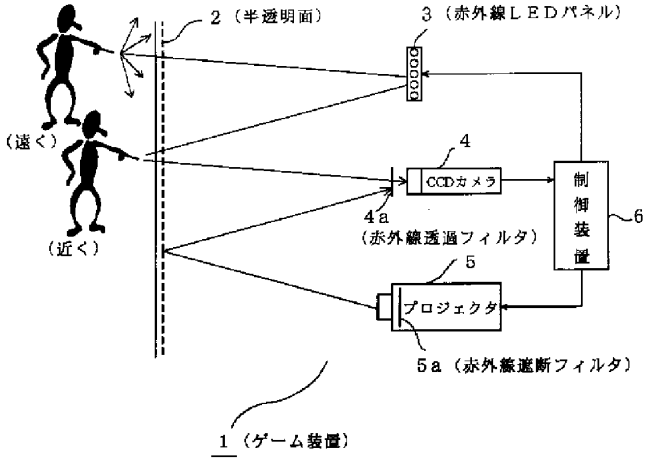
【図２】図１に示すゲーム装置に備えられる制御装置の内部構成を示す図である。

【図３】基準入力画像レベルを検出及び保持するための処理動作を示すフローチャートである。

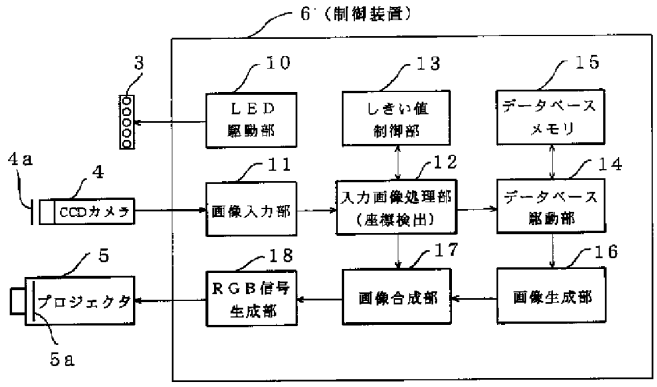
【図４】検出画像情報を生成するための処理動作を示すフローチャートである。

【図５】図１に示すゲーム装置の利用例としてメニュー画面に対する操作例を示す説明図である。
【図６】図５に示すメニュー画面に対する操作を実現するための処理動作を示すフローチャートである。
【図７】本実施の形態のゲーム装置において対戦型ゲームを実行させた時に半透明面に表示される表面画像を示した図である。
【図８】ＩＤパターンの一例を示した図である。
【図９】本発明の実施の形態としてのゲーム装置に備えられる制御装置の内部構成を示す図である。
【図１０】本発明の実施の形態としてのゲーム装置で対戦型ゲームを実行した時の初期設定時の処理動作を示すフローチャートである。
＊【図１１】本発明の実施の形態としてのゲーム装置で対戦型ゲームを実行した時の個別情報を表示させるための処理動作を示すフローチャートである。
【図１２】本実施の形態のゲーム装置に適用される表示装置の他の配置例を示した図である。
【符号の説明】
１　表示装置、２　半透明面、３　赤外線ＬＥＤパネル、４　ＣＣＤカメラ、５　プロジェクタ、６　制御装置、１０　ＬＥＤ駆動部、１１　画像入力部、１２　入力画像処理部、１３　しきい値制御部、１４　データベース駆動部、１５データベースメモリ、１６　画像生成部、１７　画像合成部、１８　ＲＧＢ信号生成部、２０　送受信部、２１　コマ、２２　ＰＤＡ

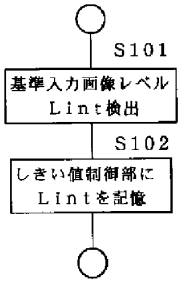
【図１】



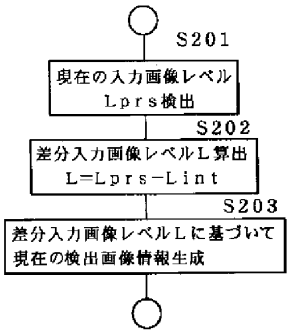
【図２】



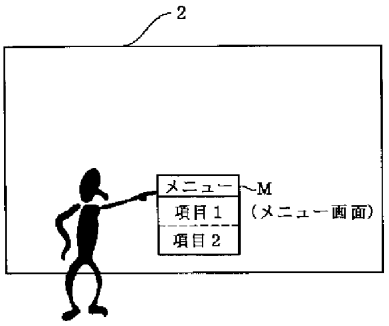
【図３】



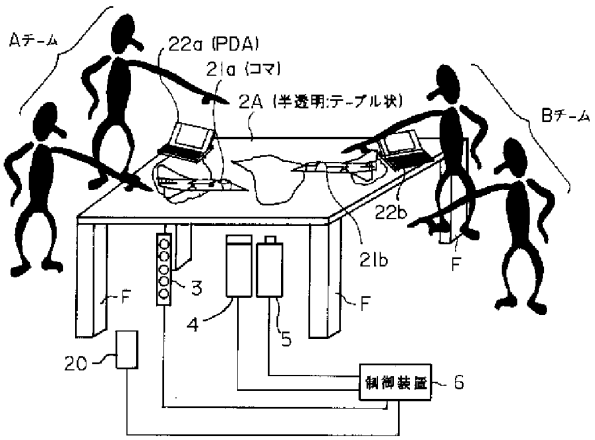
【図４】



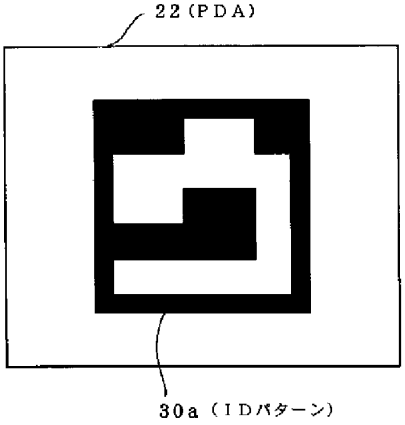
【図５】



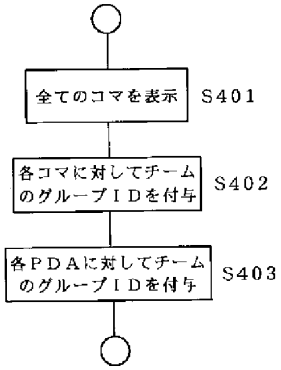
【図７】



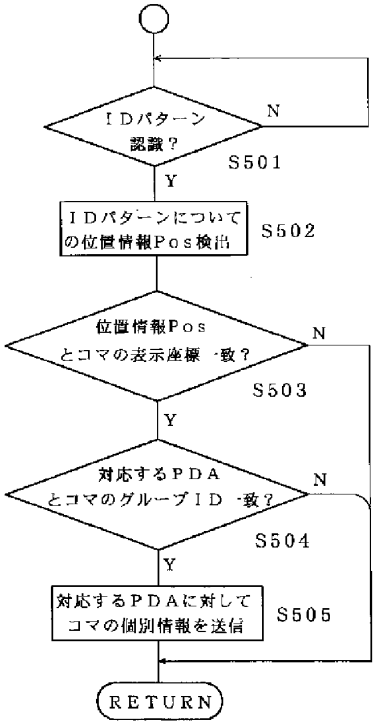
【図８】



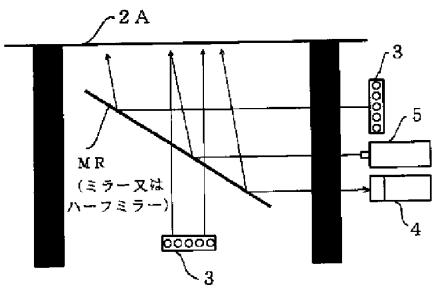
【図１０】



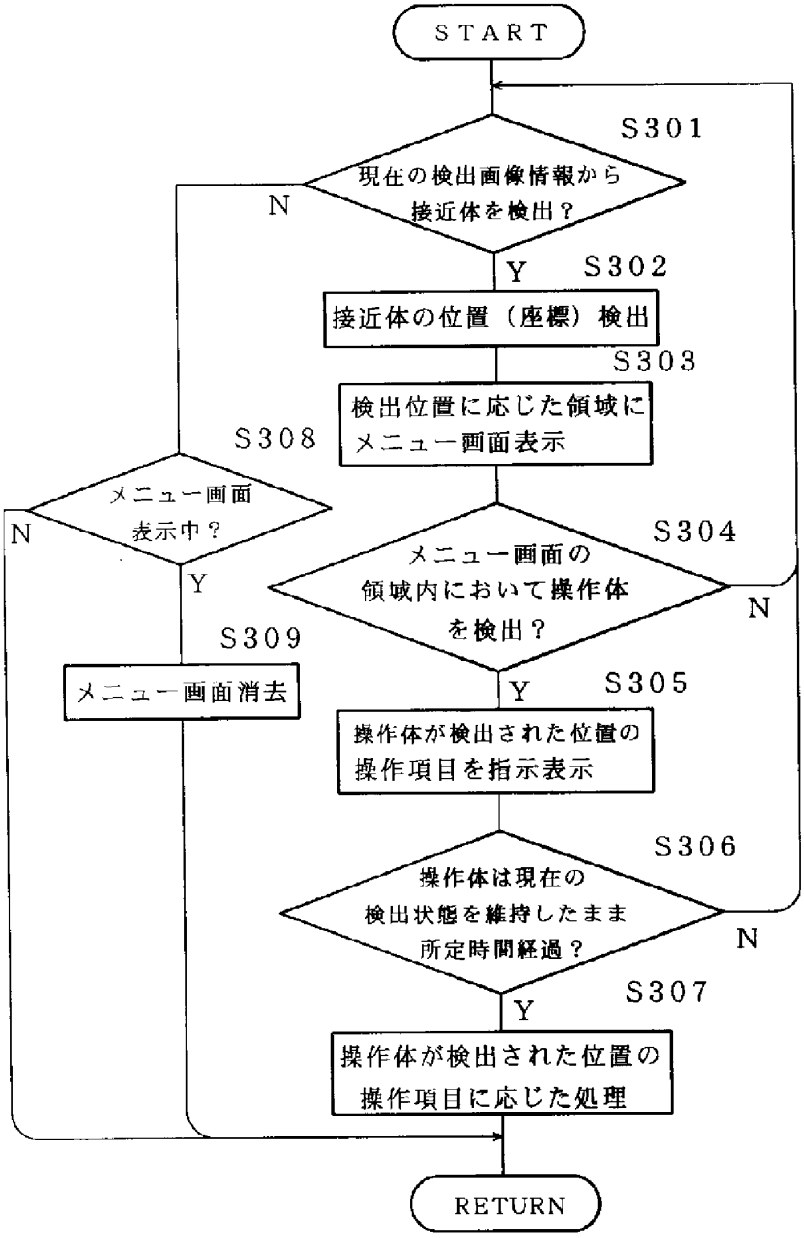
【図１１】



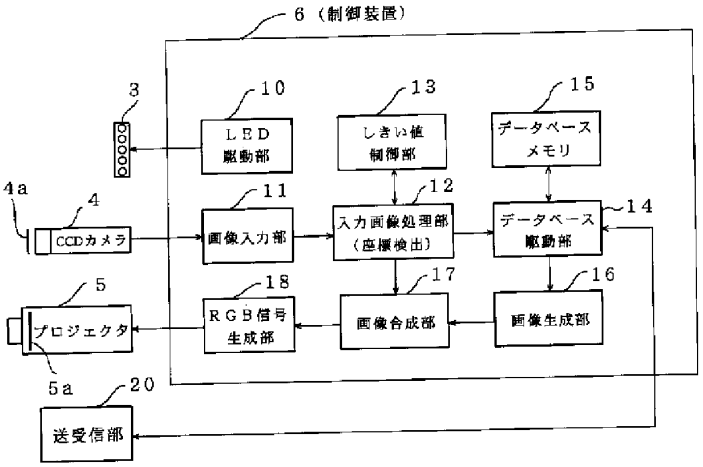
【図１２】



【図６】


START
S301
現在の検出画像情報から
接近体を検出？
N
Y
S302
接近体の位置（座標）検出
S303
検出位置に応じた領域に
メニュー画面表示
S308
メニュー画面
表示中？
N
Y
S304
メニュー画面の
領域内において操作体
を検出？
N
Y
S309
メニュー画面消去
S305
操作体が検出された位置の
操作項目を指示表示
S306
操作体は現在の
検出状態を維持したまま
所定時間経過？
N
Y
S307
操作体が検出された位置の
操作項目に応じた処理
RETURN

【図９】


6（制御装置）
3
10
LED
駆動部
13
しきい値
制御部
15
データベース
メモリ
4a
4
CCDカメラ
11
画像入力部
12
入力画像処理部
（座標検出）
14
データベース
駆動部
5
18
RGB信号
生成部
17
画像合成部
16
画像生成部
プロジェクタ
5a
20
送受信部

Electronic Acknowledgement Receipt

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Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Don Neil Caceres Pua/Erica Van Sciver
Filer Authorized By:	Don Neil Caceres Pua
Attorney Docket Number:	KM2326.007D1
Receipt Date:	16-JUL-2012
Filing Date:	16-APR-2012
Time Stamp:	18:24:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS2.pdf	118938 54dc0ba3e5062eed9e979fcd51a36b06cc375c38	yes	3

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	Multipart Description/PDF files in .zip description				
	Document Description		Start	End	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	3	
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Information:					
2	Non Patent Literature	InterviewSummaryDecember202010.pdf	273407 933f3dbac248af1c4731a88b6c15e90536e045ee	no	7
Warnings:					
Information:					
3	Non Patent Literature	InterviewSummaryJuly62011.pdf	294875 91306 39e88532b6dd1c44e6a5a0d95869bab5371	no	7
Warnings:					
Information:					
4	Non Patent Literature	FinalOAdatedMay122011.pdf	898773 81bbaf6d4acde322b7fd8be702a4c4ecc4bbd841	no	22
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5	Non Patent Literature	InterviewSummaryJuly142011.pdf	319027 95fdf1e4d6b8fbed72d46380352e93f7c8bfb612	no	8
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6	Non Patent Literature	InterviewSummaryOct142011.pdf	380374 bcc304f340d2a622a185eb927566909f9cace408	no	9
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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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INFORMATION DISCLOSURE STATEMENT

Applicant	:	Matthew Bell
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Unknown
Art Unit	:	2875
Conf. No.	:	3370

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Submitted herewith in the above-identified application is an Information Disclosure Statement listing references for consideration. Copies of any listed foreign and non-patent literature references are being submitted.

For the cited Japanese patent references, Applicant has attached English abstracts and/or machine translations of the Japanese patent references obtained from the Japanese Patent Office website. Applicant makes no representation as to the accuracy of the English abstracts or machine translations. If the Examiner would like additional information regarding these references or if anything is unclear, the Examiner is invited to request such information, and Applicant will attempt to comply with any such request.

Timing of Disclosure

This Information Disclosure Statement is being filed before the receipt of a first Office Action on the merits, and presumably no fee is required. If a first Office Action on the merits was mailed before the mailing date of this Statement, the Commissioner is authorized to charge the fee set forth in 37 CFR 1.17(p) to Deposit Account No. 11-1410.

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Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: July 16, 2012

By: _____

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LAG-VW00000074

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Volkswagen v. Longhorn - IPR2025-00925

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Examiner	:	Unknown
Art Unit	:	2875
Conf. No.	:	3370

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Submitted herewith in the above-identified application is an Information Disclosure Statement listing references for consideration. Listed references are of record in U.S. patent application No. 12/269,849, filed November 12, 2008, which is the parent of this application, and is relied upon for an earlier filing date under 35 USC 120. Copies of the references are not submitted pursuant to 37 CFR 1.98(d).

Timing of Disclosure

This Information Disclosure Statement is being filed before the receipt of a first Office Action on the merits, and presumably no fee is required. If a first Office Action on the merits was mailed before the mailing date of this Statement, the Commissioner is authorized to charge the fee set forth in 37 CFR 1.17(p) to Deposit Account No. 11-1410.

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: July 16, 2012

By: _____

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13615055

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Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	2,917,980	12-22-1959	Grube et al.	
	2	3,068,754	12-18-1962	Benjamin et al.	
	3	3,763,468	10-02-1973	Ovshinsky et al.	
	4	4,053,208	10-11-1977	Kato et al.	
	5	4,275,395	06-23-1981	Dewey et al.	
	6	4,573,191	02-25-1986	Kidode et al.	
	7	4,725,863	02-16-1988	Dumbreck et al.	
	8	4,791,572	12-13-1988	Green et al.	
	9	4,843,568	06-27-1989	Krueger et al.	
	10	4,887,898	12-19-1989	Halliburton et al.	
	11	4,948,371	08-14-1990	Howard F. Hall	
	12	5,001,558	03-19-1991	Burley et al.	
	13	5,138,304	08-11-1992	Bronson	
	14	5,151,718	09-29-1992	Nelson, William E.	
	15	5,239,373	08-24-1993	Tang et al.	
	16	5,276,609	01-04-1994	Durlach	
	17	5,319,496	06-07-1994	Jewell et al.	
	18	5,325,472	06-28-1994	Horiuchi et al.	
	19	5,325,473	06-28-1994	Monroe et al.	
	20	5,426,474	06-20-1995	Rubstov et al.	
	21	5,436,639	07-25-1995	Arai et al.	
	22	5,442,252	08-15-1995	Golz, Thomas M.	
	23	5,454,043	09-26-1995	Freeman	
	24	5,497,269	03-05-1996	Gal, George	
	25	5,510,828	04-23-1996	Lutterbach et al.	
	26	5,526,182	06-11-1996	Jewell et al.	
	27	5,528,263	06-18-1996	Platzker et al.	
	28	5,528,297	06-18-1996	Seegert et al.	
	29	5,534,917	07-09-1996	MacDougall	
	30	5,548,694	08-20-1996	Gibson	

Examiner Signature	Date Considered

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT		
	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 2 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	31	5,591,972	01-07-1997	Noble et al.	
	32	5,594,469	01-14-1997	Freeman et al.	
	33	5,633,691	05-27-1997	Vogeley et al.	
	34	5,703,637	12-30-1997	Miyazaki et al.	
	35	5,808,784	09-15-1998	Ando et al.	
	36	5,846,086	12-08-1998	Bizzi et al.	
	37	5,861,881	01-19-1999	Freeman et al.	
	38	5,882,204	03-16-1999	Iannazo et al.	
	39	5,923,380	07-13-1999	Yang et al.	
	40	5,923,475	07-13-1999	Kurtz et al.	
	41	5,953,152	09-14-1999	Hewlett	
	42	5,969,754	10-19-1999	Zeman	
	43	5,978,136	11-02-1999	Ogawa et al.	
	44	5,982,352	11-09-1999	Pryor	
	45	6,008,800	12-28-1999	Pryor	
	46	6,058,397	05-02-2000	Barrus et al.	
	47	6,075,895	06-16-2000	Qiao et al.	
	48	6,084,979	07-04-2000	Kanada et al.	
	49	6,088,612	07-11-2000	Blair	
	50	6,097,369	08-01-2000	Wambach	
	51	6,106,119	08-22-2000	Edwards	
	52	6,118,888	09-12-2000	Chino et al.	
	53	6,125,198	09-26-2000	Onda	
	54	6,166,744	12-26-2000	Jaszlics et al.	
	55	6,176,782	01-23-2001	Lyons et al.	
	56	6,191,773	02-20-2011	Maruno et al.	
	57	6,198,487	03-06-2001	Fortenbery et al.	
	58	6,198,844	03-06-2001	Nomura	
	59	6,217,449	04-17-2001	Kaku	
	60	6,263,339	07-17-2001	Hirsh	

Examiner Signature	Date Considered

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 3 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	61	6,270,403	08-07-2001	Watanabe et al.	
	62	6,278,418	08-21-2001	Doi	
	63	6,292,171	09-18-2001	Fu et al.	
	64	6,304,267	10-16-2001	Sata	
	65	6,308,565	10-30-2001	French et al.	
	66	6,323,895	11-27-2001	Sata	
	67	6,333,735	12-25-2001	Anvekar	
	68	6,335,977	01-01-2002	Kage	
	69	6,339,748	01-15-2002	Hiramatsu	
	70	6,349,301	02-19-2002	Mitchell et al.	
	71	6,353,428	03-05-2002	Maggioni et al.	
	72	6,359,612	03-19-2002	Peter et al.	
	73	6,388,657	05-14-2002	Natoli	
	74	6,394,896	05-28-2002	Sugimoto	
	75	6,400,374	06-04-2002	Lanier	
	76	6,407,870	06-18-2002	Hurevich et al.	
	77	6,414,672	07-02-2002	Rekimoto et al.	
	78	6,445,815	09-03-2002	Sato	
	79	6,454,419	09-24-2002	Kitazawa	
	80	6,480,267	11-12-2002	Yanagi et al.	
	81	6,491,396	12-10-2002	Karasawa et al.	
	82	6,501,515	12-31-2002	Iwamura	
	83	6,522,312	02-18-2003	Ohshima et al.	
	84	6,545,706	04-08-2003	Edwards et al.	
	85	6,552,760	04-22-2003	Gotoh et al.	
	86	6,598,978	07-29-2003	Hasegawa	
	87	6,607,275	08-19-2003	Cimini et al.	
	88	6,611,241	08-26-2003	Firester et al.	
	89	6,654,734	11-25-2003	Mani et al.	
	90	6,658,150	12-02-2003	Tsuji et al.	

Examiner Signature	Date Considered

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 4 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	91	6,661,918	12-09-2003	Gordon et al.	
	92	6,677,969	01-13-2004	Hongo	
	93	6,707,054	03-16-2004	Ray	
	94	6,707,444	03-16-2004	Hendriks et al.	
	95	6,712,476	03-30-2004	Ito et al.	
	96	6,720,949	04-01-2004	Pryor et al.	
	97	6,732,929	05-11-2004	Good et al.	
	98	6,747,666	06-08-2004	Utterback	
	99	6,752,720	06-22-2004	Clapper et al.	
	100	6,754,370	06-22-2004	Hall-Holt et al.	
	101	6,791,700	09-14-2004	Omura et al.	
	102	6,808,293	10-26-2004	Watanabe et al.	
	103	6,826,727	11-30-2004	Mohr et al.	
	104	6,831,664	12-14-2004	Marmaropoulos et al.	
	105	6,871,982	03-29-2005	Holman et al.	
	106	6,877,882	04-12-2005	Haven et al.	
	107	6,912,313	06-28-2005	Li	
	108	6,965,693	11-15-2005	Kondo et al.	
	109	6,975,360	12-13-2005	Slatter	
	110	6,999,600	02-14-2006	Venetianer	
	111	7,015,894	03-21-2006	Morohoshi	
	112	7,042,440	06-27-2006	Pryor et al.	
	113	7,054,068	05-30-2006	Yoshida et al.	
	114	7,058,204	06-06-2006	Hildreth et al.	
	115	7,068,274	06-27-2006	Welch et al.	
	116	7,069,516	06-27-2006	Rekimoto	
	117	7,084,859	08-01-2006	Pryor et al.	
	118	7,088,508	08-08-2006	Ebina et al.	
	119	7,129,927	10-31-2006	Mattsson	
	120	7,149,262	12-12-2006	Nayar et al.	

Examiner Signature	Date Considered

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PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 5 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	121	7,158,676	01-02-2007	Rainsford	
	122	7,170,492 (KM2326.3PPPCP1)	01-30-2007	Bell	
	123	7,190,832	03-13-2007	Frost et al.	
	124	7,193,608	03-20-2007	Stuerzlinger	
	125	7,227,526	06-05-2007	Hildreth et al.	
	126	7,259,747 (KM2326.003A)	08-21-2007	Bell	
	127	7,262,874	08-28-2007	Suzuki	
	128	7,268,950	09-11-2007	Poulsen	
	129	7,289,130	10-30-2007	Satoh et al.	
	130	7,330,584	02-12-2008	Weiguo et al.	
	131	7,339,521	03-04-2008	Scheidemann et al.	
	132	7,348,963 (KM2326.3PPPPCP1)	03-25-2008	Bell	
	133	7,379,563	05-27-2008	Shamaie	
	134	7,382,897	06-03-2008	Brown et al.	
	135	7,394,459	07-01-2008	Bathiche et al.	
	136	7,428,542 (KM2326.010A)	09-23-2008	Fink et al.	
	137	7,431,253	10-07-2008	Yeh	
	138	7,432,917	10-07-2008	Wilson et al.	
	139	7,468,742	12-23-2008	Ahn et al.	
	140	7,536,032 (KM2326.005A)	05-19-2009	Bell	
	141	7,559,841	07-14-2009	Hashimoto	
	142	7,576,727 (KM2326.011A)	08-18-2009	Bell	
	143	7,598,942	10-06-2009	Underkoffler et al.	
	144	7,619,824	11-17-2009	Poulsen	
	145	7,665,041	02-16-2010	Wilson et al.	
	146	7,710,391 (KM2326.003CP3)	05-04-2010	Bell et al.	
	147	7,728,280	06-01-2010	Feilkas et al.	

Examiner Signature	Date Considered
***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 6 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	148	7,737,636	06-15-2010	Li et al.	
	149	7,745,771	06-29-2011	Troxell et al.	
	150	7,809,167 (KM2326.005C1)	10-05-2010	Bell	
	151	7,834,846 (KM2326.003DV1)	11-16-2010	Bell	
	152	7,961,906	06-14-2011	Ruedin	
	153	7,971,156	06-28-2011	Albertson et al.	
	154	8,035,612 (KM2326.003CP4)	10-11-2011	Bell et al.	
	155	8,035,624 (KM2326.3CPCPC1)	10-11-2011	Bell et al.	
	156	8,085,293	12-27-2011	Brodsky et al.	
	157	8,085,994	12-27-2011	Kim	
	158	8,230,367 (KM2326.008A)	07-24-2012	Bell et al.	
	159	RE 41,685	09-14-2010	Feldman et al.	
	160	2001/0012001	08-09-2001	Rekimoto et al.	
	161	2001/0033675	10-25-2001	Maurer et al.	
	162	2002/0006583	01-17-2002	Michiels et al.	
	163	2002/0032697	03-14-2002	French et al.	
	164	2002/0041327	04-11-2002	Hildreth et al.	
	165	2002/0064382	05-30-2002	Hildreth et al.	
	166	2002/0081032	06-27-2002	Chen et al.	
	167	2002/0103617	08-01-2002	Uchiyama et al.	
	168	2002/0105623	08-08-2002	Pinhanez	
	169	2002/0130839	09-19-2002	Wallace et al.	
	170	2002/0140633	10-03-2002	Rafii et al.	
	171	2002/0140682	10-03-2002	Brown et al.	
	172	2002/0178440	11-28-2002	Agnihorti et al.	
	173	2003/0032484	02-13-2003	Ohshima et al.	
	174	2003/0091724	05-15-2003	Mizoguchi	
	175	2003/0093784	05-15-2003	Dimitrova et al.	

Examiner Signature	Date Considered
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 7 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	176	2003/0098819	05-29-2003	Sukthankar et al.	
	177	2003/0103030	06-05-2003	Wu	
	178	2003/0113018	06-19-2003	Nefian et al.	
	179	2003/0122839	07-03-2003	Matraszek et al.	
	180	2003/0137494	07-24-2003	David J. Tulbert	
	181	2003/0161502	08-28-2003	Morihara et al.	
	182	2003/0178549	09-25-2003	Ray.	
	183	2004/0005924	01-08-2004	Watabe et al.	
	184	2004/0015783	01-22-2004	Lennon et al.	
	185	2004/0046744	03-11-2004	Rafii et al.	
	186	2004/0073541	04-15-2004	Lindblad et al.	
	187	2004/0091110	05-13-2004	Barkans	
	188	2005/0028188	02-03-2005	Latona et al.	
	189	2005/0039206	02-17-2005	Opdycke	
	190	2005/0086695	04-21-2005	Keele et al.	
	191	2005/0185828	04-25-2005	Semba et al.	
	192	2005/0088407 (KM2326.001A)	04-28-2005	Bell	
	193	2005/0104506	05-19-2005	Youh et al.	
	194	2005/0122308 (KM2326.003CP2)	06-09-2005	Bell et al.	
	195	2005/0132266	06-16-2005	Ambrosino et al.	
	196	2005/0147282	07-07-2005	Fujii	
	197	2005/0195598	09-08-2005	Dancs et al.	
	198	2005/0265587	12-01-2005	Schneider	
	199	2006/0010400	01-12-2006	Dehlin et al.	
	200	2006/0031786	02-09-2006	Hillis et al.	
	201	2006/0168515	07-27-2006	Dorsett, Jr. et al.	
	202	2006/0184993	08-17-2006	Goldthwaite et al.	
	203	2006/0187545	08-24-2006	Doi	
	204	2006/0227099	10-12-2006	Han et al.	

Examiner Signature	Date Considered

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PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 8 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	205	2006/0242145	10-26-2006	Krishnamurthy et al.	
	206	2006/0256382	11-16-2006	Matraszek et al.	
	207	2006/0258397	11-16-2006	Kaplan et al.	
	208	2006/0294247	12-28-2006	Hinckley et al.	
	209	2007/0002039	01-04-2007	Pendleton et al.	
	210	2007/0019066	01-25-2007	Cutler	
	211	2007/0285419	02-13-2007	Givon	
	212	2008/0013826	01-17-2008	Hillis et al.	
	213	2008/0018595	01-24-2008	Hildreth et al.	
	214	2008/0030460	02-07-2008	Hildreth et al.	
	215	2008/0040692	02-14-2008	Sunday et al.	
	216	2008/0062123 (KM2326.3CP4CP1)	03-13-2008	Bell	
	217	2008/0062257	03-13-2008	Corson	
	218	2008/0090484	04-17-2008	Lee et al.	
	219	2008/0150890 (KM2326.3CP3C1)	06-26-2008	Bell et al.	
	220	2008/0252596 (KM2326.006A)	10-16-2008	Bell et al.	
	221	2009/0027337	01-29-2009	Hildreth	
	222	2009/0079813	03-26-2009	Hildreth	
	223	2009/0102788	04-23-2009	Nishida et al.	
	224	2009/0172606	07-02-2009	Dunn et al.	
	225	2009/0235295 (KM2326.001C1)	09-17-2009	Bell et al.	
	226	2010/0026624 (KM2326.011C1)	02-04-2010	Bell et al.	
	227	2010/0039500 (KM2326.013A)	02-18-2010	Bell et al.	
	228	2010/0060722 (KM2326.015A)	03-11-2010	Bell et al.	
	229	2010/0121866 (KM2326.012A)	05-13-2010	Bell et al.	

FOREIGN PATENT DOCUMENTS

Examiner Signature	Date Considered

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	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 9 OF 19	Attorney Docket No.	KM2326.007D1

Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	230	EP 0 055 366 A2	07-07-1982	Edgar		
	231	EP 0 626 636 A2	11-30-1994	Arai et al.		
	232	EP 0 913 790 A1	05-06-1999	Takenaka Corp.		
	233	EP 1 689 172 A1 (KM2326.3VR1EP)	06-04-2002	Bell		
	234	JP 57-094672	06-12-1982	Koichi et al.		
	235	JP 2000-105583	04-11-2000	Ricoh Co. Ltd.		
	236	JP 2002-014997	01-18-2002	NTT Comware Corp.		
	237	JP 2002-092023	03-29-2002	Nippon Telegr & Teleph Corp. (NTT)		
	238	JP 2002-171507	06-14-2002	Yokogawa Electric Corp.		
	239	JP 2003-271084	09-25-2003	Omron Corp.		
	240	JP 2003-517642	05-27-2003	Giraud et al.		
	241	KR 2003-0058894	07-07-2003	Cho Yeong Tark		X-Abs
	242	WO 98/38533 A1	09-03-1998	Maggioni et al.		
	243	WO 00/16562 A1	03-23-2000	General Instrument Corp.		
	244	WO 01/63916 A1	08-30-2001	Slaney et al.		
	245	WO 02/01537 A2	01-03-2002	Koninklijke Philips Electronics		
	246	WO 02/100094 A2 (KM2326.003VPC)	12-12-2002	Bell		
	247	WO 2004/055776 A1 (KM2326.011VPC)	07-01-2004	Reactrix Systems		
	248	WO 2004/097741 A1	11-11-2004	Fujitsu Ltd.		
	249	WO 2005/041578 A2 (KM2326.001VPC)	05-06-2005	Bell et al.		
	250	WO 2005/041579 A2 (KM2326.005VPC)	05-06-2005	Bell		
	251	WO 2005/057398 A2 (KM2326.003BPC)	06-23-2005	Bell et al.		
	252	WO 2005/057399 A2 (KM2326.003HPC)	06-23-2005	Bell et al.		
	253	WO 2005/057921 A2 (KM2326.003PPC)	06-23-2005	Bell et al.		
	254	WO 2005/091651 A2 (KM2326.003GPC)	09-02-2005	Reactrix Systems, Inc.		
	255	WO 2007/019443 A1 (KM2326.003FPC)	02-15-2007	Bell		

Examiner Signature	Date Considered

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 10 OF 19	Attorney Docket No.	KM2326.007D1

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	256	WO 2008/124820 A1 (KM2326.006VPC)	10-16-2008	Bell et al.		
	257	WO 2009/035705 A1 (KM2326.008VPC)	03-19-2009	Reactrix Systems, Inc.		

NON PATENT LITERATURE DOCUMENTS			
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	258	EffecTV Version 0.2.0 released March 27, 2001, available online at http://web.archive.org/web/20010101-20010625re_http://effectv.sourceforge.net	
	259	Index of EffecTV, as downloaded on April 30, 2007 at http://effectv.cvs.sourceforge.net/effectv/EffecTV/?pathrev=rel_0_2_0	
	260	R111, The Transformation From Digital Information to Analog Matter, available online at http://www.particles.de/paradocs/r111/10mkp2004/hmtl/r111_text111hock04.html, cited on January 17, 2005 during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	261	2001 Symposium on Interactive 3D Graphics program description, ACM SIGGRAPH, held March 19-21, 2001, Research Triangle Park, NC, downloaded from http://www.allconferences.com/conferences/2000830092631/, cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	262	Affidavit of Daniel Barthels regarding EffecTV, dated May 15, 2007 (partial machine translation), cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	263	Announcement: Workshop on Perceptual User Interfaces, The Banff Rocky Mountain Resort, Banff, Alberta, Canada, October 20-21, 1997, can be found at http://www.research.microsoft.com/PUIWorkshop/ cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	264	Bodymover Body Movement as a Means to Obtain an Audiovisual Spatial Experience, 2000 ART+COM AG Berlin; http://www.artcom.de/index.php?option=com_acprojects&page=6&id=28&Itemid=144&details=0&lang=en, as downloaded on August 8, 2005.	
	265	ART+COM Bodymover 2000, as downloaded on August 21, 2009 from http://www.artcom.de/index.php?option=com_acprojects&page=6&id=28&Itemid=144&details=0&lang=en, cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP)	
	266	Brown, Matthew, et al. "Multi-Image Matching using Multi-Scale Oriented Patches," Technical Report, December 2004, pp 1-48, available online at ftp://ftp.research.microsoft.com/pub/tr/TR-2004-133.pdf	
	267	Brown, Matthew, et al., "Multi-Image Matching using Multi-Scale Oriented Patches," Proceedings of the 2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, Conference Publication Date: 20-25 June 2005, 8 pgs.	

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	268	Buxton, Bill, "Multi-Touch Systems That I Have Known and Loved," accessed March 21, 2007, http://billbuxton.com/multitouchOverview.html	
	269	Communication dated December 10, 2008 from Patentanwalt attaching article by Katy Bachman, entitled "Reactrix Up for Sale," cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	270	Crouser, P.D., et al., "Unattenuated tracer particle extraction through time-averaged, background image subtraction with outlier rejection," Experiments in Fluids, 22, 1997, 220-228, Springer-Verlag.	
	271	Dachselt, Raimund, et al., "CONTIGRA: An XML-Based Architecture for Component-Oriented 3D Applications, 3D Technologies for the World Wide Web, Proceedings of the Seventh International Conference on 3D Technology," ACM, February 24-28, 2002, pgs. 155-163.	
	272	Davis, J.W., et al., "SIDEshow: A Silhouette-based Interactive Dual-screen Environment," August 1998, MIT Media Lab Tech Report no. 457.	
	273	Demarest, Ken, "Sand," 2000, Mine Control, art installation, available online at http://www.mine-control.com, downloaded on March 15, 2007	
	274	DePiero et al; "3-D Computer Vision Using Structured Light: Design, Calibrations and Implementation Issues"; Advances in Computers, Volume 43, Pgs. 243-278, 1996	
	275	EffecTV Software Source: effect module, dated May 20, 2001 (German); cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	276	Elgammal, Ahmed, et al., "Non-parametric Model for Background Subtraction," June 2000, European Conference on Computer Vision, Lecture Notes on Computer Science, Vol. 1843, pp. 751-767.	
	277	Foerterer, Holger, "Fluidum," 1999, art installation, description available online at http://www.foerterer.com/fluidum, downloaded on March 16, 2007	
	278	Foerterer, Holger, "Helikopter," 2001, art installation, description available online at http://www.foerterer.com/helikopter/index.htm, downloaded on March 16, 2007	
	279	Freeman, William, et al., "Computer vision for interactive computer graphics," May-June 1998, IEEE Computer Graphics and Applications, vol. 18, no. 3, pp. 42-53.	
	280	Frisken, Sarah F. et al., "Adaptively Sampled Distance Fields: A General Representation of Shape for Computer Graphics," July 23-28, 2000, Proceedings Of the 27th Annual Conference on Computer Graphics and Interactive Techniques, pp. 249-254.	
	281	Fujihata, Masaki, "Beyond Pages," 1995, art installation, description available online at http://on1.zkm.de/zkm/werke/BeyondPages downloaded on March 16, 2007	
	282	Goetz, Frank, et al., "An XML-based Visual Shading Language for Vertex and Fragment Shaders," 3D Technologies for the World Wide Web, Proceedings of Ninth International Conference on 3D Technology; ACM, April 5-8, 2004; pgs. 87-97.	
	283	GroundFX Document, GestureTek (Very Vivid, Inc.), description available online at http://www.gesturetek.com/groundfx, downloaded on August 11, 2006.	
	284	Haller, Michael et al., "Coeno-Storyboard: An Augmented Surface for Storyboard Presentations," Mensch & Computer 2005, September 4-7, 2005, Linz, Austria	

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	285	Han, Jefferson Y., "Low-Cost Multi-Touch Sensing Through Frustrated Total Internal Reflection," October 23-26, 2005, ACM Symposium on User Interface Software and Technology (UIST)	
	286	Harville, Michael et al., "Foreground Segmentation Using Adaptive Mixture Models in Color and Depth," July 8, 2001, Proceedings of IEEE Workshop on Detection and Recognition of Events in Video, pp. 3-11.	
	287	Hemmer, Raphael Lozano, "Body Movies," 2002, art project/installation, description available online at http://www.lozano-hemmer.com/eproyecto.html downloaded on March 16, 2007	
	288	Hoff, Kenneth E. III et al, "Fast and Simple 2D Geometric Proximity Queries Using Graphics Hardware," March 19-21, 2001, Proc. Of the 2001 Symposium on Interactive 3D Graphics, pp. 145-148.	
	289	Huang, Mark et al. "Shadow Vision," Introduction to Computer Graphics, Fall 1999, December 6, 1999; pgs. 1-10, XP55013291 http:groups.csail.mit.edu/graphics/classes/6.837/F99/projects/reports/team16.pdf	
	290	Ivars Peterson, "Artificial reality; combining a person's live video image with computer graphics suggests novel ways of working and playing with computers" Science News, June 22, 1985.	
	291	Jabri, Sumer et al., "Detection and Location of People in Video Images Using Adaptive Fusion of Color and Edge Information;" presented at the Int. Conf. Pattern Recognition, Barcelona, Spain, 2000.	
	292	Joyce, Arthur W. III, et al., "Implementation and capabilities of a virtual interaction system," September 10-11, 1998, Proceedings 2nd European Conference on Disability, Virtual Reality and Associated Technologies, Skovde, Sweden, pp. 237-245.	
	293	Katz, Itai et al., "A Multi-Touch Surface Using Multiple Cameras," October 3, 2007, Advanced Concepts for Intelligent Vision Systems, Volume 4678/2007	
	294	Keays, Bill, "metaField Maze," 1998, exhibited at Siggraph'99 Emerging Technologies and Ars Electronica August 8-13, 1999, description available online at http://www.billkeays.com/metaFieldInfosheet1A.pdf	
	295	Keays, Bill, "Using High-Bandwidth Input/Output in Interactive Art," June 1999, Master's Thesis, Massachusetts Institute of Technology, School of Architecture and Planning.	
	296	Khan, Jeff; "Intelligent Room with a View"; April-May 2004, RealTime Arts Magazine, Issue 60, available online at www.realtimearts.net/article/60/7432	
	297	Kjeldesn, Rick et al., "Dynamically Reconfigurable Vision-Based User Interfaces," April 2003, 3rd International Conference on Vision Systems (ICVVS '03), Graz, Austria, pp. 6-12	
	298	Kjeldsen, R. et al., "Interacting with Steerable Projected Displays," May 20-21, 2002, Proceedings Of the 5th International Conference on Automatic Face and Gesture Recognition, Washington, D.C.	
	299	Kreuger, Myron, "Videoplace - An Artificial Reality," April 1985, Conference on Human Factors in Computing Systems, San Francisco, California, pp. 35-40.	
	300	Kreuger, Myron, "Videoplace," 1969 and subsequent, summary available online at http://www.jtnimoy.com/itp/newmediahistory/videoplace, downloaded March 21, 2007	

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	301	Kurapati, Kaushal, et al., "A Multi-Agent TV Recommender," July 13-14, 2001, Workshop on Personalization in Future TV, pp. 1-8, XP02228335.	
	302	Lamarre, Mathieu, et al., "Background subtraction using competing models in the block-DCT domain," Pattern Recognition, 2002 Proceedings, 16 International Conference in Quebec City, Que., Canada, August 11-15, 2002.	
	303	Lantagne, Michel, et al., "VIP: Vision tool for comparing Images of People," Vision Interface, June 11-13, 2003, pgs. 1-8.	
	304	Leibe, Bastian, et al., "The Perspective Workbench; Toward Spontaneous and Natural Interaction in Semi-Immersive Virtual Environments," March 18-22, 2000, IEEE Computer Society, Los Alamitos, CA; Pgs. 13-20	
	305	Leibe, Bastian, et al., "Towards Spontaneous Interaction with the Perceptive Workbench, a Semi-Immersive Virtual Environment," November/December 2000, IEEE Computer Graphics and Applications, Vol., 20, No. 6, pp. 54-65.	
	306	Lengyel, Jed et al., "Real-Time Robot Motion Planning Using Rasterizing Computer Graphics Hardware," August 1990, ACM SIGGRAPH Computer Graphics, Vol. 24, Issue 4, pp. 327-335.	
	307	Levin, Golan "Computer Vision for Artists and Designers: Pedagogic Tools and Techniques for Novice Programmers," August 2006, AI & Society, Vol. 20, Issue 4, pp. 462-482	
	308	Lin, Mingxiu et al., "A New Approach for Vision-based Rear Vehicle Tracking," Key Laboratory of Integrated Automation of Process Industry, Ministry of Education, Northeastern University, Shenyang, Liaoning Province, China, held May 23-25, 2007, pgs. 107-1	
	309	Livingston, Mark Alan, "Vision-based Tracking with Dynamic Structured Light for Video See-through Augmented Reality," 1998, Ph.D. Dissertation, University of North Carolina at Chapel Hill, cited on June 18, 2007 during opposition of European Application N	
	310	Malik, Shahzad et al., "Visual Touchpad: A Two-Handed Gestural Input Device," October 13-15, 2004, International Conference on Multimodal Interfaces (ICMI '04)	
	311	Maria Langer, "Mac OS X 10.2: Visual QuickStart Guide," September 17, 2002, Peachpit Press, P. 111	
	312	MacIver, Malcolm, et al., "Body Electric," April 15-June 29, 2003, art installation, description available online at http://www.neuromech.northwestern.edu/uropatagium/#ArtSci	
	313	Mandala Systems, "Video Gesture Control System Concept," 1986, description available online at http://www.vividgroup.com/tech.html, downloaded on March 16, 2007.	
	314	Microsoft Surface multi-touch interface table unveiled, May 30, 2007, downloaded from http://www.dancewithshadows.com/tech/microsoft-surface.asp	
	315	Microsoft Surface Web Page, downloaded from http://www.microsoft.com/surface/Pages/Product/WhatIs.aspx on September 24, 2009.	
	316	Experience Microsoft Surface, downloaded from http://www.microsoft.com/surface/Pages/Product/Specifications.aspx on September 24, 2009.	
	317	Microsoft Surface, downloaded from http://en.wikipedia.org/wiki/Microsoft_surface on September 24, 2009.	

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	318	Mitsubishi Diamond Touch, http://www.merl.com/projects/DiamondTouch/ visited March 21, 2007	
	319	Mo, Zhenyao "SmartCanvas: A Gesture-Driven Intelligent Drawing Desk System," January 9-12, 2005, Proceedings of Intelligent User Interfaces (IUI '05)	
	320	Morano, Raymond A. et al., "Structured Light Using Pseudorandom Codes," March 1998, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 20, No. 3.	
	321	Morris, T. et al., "Real-Time Fingertip Detection for Hand Gesture Recognition," September 9-11, 2002, Advanced Concepts for Intelligent Vision Systems (ACIVS '04), Ghent University, Belgium	
	322	Muench, Wolfgang, "Bubbles", Prix Ars Electonica Catalog 1999, Springer-Verlag, Berlin, Germany; available online at http://hosting.zkm.de/wmuench/bub/text, downloaded on March 16, 2007.	
	323	Paradiso, Joseph et al., "Optical Tracking for Music and Dance Performance," Conference on Optical 3-D Measurement Techniques, XX, XX, no.4th, September 30, 1997, pgs. 1-8, XP002548974. http://www.media.mit.edu/resenv/pubs/papers/97_09_Zurich_3D4.pdf	
	324	Paradiso, Joseph et al., "New Sensor and Music Systems for Large Interactive Surfaces," August 2000, Proceedings Of the Interactive Computer Music Conference, Berlin, Germany, pp. 277-280.	
	325	Penny, Simon, "Fugitive"; October 1997; http://www.ace.uci.edu/penny/works/fugitive/fugitive.html	
	326	Penny, Simon, et al., "Fugitive II, " January 8 - March 14, 2004, Australian Center for the Moving Image, art installation, description available online at http://www.acmi.net.au/fugitive.jsp?	
	327	Penny, Simon, et al.; "TRACES: WIRELESS full body tracking in the CAVE, December 16-18, 1999; Japan; ICAT Virtual Reality Conference; http://turing.ace.uci.edu/pennytexts/traces/	
	328	Pinhanez, C. et al., "Ubiquitous Interactive Graphics," July 29-31 2003, IBM Research Report RC22495, available at http://www.research.ibm.com/ed/publications/rc22495.pdf	
	329	Pinhanez, C., "The Everywhere Displays Projector: A Device to Create Ubiquitous Graphical Interfaces," Ubicomp 2001: Ubiquitous Computing: International Conference Atlanta, Georgia, USA, September 30 - October 2, 2001 Proceedings (Lecture Notes in Compute	
	330	PLASMA; 3 pages; http://www.particles.de/paradocs/plasma/index.html, cited in U.S. Application No. 10/160,217 on August 8, 2005 (Attorney Docket No. KM2326.003A).	
	331	Quinz, Emanuele; "Conference Papers", April 10, 2001, XP55013293, Retrieved from the internet http://www.isea2000.com/pop_actes.htm	
	332	Quinz, Emanuele; "Digital Performance", pages 1-3, Retrieved from the internet on November 28, 2011 http://www.noemalab.org/sections/ideas/ideas_articles/pdf/	
	333	Reatrix, Inc. website, 28 March 2003, http://web.archive.org/web/20030328234205/http://www.reatrix.com and http://web.archive.org/web/20030328234205/http://www.reatrix.com/webdemo.php	
	334	Rekimoto, J., et al., "Perceptual Surfaces: Towards a Human and Object Sensitive Interactive Display," October 19-21, 1997, Proceedings Of the Workshop on Perceptual User Interfaces, Banff, Canada, pp.30-32.	

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	335	Rekimoto, Jun, "SmartSkin: An Infrastructure for Freehand Manipulation on Interactive Surfaces." Vol. No.4, Issue No. 1, Pages 113-120, April 2002	
	336	Ringel, M. et al., "Barehands: Implement-Free Interaction with a Wall-Mounted Display," March 31 - April 5, 2001, Proceedings Of the 2001 ACM CHI Conference on Human Factors in Computing Systems (Extended Abstracts), p. 367-368.	
	337	Rogala, Miroslav, "Lovers Leap," November 21-26, 1995, art installation, Dutch Electronic Arts Festival, description available online at http://wayback.v2.nl/DEAF/persona/rogala.html	
	338	Rokeby, David, "Very Nervous System (VNS)," March 1995, Wired Magazine, available online at <http://www.wired.com/wired/archive/3.03/rokeby.html>; sold as software at http://homepage.mac.com/davidrokeby/softVNS.html	
	339	Rokeby, David, "softVNS 2 real time video processing and tracking software for Max;" SoftVNS 2 downloads, as downloaded from http://homepage.mac.com/davidrokeby/softVNS.html on March 16, 2007.	
	340	Sato, Yoichi, et al., "Fast Tracking of Hands and Fingertips in Infrared Images for Augmented Desk Interface," March 2000, 4th International Conference on Automatic Face -and Gesture-Recognition, Grenoble, France.	
	341	Schneider, John K., "Improved Fingerprint System Using Rolled and Multi-segmented Techniques," Provisional US Patent Application No. 60/575952, filed on 06/01/2004, pages 1-6.	
	342	Screenshots of Reactrix Product Demo Video, 28 March 2003, http://web.archive.org/web/20030407174258/http://www.reactrix.com/demo/reactrix_demo.wmv	
	343	Sester, Marie, "Access," December 2001, Interaction "99 Biennial Catalog, Gifu, Japan, available online at http://www.accessproject.net/concept.html	
	344	Snibbe, Scott, "Boundary Functions," September 7-12, 1998, art installation, description available online at http://snibbe.com/scott/bf/index.html	
	345	Snibbe, Scott, "Screen Series," 2002-2003 art installation, description available online at http://snibbe.com/scott/screen/index.html, downloaded on March 16, 2007.	
	346	Sonneck, Georg, et al., "Optimized One-to-One Personalization of Web Applications using a Graph Based Model," IEEE-22, April 26, 2003, 9 pgs.	
	347	Sparacino, Flavia, et al., "Dance Space: An Interactive Video Interface", Actes/Proceeding, ISEA2000-10/12/2000-Auditorium 1, December 10, 2000	
	348	Sparacino, Flavia, et al., "Media in performance: interactive spaces for dance, theater, circus and museum exhibits," November 2000, IBM Systems Journal, vol. 39, no. 3-4, pp. 479-510.	
	349	Sparacino, Flavia, "(Some) Computer Visions Based Interfaces for Interactive Art and Entertainment Installations," 2001, INTER_FACE Body Boundaries, Anomalie digital_arts, no. 2, Paris, France, http://alumni.media.mit.edu/~flavia/publications.html	
	350	Stauffer, Chris, et al., "Learning Patterns of Activity Using Real-Time Tracking," August 2000, IEEE Transaction on Pattern Analysis and Machine Intelligence, vol. 22, no. 8, pp. 747-757.	

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	351	SUPREME PARTICLES, "PLASMA/Architexture," 1994, available online at http://www.particles.de/paradocs/plasma/plasma_e.html downloaded on May 21, 2007	
	352	SUPREME PARTICLES; R111, 1999, available online at http://www.r111.org, obtained July 12, 2005, XP-002989704.	
	353	Tan, et al., "Highlight Removal by Illumination-Constrained Inpainting," Ninth IEEE International Conference on Computer Vision, October 13-16, 2003.	
	354	The History of Microsoft Surface, downloaded from http://www.microsoft.com/presspass/presskits/surfacecomputing/docs/SurfaceHistoryBG.doc on September 24, 2009	
	355	Torr, P.H.S. et al., "The Development and Comparison of Robust Methods for Estimating the Fundamental Matrix," September/October 1997, International Journal of Computer Vision, Vol. 24, No. 3, pp. 271-300	
	356	Toth, Daniel et al., "Illumination-Invariant Change Detection," April 2-4, 2000, 4th IEEE Southwest Symposium on Image Analysis and Interpretation, p. 3.	
	357	Trefzger, Petra, "Vorwerk," 2000, art installation, description available online at http://www.petracolor.de/ cited on January 17, 2005 during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP)	
	358	Utterback, Camille, et al., "Text Rain,"1999, art installation, available online at www.camilleutterback.com/textrain.html, March 16, 2007	
	359	Vogt, Florian et al., "Highlight Substitution in Light Fields," IEEE International Conference on Image Processing, September 22-25, 2002.	
	360	Wang, Junxian, et al., "Specular reflection removal for human detection under aquatic environment," 27 June - 2 July 2004 IEEE Conference on Computer and Pattern Recognition Workshop (CVPRW04) Volume 8, pg. 130.	
	361	Wellner, Pierre, "Interacting with paper on the DigitalDesk," July 1993, Communications of the ACM, Special issue on computer augmented environments: back to the real world, Vol. 36, Issue 7, pp. 87-96.	
	362	Wellner, Pierre, "Digital Desk Calculator:Tangible Manipulation on a Desktop Display" Proceedings of the Symposium on User Interface Software and Technol (UIST), Hilton Head, S. Carolina, November 11-13, 1991	
	363	Wilson, Andrew, "PlayAnywhere: A Compact Interactive Tabletop Projection-Vision System," ACM Symposium on User Interface Software and Technology (UIST), October 23-27, 2005, Seattle, Washington, U.S.A.	
	364	Xiao, Yang; "Throughput and Delay Limits of IEEE 802.11," IEEE Communications Letters, Vol.6, No.8, Pages 355-357, August, 2002	
	365	International Preliminary Report on Patentability for PCT/US2004/035477 (KM2326.001VPC), filed October 25, 2004	
	366	International Search Report for PCT/US2004/035477 (KM2326.001VPC), filed October 25, 2004	
	367	Written Opinion of the International Searching Authority for PCT/US2004/035477 (KM2326.001VPC), filed October 25, 2004	

Examiner Signature	Date Considered

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

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Volkswagen Exhibit 1037, Page 91 of 2532
Volkswagen v. Longhorn - IPR2025-00925

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 17 OF 19	Attorney Docket No.	KM2326.007D1

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
	368	International Preliminary Report on Patentability for PCT/US2004/041318 (KM2326.003BPC), filed December 9, 2004	
	369	International Search Report for PCT/US2004/041318 (KM2326.003BPC), filed December 9, 2004	
	370	Written Opinion of the International Searching Authority for PCT/US2004/041318 (KM2326.003BPC), filed December 9, 2004	
	371	International Preliminary Report on Patentability for PCT/US2006/030720 (KM2326.003FPC), filed on August 4, 2006	
	372	International Search Report for PCT/US2006/030720 (KM2326.003FPC), filed August 4, 2006	
	373	Written Opinion of the International Searching Authority for PCT/US2006/030720 (KM2326.003FPC), filed August 4, 2006	
	374	International Preliminary Report on Patentability for PCT/US2005/008984 (KM2326.003GPC), filed March 18, 2005	
	375	International Search Report for PCT/US2005/008984 (KM2326.003GPC), filed March 18, 2005	
	376	Written Opinion of the International Searching Authority for PCT/US2005/008984 (KM2326.003GPC), filed March 18, 2005	
	377	International Preliminary Report on Patentability for PCT/US2004/041320 (KM2326.003HPC), filed December 9, 2004	
	378	International Search Report for PCT/US2004/041320 (KM2326.003HPC), filed December 9, 2004	
	379	Written Opinion of the International Searching Authority for PCT/US2004/041320 (KM2326.003HPC), filed December 9, 2004	
	380	International Preliminary Report on Patentability for PCT/US2004/041319 (KM2326.003PPC), filed December 9, 2004	
	381	International Search Report for PCT/US2004/041319 (KM2326.003PPC), filed December 9, 2004	
	382	Written Opinion of the International Searching Authority for PCT/US2004/041319 (KM2326.003PPC), filed December 9, 2004	
	383	Article 96(2) Communication dated in European Application No. 02739710.8 (KM2326.003VEP), March 31, 2004	
	384	Observation by third party Michael Saup cited during opposition of European Application No. 02739710.8 filed June 4, 2002 (KM2326.003VEP), dated January 17, 2005	
	385	Observation by third party Petra Trefzger cited during opposition of European Application No. 02739710.8 filed June 4, 2002 (KM2326.003VEP), dated January 17, 2005	
	386	Observation by third party Simon Penny cited during opposition of European Application No. 02739710.8 filed June 4, 2002 (KM2326.003VEP), dated January 17, 2005	

Examiner Signature	Date Considered

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 18 OF 19	Attorney Docket No.	KM2326.007D1

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
	387	Article 96(2) Communication in European Application No. 02739710.8 (KM2326.003VEP), dated February 25, 2005	
	388	Summons to Attend Oral Proceedings in European Application No. 02739710.8 (Attorney Docket No. KM2326.003VEP), dated August 12, 2005.	
	389	Notice of Opposition in European Application No. 02739710.8 (Attorney Docket No. KM2326.003VEP) dated May 14, 2007	
	390	Letter dated from Christian Zuckschwerdt regarding EffecTV, (partial machine translation), cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (KM2326.003VEP), May 16, 2007	
	391	Summons to Attend Oral Proceedings in European Application No. 02739710.8 (Attorney Docket No. KM2326.003VEP), dated June 12, 2009	
	392	Decision revoking the European Patent in European Application No. 02739710.8 (KM2326.003VEP), dated December 28, 2009	
	393	Provision of a copy of the minutes in European Application No. 02739710.8 (KM2326.003VEP), dated December 28, 2009	
	394	Letter of the opponent O2 in European Application No. 02739710.8, filed June 4, 2002 (KM2326.003VEP), dated May 28, 2010	
	395	Notice of Opposition in European Application No. 02739710.8 (KM2326.003VEP), dated August 23, 2010	
	396	International Preliminary Examination Report for PCT/US2002/017843 (KM2326.003VPC), filed June 4, 2002	
	397	Written Opinion for PCT/US2002/017843 (KM2326.003VPC), filed June 4, 2002	
	398	International Search Report for PCT/US2002/017843, filed June 4, 2002 (KM2326.003VPC), dated February 5, 2003	
	399	Extended Search Report for European Application No. 06010825.5, filed June 4, 2002 (KM2326.3VR1EP), dated July 6, 2006	
	400	International Preliminary Report on Patentability for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	401	International Search Report for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	402	Written Opinion of the International Searching Authority for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	403	Invitation to Pay Additional Fees and Partial international Search Report on Patentability for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	404	International Preliminary Report on Patentability for PCT/US2008/059900 (KM2326.006VPC), filed on April 10, 2008	
	405	International Search Report for PCT/US2008/059900 (KM2326.006VPC), filed April 10, 2008	

Examiner Signature	Date Considered
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 19 OF 19	Attorney Docket No.	KM2326.007D1

NON PATENT LITERATURE DOCUMENTS			
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	406	Written Opinion of the International Searching Authority for PCT/US2008/059900 (KM2326.006VPC), filed April 10, 2008	
	407	Official Report in Australian Application No. 2008299883 (KM2326.008VAU), dated December 8, 2010	
	408	International Preliminary Report on Patentability for PCT/US2008/10750 (KM2326.008VPC), filed September 15, 2008	
	409	International Search Report for PCT/US2008/10750 (KM2326.008VPC), filed September 15, 2008	
	410	International Search Report for PCT/US03/40321 (KM2326.011VPC), filed December 15, 2003	

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Examiner Signature	Date Considered
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Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt

EFS ID:	13261706
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Don Neil Caceres Pua/Lori Larson
Filer Authorized By:	Don Neil Caceres Pua
Attorney Docket Number:	KM2326.007D1
Receipt Date:	16-JUL-2012
Filing Date:	16-APR-2012
Time Stamp:	18:25:35
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	1501057 6641e5b0feac43ecc7af0de1b2ca2565c685a9e0	no	20

Warnings:	
Information:	

This is not an USPTO supplied IDS fillable form	
Total Files Size (in bytes):	1501057

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Volkswagen v. Longhorn - IPR2025-00925

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 08/07/2012

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EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

NOTIFICATION DATE	DELIVERY MODE
08/07/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

jayna.cartee@knobbe.com
efiling@knobbe.com

Office Action Summary	Application No.	Applicant(s)	
	13/448,321	BELL, MATTHEW	
	Examiner	Art Unit	
	GORDON STOCK JR	2886	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 April 2012*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1-20* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1-20* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☒ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *16 April 2012* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20120716-1;20120716-2*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original nonprovisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994).

The disclosure of the prior-filed application, Application No. 12/269,849, fails to provide adequate support or enablement in the manner provided by the first paragraph of 35 U.S.C. 112 for one or more claims of this application. 12/269,849 fails to provide adequate support with regards to **claims 15-20**. 12/269,849 fails to mention a tangible computer readable medium having instructions stored thereoon, the instructions configured for execution by a computing system having one or more hardware processors in order to perform operations comprising: the particular instructing and detecting operations. It appears to mention solely the determining operation with regards to a computer program stored in memory (page 5, first paragraph).

Since there is not adequate support for **claims 15-20** in **12/269,849, claims 15-20** have priority back to the original filing date of March 16, 2012.

Information Disclosure Statement

2. The information disclosure statements (IDS) submitted on July 16, 2012 have been considered by the examiner.

Drawings and Specification

3. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the camera and computing device of **claim 1** must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

4. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the

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following is required: it appears that all of **claim 15** lacks proper antecedent basis in the specification.

Claim Objections

5. **Claims 3, 4, 10, 11, and 17** are objected to for the following: 'cluster of lens' should read –cluster of lenses-. Corrections are required.

Claim Rejections - 35 USC § 112

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

The following is a quotation of the fourth paragraph of 35 U.S.C. 112:

> Subject to the following paragraph, a claim in dependent form shall contain a reference to a claim previously set forth and then specify a further limitation of the subject matter claimed. A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers.

7. **Claim 17** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

'The condenser lens' lacks proper antecedent basis in the claim.

8. **Claims 16-20** are rejected under 35 USC 112 fourth paragraph as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. **Claims 16-20** do not further limit **claim 15** for they merely comprise the intended use recitation with regards to the instructions. It has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be

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employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex Parte Masham, 2 USPQ F.2d 1647 (1987).

Claim Rejections - 35 USC § 102

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

10. **Claims 1, 2, 4, 7, 8, 9, 11, and 14** are rejected under 35 U.S.C. 102(e) as being anticipated by **Bell et al. (2008/0252296)-cited by applicant.**

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 102(e) might be overcome either by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not the invention "by another," or by an appropriate showing under 37 CFR 1.131.

As for **claims 1 and 8**, Bell discloses the following: a system for projecting a pattern of infrared light (abstract; paragraph 0028), the system comprising: a light source including a plurality of emitters configured to emit infrared light (paragraph 0028 and 0030 with Fig. 1: 115), the plurality of emitters arranged in a pattern (paragraph 0030: grouped together or

spatially dispersed); a cluster of lenses located in front of the light source (Fig. 3: 315), the cluster of lenses configured to focus and project light from the emitters in a plurality of directions (Fig. 3: 315 with at least focusing in four different directions), the focused and projected light forming a pattern of light (Fig. 3: 315 with 320); a camera configured to detect the pattern of light on an object illuminated by the plurality of emitters (Fig. 1: 110); and a computing device configured to execute instructions stored in memory to determine a location of the object in space utilizing at least the detected pattern of light on the object (abstract; Fig. 1: 120).

As for **claims 2 and 9**, Bell discloses everything as above (see **claims 1 and 8**). In addition, he discloses wherein the plurality of emitters infrared light emitting diodes (paragraph 0030: grouped together or spatially dispersed) configured to generate infrared light that is detectable by the camera but not by the eye of a human observer interacting with the object (abstract; paragraph 0028 with paragraph 0024).

As for **claims 4 and 11,** Bell discloses everything as above (see **claims 1 and 8**). In addition, he discloses the cluster of lenses includes a Fresnel lens (paragraph 0034).

As for **claims 7 and 14**, Bell discloses everything as above (see **claims 1 and 8**). In addition, he suggests the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension (paragraphs 0031: by virtue of the pattern being a random dot pattern).

11. **Claims 15-20** are rejected under 35 U.S.C. 102(b) as being anticipated by **Bell et al. (2008/0252296)-cited by applicant.**

As for **claims 15-20**, Bell discloses the following: a tangible computer readable medium having instructions stored thereon (paragraph 0065). As for 'configured for execution by a

computing system having one or more hardware processors' and 'in order to perform...' it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex Parte Masham, 2 USPQ F.2d 1647 (1987).

With regards to 'instructions,' instructions are functional descriptive material which is non-statutory subject matter. Please see MPEP 2106 IV. B.

If treating the intended recitations as positively cited, with regards to **claims 15, 16, and 20**, Bell discloses the following: a tangible computer readable medium having instructions stored thereon wherein the instructions are executed by a computing system having one or more hardware processors that perform the following operations (**claim 15**) (paragraph 0065: one or more hardware processors demonstrated by plurality of integrated circuits) comprising: instructing a light source to emit light from a plurality of emitters arranged in a pattern, wherein the emitted light is focused in a plurality of directions by a cluster of lenses located in front of the light source in order to form a pattern of light (**claim 15**) (paragraphs 0065-0066 with paragraph 0028 and paragraph 0030 with Fig. 3: 315, 310); detecting the pattern of light on an object illuminated by at least a portion of the pattern of light (**claim 15**) (Fig. 1: 110); determine a location of the object in space utilizing at least the detected pattern of light on the object (**claim 15**) (abstract; Fig. 1: 120); wherein the plurality of emitters includes light emitting diodes (**claim 16**)(paragraph 0030: grouped together or spatially dispersed) configured to generate infrared light that is detectable by the camera but not by the eye of a human observer interacting with the object (**claim 16**)(abstract; paragraph 0028 with paragraph 0024); and

suggests the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension (**claim 20**)(paragraphs 0031: by virtue of the pattern being a random dot pattern).

12. **Claims 15-20** are rejected under 35 U.S.C. 102(b) as being anticipated by **Bell et al. (2005/0110964)-cited by applicant.**

As for **claims 15-20**, Bell demonstrates the following: a tangible computer readable medium having instructions stored thereon (paragraphs 0053, 0054, 0246). As for 'configured for execution by a computing system having one or more hardware processors' and 'in order to perform...' it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex Parte Masham, 2 USPQ F.2d 1647 (1987).

With regards to 'instructions,' instructions are functional descriptive material which is non-statutory subject matter. Please see MPEP 2106 IV. B.

Claim Rejections - 35 USC § 103

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

14. **Claims 3, 10, and 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2008/0252296)-cited by applicant** in view of **Ogawa et al. (5,978,136)-cited by applicant.**

As for **claims 3, 10, and 17**, Bell discloses everything as above (see **claims 1, 8, and 15**). Bell is silent concerning a condenser lens located between the light source and the cluster of lenses wherein the condenser lens concentrates light from the light source to the cluster of lenses. Nevertheless, Ogawa discloses a condenser lens that concentrates light from a light source to a cluster of lenses (Fig. 1: 200, condenser lens, with 310). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have a condenser lens that concentrates the light from the emitters to the cluster of lenses in order to guide the pattern of light to the cluster for projection.

With regards to **claims 3 and 10**, the applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

15. **Claims 5, 12, and 18** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2008/0252296)-cited by applicant** in view of **Bell et al. (2005/0110964)-cited by applicant.**

As for **claims 5, 12, and 18**, Bell ('296) discloses everything as above (see **claims 1, 8 and 15**). As for the emitters are arranged in an irregular pattern, Bell '296 does not explicitly state this. Nevertheless, he does imply this for the emitters may provide a random dot pattern (paragraphs 0030-0032). And Bell '964 suggests the emitters are arranged in a random pattern (paragraph 0186). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the emitters arranged in an irregular pattern in order to produce a random dot pattern to be detected.

With regards to **claims 5 and 12**, the applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might

also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

16. **Claims 6, 13, and 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2008/0252296)-cited by applicant** in view of **Jewell (5,319,496)-cited by applicant.**

As for **claims 6, 13, and 19,** Bell discloses everything as above (see **claims 1, 8, and 15**). As for wherein the pattern of light projected by one of the lenses from the cluster of lenses overlaps with the pattern of light projected by another of the lenses from the cluster of lenses, Bell is silent. Nevertheless, Jewell does demonstrate the pattern of light projected by one of the lenses from the cluster of lenses overlapping with the pattern of light projected by another of the lenses from the cluster of lenses (Fig. 4: 60, 70 with two patterns of light overlapping as it is delivered to 74). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the pattern of light projected by one of the lenses from the cluster of lenses overlaps with the pattern of light projected by another of the lenses from the cluster of lenses in order to deliver a pattern of light to the object to be located.

With regards to **claims 6 and 13**, the applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration

under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

17. **Claims 1, 2, 5, 7-9, 12, 14-16, 18, and 20** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2005/0110964)-cited by applicant** in view of **Li et al. (7,737,636)-cited by applicant.**

As for **claims 1 and 8**, Bell discloses the following: a system for projecting a pattern of infrared light (Fig. 17: 1700, IR LED array: 1710), the system comprising: a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern (Fig. 17: IR LED array: 1710); a camera configured to detect the pattern of light on an object illuminated by the plurality of emitters (Fig. 17: camera); and a computing device configured to execute instructions stored in memory to determine a location of the object in space utilizing at least the detected pattern of light on the object (Fig. 17: 1740; paragraph 0158, paragraph 0162).

As for a cluster of lenses located in front of the light source, the cluster of lenses configured to focus and project light from the emitters in a plurality of directions, the focused and projected light forming a pattern of light**,** Bell does not explicitly state this. Though, he does suggest that there is a cluster of lenses by showing conical shapes above the illuminator (Fig. 17: 1710) as well as showing that the rays from the illuminator are in different directions (Fig. 17: patterned light as well see Fig. 16: light rays diverging from illuminator). Nevertheless, Li

teaches that lens clusters are typically used with LED arrays (Fig. 7d: 5 with 2 as well see Fig. 6(h).) Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have a cluster of lenses located in front of the light source, the cluster of lenses configured to focus and project light from the emitters in a plurality of directions, the focused and projected light forming a pattern of light in order to direct and focus the light from the light source into a predetermined pattern of light.

As for **claims 2 and 9**, Bell in view of Li discloses everything as above (see **claims 1 and 8**). In addition, Bell discloses wherein the plurality of emitters infrared light emitting diodes (Fig. 17: 1710) and suggests it is configured to generate infrared light that is detectable by the camera but not by the eye of a human observer interacting with the object (paragraph 0057).

As for **claims 5, 7, 12, and 14,** Bell in view of Li discloses everything as above (see **claims 1 and 8**). In addition, Bell suggests the emitters are arranged in an irregular pattern and suggests in view of Li the pattern of light projected is aperiodic along at least one dimension (Bell: paragraphs 0074 and 0156; in view of Li there is a cluster of lenses)

If treating the intended recitations as positively cited, with regards to **claims 15**, **16, and 18**, Bell suggests the following: a tangible computer readable medium having instructions stored thereon wherein the instructions are executed by a computing system having one or more hardware processors that perform the following operations (**claim 15**) (paragraphs 0053, 0054, 0246) comprising: instructing a light source to emit light from a plurality of emitters arranged in a pattern (**claim 15**) (paragraph 0054 with Fig. 17: 1710); detecting the pattern of light on an object illuminated by at least a portion of the pattern of light (**claim 15**) (paragraph 0054 with Fig. 17: camera); determine a location of the object in space utilizing at least the detected pattern

of light on the object (**claim 15**) (abstract; Fig. 1: 120); wherein the plurality of emitters includes light emitting diodes (**claim 16**)(Fig. 17: 1710) and suggests it is configured to generate infrared light that is detectable by the camera but not by the eye of a human observer interacting with the object (**claim 16**)(paragraph 0057); and suggests the emitters are arranged in an irregular pattern (paragraph 0186).

As for wherein the emitted light is focused in a plurality of directions by a cluster of lenses located in front of the light source in order to form a pattern of light, Bell does not explicitly state this. Though, he does suggest that there is a cluster of lenses by showing conical shapes above the illuminator (Fig. 17: 1710) as well as showing that the rays from the illuminator are in different directions (Fig. 17: patterned light as well see Fig. 16: light rays diverging from illuminator). Nevertheless, Li teaches that lens clusters are typically used with LED arrays (Fig. 7d: 5 with 2 as well see Fig. 6(h).) Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the emitted light be focused in a plurality of directions by a cluster of lenses located in front of the light source in order to form a pattern of light in order to direct and focus the light from the light source into a predetermined pattern of light.

As for **claim 20**, Bell in view of Li disclose everything as above (see **claim 15**). In addition, Bell suggests in view of Li the pattern of light projected is aperiodic along at least one dimension (Bell: paragraphs 0074 and 0156; in view of Li there is a cluster of lenses)

18. **Claims 3, 10, and 17** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2005/0110964)-cited by applicant** in view of **Li et al. (7,737,636)-cited by applicant** in view of **Ogawa et al. (5,978,136)-cited by applicant.**

As for **claims 3, 10, and 17**, Bell in view of Li discloses everything as above (see **claims 1, 8 and 15**). Bell is silent concerning a condenser lens located between the light source and the cluster of lenses wherein the condenser lens concentrates light from the light source to the cluster of lenses. Nevertheless, Ogawa discloses a condenser lens that concentrates light from a light source to a cluster of lenses (Fig. 1: 200, condenser lens, with 310). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have a condenser lens located between the light source and the cluster of lenses wherein the condenser lens concentrates light from the light source to the cluster of lenses in order to guide the pattern of light to the cluster for projection.

19. **Claims 4 and 11** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2005/0110964)-cited by applicant** in view of **Li et al. (7,737,636)-cited by applicant** in view of **Troxell et al. (2008/0245952).**

As for **claims 4 and 11**, Bell in view of Li discloses everything as above (see **claims 1 and 8**). Bell in view of Li does not explicitly state the cluster of lens includes a Fresnel lens. Bell does teach having a Fresnel lens in the system (paragraph 0105). Nevertheless, Troxell teaches a cluster of lenses comprising Fresnel lenses (paragraph 0024, paragraph 0046, paragraph 0047).

Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the cluster of lens includes a Fresnel lens in order to direct the light of the light emitting diode array to form a pattern of light to be detected.

20. **Claims 6, 13, and 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2005/0110964)-cited by applicant** in view of **Li et al. (7,737,636)-cited by applicant** further in view of **Jewell (5,319,496)-cited by applicant.**

As for **claims 6, 13, and 19,** Bell in view of Li discloses everything as above (see **claims 1, 8, and 15**). As for wherein the pattern of light projected by one of the lenses from the cluster of lenses overlaps with the pattern of light projected by another of the lenses from the cluster of lenses, Bell in view of Li is silent. Nevertheless, Jewell does demonstrate the pattern of light projected by one of the lenses from the cluster of lenses overlapping with the pattern of light projected by another of the lenses from the cluster of lenses (Fig. 4: 60, 70 with two patterns of light overlapping as it is delivered to 74). Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have the pattern of light projected by one of the lenses from the cluster of lenses overlaps with the pattern of light projected by another of the lenses from the cluster of lenses in order to deliver a pattern of light to the object to be located.

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by fax transmission. The fax phone number for Patent Technology Center 2800 is 571-273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (571) 272-2431. The examiner can normally be reached on Monday-Friday, 8:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tarifur R. Chowdhury, can be reached at 571-272-2287.

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/Gordon J Stock/

Examiner, Art Unit 2886

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Notice of References Cited	Application/Control No. 13/448,321	Applicant(s)/Patent Under Reexamination BELL, MATTHEW	
	Examiner GORDON STOCK JR	Art Unit 2886	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2008/0245952	10-2008	Troxell et al.	250/208.1
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
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FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
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	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	Art Unit
	GORDON STOCK JR	2886

SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
references cited by applicant	7/28/12	gjs
356/600-624 (text only) see search history printout	7/28/12	gjs
parent application 12/269,849	7/28/12	gjs
359/454,455,721,737,796,797 (text only) see search history printout	7/28/12	gjs
362/221,235,236,244,242,299,308,309,326-340 (text only) see search history printout	7/28/12	gjs
382/151,159 (text only) see search history printout	7/28/12	gjs
348/135-142,169-172 (text only) see search history printout	7/28/12	gjs
353/79-81 (text only) see search history printout	7/28/12	gjs

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	2,917,980	12-22-1959	Grube et al.	
	2	3,068,754	12-18-1962	Benjamin et al.	
	3	3,763,468	10-02-1973	Ovshinsky et al.	
	4	4,053,208	10-11-1977	Kato et al.	
	5	4,275,395	06-23-1981	Dewey et al.	
	6	4,573,191	02-25-1986	Kidode et al.	
	7	4,725,863	02-16-1988	Dumbreck et al.	
	8	4,791,572	12-13-1988	Green et al.	
	9	4,843,568	06-27-1989	Krueger et al.	
	10	4,887,898	12-19-1989	Halliburton et al.	
	11	4,948,371	08-14-1990	Howard F. Hall	
	12	5,001,558	03-19-1991	Burley et al.	
	13	5,138,304	08-11-1992	Bronson	
	14	5,151,718	09-29-1992	Nelson, William E.	
	15	5,239,373	08-24-1993	Tang et al.	
	16	5,276,609	01-04-1994	Durlach	
	17	5,319,496	06-07-1994	Jewell et al.	
	18	5,325,472	06-28-1994	Horiuchi et al.	
	19	5,325,473	06-28-1994	Monroe et al.	
	20	5,426,474	06-20-1995	Rubstov et al.	
	21	5,436,639	07-25-1995	Arai et al.	
	22	5,442,252	08-15-1995	Golz, Thomas M.	
	23	5,454,043	09-26-1995	Freeman	
	24	5,497,269	03-05-1996	Gal, George	
	25	5,510,828	04-23-1996	Lutterbach et al.	
	26	5,526,182	06-11-1996	Jewell et al.	
	27	5,528,263	06-18-1996	Platzker et al.	
	28	5,528,297	06-18-1996	Seegert et al.	
	29	5,534,917	07-09-1996	MacDougall	
	30	5,548,694	08-20-1996	Gibson	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
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	First Named Inventor	Matthew Bell
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SHEET 2 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	31	5,591,972	01-07-1997	Noble et al.	
	32	5,594,469	01-14-1997	Freeman et al.	
	33	5,633,691	05-27-1997	Vogeley et al.	
	34	5,703,637	12-30-1997	Miyazaki et al.	
	35	5,808,784	09-15-1998	Ando et al.	
	36	5,846,086	12-08-1998	Bizzi et al.	
	37	5,861,881	01-19-1999	Freeman et al.	
	38	5,882,204	03-16-1999	Iannazo et al.	
	39	5,923,380	07-13-1999	Yang et al.	
	40	5,923,475	07-13-1999	Kurtz et al.	
	41	5,953,152	09-14-1999	Hewlett	
	42	5,969,754	10-19-1999	Zeman	
	43	5,978,136	11-02-1999	Ogawa et al.	
	44	5,982,352	11-09-1999	Pryor	
	45	6,008,800	12-28-1999	Pryor	
	46	6,058,397	05-02-2000	Barrus et al.	
	47	6,075,895	06-16-2000	Qiao et al.	
	48	6,084,979	07-04-2000	Kanada et al.	
	49	6,088,612	07-11-2000	Blair	
	50	6,097,369	08-01-2000	Wambach	
	51	6,106,119	08-22-2000	Edwards	
	52	6,118,888	09-12-2000	Chino et al.	
	53	6,125,198	09-26-2000	Onda	
	54	6,166,744	12-26-2000	Jaszlics et al.	
	55	6,176,782	01-23-2001	Lyons et al.	
	56	6,191,773	02-20-2011	Maruno et al.	
	57	6,198,487	03-06-2001	Fortenbery et al.	
	58	6,198,844	03-06-2001	Nomura	
	59	6,217,449	04-17-2001	Kaku	
	60	6,263,339	07-17-2001	Hirsh	

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U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	61	6,270,403	08-07-2001	Watanabe et al.	
	62	6,278,418	08-21-2001	Doi	
	63	6,292,171	09-18-2001	Fu et al.	
	64	6,304,267	10-16-2001	Sata	
	65	6,308,565	10-30-2001	French et al.	
	66	6,323,895	11-27-2001	Sata	
	67	6,333,735	12-25-2001	Anvekar	
	68	6,335,977	01-01-2002	Kage	
	69	6,339,748	01-15-2002	Hiramatsu	
	70	6,349,301	02-19-2002	Mitchell et al.	
	71	6,353,428	03-05-2002	Maggioni et al.	
	72	6,359,612	03-19-2002	Peter et al.	
	73	6,388,657	05-14-2002	Natoli	
	74	6,394,896	05-28-2002	Sugimoto	
	75	6,400,374	06-04-2002	Lanier	
	76	6,407,870	06-18-2002	Hurevich et al.	
	77	6,414,672	07-02-2002	Rekimoto et al.	
	78	6,445,815	09-03-2002	Sato	
	79	6,454,419	09-24-2002	Kitazawa	
	80	6,480,267	11-12-2002	Yanagi et al.	
	81	6,491,396	12-10-2002	Karasawa et al.	
	82	6,501,515	12-31-2002	Iwamura	
	83	6,522,312	02-18-2003	Ohshima et al.	
	84	6,545,706	04-08-2003	Edwards et al.	
	85	6,552,760	04-22-2003	Gotoh et al.	
	86	6,598,978	07-29-2003	Hasegawa	
	87	6,607,275	08-19-2003	Cimini et al.	
	88	6,611,241	08-26-2003	Firester et al.	
	89	6,654,734	11-25-2003	Mani et al.	
	90	6,658,150	12-02-2003	Tsuji et al.	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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SHEET 4 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	91	6,661,918	12-09-2003	Gordon et al.	
	92	6,677,969	01-13-2004	Hongo	
	93	6,707,054	03-16-2004	Ray	
	94	6,707,444	03-16-2004	Hendriks et al.	
	95	6,712,476	03-30-2004	Ito et al.	
	96	6,720,949	04-01-2004	Pryor et al.	
	97	6,732,929	05-11-2004	Good et al.	
	98	6,747,666	06-08-2004	Utterback	
	99	6,752,720	06-22-2004	Clapper et al.	
	100	6,754,370	06-22-2004	Hall-Holt et al.	
	101	6,791,700	09-14-2004	Omura et al.	
	102	6,808,293	10-26-2004	Watanabe et al.	
	103	6,826,727	11-30-2004	Mohr et al.	
	104	6,831,664	12-14-2004	Marmaropoulos et al.	
	105	6,871,982	03-29-2005	Holman et al.	
	106	6,877,882	04-12-2005	Haven et al.	
	107	6,912,313	06-28-2005	Li	
	108	6,965,693	11-15-2005	Kondo et al.	
	109	6,975,360	12-13-2005	Slatter	
	110	6,999,600	02-14-2006	Venetianer	
	111	7,015,894	03-21-2006	Morohoshi	
	112	7,042,440	06-27-2006	Pryor et al.	
	113	7,054,068	05-30-2006	Yoshida et al.	
	114	7,058,204	06-06-2006	Hildreth et al.	
	115	7,068,274	06-27-2006	Welch et al.	
	116	7,069,516	06-27-2006	Rekimoto	
	117	7,084,859	08-01-2006	Pryor et al.	
	118	7,088,508	08-08-2006	Ebina et al.	
	119	7,129,927	10-31-2006	Mattsson	
	120	7,149,262	12-12-2006	Nayar et al.	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 5 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	121	7,158,676	01-02-2007	Rainsford	
	122	7,170,492 (KM2326.3PPPCP1)	01-30-2007	Bell	
	123	7,190,832	03-13-2007	Frost et al.	
	124	7,193,608	03-20-2007	Stuerzlinger	
	125	7,227,526	06-05-2007	Hildreth et al.	
	126	7,259,747 (KM2326.003A)	08-21-2007	Bell	
	127	7,262,874	08-28-2007	Suzuki	
	128	7,268,950	09-11-2007	Poulsen	
	129	7,289,130	10-30-2007	Satoh et al.	
	130	7,330,584	02-12-2008	Weiguo et al.	
	131	7,339,521	03-04-2008	Scheidemann et al.	
	132	7,348,963 (KM2326.3PPPPCP1)	03-25-2008	Bell	
	133	7,379,563	05-27-2008	Shamaie	
	134	7,382,897	06-03-2008	Brown et al.	
	135	7,394,459	07-01-2008	Bathiche et al.	
	136	7,428,542 (KM2326.010A)	09-23-2008	Fink et al.	
	137	7,431,253	10-07-2008	Yeh	
	138	7,432,917	10-07-2008	Wilson et al.	
	139	7,468,742	12-23-2008	Ahn et al.	
	140	7,536,032 (KM2326.005A)	05-19-2009	Bell	
	141	7,559,841	07-14-2009	Hashimoto	
	142	7,576,727 (KM2326.011A)	08-18-2009	Bell	
	143	7,598,942	10-06-2009	Underkoffler et al.	
	144	7,619,824	11-17-2009	Poulsen	
	145	7,665,041	02-16-2010	Wilson et al.	
	146	7,710,391 (KM2326.003CP3)	05-04-2010	Bell et al.	
	147	7,728,280	06-01-2010	Feilkas et al.	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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PTO/SB/08 Equivalent

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	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 6 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	148	7,737,636	06-15-2010	Li et al.	
	149	7,745,771	06-29-2011	Troxell et al.	
	150	7,809,167 (KM2326.005C1)	10-05-2010	Bell	
	151	7,834,846 (KM2326.003DV1)	11-16-2010	Bell	
	152	7,961,906	06-14-2011	Ruedin	
	153	7,971,156	06-28-2011	Albertson et al.	
	154	8,035,612 (KM2326.003CP4)	10-11-2011	Bell et al.	
	155	8,035,624 (KM2326.3CPCPC1)	10-11-2011	Bell et al.	
	156	8,085,293	12-27-2011	Brodsky et al.	
	157	8,085,994	12-27-2011	Kim	
	158	8,230,367 (KM2326.008A)	07-24-2012	Bell et al.	
	159	RE 41,685	09-14-2010	Feldman et al.	
	160	2001/0012001	08-09-2001	Rekimoto et al.	
	161	2001/0033675	10-25-2001	Maurer et al.	
	162	2002/0006583	01-17-2002	Michiels et al.	
	163	2002/0032697	03-14-2002	French et al.	
	164	2002/0041327	04-11-2002	Hildreth et al.	
	165	2002/0064382	05-30-2002	Hildreth et al.	
	166	2002/0081032	06-27-2002	Chen et al.	
	167	2002/0103617	08-01-2002	Uchiyama et al.	
	168	2002/0105623	08-08-2002	Pinhanez	
	169	2002/0130839	09-19-2002	Wallace et al.	
	170	2002/0140633	10-03-2002	Rafii et al.	
	171	2002/0140682	10-03-2002	Brown et al.	
	172	2002/0178440	11-28-2002	Agnihorti et al.	
	173	2003/0032484	02-13-2003	Ohshima et al.	
	174	2003/0091724	05-15-2003	Mizoguchi	
	175	2003/0093784	05-15-2003	Dimitrova et al.	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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PTO/SB/08 Equivalent

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	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 7 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	176	2003/0098819	05-29-2003	Sukthankar et al.	
	177	2003/0103030	06-05-2003	Wu	
	178	2003/0113018	06-19-2003	Nefian et al.	
	179	2003/0122839	07-03-2003	Matraszek et al.	
	180	2003/0137494	07-24-2003	David J. Tulbert	
	181	2003/0161502	08-28-2003	Morihara et al.	
	182	2003/0178549	09-25-2003	Ray.	
	183	2004/0005924	01-08-2004	Watabe et al.	
	184	2004/0015783	01-22-2004	Lennon et al.	
	185	2004/0046744	03-11-2004	Rafii et al.	
	186	2004/0073541	04-15-2004	Lindblad et al.	
	187	2004/0091110	05-13-2004	Barkans	
	188	2005/0028188	02-03-2005	Latona et al.	
	189	2005/0039206	02-17-2005	Opdycke	
	190	2005/0086695	04-21-2005	Keele et al.	
	191	2005/0185828	04-25-2005	Semba et al.	
	192	2005/0088407 (KM2326.001A)	04-28-2005	Bell	
	193	2005/0104506	05-19-2005	Youh et al.	
	194	2005/0122308 (KM2326.003CP2)	06-09-2005	Bell et al.	
	195	2005/0132266	06-16-2005	Ambrosino et al.	
	196	2005/0147282	07-07-2005	Fujii	
	197	2005/0195598	09-08-2005	Dancs et al.	
	198	2005/0265587	12-01-2005	Schneider	
	199	2006/0010400	01-12-2006	Dehlin et al.	
	200	2006/0031786	02-09-2006	Hillis et al.	
	201	2006/0168515	07-27-2006	Dorsett, Jr. et al.	
	202	2006/0184993	08-17-2006	Goldthwaite et al.	
	203	2006/0187545	08-24-2006	Doi	
	204	2006/0227099	10-12-2006	Han et al.	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 8 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	205	2006/0242145	10-26-2006	Krishnamurthy et al.	
	206	2006/0256382	11-16-2006	Matraszek et al.	
	207	2006/0258397	11-16-2006	Kaplan et al.	
	208	2006/0294247	12-28-2006	Hinckley et al.	
	209	2007/0002039	01-04-2007	Pendleton et al.	
	210	2007/0019066	01-25-2007	Cutler	
	211	2007/0285419	02-13-2007	Givon	
	212	2008/0013826	01-17-2008	Hillis et al.	
	213	2008/0018595	01-24-2008	Hildreth et al.	
	214	2008/0030460	02-07-2008	Hildreth et al.	
	215	2008/0040692	02-14-2008	Sunday et al.	
	216	2008/0062123 (KM2326.3CP4CP1)	03-13-2008	Bell	
	217	2008/0062257	03-13-2008	Corson	
	218	2008/0090484	04-17-2008	Lee et al.	
	219	2008/0150890 (KM2326.3CP3C1)	06-26-2008	Bell et al.	
	220	2008/0252596 (KM2326.006A)	10-16-2008	Bell et al.	
	221	2009/0027337	01-29-2009	Hildreth	
	222	2009/0079813	03-26-2009	Hildreth	
	223	2009/0102788	04-23-2009	Nishida et al.	
	224	2009/0172606	07-02-2009	Dunn et al.	
	225	2009/0235295 (KM2326.001C1)	09-17-2009	Bell et al.	
	226	2010/0026624 (KM2326.011C1)	02-04-2010	Bell et al.	
	227	2010/0039500 (KM2326.013A)	02-18-2010	Bell et al.	
	228	2010/0060722 (KM2326.015A)	03-11-2010	Bell et al.	
	229	2010/0121866 (KM2326.012A)	05-13-2010	Bell et al.	

FOREIGN PATENT DOCUMENTS

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 9 OF 19	Attorney Docket No.	KM2326.007D1

Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	230	EP 0 055 366 A2	07-07-1982	Edgar		
	231	EP 0 626 636 A2	11-30-1994	Arai et al.		
	232	EP 0 913 790 A1	05-06-1999	Takenaka Corp.		
	233	EP 1 689 172 A1 (KM2326.3VR1EP)	06-04-2002	Bell		
	234	JP 57-094672	06-12-1982	Koichi et al.		
	235	JP 2000-105583	04-11-2000	Ricoh Co. Ltd.		
	236	JP 2002-014997	01-18-2002	NTT Comware Corp.		
	237	JP 2002-092023	03-29-2002	Nippon Telegr & Teleph Corp. (NTT)		
	238	JP 2002-171507	06-14-2002	Yokogawa Electric Corp.		
	239	JP 2003-271084	09-25-2003	Omron Corp.		
	240	JP 2003-517642	05-27-2003	Giraud et al.		
	241	KR 2003-0058894	07-07-2003	Cho Yeong Tark		X-Abs
	242	WO 98/38533 A1	09-03-1998	Maggioni et al.		
	243	WO 00/16562 A1	03-23-2000	General Instrument Corp.		
	244	WO 01/63916 A1	08-30-2001	Slaney et al.		
	245	WO 02/01537 A2	01-03-2002	Koninklijke Philips Electronics		
	246	WO 02/100094 A2 (KM2326.003VPC)	12-12-2002	Bell		
	247	WO 2004/055776 A1 (KM2326.011VPC)	07-01-2004	Reactrix Systems		
	248	WO 2004/097741 A1	11-11-2004	Fujitsu Ltd.		
	249	WO 2005/041578 A2 (KM2326.001VPC)	05-06-2005	Bell et al.		
	250	WO 2005/041579 A2 (KM2326.005VPC)	05-06-2005	Bell		
	251	WO 2005/057398 A2 (KM2326.003BPC)	06-23-2005	Bell et al.		
	252	WO 2005/057399 A2 (KM2326.003HPC)	06-23-2005	Bell et al.		
	253	WO 2005/057921 A2 (KM2326.003PPC)	06-23-2005	Bell et al.		
	254	WO 2005/091651 A2 (KM2326.003GPC)	09-02-2005	Reactrix Systems, Inc.		
	255	WO 2007/019443 A1 (KM2326.003FPC)	02-15-2007	Bell		

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 10 OF 19	Attorney Docket No.	KM2326.007D1

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	256	WO 2008/124820 A1 (KM2326.006VPC)	10-16-2008	Bell et al.		
	257	WO 2009/035705 A1 (KM2326.008VPC)	03-19-2009	Reactrix Systems, Inc.		

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
	258	EffecTV Version 0.2.0 released March 27, 2001, available online at http://web.archive.org/web/20010101-20010625re_http://effectv.sourceforge.net	
	259	Index of EffecTV, as downloaded on April 30, 2007 at http://effectv.cvs.sourceforge.net/effectv/EffecTV/?pathrev=rel_0_2_0	
	260	R111, The Transformation From Digital Information to Analog Matter, available online at http://www.particles.de/paradocs/r111/10mkp2004/hmtl/r111_text111hock04.html, cited on January 17, 2005 during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	261	2001 Symposium on Interactive 3D Graphics program description, ACM SIGGRAPH, held March 19-21, 2001, Research Triangle Park, NC, downloaded from http://www.allconferences.com/conferences/2000830092631/, cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	262	Affidavit of Daniel Barthels regarding EffecTV, dated May 15, 2007 (partial machine translation), cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	263	Announcement: Workshop on Perceptual User Interfaces, The Banff Rocky Mountain Resort, Banff, Alberta, Canada, October 20-21, 1997, can be found at http://www.research.microsoft.com/PUIWorkshop/ cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	264	Bodymover Body Movement as a Means to Obtain an Audiovisual Spatial Experience, 2000 ART+COM AG Berlin; http://www.artcom.de/index.php?option=com_acprojects&page=6&id=28&Itemid=144&details=0&lang=en, as downloaded on August 8, 2005.	
	265	ART+COM Bodymover 2000, as downloaded on August 21, 2009 from http://www.artcom.de/index.php?option=com_acprojects&page=6&id=28&Itemid=144&details=0&lang=en, cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP)	
	266	Brown, Matthew, et al. "Multi-Image Matching using Multi-Scale Oriented Patches," Technical Report, December 2004, pp 1-48, available online at ftp://ftp.research.microsoft.com/pub/tr/TR-2004-133.pdf	
	267	Brown, Matthew, et al., "Multi-Image Matching using Multi-Scale Oriented Patches," Proceedings of the 2005 IEEE Computer Society Conference on Computer Vision and Pattern Recognition, Conference Publication Date: 20-25 June 2005, 8 pgs.	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 11 OF 19	Attorney Docket No.	KM2326.007D1

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
	268	Buxton, Bill, "Multi-Touch Systems That I Have Known and Loved," accessed March 21, 2007, http://billbuxton.com/multitouchOverview.html	
	269	Communication dated December 10, 2008 from Patentanwalt attaching article by Katy Bachman, entitled "Reactrix Up for Sale," cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	270	Crouser, P.D., et al., "Unattenuated tracer particle extraction through time-averaged, background image subtraction with outlier rejection," Experiments in Fluids, 22, 1997, 220-228, Springer-Verlag.	
	271	Dachselt, Raimund, et al., "CONTIGRA: An XML-Based Architecture for Component-Oriented 3D Applications, 3D Technologies for the World Wide Web, Proceedings of the Seventh International Conference on 3D Technology," ACM, February 24-28, 2002, pgs. 155-163.	
	272	Davis, J.W., et al., "SIDEshow: A Silhouette-based Interactive Dual-screen Environment," August 1998, MIT Media Lab Tech Report no. 457.	
	273	Demarest, Ken, "Sand," 2000, Mine Control, art installation, available online at http://www.mine-control.com, downloaded on March 15, 2007	
	274	DePiero et al; "3-D Computer Vision Using Structured Light: Design, Calibrations and Implementation Issues"; Advances in Computers, Volume 43, Pgs. 243-278, 1996	
	275	EffecTV Software Source: effect module, dated May 20, 2001 (German); cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP).	
	276	Elgammal, Ahmed, et al., "Non-parametric Model for Background Subtraction," June 2000, European Conference on Computer Vision, Lecture Notes on Computer Science, Vol. 1843, pp. 751-767.	
	277	Foerterer, Holger, "Fluidum," 1999, art installation, description available online at http://www.foerterer.com/fluidum, downloaded on March 16, 2007	
	278	Foerterer, Holger, "Helikopter," 2001, art installation, description available online at http://www.foerterer.com/helikopter/index.htm, downloaded on March 16, 2007	
	279	Freeman, William, et al., "Computer vision for interactive computer graphics," May-June 1998, IEEE Computer Graphics and Applications, vol. 18, no. 3, pp. 42-53.	
	280	Frisken, Sarah F. et al., "Adaptively Sampled Distance Fields: A General Representation of Shape for Computer Graphics," July 23-28, 2000, Proceedings Of the 27th Annual Conference on Computer Graphics and Interactive Techniques, pp. 249-254.	
	281	Fujihata, Masaki, "Beyond Pages," 1995, art installation, description available online at http://on1.zkm.de/zkm/werke/BeyondPages downloaded on March 16, 2007	
	282	Goetz, Frank, et al., "An XML-based Visual Shading Language for Vertex and Fragment Shaders," 3D Technologies for the World Wide Web, Proceedings of Ninth International Conference on 3D Technology; ACM, April 5-8, 2004; pgs. 87-97.	
	283	GroundFX Document, GestureTek (Very Vivid, Inc.), description available online at http://www.gesturetek.com/groundfx, downloaded on August 11, 2006.	
	284	Haller, Michael et al., "Coeno-Storyboard: An Augmented Surface for Storyboard Presentations," Mensch & Computer 2005, September 4-7, 2005, Linz, Austria	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
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SHEET 12 OF 19	Attorney Docket No.	KM2326.007D1

NON PATENT LITERATURE DOCUMENTS			
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	285	Han, Jefferson Y., "Low-Cost Multi-Touch Sensing Through Frustrated Total Internal Reflection," October 23-26, 2005, ACM Symposium on User Interface Software and Technology (UIST)	
	286	Harville, Michael et al., "Foreground Segmentation Using Adaptive Mixture Models in Color and Depth," July 8, 2001, Proceedings of IEEE Workshop on Detection and Recognition of Events in Video, pp. 3-11.	
	287	Hemmer, Raphael Lozano, "Body Movies," 2002, art project/installation, description available online at http://www.lozano-hemmer.com/eproyecto.html downloaded on March 16, 2007	
	288	Hoff, Kenneth E. III et al, "Fast and Simple 2D Geometric Proximity Queries Using Graphics Hardware," March 19-21, 2001, Proc. Of the 2001 Symposium on Interactive 3D Graphics, pp. 145-148.	
	289	Huang, Mark et al. "Shadow Vision," Introduction to Computer Graphics, Fall 1999, December 6, 1999; pgs. 1-10, XP55013291 http:groups.csail.mit.edu/graphics/classes/6.837/F99/projects/reports/team16.pdf	
	290	Ivars Peterson, "Artificial reality; combining a person's live video image with computer graphics suggests novel ways of working and playing with computers" Science News, June 22, 1985.	
	291	Jabri, Sumer et al., "Detection and Location of People in Video Images Using Adaptive Fusion of Color and Edge Information;" presented at the Int. Conf. Pattern Recognition, Barcelona, Spain, 2000.	
	292	Joyce, Arthur W. III, et al., "Implementation and capabilities of a virtual interaction system," September 10-11, 1998, Proceedings 2nd European Conference on Disability, Virtual Reality and Associated Technologies, Skovde, Sweden, pp. 237-245.	
	293	Katz, Itai et al., "A Multi-Touch Surface Using Multiple Cameras," October 3, 2007, Advanced Concepts for Intelligent Vision Systems, Volume 4678/2007	
	294	Keays, Bill, "metaField Maze," 1998, exhibited at Siggraph'99 Emerging Technologies and Ars Electronica August 8-13, 1999, description available online at http://www.billkeays.com/metaFieldInfosheet1A.pdf	
	295	Keays, Bill, "Using High-Bandwidth Input/Output in Interactive Art," June 1999, Master's Thesis, Massachusetts Institute of Technology, School of Architecture and Planning.	
	296	Khan, Jeff; "Intelligent Room with a View"; April-May 2004, RealTime Arts Magazine, Issue 60, available online at www.realtimearts.net/article/60/7432	
	297	Kjeldesn, Rick et al., "Dynamically Reconfigurable Vision-Based User Interfaces," April 2003, 3rd International Conference on Vision Systems (ICVVS '03), Graz, Austria, pp. 6-12	
	298	Kjeldsen, R. et al., "Interacting with Steerable Projected Displays," May 20-21, 2002, Proceedings Of the 5th International Conference on Automatic Face and Gesture Recognition, Washington, D.C.	
	299	Kreuger, Myron, "Videoplace - An Artificial Reality," April 1985, Conference on Human Factors in Computing Systems, San Francisco, California, pp. 35-40.	
	300	Kreuger, Myron, "Videoplace," 1969 and subsequent, summary available online at http://www.jtnimoy.com/itp/newmediahistory/videoplace, downloaded March 21, 2007	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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	301	Kurapati, Kaushal, et al., "A Multi-Agent TV Recommender," July 13-14, 2001, Workshop on Personalization in Future TV, pp. 1-8, XP02228335.	
	302	Lamarre, Mathieu, et al., "Background subtraction using competing models in the block-DCT domain," Pattern Recognition, 2002 Proceedings, 16 International Conference in Quebec City, Que., Canada, August 11-15, 2002.	
	303	Lantagne, Michel, et al., "VIP: Vision tool for comparing Images of People," Vision Interface, June 11-13, 2003, pgs. 1-8.	
	304	Leibe, Bastian, et al., "The Perspective Workbench; Toward Spontaneous and Natural Interaction in Semi-Immersive Virtual Environments," March 18-22, 2000, IEEE Computer Society, Los Alamitos, CA; Pgs. 13-20	
	305	Leibe, Bastian, et al., "Towards Spontaneous Interaction with the Perceptive Workbench, a Semi-Immersive Virtual Environment," November/December 2000, IEEE Computer Graphics and Applications, Vol., 20, No. 6, pp. 54-65.	
	306	Lengyel, Jed et al., "Real-Time Robot Motion Planning Using Rasterizing Computer Graphics Hardware," August 1990, ACM SIGGRAPH Computer Graphics, Vol. 24, Issue 4, pp. 327-335.	
	307	Levin, Golan "Computer Vision for Artists and Designers: Pedagogic Tools and Techniques for Novice Programmers," August 2006, AI & Society, Vol. 20, Issue 4, pp. 462-482	
	308	Lin, Mingxiu et al., "A New Approach for Vision-based Rear Vehicle Tracking," Key Laboratory of Integrated Automation of Process Industry, Ministry of Education, Northeastern University, Shenyang, Liaoning Province, China, held May 23-25, 2007, pgs. 107-1	
	309	Livingston, Mark Alan, "Vision-based Tracking with Dynamic Structured Light for Video See-through Augmented Reality," 1998, Ph.D. Dissertation, University of North Carolina at Chapel Hill, cited on June 18, 2007 during opposition of European Application N	
	310	Malik, Shahzad et al., "Visual Touchpad: A Two-Handed Gestural Input Device," October 13-15, 2004, International Conference on Multimodal Interfaces (ICMI '04)	
	311	Maria Langer, "Mac OS X 10.2: Visual QuickStart Guide," September 17, 2002, Peachpit Press, P. 111	
	312	MacIver, Malcolm, et al., "Body Electric," April 15-June 29, 2003, art installation, description available online at http://www.neuromech.northwestern.edu/uropatagium/#ArtSci	
	313	Mandala Systems, "Video Gesture Control System Concept," 1986, description available online at http://www.vividgroup.com/tech.html, downloaded on March 16, 2007.	
	314	Microsoft Surface multi-touch interface table unveiled, May 30, 2007, downloaded from http://www.dancewithshadows.com/tech/microsoft-surface.asp	
	315	Microsoft Surface Web Page, downloaded from http://www.microsoft.com/surface/Pages/Product/WhatIs.aspx on September 24, 2009.	
	316	Experience Microsoft Surface, downloaded from http://www.microsoft.com/surface/Pages/Product/Specifications.aspx on September 24, 2009.	
	317	Microsoft Surface, downloaded from http://en.wikipedia.org/wiki/Microsoft_surface on September 24, 2009.	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

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	318	Mitsubishi Diamond Touch, http://www.merl.com/projects/DiamondTouch/ visited March 21, 2007	
	319	Mo, Zhenyao "SmartCanvas: A Gesture-Driven Intelligent Drawing Desk System," January 9-12, 2005, Proceedings of Intelligent User Interfaces (IUI '05)	
	320	Morano, Raymond A. et al., "Structured Light Using Pseudorandom Codes," March 1998, IEEE Transactions on Pattern Analysis and Machine Intelligence, Vol. 20, No. 3.	
	321	Morris, T. et al., "Real-Time Fingertip Detection for Hand Gesture Recognition," September 9-11, 2002, Advanced Concepts for Intelligent Vision Systems (ACIVS '04), Ghent University, Belgium	
	322	Muench, Wolfgang, "Bubbles", Prix Ars Electonica Catalog 1999, Springer-Verlag, Berlin, Germany; available online at http://hosting.zkm.de/wmuench/bub/text, downloaded on March 16, 2007.	
	323	Paradiso, Joseph et al., "Optical Tracking for Music and Dance Performance," Conference on Optical 3-D Measurement Techniques, XX, XX, no.4th, September 30, 1997, pgs. 1-8, XP002548974. http://www.media.mit.edu/resenv/pubs/papers/97_09_Zurich_3D4.pdf	
	324	Paradiso, Joseph et al., "New Sensor and Music Systems for Large Interactive Surfaces," August 2000, Proceedings Of the Interactive Computer Music Conference, Berlin, Germany, pp. 277-280.	
	325	Penny, Simon, "Fugitive"; October 1997; http://www.ace.uci.edu/penny/works/fugitive/fugitive.html	
	326	Penny, Simon, et al., "Fugitive II, " January 8 - March 14, 2004, Australian Center for the Moving Image, art installation, description available online at http://www.acmi.net.au/fugitive.jsp?	
	327	Penny, Simon, et al.; "TRACES: WIRELESS full body tracking in the CAVE, December 16-18, 1999; Japan; ICAT Virtual Reality Conference; http://turing.ace.uci.edu/pennytexts/traces/	
	328	Pinhanez, C. et al., "Ubiquitous Interactive Graphics," July 29-31 2003, IBM Research Report RC22495, available at http://www.research.ibm.com/ed/publications/rc22495.pdf	
	329	Pinhanez, C., "The Everywhere Displays Projector: A Device to Create Ubiquitous Graphical Interfaces," Ubicomp 2001: Ubiquitous Computing: International Conference Atlanta, Georgia, USA, September 30 - October 2, 2001 Proceedings (Lecture Notes in Compute	
	330	PLASMA; 3 pages; http://www.particles.de/paradocs/plasma/index.html, cited in U.S. Application No. 10/160,217 on August 8, 2005 (Attorney Docket No. KM2326.003A).	
	331	Quinz, Emanuele; "Conference Papers", April 10, 2001, XP55013293, Retrieved from the internet http://www.isea2000.com/pop_actes.htm	
	332	Quinz, Emanuele; "Digital Performance", pages 1-3, Retrieved from the internet on November 28, 2011 http://www.noemalab.org/sections/ideas/ideas_articles/pdf/	
	333	Reatrix, Inc. website, 28 March 2003, http://web.archive.org/web/20030328234205/http://www.reatrix.com and http://web.archive.org/web/20030328234205/http://www.reatrix.com/webdemo.php	
	334	Rekimoto, J., et al., "Perceptual Surfaces: Towards a Human and Object Sensitive Interactive Display," October 19-21, 1997, Proceedings Of the Workshop on Perceptual User Interfaces, Banff, Canada, pp.30-32.	

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SHEET 15 OF 19	Attorney Docket No.	KM2326.007D1

NON PATENT LITERATURE DOCUMENTS			
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	335	Rekimoto, Jun, "SmartSkin: An Infrastructure for Freehand Manipulation on Interactive Surfaces." Vol. No.4, Issue No. 1, Pages 113-120, April 2002	
	336	Ringel, M. et al., "Barehands: Implement-Free Interaction with a Wall-Mounted Display," March 31 - April 5, 2001, Proceedings Of the 2001 ACM CHI Conference on Human Factors in Computing Systems (Extended Abstracts), p. 367-368.	
	337	Rogala, Miroslav, "Lovers Leap," November 21-26, 1995, art installation, Dutch Electronic Arts Festival, description available online at http://wayback.v2.nl/DEAF/persona/rogala.html	
	338	Rokeby, David, "Very Nervous System (VNS)," March 1995, Wired Magazine, available online at <http://www.wired.com/wired/archive/3.03/rokeby.html>; sold as software at http://homepage.mac.com/davidrokeby/softVNS.html	
	339	Rokeby, David, "softVNS 2 real time video processing and tracking software for Max;" SoftVNS 2 downloads, as downloaded from http://homepage.mac.com/davidrokeby/softVNS.html on March 16, 2007.	
	340	Sato, Yoichi, et al., "Fast Tracking of Hands and Fingertips in Infrared Images for Augmented Desk Interface," March 2000, 4th International Conference on Automatic Face -and Gesture-Recognition, Grenoble, France.	
	341	Schneider, John K., "Improved Fingerprint System Using Rolled and Multi-segmented Techniques," Provisional US Patent Application No. 60/575952, filed on 06/01/2004, pages 1-6.	
	342	Screenshots of Reactrix Product Demo Video, 28 March 2003, http://web.archive.org/web/20030407174258/http://www.reactrix.com/demo/reactrix_demo.wmv	
	343	Sester, Marie, "Access," December 2001, Interaction "99 Biennial Catalog, Gifu, Japan, available online at http://www.accessproject.net/concept.html	
	344	Snibbe, Scott, "Boundary Functions," September 7-12, 1998, art installation, description available online at http://snibbe.com/scott/bf/index.html	
	345	Snibbe, Scott, "Screen Series," 2002-2003 art installation, description available online at http://snibbe.com/scott/screen/index.html, downloaded on March 16, 2007.	
	346	Sonneck, Georg, et al., "Optimized One-to-One Personalization of Web Applications using a Graph Based Model," IEEE-22, April 26, 2003, 9 pgs.	
	347	Sparacino, Flavia, et al., "Dance Space: An Interactive Video Interface", Actes/Proceeding, ISEA2000-10/12/2000-Auditorium 1, December 10, 2000	
	348	Sparacino, Flavia, et al., "Media in performance: interactive spaces for dance, theater, circus and museum exhibits," November 2000, IBM Systems Journal, vol. 39, no. 3-4, pp. 479-510.	
	349	Sparacino, Flavia, "(Some) Computer Visions Based Interfaces for Interactive Art and Entertainment Installations," 2001, INTER_FACE Body Boundaries, Anomalie digital_arts, no. 2, Paris, France, http://alumni.media.mit.edu/~flavia/publications.html	
	350	Stauffer, Chris, et al., "Learning Patterns of Activity Using Real-Time Tracking," August 2000, IEEE Transaction on Pattern Analysis and Machine Intelligence, vol. 22, no. 8, pp. 747-757.	

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	351	SUPREME PARTICLES, "PLASMA/Architexture," 1994, available online at http://www.particles.de/paradocs/plasma/plasma_e.html downloaded on May 21, 2007	
	352	SUPREME PARTICLES; R111, 1999, available online at http://www.r111.org, obtained July 12, 2005, XP-002989704.	
	353	Tan, et al., "Highlight Removal by Illumination-Constrained Inpainting," Ninth IEEE International Conference on Computer Vision, October 13-16, 2003.	
	354	The History of Microsoft Surface, downloaded from http://www.microsoft.com/presspass/presskits/surfacecomputing/docs/SurfaceHistoryBG.doc on September 24, 2009	
	355	Torr, P.H.S. et al., "The Development and Comparison of Robust Methods for Estimating the Fundamental Matrix," September/October 1997, International Journal of Computer Vision, Vol. 24, No. 3, pp. 271-300	
	356	Toth, Daniel et al., "Illumination-Invariant Change Detection," April 2-4, 2000, 4th IEEE Southwest Symposium on Image Analysis and Interpretation, p. 3.	
	357	Trefzger, Petra, "Vorwerk," 2000, art installation, description available online at http://www.petracolor.de/ cited on January 17, 2005 during opposition of European Application No. 02739710.8, filed June 4, 2002 (Attorney Docket No. KM2326.003VEP)	
	358	Utterback, Camille, et al., "Text Rain,"1999, art installation, available online at www.camilleutterback.com/textrain.html, March 16, 2007	
	359	Vogt, Florian et al., "Highlight Substitution in Light Fields," IEEE International Conference on Image Processing, September 22-25, 2002.	
	360	Wang, Junxian, et al., "Specular reflection removal for human detection under aquatic environment," 27 June - 2 July 2004 IEEE Conference on Computer and Pattern Recognition Workshop (CVPRW04) Volume 8, pg. 130.	
	361	Wellner, Pierre, "Interacting with paper on the DigitalDesk," July 1993, Communications of the ACM, Special issue on computer augmented environments: back to the real world, Vol. 36, Issue 7, pp. 87-96.	
	362	Wellner, Pierre, "Digital Desk Calculator:Tangible Manipulation on a Desktop Display" Proceedings of the Symposium on User Interface Software and Technol (UIST), Hilton Head, S. Carolina, November 11-13, 1991	
	363	Wilson, Andrew, "PlayAnywhere: A Compact Interactive Tabletop Projection-Vision System," ACM Symposium on User Interface Software and Technology (UIST), October 23-27, 2005, Seattle, Washington, U.S.A.	
	364	Xiao, Yang; "Throughput and Delay Limits of IEEE 802.11," IEEE Communications Letters, Vol.6, No.8, Pages 355-357, August, 2002	
	365	International Preliminary Report on Patentability for PCT/US2004/035477 (KM2326.001VPC), filed October 25, 2004	
	366	International Search Report for PCT/US2004/035477 (KM2326.001VPC), filed October 25, 2004	
	367	Written Opinion of the International Searching Authority for PCT/US2004/035477 (KM2326.001VPC), filed October 25, 2004	

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	368	International Preliminary Report on Patentability for PCT/US2004/041318 (KM2326.003BPC), filed December 9, 2004	
	369	International Search Report for PCT/US2004/041318 (KM2326.003BPC), filed December 9, 2004	
	370	Written Opinion of the International Searching Authority for PCT/US2004/041318 (KM2326.003BPC), filed December 9, 2004	
	371	International Preliminary Report on Patentability for PCT/US2006/030720 (KM2326.003FPC), filed on August 4, 2006	
	372	International Search Report for PCT/US2006/030720 (KM2326.003FPC), filed August 4, 2006	
	373	Written Opinion of the International Searching Authority for PCT/US2006/030720 (KM2326.003FPC), filed August 4, 2006	
	374	International Preliminary Report on Patentability for PCT/US2005/008984 (KM2326.003GPC), filed March 18, 2005	
	375	International Search Report for PCT/US2005/008984 (KM2326.003GPC), filed March 18, 2005	
	376	Written Opinion of the International Searching Authority for PCT/US2005/008984 (KM2326.003GPC), filed March 18, 2005	
	377	International Preliminary Report on Patentability for PCT/US2004/041320 (KM2326.003HPC), filed December 9, 2004	
	378	International Search Report for PCT/US2004/041320 (KM2326.003HPC), filed December 9, 2004	
	379	Written Opinion of the International Searching Authority for PCT/US2004/041320 (KM2326.003HPC), filed December 9, 2004	
	380	International Preliminary Report on Patentability for PCT/US2004/041319 (KM2326.003PPC), filed December 9, 2004	
	381	International Search Report for PCT/US2004/041319 (KM2326.003PPC), filed December 9, 2004	
	382	Written Opinion of the International Searching Authority for PCT/US2004/041319 (KM2326.003PPC), filed December 9, 2004	
	383	Article 96(2) Communication dated in European Application No. 02739710.8 (KM2326.003VEP), March 31, 2004	
	384	Observation by third party Michael Saup cited during opposition of European Application No. 02739710.8 filed June 4, 2002 (KM2326.003VEP), dated January 17, 2005	
	385	Observation by third party Petra Trefzger cited during opposition of European Application No. 02739710.8 filed June 4, 2002 (KM2326.003VEP), dated January 17, 2005	
	386	Observation by third party Simon Penny cited during opposition of European Application No. 02739710.8 filed June 4, 2002 (KM2326.003VEP), dated January 17, 2005	

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	387	Article 96(2) Communication in European Application No. 02739710.8 (KM2326.003VEP), dated February 25, 2005	
	388	Summons to Attend Oral Proceedings in European Application No. 02739710.8 (Attorney Docket No. KM2326.003VEP), dated August 12, 2005.	
	389	Notice of Opposition in European Application No. 02739710.8 (Attorney Docket No. KM2326.003VEP) dated May 14, 2007	
	390	Letter dated from Christian Zuckschwerdt regarding EffecTV, (partial machine translation), cited during opposition of European Application No. 02739710.8, filed June 4, 2002 (KM2326.003VEP), May 16, 2007	
	391	Summons to Attend Oral Proceedings in European Application No. 02739710.8 (Attorney Docket No. KM2326.003VEP), dated June 12, 2009	
	392	Decision revoking the European Patent in European Application No. 02739710.8 (KM2326.003VEP), dated December 28, 2009	
	393	Provision of a copy of the minutes in European Application No. 02739710.8 (KM2326.003VEP), dated December 28, 2009	
	394	Letter of the opponent O2 in European Application No. 02739710.8, filed June 4, 2002 (KM2326.003VEP), dated May 28, 2010	
	395	Notice of Opposition in European Application No. 02739710.8 (KM2326.003VEP), dated August 23, 2010	
	396	International Preliminary Examination Report for PCT/US2002/017843 (KM2326.003VPC), filed June 4, 2002	
	397	Written Opinion for PCT/US2002/017843 (KM2326.003VPC), filed June 4, 2002	
	398	International Search Report for PCT/US2002/017843, filed June 4, 2002 (KM2326.003VPC), dated February 5, 2003	
	399	Extended Search Report for European Application No. 06010825.5, filed June 4, 2002 (KM2326.3VR1EP), dated July 6, 2006	
	400	International Preliminary Report on Patentability for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	401	International Search Report for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	402	Written Opinion of the International Searching Authority for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	403	Invitation to Pay Additional Fees and Partial international Search Report on Patentability for PCT/US2004/035478 (KM2326.005VPC), filed October 25, 2004	
	404	International Preliminary Report on Patentability for PCT/US2008/059900 (KM2326.006VPC), filed on April 10, 2008	
	405	International Search Report for PCT/US2008/059900 (KM2326.006VPC), filed April 10, 2008	

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 19 OF 19	Attorney Docket No.	KM2326.007D1

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
	406	Written Opinion of the International Searching Authority for PCT/US2008/059900 (KM2326.006VPC), filed April 10, 2008	
	407	Official Report in Australian Application No. 2008299883 (KM2326.008VAU), dated December 8, 2010	
	408	International Preliminary Report on Patentability for PCT/US2008/10750 (KM2326.008VPC), filed September 15, 2008	
	409	International Search Report for PCT/US2008/10750 (KM2326.008VPC), filed September 15, 2008	
	410	International Search Report for PCT/US03/40321 (KM2326.011VPC), filed December 15, 2003	

13573133

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

Volkswagen Exhibit 1037, Page 135 of 2532
Volkswagen v. Longhorn - IPR2025-00925

/GS/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S167	3	US-8081822-$.DID. OR US-8098277-$.DID. OR US-8159682-$.DID.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 19:32
S168	1	("20090179733").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 19:33
S169	214	("20010012001" | "20010033675" | "20020006583" | "20020032697" | "20020041327" | "20020064382" | "20020081032" | "20020103617" | "20020105623" | "20020130839" | "20020140633" | "20020140682" | "20020178440" | "20020186221" | "20030032484" | "20030076293" | "20030091724" | "20030093784" | "20030098819" | "20030103030" | "20030113018" | "20030122839" | "20030137494" | "20030161502" | "20030178549" | "20040005924" | "20040015783" | "20040046736" | "20040046744" | "20040073541" | "20040091110" | "20040095768" | "20040183775" | "20050088407" | "20050089194" | "20050104506" | "20050110964" | "20050122308" | "20050132266" | "20050147282" | "20050162381" | "20050185828" | "20050195598" | "20050265587" | "20060010400" | "20060031786" | "20060132432" | "20060139314" | "20060168515" | "20060184993" | "20060187545" | "20060227099" | "20060242145" | "20060256382" | "20060258397" | "20060294247" | "20070285419" | "20080040692" | "20080062123" | "20080090484" | "20080150890" | "20080150913" | "20080170776" | "20080245952" | "20080252596" | "20090027337" | "20090077504" | "20090102788" | "20090225196" | "20090235295" | "20100026624" | "20100039500" | "20100060722" | "20100121866" | "2917980" | "3068754" | "3763468" | "4053208" | "4275395" | "4573191" | "4725863" | "4843568" | "4887898" | "4948371" | "5001558" | "5138304" | "5151718" | "5239373" | "5276609" | "5319496" | "5325472" | "5325473" | "5426474" | "5436639" | "5442252" | "5454043" | "5497269" | "5510828" | "5526182" | "5528263").PN. OR ("5528297"	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 19:33

LAG-VW00000136

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Volkswagen v. Longhorn - IPR2025-00925

		| "5534917" | "5548694" | "5591972" | "5594469" | "5633691" | "5703637" | "5808784" | "5861881" | "5882204" | "5923380" | "5923475" | "5953152" | "5969754" | "5978136" | "5982352" | "6008800" | "6058397" | "6075895" | "6084979" | "6088612" | "6097369" | "6106119" | "6118888" | "6125198" | "6166744" | "6176782" | "6191773" | "6198487" | "6198844" | "6263339" | "6292171" | "6308565" | "6323895" | "6333735" | "6335977" | "6339748" | "6349301" | "6353428" | "6359612" | "6388657" | "6400374" | "6407870" | "6414672" | "6445815" | "6454419" | "6480267" | "6491396" | "6501515" | "6522312" | "6545706" | "6552760" | "6598978" | "6607275" | "6611241" | "6654734" | "6658150" | "6661918" | "6677969" | "6707054" | "6707444" | "6712476" | "6720949" | "6732929" | "6747666" | "6752720" | "6754370" | "6791700" | "6826727" | "6831664" | "6871982" | "6877882" | "6912313" | "6965693" | "6975360" | "6999600" | "7015894" | "7042440" | "7054068" | "7058204" | "7068274" | "7069516" | "7084859" | "7088508" | "7149262" | "7158676" | "7170492" | "7190832" | "7193608" | "7227526" | "7259747" | "7262874" | "7289130" | "7330584" | "7339521" | "7348963" | "7379563" | "7382897" | "7394459" | "7428542" | "7432917" | "7536032" | "7559841" | "7576727" | "7598942" | "7619824" | "7665041" | "7710391" | "7737636" | "7809167" | "7834846" | "RE41685").PN.				
S170	14	(("5846086") or ("6217449") or ("6270403") or ("6278418") or ("6304267") or ("6394896") or ("6677969") or ("6808293") or ("7129927") or ("7170492") or ("7268950") or ("7431253") or ("7468742") or ("7728280")).PN.	USPAT; USOCR	OR	OFF	2012/07/28 20:02
S171	19	(("7745771") or ("7961906") or ("7971156") or ("80356128035624") or ("8085293") or ("8085994") or ("8230367") or ("20010012001") or ("20050028188") or ("20050039206") or ("20050086695") or ("20050185828") or ("20070002039") or ("20070019066") or ("20080013826") or ("20080018595") or ("20080030460") or ("20080062257") or ("20090079813") or ("20090172606")).PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:07
S172	26	(S167 S168 S169 S170 S171) and fresnel	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:08
S173	3898	(prismlet lenslet ((micro$1lens lens) near5 (cluster$3 array$3 fragment$3))) same ((project$3 light$3 illuminat$3) near5 pattern$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2012/07/28 20:24

LAG-VW00000137

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Volkswagen v. Longhorn - IPR2025-00925

S174	7100	(356/600-624).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:25
S175	1758	(359/454,455,721,737,796,797).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:25
S176	10309	(362/221,235,236,244,242,299,308,309,326-340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:25
S177	1949	(382/151,159).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:25
S178	3306	(348/135-142,169-172).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:25
S179	1361	(353/79-81).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2012/07/28 20:25
S180	219	(S174 S175 S176 S177 S178 S179) and S173	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2012/07/28 20:25
S181	539	S173 and ((ir infrared infra$1red) near10 (emit$4 emiss$3 led))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2012/07/28 20:26
S182	541	S173 and ((ir infrared infra$1red) near10 (emit$4 emiss$3 led))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/07/28 20:26
S183	4243	(prismlet lenslet ((micro$1lens lens) near5 (cluster$3 array$3 fragment$3))) same ((project$3 light$3 illuminat$3) near5 pattern$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/07/28 20:26
S184	581	S183 and ((ir infrared infra$1red) near10 (emit$4 emiss$3 led))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2012/07/28 20:26
S185	31	(S174 S175 S176 S177 S178 S179) and S184	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2012/07/28 20:26

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Volkswagen Exhibit 1037, Page 138 of 2532
Volkswagen v. Longhorn - IPR2025-00925

7/30/2012 12:59:03 PM
C:\Users\gstock\Documents\EAST\Workspaces\13448321.wsp

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
/G.S./	1	8,081,822 (KM2326.002A)	12-20-2011	Bell	
/G.S./	2	8,098,277 (KM2326.009A)	01-17-2012	Bell	
/G.S./	3	8,159,682 (KM2326.007A)	04-17-2012	Bell	
/G.S./	4	2009/0179733	07-16-2009	Hattori et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
/G.S./	5	JP 10-207619	08-07-1998	Toshiba Corp.		X
/G.S./	6	JP 11-057216	03-02-1999	Sony Corp.		X-Abstract

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]
/G.S./	7	Office Action in U.S. Application No. 12/269,849 (KM2326.007A), dated November 12, 2010	
/G.S./	8	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated December 20, 2010	
/G.S./	9	Final Office Action in U.S. Application No. 12/269,849 (KM2326.007A), dated May 12, 2011	
/G.S./	10	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated July 6, 2011	
/G.S./	11	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated July 14, 2011	
/G.S./	12	Office Action in U.S. Application No. 12/269,849 (KM2326.007A), dated August 18, 2011	
/G.S./	13	Examiner Interview Summary in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated October 14, 2011	
/G.S./	14	Notice of Allowance in U.S. Patent Application No. 12/269,849 (KM2326.007A), dated December 2, 2011	

13615161

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/30/2012								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
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	9	✓								
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	18	✓								
	19	✓								
	20	✓								

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UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1

CONFIRMATION NO. 3370

20995
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

PUBLICATION NOTICE



Title:LENS SYSTEM

Publication No.US-2012-0200843-A1
Publication Date:08/09/2012

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

LAG-VW00000142

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Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 10/05/2012

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

NOTIFICATION DATE	DELIVERY MODE
10/05/2012	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

jayna.cartee@knobbe.com
efiling@knobbe.com

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/448,321	BELL, MATTHEW	
	Examiner	Art Unit	
	GORDON STOCK JR	2886	

All participants (applicant, applicant's representative, PTO personnel):

(1) *GORDON STOCK JR*.

(2) *ATTORNEY DON PUA*.

(3) *ATTORNEY RUSSELL JEIDE*.

(4)_____.

Date of Interview: *21 September 2012*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☒112 ☒102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1,3,8,10 and 15-20*.

Identification of prior art discussed: *US 2008/0252596; US 20050110964; US 7737636; US 5978136; US 2008/0245952*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

See Continuation Sheet.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/Gordon J Stock/ Examiner, Art Unit 2886	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: With regards to claims 1 and 8 Examiner stated that 'to execute instructions stored in memory/executing instructions stored in memory' should be cancelled from the claims to have priority back to filing date of 60/987,315. With regards to claim 15 Examiner stated that in view of Applicant's disclosure page 3 that it appears that the 'tangible computer readable medium' refers only to a determining operation and not an instructing and detecting operation. In addition, Applicant's parent application does not provide support for 'one or more hardware processors.' In addition, with regards to claims 15-20 to have priority back to the filing date of 60/987,315 Examiner suggested drafting claims 15-20 as a computer vision device/apparatus or computing device rather than a tangible computer readable medium. Examiner also suggested removing intended use recitations from claim 15. It was suggested to incorporate limitations of claim 3 into claim 1 and limitations of claim 10 into claim 8. Examiner agreed that the proposal with regards to claims 1 and 3 and claims 8 and 10 overcomes the prior art of record rejection; however, further search and consideration are necessary. In addition, Examiner mentioned that it appears that a new grounds of rejection might be possible if claim 3 and claim 10's limitations are incorporated into claim 1 and 8 with a new grounds of rejection with regards to US 2008/0252596, 20050110964 with 7737636, 5978136, and 2008/0245952. To overcome a potential rejection under 103(a) with 2008/0252596, Examiner suggested showing that the reference is disqualified under 35 USC 103(c). It was also proposed to the Examiner to further clarify Applicant's invention over the prior art of record with regards to the condensing lens; again, Examiner stated that incorporating the limitations of claims 3 and 10 into claims 1 and 8 overcomes the prior art rejection; however, further search and consideration are necessary. Examiner stated that he would call the attorneys after a formal response is submitted.

Knobbe Martens
INTELLECTUAL PROPERTY LAW

KNOBBE MARTENS OLSON & BEAR LLP

2040 Main St., 14th Fl. Irvine, CA 92614
T (949) 760-0404

Don C. Pua
Don.Pua@knobbe.com

FACSIMILE TRANSMITTAL SHEET

CONFIRMATION COPY WILL FOLLOW VIA:

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TO:	Gordon J Stock Jr.
FIRM:	USPTO
FACSIMILE NO.:	571-273-2431
OUR REF.:	KM2326.007D1
YOUR REF.:	Application No. 13/448,321; Atty Docket No.: KM2326.007D1
FROM:	Don Pua
OPERATOR:	Mireya Velez — NO. OF PAGES: 4 (incl. cover sheet)
DATE:	September 17, 2012 — TIME: 5:05pm PST

IF YOU DID NOT RECEIVE ALL OF THE PAGES PLEASE CALL BACK IMMEDIATELY
OPERATOR PHONE NO.: (949) 760-0404 FACSIMILE NO.: (949) 760-9502

MESSAGE:

DEAR EXAMINER STOCK,

ATTACHED PLEASE FIND AN INTERVIEW REQUEST FORM FROM MR. DON PUA. SHOULD YOU HAVE ANY QUESTIONS, PLEASE DON'T HESITATE TO CONTACT US.

13989319
091712

Doc Code: M865 or FAI.REQ.INTV

PTOL-413A (08-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Applicant Initiated Interview Request Form

Application No.: 13/448,321 First Named Applicant: Matthew Bell
Examiner: Gordon J. Stock, Jr. Art Unit: 2162 Status of Application: Pending

Tentative Participants:
(1) Examiner Gordon J. Stock, Jr. (2) Don Pua
(3) Russell Jeide (4)

Proposed Date of Interview: September 18 **Proposed Time:** 1:00PM EDT (AM/PM)

Type of Interview Requested:
(1) [✓] Telephonic (2) [ ] Personal (3) [ ] Video Conference

Exhibit To Be Shown or Demonstrated: [ ] YES [✓] NO
If yes, provide brief description:

Issues To Be Discussed

Issues (Rej., Obj., etc)	Claims/ Fig. #s	Prior Art	Discussed	Agreed	Not Agreed
(1) Rej. 112/ Priority	15-20		[x]	[ ]	[ ]
(2) Rej. 102/103	All	Bell et al.	[x]	[ ]	[ ]
(3) Drawings	Fig. 1		[ ]	[ ]	[ ]
(4)			[ ]	[ ]	[ ]

[ ] Continuation Sheet Attached [ ] Proposed Amendment or Arguments Attached

Brief Description of Arguments to be Presented: The Bell '737 reference and the present '321 application were commonly owned by Roactrix at the time the invention was made. Claim 3 is not disclosed by the cited art. Further, claims 15-20 are entitled to the earlier priority date.

An interview was conducted on the above-identified application on 09/21/12

NOTE: This form should be completed and filed by applicant in advance of the interview (see MPEP § 713.01). If this form is signed by a registered practitioner not of record, the Office will accept this as an indication that he or she is authorized to conduct an interview on behalf of the principal (37 CFR 1.32(a)(3)) pursuant to 37 CFR 1.34. This is not a power of attorney to any above named practitioner. See the Instruction Sheet for this form, which is incorporated by reference. By signing this form, applicant or practitioner is certifying that he or she has read the Instruction Sheet. After the interview is conducted, applicant is advised to file a statement of the substance of this interview (37 CFR 1.133(b)) as soon as possible. This application will not be delayed from issue because of applicant's failure to submit a written record of this interview.

/Gordon J Stock/
Examiner/SPE Signature

Applicant/Applicant's Representative Signature

Don C. Pua
Typed/Printed Name of Applicant or Representative

67,028
Registration Number, if applicable

This collection of information is required by 37 CFR 1.133. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 24 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: **Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTOL-413A (08-10)
Approved for use through 07/31/2012, OMB 0651-0031
U.S. Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Instruction Sheet for:
APPLICANT INITIATED INTERVIEW REQUEST FORM

(Not to be Submitted to the USPTO)

1. If this form is signed by a registered practitioner not of record, the authority to submit the Applicant Initiated Interview Request Form is pursuant to limited authority to act in a representative capacity under 37 CFR 1.34 and further proof of authority to act in a representative capacity may be required. *See* 37 CFR 1.34.

   The Office will accept the signed form as an indication that the registered practitioner not of record is authorized to conduct an interview on behalf of the principal in pursuant to 37 CFR 1.34.

   For more information, see the "Conducting an Interview with a Registered Practitioner Acting in a Representative Capacity" notice which is available on the USPTO Web site at: http://www.uspto.gov/patents/law/notices/2010.jsp.

2. This is not a power of attorney to any named practitioner. Accordingly, any registered practitioner not of record named on the form does not have authority to sign a request to change the correspondence address, a request for express abandonment, a disclaimer, a power of attorney, or other document requiring the signature of the applicant, assignee of the entire interest or an attorney of record. If appropriate, a separate power of attorney to the named practitioner should be executed and filed in the US Patent and Trademark Office.

3. Any interview concerning an unpublished application under 35 U.S.C. § 122(b) with a registered practitioner not of record, pursuant to 37 CFR 1.34, will be conducted based on the information and files supplied by the practitioner in view of the confidentiality requirements of 35 U.S.C. § 122(a).

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Volkswagen v. Longhorn - IPR2025-00925

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Bell
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr, Gordon J
Art Unit	:	2886
Conf No.	:	3370

RESPONSE TO NON-FINAL OFFICE ACTION MAILED AUGUST 7, 2012

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Non-final Office Action mailed August 7, 2012, please consider the following:

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Amendments to the Drawings begin on page 6 of this paper. A "New Sheet" for FIG. 5 of the drawings can be found in the Appendix.

Summary of Interview begins on page 7 of this paper.

Remarks begin on page 8 of this paper.

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AMENDMENTS TO THE SPECIFICATION

Changes to the specification are shown below, where insertions appear as underlined text (e.g., insertions) while deletions appear as strikethrough text (e.g., ~~deletions~~) or double brackets (e.g., [[~~deletions~~]]).

Please insert the following paragraph indicated below after paragraph 12 (as numbered in the publication of the present application).

[0012] FIG. 4 illustrates a cross-sectional illustration of light as created by an LED in an illuminator light source.

FIG. 5 is a block diagram illustrating light emitted in a cone from an LED in an infrared LED cluster.

Please insert the following paragraph indicated below after paragraph 36 (as numbered in the publication of the present application).

[0036] The use of infrared light (or other types of non-visible or substantially invisible light) may prove useful in that it may be invisible (or nearly invisible) to the human eye of an observer interacting with an illuminated object. In this way, the illuminated object is not obscured by an illumination pattern nor or does the overall appearance of the object appear to have been altered. Notwithstanding, a computing device coupled to a camera may detect the pattern in order to track the object and interactions with the same with an increased degree of accuracy.

FIG. 5 is a block diagram illustrating light emitted in a cone from an LED in the infrared LED cluster 110, which corresponds to lighting source 110 of FIG. 1. The light path is redirected toward the center of the lens cluster by the condenser lens 120, which likewise corresponds to the optional condenser lens of FIG. 1. When the light cone hits the lens cluster 130 (which corresponds to cluster 130 of FIG. 1), different parts of the LED light are focused onto different locations on a distant plane. This causes several bright spots to be created from the light of a single LED. When all the light from all the LEDs is tracked, the result is a dense overlapping pattern of focused light beams creating a discernable pattern that may be detected by a camera(s) 510 and processed by a corresponding computing device 515.

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AMENDMENTS TO THE CLAIMS

1. (Currently amended) A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern;

a cluster of lenses located in front of the light source, the cluster of lenses configured to focus and project light from the emitters in a plurality of directions, the focused and projected light forming a pattern of light;

a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses;

a camera configured to detect the pattern of light on an object illuminated by at least a portion of the pattern of light; and

a computing device configured to ~~execute instructions stored in memory to~~ determine a location of the object in space based on at least the detected pattern of light on the object.

2. (Original) The system of claim 1, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is detectable by the camera but not by an eye of a human observer interacting with the object.

3. (Canceled).

4. (Currently amended) The system of claim 1, wherein the cluster of lenses includes a Fresnel lens.

5. (Original) The system of claim 1, wherein the emitters are arranged in an irregular pattern.

6. (Original) The system of claim 1, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

7. (Original) The system of claim 1, wherein the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

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Volkswagen v. Longhorn - IPR2025-00925

8. (Currently amended) A method ~~for projecting a pattern of infrared light, the method~~ comprising:

emitting light from a light source including a plurality of emitters~~, the plurality of emitters~~ arranged in a pattern;

concentrating light from each of the plurality of emitters towards a center of a cluster of lenses using a condenser lens located between the light source and the cluster of lenses;

focusing the emitted light in a plurality of directions using ~~a~~ the cluster of lenses located in front of the light source, the focused light forming a pattern of light;

detecting the pattern of light on an object illuminated by at least a portion of the pattern of light; and

determining a location of the object in space based on at least the detected pattern of light on the object, wherein the location of the object is determined by a computing device ~~executing instructions stored in memory~~.

9. (Original) The method of claim 8, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is not detectable by an eye of a human observer interacting with the object.

10. (Canceled).

11. (Currently amended) The method of claim 8, wherein the cluster of lenses includes a Fresnel lens.

12. (Original) The method of claim 8, wherein the emitters are arranged in an irregular pattern.

13. (Original) The method of claim 8, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

14. (Original) The method of claim 8, wherein the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

15-20. (Canceled).

21. (New) A system for projecting a pattern of light, the system comprising:

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a computing device configured to analyze images of a pattern of light on an object to determine a location of the object in space based on at least the pattern of light on the object; and

a condenser lens located between a light source including a plurality of emitters configured to emit light and a cluster of lenses, wherein the condenser lens concentrates light from each of the plurality of emitters towards the center of the cluster of lenses;

wherein the light source and cluster of lenses are configured to generate the pattern of light.

22. (New) The system of claim 21, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is not detectable by an eye of a human observer interacting with the object.

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AMENDMENTS TO THE DRAWINGS

The Office Action objected to the figures as not showing every feature of the invention specified in the claims. In response to an indication by the Examiner (in the below-discussed interview) that having a figure showing these claim features would be required in order to advance prosecution, the Applicant has added FIG. 5 to address the objection to the figures. Applicant therefore respectfully requests the withdrawal of this objection.

The attached New Sheet of drawings includes the added FIG. 5. No new matter has been added by these amendments. Support for FIG. 5 can be found at least in FIG. 4 and in paragraph 35 of the publication, which recites:

> [0035] In FIG. 4, light is emitted in a cone from an LED in the infrared LED cluster 110, which corresponds to lighting source 110 of FIG. 1. The light path is redirected toward the center of the lens cluster by the condenser lens 120, which likewise corresponds to the optional condenser lens of FIG. 1. When the light cone hits the lens cluster 130 (which corresponds to cluster 130 of FIG. 1), different parts of the LED light are focused onto different locations on a distant plane. This causes several bright spots to be created from the light of a single LED. When all the light from all the LEDs is tracked, the result is a dense overlapping pattern of focused light beams creating a discernable pattern that may be detected by a camera(s) and processed by a corresponding computing device.

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SUMMARY OF INTERVIEW

A telephone interview was conducted on September 21, 2012 and attended by Examiner Gordon Stock and Applicant's representatives Russell Jeide and Don Pua. Applicant thanks the Examiner for his willingness to discuss claims 1 and 3 and the rejections over U.S. Publication No. 2008/0252296 to Bell and U.S. Patent No. 5,978,136 to Ogawa. Examiner Stock indicated that an amendment proposed during the interview, which is reflected in the amended claims, would overcome the current rejections, subject to further search.

Applicant requests that this paper constitute the Interview Summary. If the Examiner notices any deficiencies in this regard, the Examiner is encouraged to contact the undersigned representative to correct such deficiencies.

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REMARKS

The Applicant would like to thank Examiner Stock for the interview extended to the Applicant's counsels of record, representative Russell Jeide and Don Pua. This Amendment is responsive to the Office Action mailed on August 7, 2012 ("Office Action").

In the present amendment, the Applicant amended the specification, amended the drawings, canceled claims, amended the claims, and added new claims. Please reconsider the application in view of the foregoing amendments and the following remarks.

Status of the Claims

Prior to entry of the foregoing amendments, claims 1-20 were pending in this application. Claims 1, 4, 8 and 11 are hereby amended. Claims 3, 10 and 15-20 are canceled. New claims 21-22 are hereby added. Accordingly, claims 1-2, 4-9, 11-14, and 21-22 are currently pending.

New Claims

New claims 21-22 have been added and are believed to be fully distinguished over the cited art of record. The Applicant respectfully submits that no new matter is introduced by way of these new claims.

Objections to the Drawings and Specification

As discussed above, the Applicant has added FIG. 5 to address the objection to the figures.

With respect to the objection to the specification for failure to provide proper antecedent basis, Applicant believes this objection is now moot with the cancellation of claim 15. Applicant therefore respectfully requests the withdrawal of these objections.

Claim Objections

Claims 3, 4, 10, 11 and 17 are objected to for reciting "cluster of lens." The above claims have been amended as requested or canceled. Applicant therefore respectfully requests the withdrawal of these objections.

Claim Rejections under 35 U.S.C. § 112

Applicant believes the amendment to independent claim 8 addresses the rejection of dependent claim 17 for lack of antecedent basis.

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In light of their cancellation, the rejections of claim 16-20 are now moot. Applicant therefore respectfully requests the withdrawal of these § 112 rejections.

Claim Rejection under 35 U.S.C. § 102(e)

Independent claims 1 and 8 stand rejected as being anticipated by US Patent Application Publication No. 20080252296 to Bell ("Bell"). Claims 1 and 8 have been amended to recite limitations based on previously pending claim 3 (now canceled). Claim 3 was rejected as obvious over Bell in view of U.S. Patent No. 5,978,136 to Ogawa ("Ogawa").

Further, Applicant would like bring to the Examiner's attention that the present application and Bell were, at the time the invention of the present application was made, owned by Reactrix Systems, Inc, as recorded in Reel 024214, Frame 0121 for the present application and Reel 020974, Frame 0285 for Bell.

Each independent claim is discussed below.

Independent claim 1

With respect to amended claim 1, the Office Action fails to point to teachings in Bell and Ogawa of at least the following features:

> a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens concentrates light from each of the plurality of emitters towards a center of the cluster of lenses.

Based on the discussions with the Examiner, Applicant submits that claim 1 is in condition for allowance.

Independent claim 8

With respect to amended claim 8, the Office Action fails to point to teachings in Bell and Ogawa of at least the following features:

> concentrating light from each of the plurality of emitters towards a center of a cluster of lenses using a condenser lens located between the light source and the cluster of lenses.

Based on the discussions with the Examiner, Applicant submits that claim 8 is in condition for allowance.

LAG-VW00000159

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Dependent claims

Applicant respectfully submits that the rejections of the dependent claims are improper in view of the respective dependency of each such claim from an allowable independent claim. In addition, the dependent claims recite features that represent additional patentable distinctions over the cited art.

Conclusion

Applicant respectfully submits that the claims are in condition for allowance. The Examiner has issued several rejections and objections in the Office Action. Applicant respectfully traverses the rejections and objections and disagrees with the rejections and objections and with the characterization of the claims. Applicant also respectfully disagrees with any explicit or implicit Official Notice taken to support the rejections and objections.

Furthermore, any remarks in support of patentability of one claim should not be imputed to any other claim, even if similar terminology is used. Any remarks referring to only a portion of a claim should not be understood to base patentability on that portion or that the limitation discussed is essential or critical; rather, patentability must rest on each claim taken as a whole.

In addition, should there be any questions or issues that could be resolved via a telephone conversation, the Applicant invites the Examiner to contact the undersigned at the number shown below.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that

Volkswagen Exhibit 1037, Page 160 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: November 6, 2012

By: _____

Don C. Pua
Registration No. 67,028
Attorney of Record
Customer No. 20995
(949) 721-7629

13754405

LAG-VW00000161

Volkswagen Exhibit 1037, Page 161 of 2532
Volkswagen v. Longhorn - IPR2025-00925

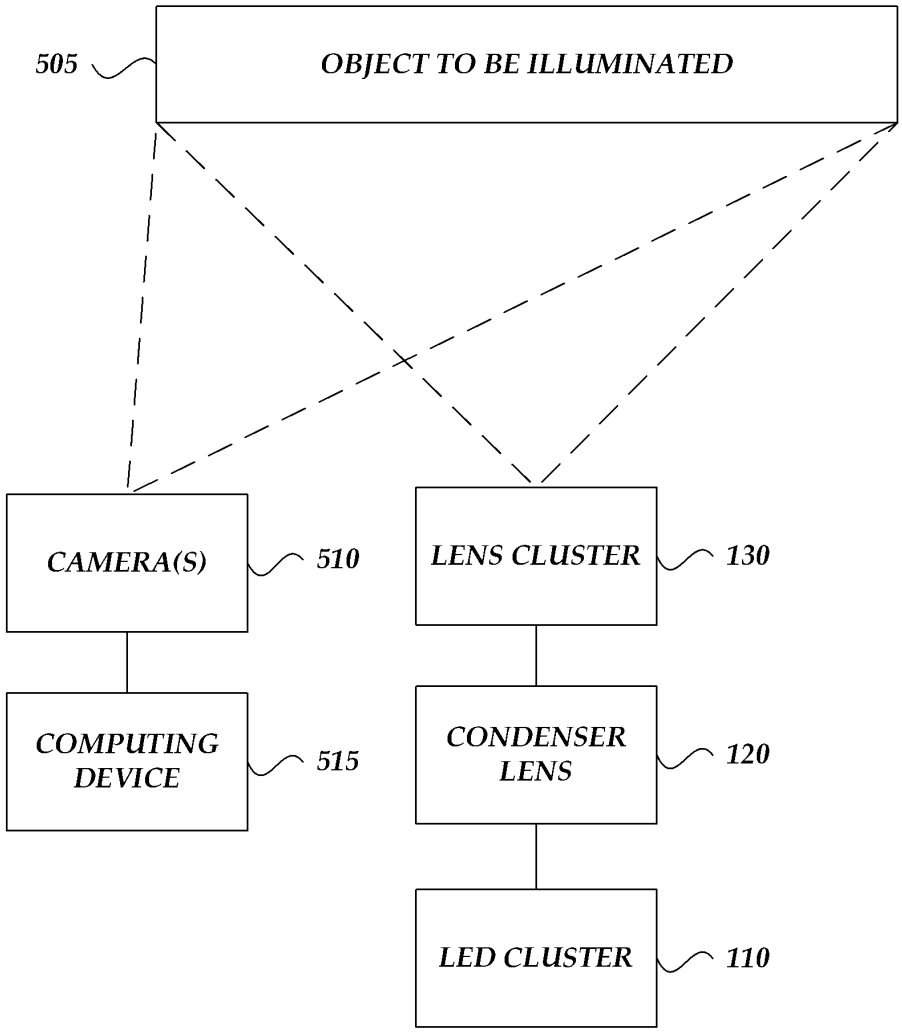

505
OBJECT TO BE ILLUMINATED
CAMERA(S)
510
LENS CLUSTER
130
COMPUTING DEVICE
515
CONDENSER LENS
120
LED CLUSTER
110

Fig. 5

INFORMATION DISCLOSURE STATEMENT

Inventor	:	Matthew Bell
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr, Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Submitted herewith in the above-identified application is an Information Disclosure Statement listing references for consideration. Copies of any listed foreign and non-patent literature references are being submitted.

Pursuant to 37 C.F.R § 1.97(g) and (h), Applicant makes no representation that the information is considered to be material to patentability. Additionally, inclusion on this list is not an admission that any of the cited documents are prior art in this application. Further, Applicant makes no representation regarding the completeness of this list, or that better art does not exist.

Timing of Disclosure

This Information Disclosure Statement is being filed after receipt of a first office action, but before the mailing date of a final action and before the mailing date of a Notice of Allowance. This Statement is accompanied by the fees set forth in 37 C.F.R. § 1.17(p). The

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Volkswagen v. Longhorn - IPR2025-00925

Application No.: **13/448,321**
Filing Date: **April 16, 2012**

Commissioner is hereby authorized to charge any additional fees which may be required or to credit any overpayment to Account No. 11-1410.

Respectfully submitted,
KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: November 6, 2012

By: _____
Don C. Pua
Registration No. 67,028
Attorney of Record
Customer No. 20995
(949) 721-7629

14280101

LAG-VW00000164

Volkswagen Exhibit 1037, Page 164 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2886
(Multiple sheets used when necessary)	Examiner	Gordon J. Stock Jr.
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	4,769,697	09-06-1988	Gilley et al.	
	2	5,771,307	06-23-1998	Lu et al.	
	3	5,966,696	10-12-1999	Giraud	
	4	6,873,710	03-29-2005	Cohen-Solal et al.	
	5	7,738,725	06-15-2010	Raskar et al.	
	6	8,199,108 (KM2326.011C1)	06-12-2012	Bell et al.	
	7	8,259,163 (KM2326.015A)	09-04-2012	Bell et al.	
	8	2002/0046100	04-18-2002	Kinjo	
	9	2002/0073417	06-13-2002	Kondo et al.	
	10	2003/0065563	04-03-2003	Elliott et al.	
	11	2002/0078441	06-20-2002	Drake et al.	
	12	2003/0126013	07-03-2003	Shand	
	13	2011/0157316	06-30-2011	Okamoto et al.	

14098617

Examiner Signature	Date Considered
***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

T[1] - Place a check mark in this area when an English language Translation is attached.

Electronic Patent Application Fee Transmittal	
Application Number:	13448321
Filing Date:	16-Apr-2012
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Filer:	Don Neil Caceres Pua/Will Nguyen
Attorney Docket Number:	KM2326.007D1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

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Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt	
EFS ID:	14162682
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Don Neil Caceres Pua/Daniela Lopez
Filer Authorized By:	Don Neil Caceres Pua
Attorney Docket Number:	KM2326.007D1
Receipt Date:	06-NOV-2012
Filing Date:	16-APR-2012
Time Stamp:	17:15:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	16103
Deposit Account	111410
Authorized User	KNOBBE MARTENS OLSON AND BEAR
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		KM2326-007D1_RESPONSE.pdf	441663 330043d6682530a2b0c4d92b794ddeb73c1 24364	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Specification		2	2	
	Claims		3	5	
	Drawings-only black and white line drawings		6	6	
	Applicant summary of interview with examiner		7	7	
	Applicant Arguments/Remarks Made in an Amendment		8	11	
Warnings:					
Information:					
2	Drawings-only black and white line drawings	KM2326-007D1_DRAW.pdf	39727 1fbac436d876f6d9369b52bf7b2f754c39d8 22d6	no	1
Warnings:					
Information:					
3		KM2326-007D1_IDS.pdf	92536 c13fe1f020e13c1e0eaf7c5aae5ca61ceddc6 707	yes	3
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Transmittal Letter		1	2	
	Information Disclosure Statement (IDS) Form (SB08)		3	3	
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30218 8eeeb83f4426f91b83ebb70e22753843816 3095d	no	2
Warnings:					
Information:					

Total Files Size (in bytes):	604144

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/448,321	Filing Date 04/16/2012	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
	11/06/2012	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 14	Minus	** 20	= 0	X $ =		OR	X $62=	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $ =		OR	X $250=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)					
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/JACQUELINE COUPLIN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

20995 7590 03/11/2013

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER
STOCK JR, GORDON J

ART UNIT	PAPER NUMBER
2886	

DATE MAILED: 03/11/2013

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

TITLE OF INVENTION: LENS SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1770	$300	$0	$2070	06/11/2013

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

LAG-VW00000172

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Volkswagen v. Longhorn - IPR2025-00925

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

20995 7590 03/11/2013
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

TITLE OF INVENTION: LENS SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1770	$300	$0	$2070	06/11/2013

EXAMINER	ART UNIT	CLASS-SUBCLASS
STOCK JR, GORDON J	2886	356-614000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
❑ Issue Fee
❑ Publication Fee (No small entity discount permitted)
❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)
❑ A check is enclosed.
❑ Payment by credit card. Form PTO-2038 is attached.
❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 03/11/2013

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

DATE MAILED: 03/11/2013

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 5 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 5 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

LAG-VW00000174

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Volkswagen v. Longhorn - IPR2025-00925

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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Volkswagen v. Longhorn - IPR2025-00925

Notice of Allowability	Application No.	Applicant(s)	
	13/448,321	BELL, MATTHEW	
	Examiner	Art Unit	
	GORDON STOCK JR	2886	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment received on 11/6/12*.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *1,2,4-9,11-14,21 and 22*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .

4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has **TH**REE MON**TH**S FROM **TH**E "MAILING DA**T**E" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMEN**T** FOR **TH**E DEPOSI**T** OF BIOLOGICAL MA**T**ERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 20121106
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

DETAILED ACTION

1. The Amendment received on November 6, 2012 has been entered into the record.

Drawings

2. The Drawing received on November 6, 2012 is accepted by the Examiner.

Information Disclosure Statement

3. The information disclosure statement (IDS) submitted on November 6, 2012 has been considered by the examiner.

Allowable Subject Matter

4. **Claims 1, 2, 4-9, 11-14, and 21-22** are allowed.

The following is an examiner's statement of reasons for allowance:

As to **claim 1**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a system for projecting a pattern of light 'a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses' and 'a computing device configured to determine a location of the object in space based on at least the detected pattern of light on the object,' in combination with the rest of the limitations of **claim 1.** **Claims 2 and 4-7** are allowed by virtue of their dependency from **claim 1.**

As to **claim 8**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a method 'concentrating light from each of the plurality of emitters towards a center of a cluster of lenses using a condenser lens located between the light source and the cluster of lenses' and 'determining a location of the object in space based on at least the detected pattern of light on the object, wherein the location of the object is determined by a computing

device' in combination with the rest of the limitations of **claim 8. Claims 9 and 11-14** are allowed by virtue of their dependency from **claim 8.**

As to **claim 21**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a system for projecting a pattern of light 'a computing device configured to analyze images of a pattern of light on an object to determine a location of the object in space based on at least the pattern of light on the object' and 'a condenser lens located between a light source including a plurality of emitters configured to emit light and a cluster of lenses, wherein the condenser lens concentrates light from each of the plurality of emitters towards the center of the cluster of lenses' in combination with the rest of the limitations of **claim 21. Claim 22** is allowed by virtue of their dependency from **claim 21.**

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Please refer to attached PTO-892.

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by fax transmission. The fax phone number for Patent Technology Center 2800 is 571-273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (571) 272-2431. The examiner can normally be reached on Monday-Friday, 8:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tarifur R. Chowdhury, can be reached at 571-272-2287.

Information regarding the status of an application may be obtained from the Patent Application lnformation Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private Pair system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Gordon J Stock/

Primary Examiner, Art Unit 2886

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Volkswagen v. Longhorn - IPR2025-00925

Notice of References Cited	Application/Control No. 13/448,321	Applicant(s)/Patent Under Reexamination BELL, MATTHEW	
	Examiner GORDON STOCK JR	Art Unit 2886	Page 1 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2012/0293625	11-2012	SCHNEIDER et al.	348/46
*	B	US-2012/0080411	04-2012	MIZUYAMA et al.	219/121.6
*	C	US-2006/0132725	06-2006	Terada et al.	353/102
*	D	US-2006/0078015	04-2006	Franck, Jerome B.	372/030
*	E	US-2006/0001760	01-2006	Matsumura et al.	348/335
*	F	US-2005/0147135	07-2005	Kurtz et al.	372/023
*	G	US-7,671,321	03-2010	Perlman et al.	250/216
*	H	US-6,902,310	06-2005	Im, Yong-seok	362/558
*	I	US-6,882,480	04-2005	Yanagisawa, Yoshiyuki	359/634
*	J	US-6,513,953	02-2003	Itoh, Yoshitaka	362/331
*	K	US-6,464,375	10-2002	Wada et al.	362/268
*	L	US-6,254,246	07-2001	Tiao et al.	362/614
*	M	US-5,900,982	05-1999	Dolgoff et al.	359/619

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Notice of References Cited	Application/Control No. 13/448,321	Applicant(s)/Patent Under Reexamination BELL, MATTHEW	
	Examiner GORDON STOCK JR	Art Unit 2886	Page 2 of 2

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,662,401	09-1997	Shimizu et al.	353/38
*	B	US-5,473,396	12-1995	Okajima et al.	353/122
*	C	US-5,418,583	05-1995	Masumoto, Yoshihiro	353/38
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FOREIGN PATENT DOCUMENTS

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Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2886
(Multiple sheets used when necessary)	Examiner	Gordon J. Stock Jr.
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	4,769,697	09-06-1988	Gilley et al.	
	2	5,771,307	06-23-1998	Lu et al.	
	3	5,966,696	10-12-1999	Giraud	
	4	6,873,710	03-29-2005	Cohen-Solal et al.	
	5	7,738,725	06-15-2010	Raskar et al.	
	6	8,199,108 (KM2326.011C1)	06-12-2012	Bell et al.	
	7	8,259,163 (KM2326.015A)	09-04-2012	Bell et al.	
	8	2002/0046100	04-18-2002	Kinjo	
	9	2002/0073417	06-13-2002	Kondo et al.	
	10	2003/0065563	04-03-2003	Elliott et al.	
	11	2002/0078441	06-20-2002	Drake et al.	
	12	2003/0126013	07-03-2003	Shand	
	13	2011/0157316	06-30-2011	Okamoto et al.	

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Examiner Signature	/Gordon Stock Jr/	Date Considered	02/01/2013

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] - Place a check mark in this area when an English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

/GS/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1188	(lenslet cluster microlens) near5 (lens near5 (converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/02/21 17:09
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L11	1406	(353/79-81).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 18:51
L12	13930	(356/3-22,600-624).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 18:51
L13	10789	(362/221,235,236,244,242,299,308,309,326-340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 18:52
L14	2125	(382/151,159).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 18:52
L15	10152	(348/135-152,169-172).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 18:52
L16	3652	(348/135-142,169-172).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 18:52
L17	2818	(250/203.1-203.7,202,341.7).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 18:55
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L21	33	18 and (((determin$5 detect$3 sens$3 calculat$3 comput$3) near4 (position$3 orient$5 locat$3 distance coordinate)) same pattern$3)	US-PGPUB; USPAT; USOCR	OR	ON	2013/02/21 19:36
L22	8118	(lenslet cluster microlens (lens near1 array)) near5 (lens near5 (condens$3 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/02/21 19:37
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L31	104841	("382").CLAS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 20:22
L32	186341	("348").CLAS.	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 20:22
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LAG-VW00000187

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Volkswagen v. Longhorn - IPR2025-00925

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L36	15754	(lenslet cluster microlens (lens near1 array)) and (((determin$5 detect$3 sens$3 calculat$3 comput$3) near4 (position$3 orient$5 locat$3 distance coordinate)) same pattern$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/02/21 20:45
L37	943	((lenslet cluster microlens (lens near1 array)) same ((laser light led emitter) near2 array)) and (((determin$5 detect$3 sens$3 calculat$3 comput$3) near4 (position$3 orient$5 locat$3 distance coordinate)) same pattern$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/02/21 20:46
L38	10	((lenslet cluster microlens (lens near1 array)) same ((laser light led emitter) near2 array)) and (((determin$5 detect$3 sens$3 calculat$3 comput$3) near4 (position$3 orient$5 locat$3 distance coordinate)) same pattern$3)	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/02/21 20:47
L39	0	38 and (11 12 13 14 15 16 17)	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 20:48
L40	53	37 and (11 12 13 14 15 16 17)	US-PGPUB; USPAT; USOCR	OR	OFF	2013/02/21 20:48
L41	351	37 and (30 31 32 33)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/02/21 20:54
L42	250	41 not 35	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2013/02/21 20:54

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L43	196	(lens same cluster).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/02/21 21:14
L44	7	43 and condens$3.clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/02/21 21:14
L45	25	43 and (pattern$3 same light).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2013/02/21 21:17

2/ 21/ 2013 9:27:15 PM
C:\ Users\ gstock\ Documents\ EAST\ Workspaces\ 13448321update.wsp

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Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 3370

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/448,321	04/16/2012	356	2886	KM2326.007D1

APPLICANTS
Matthew Bell, Palo Alto, CA;

**** CONTINUING DATA ***************************
This application is a DIV of 12/269,849 11/12/2008 PAT 8,159,682 ok /GS/ 2/21/13
which claims benefit of 60/987,315 11/12/2007
(*)Data provided by applicant is not consistent with PTO records.

**** FOREIGN APPLICATIONS ***************************
none /GS/ 2/21/13

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
04/26/2012

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /GORDON J STOCK JR/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	5 ~~4~~	14 ~~20~~	3

ADDRESS /GS/ 2/21/13 /GS/ 2/21/13

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614
UNITED STATES

TITLE
LENS SYSTEM

FILING FEE RECEIVED		
1250	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	Art Unit
	GORDON STOCK JR	2886

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
references cited by applicant	2/21/13	gjs
356/600-624,3-22 (text only) see search history printout	2/21/13	gjs
parent application 12/269,849	2/21/13	gjs
359/454,455,721,737,796,797 (text only) see search history printout	2/21/13	gjs
362/221,235,236,244,242,299,308,309,326-340 (text only) see search history printout	2/21/13	gjs
382/151,159 (text only) see search history printout	2/21/13	gjs
348/135-142,169-172 (text only) see search history printout	2/21/13	gjs
353/79-81 (text only) see search history printout	2/21/13	gjs
250/203.1-203.7,202,341.7 (text only) see search history printout	2/21/13	gjs

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	interference search printout	2/21/13	gjs

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

CPC		
Symbol	**Type**	**Version**

CPC Combination Sets				
Symbol	**Type**	**Set**	**Ranking**	**Version**

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION									
CLASS	**SUBCLASS**	**CLAIMED**					**NON-CLAIMED**				
356	614	G	0	1	B	11 / 14 (2006.01.01)					
CROSS REFERENCE(S)											
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**										

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/GORDON STOCK JR/ Primary Examiner.Art Unit 2886	02/21/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	14	
/GORDON STOCK JR/ Primary Examiner.Art Unit 2886	02/21/2013	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	5

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		17												
2	2		18												
	3		19												
3	4		20												
4	5	13	21												
5	6	14	22												
6	7														
7	8														
8	9														
	10														
9	11														
10	12														
11	13														
12	14														
	15														
	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 14	
/GORDON STOCK JR/ Primary Examiner.Art Unit 2886 (Primary Examiner)	02/21/2013 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 5

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	13448321	Filing Date	2012-04-16	Docket Number (if applicable)	KM2326.007D1	Art Unit	2886
First Named Inventor	Matthew Bell			Examiner Name	Stock Jr, Gordon J.		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

☐ Other _____

☒ Enclosed

☒ Amendment/Reply

☒ Information Disclosure Statement (IDS)

☐ Affidavit(s)/ Declaration(s)

☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 111410

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Signature of Registered U.S. Patent Practitioner			
Signature	/CHRISTOPHER M. DILEO/	Date (YYYY-MM-DD)	2013-06-10
Name	Christopher M. DiLeo	Registration Number	61738

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these records.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Bell, Matthew
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr., Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

AMENDMENT AND REMARKS ACCOMPANYING A REQUEST FOR CONTINUED EXAMINATION

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Notice of Allowance mailed March 11, 2013, Applicant requests continued examination in view of the following:

Amendments to the Claims as reflected in the listing of claims which begins on page 2 of this paper; and

Remarks beginning on page 6 of this paper.

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AMENDMENTS TO THE CLAIMS

The listing of claims below replaces and supersedes all previous listing of claims in this application.

LISTING OF CLAIMS:

1. (Currently Amended) A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern;

a cluster of lenses located in front of the light source, the cluster of lenses configured to focus and project light from the emitters in a plurality of directions, the focused and projected light forming [[a]] the pattern of light; and

a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses;

~~a camera configured to detect the pattern of light on an object illuminated by at least a portion of the pattern of light; and~~

~~a computing device configured to determine a location of the object in space based on at least the detected pattern of light on the object.~~

2. (Currently Amended) The system of claim 1, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is detectable by ~~the~~ a camera but not by an eye of a human observer interacting with ~~the~~ an object illuminated by at least a portion of the pattern of light.

3. (Canceled).

4. (Previously Presented) The system of claim 1, wherein the cluster of lenses includes a Fresnel lens.

5. (Original) The system of claim 1, wherein the emitters are arranged in an irregular pattern.

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6. (Original) The system of claim 1, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

7. (Original) The system of claim 1, wherein the pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

8. (Currently Amended) A method comprising:

emitting a plurality of lights ~~from a light source including a plurality of emitters~~ arranged in a pattern;

concentrating the plurality of lights towards a central location ~~from each of the plurality of emitters towards a center of a cluster of lenses using a condenser lens located between the light source and the cluster of lenses~~; and

focusing the emitted light in a plurality of directions from the central location ~~using the cluster of lenses located in front of the light source~~, the focused light forming a pattern of light~~;~~

~~detecting the pattern of light on an object illuminated by at least a portion of the pattern of light; and~~

~~determining a location of the object in space based on at least the detected pattern of light on the object, wherein the location of the object is determined by a computing device~~.

9. (Currently Amended) The method of claim 8, wherein said emitting ~~the plurality of emitters~~ includes ~~light emitting diodes configured to generate~~ generating infrared light that is not detectable by an eye of a human observer interacting with ~~the~~ an object illuminated by at least a portion of the pattern of light.

10. (Canceled).

11. (Currently Amended) The method of claim 8, wherein said concentrating comprises concentrating the plurality of lights towards a center of a ~~the~~ cluster of lenses ~~includes~~ including a Fresnel lens.

12. (Currently Amended) The method of claim 8, wherein the pattern of light comprises ~~emitters are arranged in~~ an irregular pattern.

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13. (Currently Amended) The method of claim 8, wherein the pattern of light includes a first pattern of light ~~projected by one of the lenses from the cluster of lenses overlaps~~ overlapping with a second pattern of light ~~projected by another of the lenses from the cluster of lenses~~.

14. (Currently Amended) The method of claim 8, wherein the pattern of light ~~projected by the cluster of lenses~~ is aperiodic along at least one dimension.

15–20. (Canceled).

21. (Currently Amended) A system for projecting a pattern of light, the system comprising:

~~a computing device configured to analyze images of a pattern of light on an object to determine a location of the object in space based on at least the pattern of light on the object; and~~

a light source including a plurality of emitters configured to emit light;

a cluster of lenses configured to receive the emitted light; and

a condenser lens located between [[a]] said light source ~~including a plurality of emitters configured to emit light~~ and [[a]] said cluster of lenses, ~~wherein~~ the condenser lens ~~concentrates~~ concentrating light from each of the plurality of emitters towards the center of the cluster of lenses;

wherein the light source and cluster of lenses are configured to generate ~~the~~ a pattern of light.

22. (Previously Presented) The system of claim 21, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is not detectable by an eye of a human observer interacting with the object.

23. (New) The system of claim 21, further comprising a computing device configured to analyze images of the pattern of light on an object to determine a location of the object in space based on at least the pattern of light on the object.

24. (New) The system of claim 1, further comprising:

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a camera configured to detect the pattern of light on an object illuminated by at least a portion of the pattern of light; and

a computing device configured to determine a location of the object in space based on at least the detected pattern of light on the object.

25. (New) The method of claim 8, further comprising:

detecting the pattern of light on an object illuminated by at least a portion of the pattern of light; and

determining a location of the object in space based on at least the detected pattern of light on the object

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REMARKS

In the Notice of Allowance dated March 11, 2013, the Examiner allowed Claims 1, 2, 4–9, 11–14, 21, and 22. Applicant thanks the Examiner for the statement of allowance of the previously pending claims. By this paper, Claims 1, 2, 8, 9, 11–14, and 21 are amended and Claims 23–25 are introduced. The amendments are supported at least by the previously pending claims. No new matter is added. Applicant requests reconsideration of the claims in light of the amendments above and remarks that follow.

Discussion of Amended Independent Claims

Applicant has amended independent Claims 1, 8, and 21 to further clarify the subject matter recited therein. Specifically, Applicant has clarified the aspects of the lens system and method recited in the claims.

Applicant submits that the prior art of record does not disclose the combination of features in the independent claims at least for similar reasons as indicated in the Examiner's statement of reasons for allowance. *Notice of Allowance* item 4, p. 2. Accordingly, Applicant respectfully submits the claims are still in condition for allowance.

Discussion of Dependent Claims

The remaining claims each depend directly or indirectly from one of the independent claims discussed above. Applicant respectfully submits that these dependent claims are in condition for allowance for at least the same reasons discussed with respect to the independent claims, and for their own patentable features.

Rescission of Any Prior Disclaimers and Request to Revisit Art

The claims of the present application as amended may be broader in scope than the claims previously pursued during prosecution of this application. To the extent that any prior amendments or characterizations of the scope of any claim or referenced art

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could be construed as a disclaimer of any subject matter supported by the present disclosure, Applicants hereby rescind and retract such disclaimer. Accordingly, the references previously considered during prosecution may need to be re-visited.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Conclusion

In view of the forgoing, Applicant respectfully submits that Claims , as presented herein, define subject matter that is patentable over the references of record. Accordingly, Applicant respectfully submits that the indicated claims remain in condition for immediate allowance and such prompt allowance of the same is respectfully requested. If the Examiner finds any remaining impediment to the prompt allowance of these claims that could be clarified with a telephone conference, the Examiner is respectfully requested to initiate the same with the undersigned.

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Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: June 10, 2013

By: /CHRISTOPHER M. DILEO/
Christopher M. DiLeo
Registration No. 61,738
Attorney of Record
Customer No. 20,995
(858) 707-4000

15563959 // 061013

LAG-VW00000204

Volkswagen Exhibit 1037, Page 204 of 2532
Volkswagen v. Longhorn - IPR2025-00925

INFORMATION DISCLOSURE STATEMENT

Inventor	:	Matthew Bell
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr, Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

References and Listing

Submitted herewith in the above-identified application is an Information Disclosure Statement listing references for consideration. Copies of any listed foreign and non-patent literature references are being submitted.

For certain cited non-English patent and/or non-patent references, machine translations of the references (and/or Abstracts) are included, and inclusion is indicated in the last column. Applicant makes no representation as to the accuracy of the English machine translations. If the Examiner would like additional information regarding these references or if anything is unclear, the Examiner is invited to request such information, and Applicant will attempt to comply with any such request.

Pursuant to 37 C.F.R. § 1.97(g) and (h), Applicant makes no representation that the information is considered to be material to patentability. Additionally, inclusion on this list is not an admission that any of the cited documents are prior art in this application. Further, Applicant makes no representation regarding the completeness of this list, or that better art does not exist.

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Volkswagen v. Longhorn - IPR2025-00925

Timing of Disclosure

This Information Disclosure Statement is being filed within three months of the filing date or date of national phase entry, with an RCE or before receipt of a First Office Action after an RCE and no fee is required.

The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment, to Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: June 10, 2013

By: /CHRISTOPHER M. DILEO/
Christopher M. DiLeo
Registration No. 61,738
Attorney of Record
Customer No. 20,995
(858) 707-4000

15556346 sma060713

LAG-VW00000206

Volkswagen Exhibit 1037, Page 206 of 2532
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PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2886
(Multiple sheets used when necessary)	Examiner	Stock Jr, Gordon J.
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	6,351,222	02-26-2002	Swan et al.	
	2	8,018,579	09-13-2011	Krah	
	3	2008/0036732	02-14-2008	Wilson et al.	
	4	2012/0287044 (KM2326.008D1)	11-15-2012	Bell et al.	
	5	2012/0317511 (KM2326.015C1)	12-13-2012	Bell et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	6	JP 2004-246578	09-02-2004	Nippon Telegr & Teleph Corp. (NTT)		X-Abs
	7	JP 2007-514242	05-31-2007	Bell et al.		X-Abs
	8	WO 2005/003948	01-13-2005	Sony Computer Entertainment Inc.		X-Abs

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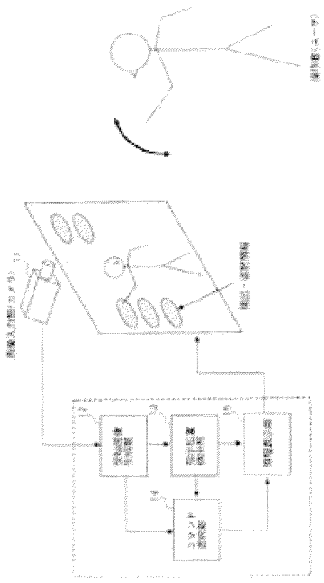
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(54) INTERFACE METHOD AND DEVICE USING SELF-IMAGE DISPLAY, AND PROGRAM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a highly convenient interface device capable of detecting an operation in a non-contact status and in an arbitrary place.
SOLUTION: An image including an operator is designated by an image inputting part 11. An image(inverted image) photographed by the image inputting part 11, and inverted right and left is generated by an inverted image generating part 12. A position(user instructed position) shown by a user with the site of the body such as the finger is detected on the inverted image by an instructed position detection part 13. A command selecting part 14 collates the user instructed position obtained by the instructed position detecting part 13 with the display position of a plurality of command information displayed at an information display part 15, and retrieves and selects the command information to be instructed by the user from their positional relation.



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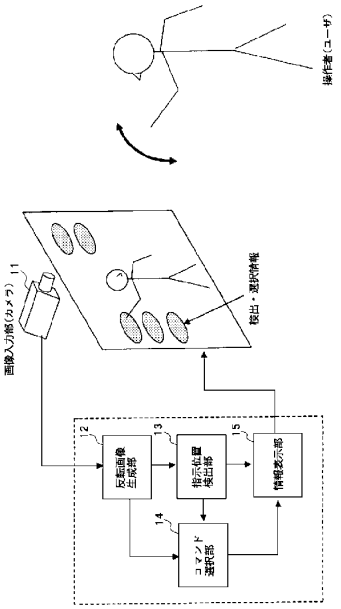
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(54)【発明の名称】自己画像表示を用いたインタフェース方法、装置、およびプログラム

(57)【要約】
【課題】非接触で、かつ任意の場所での動作検出が可能で、利便性が向上したインタフェース装置を提供する。
【解決手段】画像入力部１１によって操作者を含む画像が指定される。反転画像生成部１２によって、画像入力部１１で撮影された左右反転させた画像（反転画像）が生成される。指示位置検出部１３は反転画像上で、ユーザが手指等の体の部位で指し示す位置（ユーザ指示位置）を検出する。コマンド選択部１４は、指示位置検出部１３で得られたユーザ指示位置と、情報表示部１５で表示される複数のコマンド情報の表示位置を照らし合わせ、両者の位置関係からユーザが指示しようとするコマンド情報を探索し選択する。
【選択図】　図１



【特許請求の範囲】
【請求項１】
カメラからの画像を入力し、人間の動作を認識するインタフェース方法であって、
操作者を含む画像を撮影する画像入力ステップと、
入力された画像を左右反転した反転画像を生成するステップと、
該反転画像上で、操作者の指定する位置を検出するステップと、
該反転画像上で、操作者の指定するコマンドを選択するステップと、
該指定された位置とコマンドに基づき該反転画像上に情報を表示するステップとを有するインタフェース方法。
【請求項２】
前記コマンドを選択するステップは、
該反転画像上に表示された実空間が撮影された画像中において、予め任意に実物体位置を登録するステップと、
該反転画像上で、操作者の指定する実物体を予め登録された複数の実物体の中から検出するステップとを含む請求項１記載のインタフェース方法。
【請求項３】
カメラからの画像を入力し、人間の動作を認識するインタフェース装置であって、
操作者を含む画像を撮影する画像入力手段と、
入力された画像を左右反転した反転画像を生成する手段と、
該反転画像上で、操作者の指定する位置を検出する手段と、
該反転画像上で、操作者の指定するコマンドを選択する手段と、
該指定された位置とコマンドに基づき該反転画像上に情報を表示する手段とを有するインタフェース装置。
【請求項４】
前記コマンドを選択する手段は、該反転画像上に表示された実空間が撮影された画像中において、予め任意の実物体位置を登録する手段と、該反転画像上で、操作者の指定する実物体を予め登録された複数の実物体の中から検出する手段とを含む請求項３記載のインタフェース装置。
【請求項５】
請求項１または２に記載のインタフェース方法をコンピュータに実行させるためのインタフェースプログラム。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、カメラからの画像を入力とし、人間の動作に基づき画面上でメニューを選択するインタフェース方法および装置に関する。
【０００２】
【従来の技術】
従来、コンピュータと人間とのインタフェースにおいて、カメラからの画像を入力とし、人間の動作に基づき、画面上でメニュー選択するインタフェース装置としては、キーボードやマウス等のポインティング装置を用いる装置がある。また、体にマーカーを装着しカメラからの画像情報から動きを検出する方法や、体にセンサを装着し直接その動きを検出する方法がある。さらには、体に何も装着せずに、カメラからの入力画像等の情報から人間の動きを検出する方法もある。
【０００３】
このような方法を用いたインタフェース装置の第１の従来例として、現在一般のコンピュータに接続可能で市販されている装置として、キーボード、マウス、タッチパネル型のディスプレイがある。これらはいずれもユーザの手の動きを検出し、入力情報に変換するものである。
【０００４】

また、第２の従来例として、モーションキャプチャシステム関連の製品で、体にマーカーを装着し画像処理によって動きを検出する装置がある。例えば、Ｖｉｃｏｎ Ｍｏｔｉｏｎ Ｓｙｓｔｅｍｓ Ｌｔｄ．社の「３次元動作解析システムＶｉｃｏｎ」（販売元：株式会社ナックイメージテクノロジー）は、体の複数の部位に球形の反射マーカーを貼付け、複数台のカメラからの入力画像から画像処理により各マーカーの３次元座標を算出する方法である。

【０００５】

また、第３の従来例として、体に動作計測可能なセンサを装着し、センサ情報から動きを検出する装置、例えば、磁気センサを用いた装置（ＡＳＣＥＮＳＩＯＮ社の「Ｍｏｔｉｏｎ Ｓｔａｒ」等）や、機械式センサを用いた装置（スパイス社の「Ｇｙｐｓｙ」、Ｉｍｍｅｒｓｉｏｎ社の「Ｃｙｂｅｒ Ｇｌｏｖｅ」等）などがある。

【０００６】

また、第４の従来例として、体に何も装着せずにカメラ入力画像のみから動きを検出する装置がある（非特許文献１）。本方法は、画像処理によりマーカーやセンサを装着することなく人物の身振り認識をする方法で、画像から人物の動作に関わる特徴の抽出を行い動作認識を行う。

【０００７】

また、第５の従来例として、Ｖｉｖｉｄ Ｇｒｏｕｐ社のＧｅｓｔｕｒｅ Ｘｔｒｅｍｅ Ｓｏｆｔｗａｒｅ関連製品（例えばＳｏｃｃｅｒ ＧＸ， Ｖｏｌｌｅｙｂａｌｌ等）がある。本製品は、ＣＧ背景画像上に自己画像を重ね合わせ、画像上でＣＧのボール等とユーザの体との接触判定を行い、その結果に基づいてゲーム等のＣＧソフトとユーザとのインタフェースを実現している。

【０００８】

また、第６の従来例として、非特許文献２に記載の方法がある。本方法は、自画像上にＣＧのアイコンを表示させ、カメラに向かって行った動作に基づき希望のアイコンを選択（実行）するものである。

【０００９】

【非特許文献１】

桐島ら、“注視点の学習と選択制御による身振りの実時間画像認識”、 ＰＲＭＵ２００１－２０３， ２００２．１

【非特許文献２】

佐木ら、“パソコン映像入力を用いたアクション・インタフェースの試み”、第１２回ヒューマン・インタフェース・シンポジウム論文集、ｐｐ．２１－２１８， １９９６．

【００１０】

【発明が解決しようとする課題】

しかしながら、上述した従来の方法では、以下に示す問題があった。

【００１１】

第１の従来例は、操作者（ユーザ）の手の動きを検出する際に装置に接触する必要があることと、装置を利用するための固定し限定された場所が必要であることのため、接触型であることと、任意の場所での動作検出を行うことが困難であることである。

【００１２】

第２、第３の従来例は、非接触型でありカメラ画像に写る範囲の任意の場所での動作を検出できるが、体の部位に常に何らかのマーカーまたはセンサを装着する必要があるため、家庭や職場等の通常生活におけるインタフェース装置としての利便性に欠ける。

【００１３】

第４の従来例は、体に何も装着せずに動きを検出できるが、ユーザの動きが認識されているかどうか、目視で確認できないため、ユーザの利便性に欠ける。

【００１４】

第５の従来例では、自画像を見ながら同じディスプレイに表示されたＣＧに体が触れることでユーザの位置を検出できるが、ユーザの体全体で接触判定を行うので、手指以外の部

分（頭、腰、足等）がアイコン（接触すべきＣＧ）に触っても区別なく接触とみなされることから、誤認識する可能性が高いため、認識精度が低い。また、ユーザの背後にアイコン（接触すべきＣＧ）を置くことができないことから、インタフェース用のアイコンを任意の位置に置けないため、アイコン位置およびユーザ動作の自由度に制限がある。

【００１５】

第５、第６の従来例は、自画像を見ながら同じディスプレイに表示されたＣＧの手指等を触れる（重ねる）ことでユーザの動きを検出できるが、背景に写っている実空間上の物体を指示することはできないため、応用範囲に制限がある。

【００１６】

本発明の目的は、接触型である問題、任意の場所での動作検出を行うことが困難である問題、インタフェース装置としての利便性に欠ける問題を解決したインタフェース方法および装置を提供することにある。

【００１７】

本発明の他の目的は、アイコン位置およびユーザの動作の自由度に制限がなく、かつ応用範囲に制限のないインタフェース方法および装置を提供することにある。

【００１８】

【課題を解決するための手段】

上記目的を達成するために、本発明のインタフェース装置は、
操作者を含む画像（自己画像）を撮影する画像入力手段と、
入力された画像を左右反転した反転画像を生成する手段と、
該反転画像上で、操作者の指定する位置を検出する手段と、
該反転画像上で、操作者の指定するコマンドを選択する手段と、
該指定された位置とコマンドに基づき該反転画像上に情報を表示する手段とを有している。

【００１９】

そのため、ユーザが装置と非接触で指定するコマンドを選択できるので、前記課題の（１）（２）（３）を解決できる。

【００２０】

また、本発明の実施様態では、コマンドを選択する手段は、反転画像上に表示された実空間が撮影された画像中において、予め任意の実物体位置を登録する手段と、反転画像上で、操作者の指定する実物体を予め登録された複数の実物体の中から検出する手段とを有している。

【００２１】

そのため、画像上に表示されたＣＧだけでなく実空間を撮影した画像中の実物体を指定することができるので、前記課題の（４）（５）を解決できる。

【００２２】

【発明の実施の形態】

次に、本発明の実施の形態について図面を参照して説明する。

【００２３】

図１を参照すると、本発明の第１の実施形態のインタフェース装置は、操作者（ユーザ）を含む画像（自己画像）を入力画像とし、ユーザが自己画像を自分で見ながら、ユーザの動作に基づき、画像上でコマンド選択を実行するもので、画像入力部１１と反転画像生成部１２と指示位置検出部１３と情報表示部１４とコマンド選択部１５で構成される。

【００２４】

画像入力部１１としては、図１のように１台のカメラを用いる。カメラは一般に用いられるビデオカメラでよく、白黒でもカラーでもよい。ただし下記で述べる色情報を使用した方法を用いる場合はカラーカメラが必要である。

【００２５】

反転画像生成部１２は、画像入力部１１で入力された画像（入力画像）を入力し、左右反転させた画像（反転画像）を生成する（ステップ２１）。コンピュータ内へ取り込んだ入

力画像に対し汎用の画像処理ソフトウェア（例：ＨＡＬＣＯＮ）により、リアルタイムに反転画像を生成することができる。または、入力画像を入力し反転画像をリアルタイムに生成する機器（例：（株）朋栄の画面左右反転装置ＵＰＩ―１００ＬＲＦ、またはカメラ一体型でＳＯＮＹのＥＶＹ―Ｄ１００）で実現できる。

【００２６】

指示位置検出部１３は、反転画像生成部１２で得られた該反転画像上において、ユーザが手指等の体の部位で指し示す位置（ユーザ指示位置）を検出する（ステップ２２）。

【００２７】

指示位置検出部１３の１つ目の例として、ユーザがマーカを持ち、反転画像中のマーカーを画像処理により検出する方法がある。例えば、まず、赤色（他の色でもよいが、背景画像中に少ない色が好ましい）の物体を手に持ちもしくは装着し、それをカメラ１１の前で手振りして動かす。得られたカラー画像のＲＧＢ等の色情報の値から赤色成分を抽出し（ステップ２１）、ラベリング処理（固まり毎にグループに分ける一般的な画像処理方法）を行い（ステップ２２）、その中で最も面積の大きい赤色部分を１つ選び（ステップ２３）、その位置の重心位置（ｘ，　ｙ）を求め、得られた（ｘ，　ｙ）座標をユーザ指示位置とする（ステップ２４）。ここで、赤色の物体の代わりに、赤色（前記物体同様、他の色でもよい）の発光ダイオード（ＬＥＤ）を発光させた状態で、手に持ちもしくは装着し、当該色を抽出して同様に行う方法も可能である。（ｘ，　ｙ）は重心位置（抽出した部分の全画素値のｘ座標の合計値の平均値、およびｙ座標の合計値の平均値）でなく、中心位置（抽出した部分のｘ座標の最大値と最小値の中心値、およびｙ座標の最大値と最小値の中心値）でもよい。

【００２８】

指示位置検出部１３の２つ目の例として、ユーザがマーカを持たずに、反転画像中の手の位置を画像処理により直接検出する方法がある。例えば、まず、得られたカラー画像のＲＧＢ等色情報の値から肌色成分を抽出し（ステップ３１）、ラベリング処理を行う（ステップ３２）。得られた複数の肌色部分の中から、手の大きさや位置等の制約情報を利用して、目的とする手を選択する。その選択する具体的な方法としては、通常ユーザが衣服を着ているとすると、肌色部分の候補となる可能性が高いのは両手と顔と考えられ、また最も面積の大きいのは顔と考えられるので、２つ目と３つ目の面積が大きい肌色部分を手の候補として選択する（ステップ３３）。ユーザ指定位置が両手両方とした場合、その２つの肌色部分の候補に対する重心位置を、各々左右の手のユーザ指定位置とすればよい。また、ユーザ指定位置を１つとすると、２つの候補から１つ選ぶ必要があるが、予め例えば右手を指定する手としたら、体より右手側にある候補を（右手の可能性が高いことから）右手の肌色部分として選び、その重心位置を右手のユーザ指定位置とすればよい（ステップ３４）。左手の場合も同様である。

【００２９】

指示位置検出部１３のこれらの例では、前述した検出処理をする前に、差分画像を用いた処理を加えることにより、精度を上げることもできる。差分画像を用いた処理とは、例えば、反転画像上で、予め撮影した背景画像（ユーザのいない状態で撮影した画像）と、現在撮影している現画像（ユーザがいる状態の画像）との間で差分画像を作成する。差分画像とは、例えば、全画素について、画素毎に背景画像の画素値と（同じ画素位置の）現画像の画素値の差の絶対値を求めることにより作成できる。この差分画像を用いることにより、予め体等の動く物体だけを抽出しておき、その後前述したような画像処理（例えば、体に付けたマーカを抽出する方法や、肌色を抽出する方法等）によりユーザ指定位置を検出しその座標を取得すれば、背景画像に含まれるマーカの色や肌色に似た色の誤検出を減らせることが容易に推測できる。

【００３０】

このような指示位置検出部１３により、コマンド選択のために、体全体を対象とせず、マーカや手のみを接触判定部位に用いることができるので、コマンド選択のためのアイコン等を任意の位置におけるその位置およびユーザ動作に関して高い自由度が得られる。

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【００３１】
コマンド選択部１４は、指示位置検出部１３で得られたユーザ指示位置と、情報表示部１５で表示される複数のコマンド情報の表示位置を照らし合わせ、両者の位置関係からユーザが指示しようとするコマンド情報を探索し選択する（ステップ２３）。例えば、ユーザ指示位置からある一定の距離範囲に表示されたコマンドがあればそれを選択すればよい。指示位置検出部１３では、体全体で接触判定を行わずユーザの希望する体の部位で接触判定を行うので、情報表示部１５で表示するコマンド情報の表示位置は、ユーザの体の部位で接触判定を行わない部位の後ろに隠れてもかまわないため、コマンド情報の表示位置も、ユーザ自身の位置も画面上で任意の位置に配置することができる。

【００３２】
情報表示部１５は、反転画像生成部１２で得られた反転画像と、コマンド選択部１４で選択されたコマンド情報とを重ね合わせてディスプレイに表示する（ステップ２４）。ディスプレイは、コンピュータ用に使われる汎用のディスプレイでよく、コンピュータの画面とカメラ画像を表示できるものであればよい。コマンド情報としては、コンピュータで作成したＣＧで選択可能なコマンドを各々表示すればよい。

【００３３】
ユーザは、自己画像が映った画面を見ながら、同じ画面上にＣＧ表示されているコマンド情報に手指等を重ね合わせるだけでコマンド選択が可能であるため、わかりやすく間違いの少ない指示が可能になる。

【００３４】
図４を参照すると、本発明の第２の実施形態のインタフェース装置は、操作者（ユーザ）を含む画像（自己画像）を入力画像とし、ユーザが自己画像を自分で見ながら、ユーザの動作に基づき、画像上に含まれる実空間中の実物体を選択するもので、画像入力部１１と反転画像生成部１２と指示位置検出部１３と実物体検出部１６と実物体登録部１９と情報表示部１５で構成される。

【００３５】
本実施形態では第１の実施形態で示したコマンド選択部１４に、実物体の検出ができる仕組みを装備する。具体的には、第１の実施形態のコマンド選択部１４を実物体検出部１６と実物体登録部１９で構成する。実物体登録部１９は実物体登録処理部１７と実物体位置データ１８で構成される。他の画像入力部１１、反転画像生成部１２、指示位置検出部１３、情報表示部１５は、第１の実施形態と同様である。

【００３６】
実物体登録処理部１７は、反転画像上に含まれている任意の実物体（例えば家の中とすると、テレビ、エアコン、コンピュータ、時計、窓、棚、椅子、机、引出し、書類、オーディオ機器、照明機器等）について、予め、該反転画像上での表示位置を各々求め、実物体位置データ１８へ各々登録・保存する（ステップ２５）。もしくは、予め固定の位置を求めておくのではなく、対象とする実物体毎に位置認識可能なセンサ（市販されている磁気センサや超音波センサ等）と取り付けておくことにより、各々の物体の位置をリアルタイムに認識することができるので、それらにより得られた位置情報から該実物体位置データを算出し、常時実物体位置データを更新していくことも可能である。この場合、物体を移動させてもその位置も移動させることができる。

【００３７】
実物体位置データ１８は、物体の中心座標（ｘ，　ｙ）１個でもよいが、範囲を示す情報（例えば、矩形枠の始点座標（ｘ１，　ｙ１）と終点座標（ｘ２，　ｙ２）や、中心座標（ｘ，　ｙ）と半径値ｒや、または物体の存在する全ドットの座標リスト等）を持たせておいてもよい。第１の実施形態の指示位置検出部１３の処理と同様に中心座標は重心座標でもよい。

【００３８】
実物体検出部１９は、実物体位置データ１８に保存されている複数の位置データと、指示位置検出部１３で得られたユーザ指示位置とを照らし合わせ、第１の実施形態のコマンド

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選択部１４と同様に、両者の位置関係に基づきユーザが指示しようとする実物体を検出し、選択する（ステップ２６）。例えば、ユーザ指示位置からある一定の距離範囲に実物体の位置データがあればそれを選択すればよい。または、実物体位置データとして範囲を持たせておいた場合は、ユーザ指示位置の座標がその範囲に含まれる実物体を検出し選択する。

【００３９】

図６に本実施形態によるインタフェース動作の例を示す。

【００４０】

ユーザが見ている自己画像上に映っている実物体について、予め表示位置を求め、各々実物体位置データ１８へ登録しておく（前述したように位置認識センサ等を用いた場合は自動的に実物体位置を検出し物体位置データ１８へ登録更新させることもできる）。ユーザが指示動作をしていないときは何も反応しないが、ユーザがアクセスしたい実物体に手（やマーカ）等を重ねる動作を行い、実物体検出部１６で実物体を検出したと判定したとき、検出された実物体の位置が明示される。その明示の仕方は、図のように、例えば実物体と同じ形もしくはほぼ同じ大きさのアイコン（必要に応じ色を変えたものや半透明もしくは透明にしたものや点滅させたもの等）を該実物体の上に重ねて表示する方法や、実物体の中心付近や実物体周囲にＣＧによるマーカ（必要に応じ色を変えたものや半透明もしくは透明にしたものや点滅させたもの等）を表示する方法など容易に考えられる。すなわち、実際は実物体位置上の仮想のアイコン、もしくは表示した（透明や半透明もしくはその他の色の）ＣＧアイコンを触ることとなる。また、検出された実物体の周囲等に、関連する情報（名称や状態等）を表示してもよい。さらに、図のように、検出された実物体の位置の周囲等に、その後続けて選択すべきメニューリストをＣＧ表示し、ユーザはそのメニューリストから同様の選択方法（すなわち手などを選択したいメニューアイコンに重ね合わせて選択する方法）等によりメニューを選択し実行することも可能である。

【００４１】

これにより、ユーザは、画像上に表示されたＣＧアイコンを指定してコマンド選択できるだけでなく、実空間画像中の実物体を直接選択することも可能となる。第１の実施形態のようにＣＧコマンド選択と組み合わせれば、例えば、テレビ等を指し示して選択すると、テレビのスイッチやチャンネル等を制御するコマンド選択のためのＣＧメニューが該実物体（テレビ）の周辺に表示され、ユーザは続けてコマンド選択を行い、テレビ等を制御することが可能である。

【００４２】

また、図６ではユーザが指示動作をしていないときは何も反応していないが、例えば、図７のように、実物体側でユーザに提示すべき情報が獲得していた場合、自己画像上の該実物体上または周囲に該情報を表示したり、もしくはアイコン（色を変えたものや半透明にしたものや点滅させたもの等）を該実物体上に重ねたりして明示し、見ているユーザに知らせるようにすることも考えられる。その後は前述と同様に、ユーザが該実物体を選択すると、必要な情報やメニューリストが表示される。

【００４３】

なお、本発明は専用のハードウェアにより実現されるもの以外に、その機能を実現するためのプログラムを、コンピュータ読み取り可能な記録媒体に記録して、この記録媒体に記録されたプログラムをコンピュータシステムに読み込ませ、実行するものであってもよい。コンピュータ読み取り可能な記録媒体とは、フロッピーディスク、光磁気ディスク、ＣＤ―ＲＯＭ等の記録媒体、コンピュータシステムに内蔵されるハードディスク装置等の記憶装置を指す。さらに、コンピュータ読み取り可能な記録媒体は、インターネットを介してプログラムを送信する場合のように、短時間の間、動的にプログラムを保持するもの（伝送媒体もしくは伝送波）、その場合のサーバとなるコンピュータシステム内部の揮発性メモリのように、一定時間プログラムを保持しているものも含む。

【００４４】

【発明の効果】

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請求項１、３、５の発明によれば、ユーザは何も装着せずに、また直接何も触れずに、ユーザが指令するコマンドを選択できるため、非接触で、かつ任意の場所での動作検出を行うことが可能である。また、ユーザが自己画像上において、自分の体の任意の部位（手指等）を直接見ながら、該画像上に表示されたコマンドを選択できるため、ユーザにとって直感的なインタフェース装置を実現でき、利便性が向上する。

【００４５】

請求項２、４、５の発明によれば、画像上に表示されたＣＧだけでなく実空間を撮影した画像中の実物体を指定することができるため、ＣＧによるコマンド選択だけでなく、実物体の直接選択すること可能であり、応用範囲を拡大することができる。

【図面の簡単な説明】

【図１】本発明の第１の実施形態のインタフェース装置のブロック図である。

【図２】第１の実施形態の全体の処理の流れを示すフローチャートである。

【図３】指定位置検出部１３の処理の流れを示すフローチャートである。

【図４】本発明の第２の実施形態のインタフェース装置のブロック図である。

【図５】第２の実施形態の処理の流れを示すフローチャートである。

【図６】第２の実施形態におけるインタフェース動作の例を説明する図である。

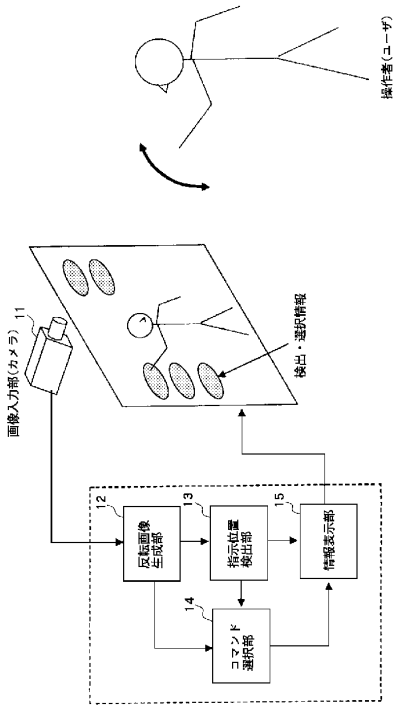
【図７】第２の実施形態における実物体の情報表示の例を説明する図である。

【符号の説明】

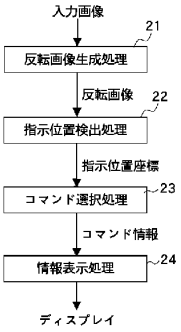
１１　画像入力部
１２　反転画像生成部
１３　指示位置検出部
１４　コマンド選択部
１５　情報表示部
１６　実物体検出部
１７　実物体登録処理部
１８　実物体位置データ
１９　実物体登録部
２１～２６、３１～３４　ステップ

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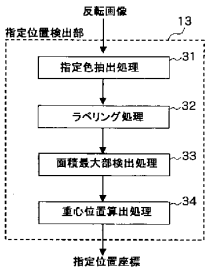
【図１】


操作者（ユーザ）
画像入力部（カメラ）
11
検出・選択情報
12
反転画像生成部
13
指示位置検出部
15
情報表示部
14
コマンド選択部

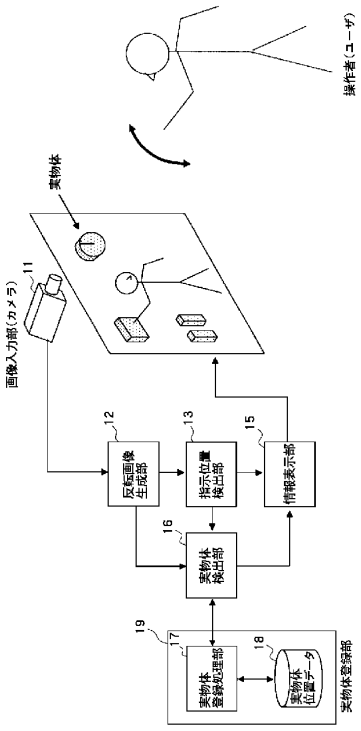
【図２】


入力画像
21
反転画像生成処理
反転画像
22
指示位置検出処理
指示位置座標
23
コマンド選択処理
コマンド情報
24
情報表示処理
ディスプレイ

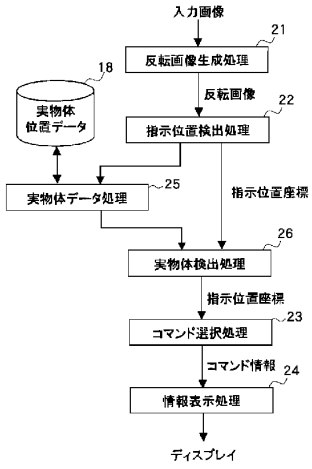
【図３】


反転画像
指定位置検出部
13
31
指定色抽出処理
32
ラベリング処理
33
面積最大部検出処理
34
重心位置算出処理
指定位置座標

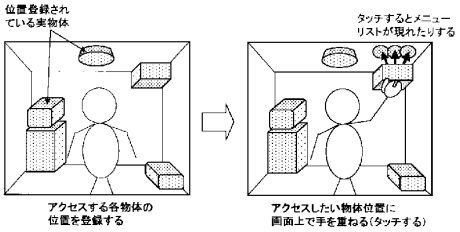
【図４】


操作者（ユーザ）
実物体
画像入力部（カメラ）
11
12
反転画像生成部
13
指示位置検出部
15
情報表示部
16
実物体検出部
19
17
実物体登録処理部
18
実物体位置データ
実物体登録部

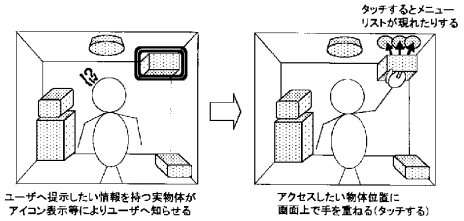
【図５】


入力画像
21
反転画像生成処理
18
実物体位置データ
反転画像
22
指示位置検出処理
25
実物体データ処理
指示位置座標
26
実物体検出処理
指示位置座標
23
コマンド選択処理
コマンド情報
24
情報表示処理
ディスプレイ

【図６】


位置登録されている実物体
タッチするとメニューリストが現れたりする
アクセスする各物体の位置を登録する
アクセスしたい物体位置に画面上で手を重ねる（タッチする）

【図７】


タッチするとメニューリストが現れたりする
ユーザへ提示したい情報を持つ実物体がアイコン表示等によりユーザへ知らせる
アクセスしたい物体位置に画面上で手を重ねる（タッチする）

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No documents available for this priority number.

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SELF-CONTAINED INTERACTIVE VIDEO DISPLAY SYSTEM

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- **cooperative:** G06F3/011; G06F3/017; G06F3/0425; G06F3/0428; G06K9/00375; G06K9/2036; G06F2203/04109

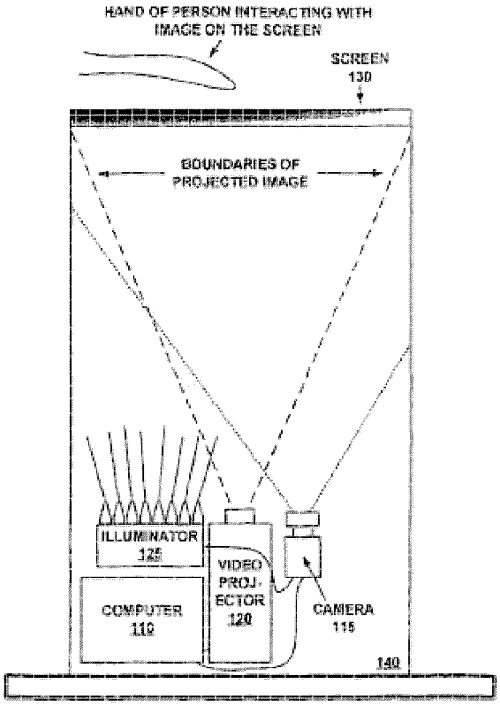
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Abstract not available for JP2007514242 (A)
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A self-contained interactive video display system. A flat-panel display screen displays a visual image for presentation to a user on a front side of the flat-panel display screen. A first illuminator illuminates the flat-panel display screen with viisible light. A second illuminator illuminates an object. A camera detects interaction of an illuminated object with the visual image, wherein the camera is operable to view the object through the flat-panel display screen. A computer system directs the projector to change the visual image in response to the interaction.



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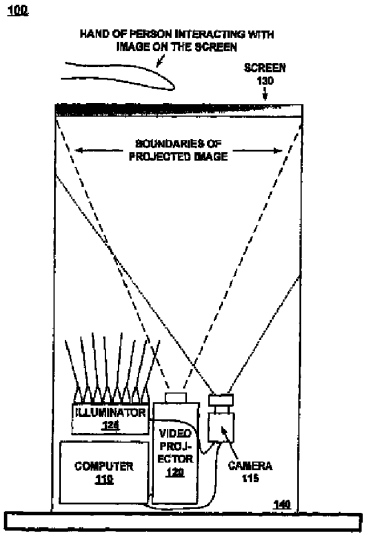
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(54)【発明の名称】内蔵型インタラクティブ・ビデオ・ディスプレイ・システム

(57)【要約】
内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。フラットパネル・ディスプレイ・スクリーンは、フラットパネル・ディスプレイ・スクリーンの前側のユーザへの提示のために、視覚イメージを表示する。第１のイルミネータは、可視光で前記ディスプレイ・スクリーンを照らす。第２のイルミネータは、対象を照らす。カメラは、照らされた対象と前記視覚イメージとの相互作用を検知し、前記カメラが、前記スクリーンを通して前記対象を見ることができるように作動する。コンピュータシステムは、前記ディスプレイ・スクリーンに、前記相互作用に応じて前記視覚イメージを変えるように指示する。



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【特許請求の範囲】
【請求項１】
フラットパネル・ディスプレイ・スクリーンの前側のユーザへの提示のために、視覚イメージを表示するディスプレイ・スクリーンと、
可視光で前記ディスプレイ・スクリーンを照らす第１のイルミネータと、
対象を照らす第２のイルミネータと、
照らされた対象と前記視覚イメージとの相互作用を検知するカメラであって、前記カメラが、前記スクリーンを通して前記対象を見ることができるカメラと、
前記ディスプレイ・スクリーンに、前記相互作用に応じて前記視覚イメージを変えるように指示するコンピュータシステムと、
を備える内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２】
前記ディスプレイ・スクリーンがフラットパネル・ディスプレイ・スクリーンである、請求項１に記載のシステム。
【請求項３】
前記フラットパネル・ディスプレイ・スクリーンが液晶ディスプレイ（ＬＣＤ）パネルである、請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項４】
前記第２のイルミネータは、赤外線照明で前記対象を照らす赤外線イルミネータであり、前記カメラは、赤外線照明を検知する赤外線カメラである、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項５】
前記第１のイルミネータの光を拡散させる拡散スクリーンをさらに備える、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６】
前記カメラ、前記第１のイルミネータ、前記第２のイルミネータ及び前記コンピュータシステムが１つのエンクロージャ内に備えられており、前記エンクロージャの一つの側部が前記フラットパネル・ディスプレイ・スクリーンを備える、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項７】
前記第２のイルミネータが、前記フラットパネル・ディスプレイ・スクリーンを通して前記対象に照明を投影し、前記第２のイルミネータが、前記カメラに対するグレアの影響を低減するように配置されている、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項８】
前記第２のイルミネータは、前記第２のイルミネータが、前記フラットパネル・ディスプレイ・スクリーンを通して照明を投影しないように、前記フラットパネル・ディスプレイ・スクリーンに隣接して配置されている請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項９】
複数の前記第２のイルミネータを備え、前記イルミネータは、前記フラットパネル・ディスプレイ・スクリーンに隣接して配置されており、また、前記フラットパネル・ディスプレイ・スクリーンを通して照明を投影せず、また、前記スクリーンの後ろに配置されている、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１０】
前記カメラは、前記フラットパネル・ディスプレイ・スクリーンの後ろに配置され、かつ前記スクリーンの方に向けられており、前記カメラが、前記スクリーン上及び前記スクリーンの前の領域を見ることができるようになっている、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

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【請求項１１】
前記カメラの視野の歪みを補正するために、前記スクリーンから一定距離に配置された一連のミラーストリップをさらに備える、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１２】
前記カメラの視野の歪みを補正するために、前記スクリーンに隣接して配置されたフレネルレンズをさらに備える、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１３】
前記フラットパネル・ディスプレイ・スクリーンに隣接して配置された波長ベースの拡散板をさらに備える、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１４】
前記波長ベースの拡散板が、赤外光に対して実質的に透過性であり、また、可視光に対して実質的に半透過性である、請求項１３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１５】
前記波長ベースの拡散板は、レイリー散乱を引き起こす材料である、請求項１３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１６】
前記フラットパネル・ディスプレイ・スクリーンに隣接して配置された拡散板をさらに備え、前記拡散板は、斜角で前記拡散板を通過する光に対しては実質的に半透過性であり、また、実質的に直角で前記拡散板を通過する光に対しては実質的に透過性であり、前記第１のイルミネータが、前記拡散板に対して斜角で配置されている、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１７】
前記フラットパネル・ディスプレイ・スクリーンに隣接して配置され、かつ前記第１のイルミネータからの光を散乱させる散乱偏光子をさらに備え、前記カメラが、前記散乱偏光子によって散乱されない偏光の光に対して感度が良い、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１８】
前記フラットパネル・ディスプレイが液晶ディスプレイパネルであり、前記散乱偏光子は、前記散乱偏光子が光を散乱させる方向に偏光された光が、前記液晶ディスプレイパネルを通過し、前記散乱偏光子が光を散乱させない方向に偏光された光が、前記液晶ディスプレイパネルによって吸収されるように方向付けされている、請求項１７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項１９】
前記カメラが、前記散乱偏光子によって散乱された光を無視できるように、前記カメラが敏感な波長で、前記カメラで受光された光を偏光する直線偏光子をさらに備える、請求項１７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２０】
実質的に半透過性から実質的に透過性に変化することができる拡散材料をさらに備え、前記拡散材料は、前記第１のイルミネータが、前記フラットパネル・ディスプレイ・スクリーンの前記前側の人であるユーザに対して見える場合に実質的に半透過性であり、前記カメラが、前記フラットパネル・ディスプレイ・スクリーンの前の対象を検知している場合に実質的に透過性であり、前記拡散材料は、前記フラットパネル・ディスプレイ・スクリーンの後ろに配置されている、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２１】
前記第２のイルミネータは、前記カメラの露出に合わせてストローブされる、請求項１

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または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２２】
前記カメラのイメージは、前記対象によって引き起こされる前記相互作用が、前記スクリーンに隣接する前記対象の物理的位置に整合するように較正される、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２３】
前記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、前記対象の前記スクリーンからの距離に関する情報を決定するようになっている、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２４】
前記カメラはステレオカメラである、請求項２３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２５】
前記カメラはタイムオブフライト型カメラである、請求項２３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２６】
前記タイムオブフライト型カメラは、前記タイムオブフライト型カメラが、それ自体へ戻して反射しないように配置されている、請求項２５に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２７】
前記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、前記対象が前記スクリーンに近接している場合に、タッチスクリーンの機能性を提供できる、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２８】
前記スクリーンの前記前側に隣接して透過性タッチスクリーンをさらに備える、請求項２７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項２９】
前記スクリーンの前記前側に隣接する縁部が照射される透過性シートをさらに備え、前記カメラは、前記対象が、前記縁部が照射される透過性シートに接触したときに生成された光を識別することができる、請求項２７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項３０】
前記対象が、人であるユーザの体の一部である、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項３１】
前記カメラ及び前記第２のイルミネータが、タイムオブフライト型カメラを備える、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項３２】
複数のタイムオブフライト型カメラは、前記ディスプレイの前の領域の完全なカバレージを提供できるように配置され、かつ前記スクリーンによる前記タイムオブフライト型カメラへの鏡面反射を防ぐように角度が付けられている、請求項１または請求項２に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項３３】
内蔵型インタラクティブ・ビデオ・ディスプレイ・システムを用いて、インタラクティブな視覚イメージを提示する方法であって、
視覚イメージをフラットパネル・ディスプレイ・スクリーン上に表示することであって、前記視覚イメージが、前記フラットパネル・ディスプレイ・スクリーンの前側のユーザに対する提示のためのものであることと、
可視光で前記フラットパネル・ディスプレイ・スクリーンの裏側を照らすことと、

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前記フラットパネル・ディスプレイ・スクリーンの前記前側の対象を照らすことと、
前記フラットパネル・ディスプレイ・スクリーンを通して、前記対象と前記視覚イメージとの相互作用を検知することと、
前記相互作用に応じて前記視覚イメージを変えることと、
を備える方法。

【請求項３４】
前記対象を照らすことが、赤外線照明を用いて前記対象を照らすことを備え、前記相互作用を検知することが、前記対象に投影された赤外線照明を検知することを備える、請求項３３に記載の方法。

【請求項３５】
前記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムが１つのエンクロージャ内に備えられており、前記エンクロージャの１つの側部が、前記フラットパネル・ディスプレイ・スクリーンを備える、請求項３３に記載の方法。

【請求項３６】
前記対象を照らすことが、前記フラットパネル・ディスプレイ・スクリーンを通して前記対象に照明を投影することを備える、請求項３３に記載の方法。

【請求項３７】
前記スクリーンに隣接して配置されたフレネルレンズを用いて、歪みを補正することをさらに備える、請求項３３に記載の方法。

【請求項３８】
前記フラットパネル・ディスプレイ・スクリーンに隣接して配置された赤外線透過性・可視光半透過性スクリーンをさらに備える、請求項３３に記載の方法。

【請求項３９】
前記フラットパネル・ディスプレイ・スクリーンに隣接して配置された物理的テクスチャーを有し、かつ前記フラットパネル・ディスプレイ・スクリーンの前記裏側を可視光で照射することによる光を散乱させる透過性スクリーンをさらに備える、請求項３３に記載の方法。

【請求項４０】
前記フラットパネル・ディスプレイ・スクリーンに隣接して配置されたレイリー散乱材料からなり、かつ前記フラットパネル・ディスプレイ・スクリーンの裏側を可視光で照らすことによる光を散乱させる透過性スクリーンをさらに備える、請求項３３に記載の方法。

【請求項４１】
前記フラットパネル・ディスプレイ・スクリーンに隣接して配置され、かつフラットパネル・ディスプレイ・スクリーンの裏側を可視光で照らすことによる光を散乱させる散乱偏光子をさらに備える、請求項３３に記載の方法。

【請求項４２】
前記内蔵型インタラクティブ・ビデオ・ディスプレイ・スクリーンが、前記フラットパネル・ディスプレイ・スクリーンに隣接して配置された波長ベースの拡散板をさらに備える、請求項３３に記載の方法。

【請求項４３】
前記内蔵型インタラクティブ・ビデオ・ディスプレイ・スクリーンが、実質的に半透過性から実質的に透過性に変化することができる拡散材料をさらに備え、前記拡散材料は、前記フラットパネル・ディスプレイ・スクリーンの前記裏側を可視光で照らし出している間は、実質的に半透過性であり、前記対象と前記視覚イメージとの相互作用を前記フラットパネル・ディスプレイ・スクリーンを通して検知している間は、実質的に透過性であり、前記拡散材料は、前記フラットパネル・ディスプレイ・スクリーンの後ろに配置されている、請求項３３に記載の方法。

【請求項４４】
前記対象を照らすことが、前記検知することに合わせてストローブされる、請求項３３

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に記載の方法。
【請求項４５】
前記対象によって引き起こされる前記相互作用が、前記スクリーンに隣接する前記対象の物理的位置に整合するように、前記検知することにおいて捉えたイメージを前記視覚イメージに対して較正することをさらに備える、請求項３３に記載の方法。
【請求項４６】
前記対象の前記スクリーンからの距離に関する情報を決定することをさらに備える、請求項３３に記載の方法。
【請求項４７】
前記検知することが、ステレオカメラによって実行される、請求項４６に記載の方法。
【請求項４８】
検知することが、タイムオブフライト型カメラによって実行される、請求項４６に記載の方法。
【請求項４９】
前記タイムオブフライト型カメラが、それ自体へ戻して反射しないように、前記タイムオブフライト型カメラを配置することをさらに備える、請求項４８に記載の方法。
【請求項５０】
前記対象が前記スクリーンに隣接している場合に、タッチスクリーンの機能性を提供することをさらに備える、請求項３３に記載の方法。
【請求項５１】
前記スクリーンの前記前側に透過性タッチスクリーンを設けることをさらに備える、請求項５０に記載の方法。
【請求項５２】
前記スクリーンの前記前側に隣接して縁部が照射される透過性シートを設けることをさらに備え、前記検知することは、前記対象が、前記縁部が照射される透過性シートに接触したときに生成される光を識別するようになっている、請求項５０に記載の方法。
【請求項５３】
前記対象が人であるユーザの体の一部である、請求項３３に記載の方法。
【請求項５４】
前記ディスプレイ・スクリーンが液晶ディスプレイ・スクリーンであり、前記第１のイルミネータが可視光イルミネータであり、前記第２のイルミネータが赤外線イルミネータであり、前記第２のカメラが赤外線カメラであり、前記赤外線カメラ、前記可視光イルミネータ、前記赤外線イルミネータ及び前記コンピュータシステムが１つのエンクロージャ内に備えられており、前記エンクロージャの１つの側部が、前記液晶ディスプレイ・スクリーンを備える、請求項１に記載のシステム。
【請求項５５】
前記可視光イルミネータの光を散乱させる拡散スクリーンをさらに備える、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項５６】
前記赤外線イルミネータが、前記液晶ディスプレイ・スクリーンを通して前記対象に照明を投影する、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項５７】
前記赤外線イルミネータは、前記赤外線カメラに対するグレアの影響の可能性を低減するように配置されている、請求項５６に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項５８】
前記赤外線イルミネータは、前記赤外線イルミネータが、前記液晶ディスプレイ・スクリーンを通して照明を投影しないように、前記液晶ディスプレイ・スクリーンに隣接して配置されている、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・

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システム。
【請求項５９】
複数の前記赤外線イルミネータを備え、前記赤外線イルミネータは、前記フラットパネル・ディスプレイ・スクリーンに隣接して配置されており、前記フラットパネル・ディスプレイ・スクリーンを通して照明を投影せず、また、前記スクリーンの後ろに配置されている、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６０】
前記赤外線カメラが、前記液晶ディスプレイ・スクリーンの後ろに配置され、かつ前記スクリーンの方に向けられており、前記赤外線カメラが、前記スクリーン上及び前記スクリーンの前の領域を見ることができるようになっている、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６１】
前記赤外線カメラの視野の歪みを補正するために、前記スクリーンから一定距離に配置された一連のミラーストリップをさらに備える、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６２】
前記赤外線カメラの視野の歪みを補正するために、前記スクリーンに隣接して配置されたフレネルレンズをさらに備える、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６３】
前記液晶ディスプレイ・スクリーンに隣接して配置された波長ベースの拡散板をさらに備える、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６４】
前記波長ベースの拡散板が、赤外光に対して実質的に透過性であり、かつ可視光に対して実質的に半透過性である、請求項６３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６５】
前記波長ベースの拡散板が、レイリー散乱を引き起こす材料である、請求項６３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６６】
前記液晶ディスプレイ・スクリーンに隣接して配置された拡散板をさらに備え、前記拡散板は、斜角で前記拡散板を通過する光に対して実質的に半透過性であり、かつ実質的に直角で前記拡散板を通過する光に対して実質的に透過性であり、前記可視光イルミネータは、前記拡散板に対して斜角で配置されている、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６７】
前記液晶ディスプレイ・スクリーンに隣接して配置され、かつ前記可視光イルミネータからの光を散乱させる散乱偏光子をさらに備え、前記赤外線カメラが、前記散乱偏光子によって散乱されない偏光の光に感度が良い、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６８】
前記液晶ディスプレイ・スクリーンが液晶ディスプレイパネルであり、前記散乱偏光子は、前記散乱偏光子が光を散乱させる方向に偏光された光が、前記液晶ディスプレイパネルを通過し、また、前記散乱偏光子が光を散乱させない方向に偏光された光が、前記散乱偏光子によって吸収されるように方向付けされている、請求項６７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【請求項６９】
前記赤外線カメラが、前記散乱偏光子によって散乱された光を無視できるように、前記赤外線カメラが敏感な波長で前記赤外線カメラにおいて受光された光を偏光する直線偏光

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子をさらに備える、請求項６７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７０】

実質的に半透過性から実質的に透過性に変化することができる拡散材料をさらに備え、前記拡散材料は、前記第１のイルミネータが、前記フラットパネル・ディスプレイ・スクリーンの前記前側の人であるユーザに対して見える場合に実質的に半透過性であり、また、前記赤外線カメラが、前記液晶ディスプレイ・スクリーンの前の対象を検知している場合に、実質的に透過性であり、前記拡散材料は、前記液晶ディスプレイ・スクリーンの後ろに配置されている、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７１】

前記赤外線イルミネータが、前記赤外線カメラの露出に合わせてストローブされる、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７２】

前記赤外線カメラのイメージの１つのイメージは、前記対象によって引き起こされた前記相互作用が、前記スクリーンに隣接する前記対象の物理的位置に整合するように、前記視覚イメージに対して較正される、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７３】

前記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、前記対象の前記スクリーンからの距離に関する情報を決定するようになっている、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７４】

前記赤外線カメラがステレオ赤外線カメラである、請求項７３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７５】

前記赤外線カメラがタイムオブフライト型赤外線カメラである、請求項７３に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７６】

前記タイムオブフライト型赤外線カメラは、前記タイムオブフライト型赤外線カメラがそれ自体へ戻して反射しないように配置されている、請求項７５に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７７】

前記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、前記対象が前記スクリーンに近接している場合に、タッチスクリーン動作機能性を提供できる、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７８】

前記スクリーンの前記前側に隣接する透過性タッチスクリーンをさらに備える、請求項７７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項７９】

前記スクリーンの前記前側に隣接する縁部が照射される透過性シートをさらに備え、前記赤外線カメラは、前記対象が、前記縁部が照射される透過性シートに接触したときに生成される光を識別するようになっている、請求項７７に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項８０】

前記対象が、人であるユーザの体の一部である、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。

【請求項８１】

前記赤外線カメラ及び前記赤外線イルミネータが、タイムオブフライト型赤外線カメラを備える、請求項５４に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システ

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ム。
【請求項８２】
複数のタイムオブフライト型赤外線カメラが、前記ディスプレイの前の領域の完全なカバレージを提供できるように配置され、かつ前記スクリーンによる前記タイムオブフライト型赤外線カメラへの鏡面反射を防ぐように角度が付けられている、請求項８１に記載の内蔵型インタラクティブ・ビデオ・ディスプレイ・システム。
【発明の詳細な説明】
【関連出願の相互参照】
【０００１】
この出願は、２００２年５月２８日に提出され、本願の譲受人に譲渡されたＢｅｌｌによる“ＩＮＴＥＲＡＣＴＩＶＥ ＶＩＤＥＯ ＤＩＳＰＬＡＹ ＳＹＳＴＥＭ”というタイトルの同時係属中の米国特許出願第１０／１６０，２１７号からの優先権を主張する一部継続特許出願であり、該出願は、参照により本明細書に組み込まれる。また、この出願は、２００３年９月１８日に提出され、本願の譲受人に譲渡されたＢｅｌｌによる“ＳＥＬＦ－ＣＯＮＴＡＩＮＥＤ ＩＮＴＥＲＡＣＴＩＶＥ ＶＩＤＥＯ ＤＩＳＰＬＡＹ ＳＹＳＴＥＭ”というタイトルの同時係属中の米国仮特許出願第６０／５０４，３７５号から、２００３年１０月２４日に提出され、本願の譲受人に譲渡されたＢｅｌｌによる“ＭＥＴＨＯＤ ＡＮＤ ＳＹＳＴＥＭ ＦＯＲ ＰＲＯＣＥＳＳＩＮＧ ＣＡＰＴＵＲＥＤ ＩＭＡＧＥ ＩＮＦＯＲＭＡＴＩＯＮ ＩＮ ＡＮ ＩＮＴＥＲＡＣＴＩＶＥ ＶＩＤＥＯ ＳＹＳＴＥＭ”というタイトルの同時係属中の米国仮特許出願第６０／５１４，０２４号から、２００３年１２月９日に提出され、本願の譲受人に譲渡されたＢｅｌｌによる“ＳＥＬＦ－ＣＯＮＴＡＩＮＥＤ ＩＮＴＥＲＡＣＴＩＶＥ ＶＩＤＥ ＤＩＳＰＬＡＹ ＳＹＳＴＥＭ ＡＮＤ ＦＥＡＴＵＲＥＳ ＲＥＬＡＴＩＮＧ ＴＨＥＲＥＴＯ”というタイトルの同時係属中の米国仮特許出願第６０／５２８，４３９号から、および２００４年３月１８日に提出され、本願の譲受人に譲渡されたＢｅｌｌ ｅｔ ａｌ．による“ＭＥＴＨＯＤ ＡＮＤ ＳＹＳＴＥＭ ＦＯＲ ＡＬＬＯＷＩＮＧ Ａ ＣＡＭＥＲＡ ＴＯ ＶＩＥＷ ＡＮ ＡＲＥＡ ＩＮ ＦＲＯＮＴ ＯＦ Ａ ＤＩＳＰＬＡＹ ＢＹ ＩＭＡＧＩＮＧ ＩＴ ＴＨＲＯＵＧＨ ＴＨＥ ＤＩＳＰＬＡＹ”というタイトルの同時係属中の米国仮特許出願第６０／５５４，５２０号から優先権を主張し、これら全ては参照により本明細書に組み込まれる。
【技術分野】
【０００２】
本文書は、ビジュアル電子ディスプレイの分野に関する。具体的には、ここで説明する実施形態は、内蔵型インタラクティブ・ビデオ・ディスプレイ・システムに関する。
【背景技術】
【０００３】
長年にわたって、情報は、典型的には、静的ディスプレイを用いてオーディエンスに伝達された。例えば、商品広告は、印刷広告やポスターを用いて提示された。テレビや映画の登場に伴って、情報は、動的ディスプレイ（例えば、コマーシャル）を用いて提示できるようになった。静的ディスプレイよりも魅力的ではあるが、動的ディスプレイは、典型的には、ユーザと該ディスプレイとの間の双方向性を実現できない。
【０００４】
最近になって、インタラクティブ・タッチスクリーンが、情報を平面上に表示するのに用いられてきている。例えば、イメージをタッチスクリーン上に表示することができ、また、ユーザは、該タッチスクリーンに触れて、該イメージを変えることにより、該イメージと対話することができる。しかし、該タッチスクリーン上に表示されたイメージと対話するために、該ユーザは、該タッチスクリーンに実際に触れなければならない。また、典型的には、タッチスクリーンは、どんなときにも１つの入力を受取ることしかできず、該入力の形態を識別することができない。本質的に、現在のタッチスクリーンは、一本指接触の入力を受取ることしかできない。

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【０００５】
店舗販売、小売広告、プロモーション、アーケードの催し場所等の使用目的によっては、情報をユーザに対して表示するインタラクティブ・インタフェースを提供することが望ましい。この双方向性は、情報を提示する、より魅力的なインタフェース（例えば、媒体、広告等）を提供する。ちょっとの間だけでも人の注目を捉えることにより、人は、従来のディスプレイよりも、該インタラクティブ・ディスプレイに表示された情報を吸収しやすくなる。
【発明の開示】
【発明が解決しようとする課題】
【０００６】
上述したように、現在のインタラクティブ・ディスプレイは、典型的には、ユーザがタッチスクリーン表面に物理的に触れることを必要とする。双方向性を提供するにはタッチスクリーンとの接触を要するため、多数の潜在的なユーザは、現在のインタラクティブ・ディスプレイに興味を持たず、あるいは、該ディスプレイを敬遠する。また、一度に、１人のユーザのみがタッチスクリーンと対話することができるため、多くのユーザは、排除される。さらに、現在のタッチスクリーンは、入力の形態を識別できないため、対話に応答して表示できる情報の種類が限定されている。
【課題を解決するための手段】
【０００７】
本発明の様々な実施形態、すなわち、内蔵型インタラクティブ・ビデオ・ディスプレイ・システムを本明細書において説明する。フラットパネル・ディスプレイ・スクリーンは、該フラットパネル・ディスプレイ・スクリーンの前面のユーザへの提示のために、視覚イメージを表示する。一実施形態において、該フラットパネル・ディスプレイ・スクリーンは、液晶ディスプレイ（ＬＣＤ）パネルである。第１のイルミネータは、該フラットパネル・ディスプレイ・スクリーンを可視光で照らす。一実施形態において、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、該第１のイルミネータのグレアを低減する拡散スクリーンをさらに備え、より均一に該フラットパネル・ディスプレイ・スクリーンを照らす。第２のイルミネータは、対象を照らす。一実施形態において、該対象は、人であるユーザの体の一部である。一実施形態において、該第２のイルミネータは、該フラットパネル・ディスプレイ・スクリーンを通して該対象に照明を投影する。一実施形態において、該第２のイルミネータは、上記カメラに対するグレアの影響の可能性を低減するように配置されている。一実施形態において、該第２のイルミネータは、該第２のイルミネータが、該フラットパネル・ディスプレイ・スクリーンを通して照明を投影しないように、該フラットパネル・ディスプレイ・スクリーンに隣接して配置されている。一実施形態において、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、複数の該第２のイルミネータを備え、該第２のイルミネータは、該フラットパネル・ディスプレイ・スクリーンに隣接して、および該スクリーンの後ろに配置されている。一実施形態において、該第２のイルミネータは、該カメラの露出に合わせてストローブされる。
【０００８】
カメラは、照らし出された対象と上記視覚イメージとの相互作用を検知し、該カメラは、上記フラットパネル・ディスプレイ・スクリーンを通して該対象を見ることができるように機能する。一実施形態において、該第２のイルミネータは、赤外線照明で該対象を照らす赤外線イルミネータであり、該カメラは、赤外線照明を検知する赤外線カメラである。一実施形態において、該カメラは、該フラットパネル・ディスプレイ・スクリーンの後ろに配置されて、該スクリーンに向けられており、該カメラが、該スクリーン上及び該スクリーンの前の領域を見ることを可能にする。一実施形態において、該カメラのイメージは、該対象によって引き起こされる相互作用が、該スクリーンに隣接する該対象の物理的位置に整合するように、該視覚イメージに対して較正される。一実施形態において、該カメラ及び該第２のイルミネータは、タイムオブフライト型カメラを備える。一実施形態においては、複数のタイムオブフライト型カメラが、該ディスプレイの前の領域の完全なカバ

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レージを実行できるように配置され、また、該スクリーンによる該タイムオブフライト型カメラへの鏡面反射を防ぐように角度が付けられている。

【０００９】

コンピュータシステムは、上記プロジェクタに、上記相互作用に応じて該視覚イメージを変えるように指示する。一実施形態において、上記カメラ、上記第１のイルミネータ、上記第２のイルミネータ及び該コンピュータシステムは、１つのエンクロージャ内に備えられており、該エンクロージャの１つの側部は、上記フラットパネル・ディスプレイ・スクリーンを備える。

【００１０】

一実施形態において、上記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、上記カメラの視野の歪みを補正するために、上記スクリーンから一定距離に配置された一連のミラーストリップをさらに備える。別の実施形態においては、該内蔵型インタラクティブ・ビデオ・ディスプレイ・ディスプレイ・システムは、該カメラの視野の歪みを補正するために、該スクリーンに隣接して配置されたフレネルレンズをさらに備える。一実施形態において、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、該フラットパネル・ディスプレイ・スクリーンに隣接して配置された波長ベースの拡散板をさらに備える。一実施形態において、該拡散板は、赤外光に対して実質的に透過性であり、また、可視光に対して実質的に半透過性である。別の実施形態においては、該拡散板は、レイリー散乱を伴う材料である。一実施形態において、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、該フラットパネル・ディスプレイ・スクリーンに隣接して配置された物理的テクスチャーを有する拡散板をさらに備え、該拡散板は、斜角で該拡散板を通過する光に対して実質的に半透過性であり、また、実質的に直角で該拡散板を通過する光に対して実質的に透過性であり、上記第１のイルミネータは、該拡散板に対して斜角で配置されている。

【００１１】

一実施形態において、上記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、上記フラットパネル・ディスプレイ・スクリーンに隣接して配置され、かつ上記第１のイルミネータからの光を散乱させる散乱偏光子をさらに備え、上記カメラは、該散乱偏光子によって散乱されない偏光の光に対して感度が良い。一実施形態において、該フラットパネル・ディスプレイ・スクリーンは液晶ディスプレイパネルである場合、該散乱偏光子は、該散乱偏光子が光を散乱させる方向に偏光された光が該液晶ディスプレイパネルを通過し、該散乱偏光子が光を散乱させない方向に偏光された光が、該液晶ディスプレイパネルによって吸収されるように、方向付けられている。別の実施形態においては、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、該カメラが、該散乱偏光子によって散乱される光を無視できるように、該カメラが敏感な波長で該カメラに受光された光を偏光させる直線偏光子をさらに備える。一実施形態において、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、実質的に半透過性から実質的に透過性に変化することができ、該第１のイルミネータが該ディスプレイを照らしているときには実質的に半透過性であり、該カメラが、該フラットパネル・ディスプレイ・スクリーンの前の対象を検知しているときには実質的に透過性である拡散材料をさらに備え、該拡散材料は、該フラットパネル・ディスプレイ・スクリーンの後ろに配置されている。

【００１２】

一実施形態において、上記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは、該対象の該スクリーンからの距離に関する情報を決定するように機能する。一実施形態において、上記カメラは、ステレオカメラである。別の実施形態においては、該カメラは、タイムオブフライト型カメラである。一実施形態において、該タイムオブフライト型カメラは、該タイムオブフライト型カメラがそれ自体へ戻して反射しないように配置される。

【００１３】

一実施形態において、上記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムは

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、上記対象が上記スクリーンに隣接している場合に、タッチスクリーン機能性を提供する。一実施形態において、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムはさらに、該スクリーンの前面に隣接する透過型タッチスクリーンを備える。別の実施形態においては、該内蔵型インタラクティブ・ビデオ・ディスプレイ・システムはさらに、該スクリーンの前面に隣接する縁部が照射される透過性シートを備え、上記カメラは、該対象が、該縁部が照射される透過性シートに接触したときに生成される光を識別するように機能する。

【００１４】

別の実施形態においては、本発明は、内蔵型インタラクティブ・ビデオ・ディスプレイ・システムを用いてインタラクティブ・視覚イメージを提示する方法を提供する。視覚イメージは、スクリーン上に投影され、該視覚イメージは、該スクリーンの前面のユーザへの提示のために、該スクリーンの裏面に投影される。該スクリーンの前面近くの対象が照らされる。該対象と該視覚イメージとの相互作用が検知され、該スクリーンは、該対象を該スクリーンを通して検知できるように、光に対して少なくとも部分的に透過性である。該視覚イメージは、該相互作用に応じて変化する。

【発明を実施するための最良の形態】

【００１５】

次に、本発明の様々な実施形態、すなわち、その実施例が添付図面に示されている、第２の電子デバイスの周囲での対象の存在をモニタリングする電子デバイスについて詳細に説明する。本発明をそれらの実施形態に関して説明するが、該実施形態は、本発明をそれらの実施形態に限定しようとするものではないことは理解されよう。むしろ本発明は、添付の請求項によって定義される本発明の趣旨及び範囲内に含まれる代替例、変更例及び等価物をカバーしようとするものである。さらに、本発明に関する以下の詳細な説明においては、本発明の完全な理解を可能にするために、多数の特定の詳細が記載されている。しかし、当業者は、本発明をそれらの特定の詳細を要することなく実施することができることを認識するであろう。他の事例において、周知の方法、処理手順、コンポーネント及び回路は、本発明の態様を不必要に分かりにくくしないように、詳細に説明されていない。

【００１６】

以下の詳細な説明のいくつかの部分は、処理手順、ステップ、論理ブロック、処理、およびコンピュータメモリ上で実行することができるデータビットに関する動作の他の記号表現に関して示されている。それらの説明及び表現は、作用の内容を当業者に有効に伝えるために、データ処理技術において当業者により用いられる手段である。処理手順、コンピュータが実行するステップ、論理ブロック、プロセス等は、ここでは及び一般に、所望の結果につながるステップまたは命令からなる自己矛盾のないシーケンスであると考えられる。該ステップは、物理量の物理的処理を要するステップである。通常、必ずしもそうではないが、それらの量は、コンピュータシステムにおいて、格納する、転送する、結合する、比較するおよび他の方法で処理することが可能な電気的または磁気的信号の形をとる。それらの信号を、ビット、値、要素、記号、文字、項、数等と呼ぶことは、一般的に有利である場合があることが分かっている。

【００１７】

しかし、それらの全て及び同様の用語は、適当な物理量と関連付けられ、および、単にそれらの量に適用される便利なラベルであると考えるべきである。以下の考察から明らかなように、別に具体的に述べない限り、本発明の全体を通して、“投影する”または“検知する”または“変化する”または“照らす”または“補正する”または“なくす”等の用語を用いる考察が、電子システム（例えば、図１のインタラクティブ・ビデオ・システム１００）または該電子デバイスのレジスタやメモリ内の物理的（電子的）量として表されたデータを処理し、かつ該データを、該電子デバイスのメモリまたはレジスタあるいは他のそのような情報蓄積、伝送または表示デバイス内の物理量として同様に表された他のデータに変換する同様の電子計算デバイスの動作及びプロセスを指すことは正しく認識されよう。

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【００１８】
本発明の様々な実施形態、すなわち内蔵型インタラクティブ・ビデオ・ディスプレイ・システムについて本明細書で説明する。一実施形態において、フラットパネル・ディスプレイ・スクリーンは、フラットパネル・ディスプレイ・スクリーンの前側のユーザへの提示のために、視覚イメージを表示する。第１のイルミネータは、可視光で前記ディスプレイ・スクリーンを照らす。第２のイルミネータは、対象を照らす。カメラは、照らされた対象と前記視覚イメージとの相互作用を検知し、前記カメラが、前記スクリーンを通して前記対象を見ることができるように作動する。コンピュータシステムは、前記ディスプレイ・スクリーンに、前記相互作用に応じて前記視覚イメージを変えるように指示する。
【００１９】
インタラクティブ・ビデオ・プロジェクション・システム
次に、本発明を、１つ以上の例示的な実施形態のかたちで説明する。１つの例示的な実施形態によれば、図１に示すようなインタラクティブ・ビデオ・システム１００が提供される。インタラクティブ・ビデオ・システム１００は、可視光を遮断するフィルタを備えるカメラ１１５と、カメラ１１５から見えるスクリーン１３０を照らすイルミネータ１２５と、イメージをスクリーン１３０のインタラクティブスペース上に投影するプロジェクタ１２０と、カメラ１１５のイメージを入力として受取り、ビデオイメージをプロジェクタ１２０へ出力するコンピュータ１１０とを使用する。一実施形態において、イルミネータ１２５は、赤外線イルミネータであり、カメラ１１５は、イルミネータ１２５の赤外光によって照らされたイメージを記録するように機能する赤外線カメラである。カメラ１１５及びイルミネータ１２５を、見えない光であって、赤外光に限定されない光の何らかの形態を用いて作動するように構成することができることを認識すべきである。
【００２０】
コンピュータ１１０は、カメラ１１５の入力を処理して、ピクセルごとの基準で、スクリーン１３０の前の空間のどの部分が人（または動く物体）で占められているか、及びスクリーン１３０のどの部分が背景であるかを識別する。コンピュータ１１０は、背景がらしく見えるかといういくつかの生成モデルを展開した後、該背景のそのコンセプトをカメラ１１５が現在見ているものと比較することにより、このことを実現する。代替的に、カメラ１１５の入力を処理するコンピュータ１１０のコンポーネントは、視覚システムとして公知である。この視覚システムの様々な実施形態は、２００２年５月２８日に提出され、本願の譲受人に譲渡されたＢｅｌｌによる“ＩＮＴＥＲＡＣＴＩＶＥ　ＶＩＤＥＯ　ＤＩＳＰＬＡＹ　ＳＹＳＴＥＭ”というタイトルの同時係属中の米国特許出願第１０／１６０，２１７号、２００３年９月１８日に提出され、本願の譲受人に譲渡されたＢｅｌｌによる“ＳＥＬＦ－ＣＯＮＴＡＩＮＥＤ　ＩＮＴＥＲＡＣＴＩＶＥ　ＶＩＤＥＯ　ＤＩＳＰＬＡＹ　ＳＹＳＴＥＭ”というタイトルの同時係属中の米国仮特許出願第６０／５０４，３７５号、及び２００３年１０月２４日に提出され、本願の譲受人に譲渡されたＢｅｌｌによる“ＭＥＴＨＯＤ　ＡＮＤ　ＳＹＳＴＥＭ　ＦＯＲ　ＰＲＯＣＥＳＳＩＮＧ　ＣＡＰＴＵＲＥＤ　ＩＭＡＧＥ　ＩＮＦＯＲＭＡＴＩＯＮ　ＩＮ　ＡＮ　ＩＮＴＥＲＡＣＴＩＶＥ　ＶＩＤＥＯ　ＳＹＳＴＥＭ”というタイトルの同時係属中の米国仮特許出願第６０／５１４，０２４号に記載されており、これらの明細書の全ては参照により本明細書に組み込まれる。
【００２１】
該生成される背景は、上記システムを、ライティングの変化、上記スクリーン上の擦り傷及び他の障害に対して復元力があるため、上記視覚の重要な部分である。該視覚システムの出力は、エフェクトエンジンに送り込まれる白黒マスクイメージであり、該エフェクトエンジンは、コンピュータ１１０上でも作動する。該エフェクトエンジンは、インタラクティブ・グラフィックをスクリーン１３０上に生成するアプリケーションを実行する。アーチストは、幅広い種類のエフェクトコンポーネント及びスクリプト記述を用いてエフェクトをデザインすることができ、該エフェクトは、多種多様のインタラクティブ・エクスペリエンスを生成することを可能にする。そして、該エフェクトエンジンにより生成され

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たイメージは、プロジェクタ１２０へ出力される。

【００２２】

インタラクティブ・ビデオ・システム１００の全ての電子コンポーネント（例えば、カメラ１１５、プロジェクタ１２０、コンピュータ１１０及びイルミネータ１２５）は、スクリーン１３０の一方側にあり、一方、ユーザとの対話は、スクリーン１３０の他方側で行われることが望ましい。一実施形態において、スクリーン１３０は、イメージをスクリーン１３０の表面に形成できるように、プロジェクタ１２０の光に対して部分的に半透過性である。しかし、スクリーン１３０は、カメラ１１５が、スクリーン１３０の反対側の対象を見ることができるように、カメラ１１５に対して部分的に透過性でもある。この明細書の全体を通して使われている透過性及び半透過性という用語は、それぞれ、少なくとも部分的に透過性および／または半透過性ということを意味するように定義されることを認識すべきである。また、この明細書の全体を通して使われている“散乱した”及び“散乱していない”という用語は、それぞれ、“実質的に散乱した”及び“実質的に散乱していない”ということを意味するように定義されることを認識すべきである。そしてまた、この明細書の全体を通して使われている“拡散した”及び“拡散していない”という用語は、それぞれ、“実質的に拡散した”及び“実質的に拡散していない”ということを意味するように定義されることを認識すべきである。

【００２３】

図１は、本発明の例示的な実施形態のコンポーネントの一つの物理的構成を示す。カメラ１１５、イルミネータ１２５、コンピュータ１１０及びプロジェクタ１２０を含む全ての感知及びディスプレイコンポーネントは、ボックス１４０の内部にある。一実施形態において、ボックス１４０の全ての側面は、１つの側面を除いて不透明である。不透明ではないこの１つの側面は、投影されたイメージを表示するスクリーン１３０である。

【００２４】

一実施形態においては、強度のレイリー散乱及び他の形態の比較的小さな散乱を有する滑らかで平坦な材料がスクリーン１３０に用いられる。光がスクリーン１３０（半透過型スクリーン）によって散乱された場合、該光は、スクリーン１３０上のイメージとして目に見えることになる。光がスクリーン１３０（透過型スクリーン）によって散乱または吸収された場合には、該光は、窓ガラスのようにスクリーン１３０をまっすぐ通過することになる。

【００２５】

レイリー散乱は、１／（波長^4）に比例し、このことは、短い波長を有する光が、長い波長を有する光よりも多く散乱することを意味する。従って、８００ナノメータ（ｎｍ）より大きい波長を有する赤外光は、４００ｎｍ　７００ｎｍの波長を有する可視光ほどは散乱しない。この実施形態において、プロジェクタ１２０は可視光を用いるが、カメラ１１５は赤外光用いて、カメラ１１５がスクリーン１３０を通して見ることを可能にすると共に、プロジェクタ１２０により放射された光は、スクリーン１３０上に散乱される。一実施形態において、スクリーン１３０の材質は、良好なレイリー散乱を有するが、他の種類の最小限の散乱を有するように、滑らかでかつ好ましくは約４０ｎｍ程度まで均質である。

【００２６】

一実施形態において、上記スクリーンの材料は、ほとんどの可視光を散乱させる微細構造を有する。しかし、該構造は、高密度すぎず、または厚すぎるものではなく、そうでなければ、ほとんどの赤外光も散乱することになる。また、該材料は、多くの可視光または赤外光を吸収すべきではなく、さもなければ、このことは、該材料を不透明にして劣等なスクリーンにすることになる。強度のレイリー散乱の特性を満たす材料の一実施例は、通常の白いプラスチックのゴミ袋である。一実施形態において、スクリーン１３０は、該袋を２つのガラスシートの間に挟み込むことによって形成される。この特性を満たす材料の別の実施例は、ポリエチレンシートである。

【００２７】

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イルミネータ１２５及びカメラ１１５のフィルタの波長を増加させると、（適切なスクリーン材料及び厚さを選択した状態で）増加した波長が（グレアを最小化する）可視光の散乱の量を最大化し、かつ（該スクリーン上の対象のカメラ１１５の視野を改善する）赤外光の散乱量を最小化するため、インタラクティブ・ビデオ・システム１００の性能が改善される。一実施形態においては、９５０ｎｍのＬＥＤクラスタ・イルミネータと、そのレンズの前に４０ｎｍ幅９５０ｎｍ中心帯域通過フィルタを有するモノクロームＣＣＤカメラとが使用される。

【００２８】

その性能をさらに向上させるために、いくつかの特徴をインタラクティブ・ビデオ・システム１００に付加することができる。

【００２９】

カメラ上のグレアを低減すること

イルミネータ１２５からカメラ１１５上には、反射グレアがある可能性がある。このグレアは、スクリーン１３０越しに見るカメラ１１５の能力に干渉する可能性がある。一実施形態においては、この干渉を緩和し、かつカメラ１１５の性能を改善するために、近赤外線反射防止膜が、スクリーン１３０の底部および／または上部に設けられる。また、イルミネータ１２５をスクリーン１３０に対して斜角に配設して、鏡面反射が起きることを防ぐことができる。

【００３０】

さらに、別の実施形態においては、グレアをさらに軽減するために、赤外線直線偏光フィルタが、イルミネータ１２５及びカメラ１１５の前に（カメラ１１５の偏光と直角なイルミネータ１２５の偏光の方向で）付加される。このグレアは、スクリーン１３０の底部で直接反射する光が、まだ偏光しており、一方、スクリーン１３０の外部で対象に当たる光が、その偏光を失うために起きる。

【００３１】

指向性周囲赤外線

周囲の赤外線源は、インタラクティブ・ビデオ・システム１００の視覚システムに対して問題を引き起こす可能性がある。例えば、明るい外部赤外線源が、一方向から該ディスプレイ上に照射されている場合、この赤外線源と上記スクリーンとの間の物体は、スクリーン１３０上に赤外線の影を落とすことになる。該視覚システムは、この影とスクリーン１３０上の実際の対象とを混同して、該アプリケーションを誤作動させる可能性がある。赤外線の影の問題を低減するために、いくつかの方法を用いることができる。

【００３２】

一実施形態において、イルミネータ１２５の波長は、出来る限り均一になるように選択することができる。イルミネータ１２５により最も強力に出力された波長の光のみを通過させる狭小の帯域通過フィルタを、カメラ１１５の前に付加することができる。

【００３３】

別の実施形態において、パターン化されたイルミネータの使用は、上記システムが、スクリーン１３０上の赤外線の影と実際の対象とを識別できるようにする。さらなる詳細は、参照により本明細書に組み込まれる、２００２年５月２８日に提出されたＢｅｌｌによる“ＩＮＴＥＲＡＣＴＩＶＥ　ＶＩＤＥＯ　ＤＩＳＰＬＡＹ　ＳＹＳＴＥＭ”というタイトルの米国特許出願第１０／１６０，２１７号を参照。

【００３４】

別の実施形態においては、イルミネータ１２５及びカメラ１１５をストロボさせることができる。発光ダイオード（ＬＥＤ）等のある照明源は、連続的につけることができる場合よりも短期間にはるかに明るくつけることができる。イルミネータ１２５が、カメラ１１５の露出中にのみつけられ、かつカメラの露出が十分短い場合、イルミネータ１２５の明るさは、周囲光と比較して大幅に増幅される。このことは、イルミネータ１２５が非常に明るくつけられる、短時間の露出中のカメラ１１５のイメージは、イルミネータ１２５が、連続的ではあるが、より低い連続使用輝度である、より長時間の露出からのイメージと

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比較して、かなり少ない周囲光を含むが、イルミネータ１２５からのほぼ同量の光を含むことになるため、真実である。

【００３５】

カメラ１１５とイルミネータ１２５は、同期させることができる。例えば、マイクロコントローラまたは他の電子回路は、カメラ露出同期を読取りまたは設定することができ、また、適当なときに、イルミネータ１２５に対してパルス状電力をトリガすることができる。

【００３６】

カメラの２番目の露出毎の間にのみイルミネータ１２５をつけることにより、ストロービングの性能をさらに改善することができる。従って、カメラ１１５は、イルミネータ１２５をオンにした状態の露出と、イルミネータ１２５をオフにした状態の露出を交互に行うことになる。目的は、周囲の赤外光を取り除くことであるため、コンピュータ１１０は、現在のイメージと前のイメージとの差をとることにより、周囲光を伴わないイメージを連続的に生成することができる。イルミネータ１２５は、２番目のフレームごとにのみ照らされるため、一方のイメージは、周囲赤外光のみを有することになるが、他方のイメージは、周囲赤外光に加えてイルミネータ１２５の光を有することになる。現在のイメージと前のイメージとの間のピクセルに関する差をとることにより、該周囲赤外光を相殺して、イルミネータ１２５の光のみを残すことができる。

【００３７】

インタレースＣＣＤカメラの場合においては、交互の露出の間にイルミネータ１２５を光らせることで、偶数のラインは、イルミネータ１２５がオンであり、奇数のラインは、イルミネータ１２５がオフであるカメラ出力イメージを生成する。従って、２つのイメージを比較する代わりに、コンピュータ１１０は、該奇数ラインと偶数ラインとの間の差をとって周囲光を取り去ることができる。ストロービングは、上記第１及び第２のカメラがそれぞれの露出をわずかに異なる時間に行い、イルミネータ１２５が、該２つの露出のうちの一方のときにのみオンになるように設定された２つのカメラ１１５を用いて実行することができる。代替的に、該２つのカメラは、わずかに異なる波長に対して感度良くすることができ、また、イルミネータ１２５は、第２の波長でのみ光を放射する。

【００３８】

別の実施形態において、周囲赤外光を伴わない環境においては、イルミネータ１２５は、２番目の露出ごとに、上記システムの反応時間を低減する。イルミネータ１２５がオフの間のいかなる動きも、２番目の露出中に気づかれない。しかし、このことは、２番目の露出ごとにイルミネータ１２５の一部のみをオフにすることにより、または単にイルミネータ１２５の出力を低減することにより改善することができる。その結果、イルミネータ１２５は、“途中ずっとオン”と“一時的にオン”との間を交互に行う。コンピュータ１１０が、現在の露出と前の露出との間の差をとった場合、その結果は、周囲赤外光を含まず、かつイルミネータ１２５の光の一部を含むことになる。この構成は、周囲光を伴わない環境及びある程度周囲光を伴う環境の両方において、ユーザにとってもっとも速い可能性のある反応時間を実現できるであろう。

【００３９】

プロジェクタ・グレア

上記スクリーン材料は、完全に半透過性ではないため、プロジェクタ１２０からの光の一部は、スクリーン１３０を直接通過する可能性がある。その結果として、プロジェクタ１２０は、ユーザの目にグレアを引き起こす可能性がある。一実施形態においては、イルミネータ１２５の波長をより長くし、かつより散乱を生じるスクリーン１３０を用いることにより、カメラ１１５は、それでもスクリーン１３０を通してみることができ、可視光グレアの量は低減される。

【００４０】

別の実施形態においては、直線偏光シートを、上記グレアをなくすまたは低減するのに用いることができる。図２は、直線偏光シートが、グレアをなくすまたは低減するのに用い

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られる一構成を示す。垂直方向偏光シート２３０および水平方向偏光シート２２０はそれぞれスクリーン２１０の真下、および真上に配置されている。投影された光が垂直方向偏光シート２３０を通過すると、その光は垂直方向に偏光される。散乱により光が偏光されるため、スクリーン２１０上の散乱光の多くは、依然としてビューワにとって可視である。しかし、（グレアを引き起こす）スクリーン２１０によって散乱されない光は、該光が垂直方向に偏光されているため、水平方向偏光シート２２０によってほとんど全てが吸収される。従って、グレアはなくなり、スクリーン２１０は、明るいままである。上記カメラが赤外光に感度が良い場合には、赤外光を偏光しない直線偏光材料を選択することができることに注意する。

【００４１】

別の実施形態において、上記プロジェクタが液晶（ＬＣＤ）プロジェクタの場合には、光は既に偏光されていることになる。いくつかのＬＣＤプロジェクタの場合、赤色、緑色及び青色光の全てが同じ方向に偏光されている。この場合、上記スクリーンの下に偏光フィルムは必要ない、いくつかのＬＣＤプロジェクタにおいては、赤色及び青色は、一方向に偏光され、緑色は、該方向から９０度ずれて偏光される。この場合、一実施形態においては、上記偏光シートが存在しており、赤―青方向から４５度および１３５度それて偏光させるべきである。別の実施形態においては、同じ方向に偏光された赤色、緑色及び青色光を得るために、色選択性偏光回転子を該プロジェクタ上または該プロジェクタ内に配設することができる。この場合、該スクリーンの前に１つのみの直線偏光子を要する。ＣｏｌｏｒＬｉｎｋ　Ｃｏｒｐｏｒａｔｉｏｎにより生み出された位相差板スタック“ＣｏｌｏｒＳｅｌｅｃｔ”技術等の色選択性偏光回転子は、緑色光の偏光を９０度だけ回転させるのに用いられる。代替的に、赤色及び青色光の偏光を９０度だけ回転させて同じ効果を得ることもできる。

【００４２】

物理的構成

上記インタラクティブ・ビデオ・ディスプレイ・システムの多くの可能な物理的構成がある。１つの構成は、図１に示しかつ描写したような卓上用ディスプレイである。該インタラクティブ・ビデオ・ディスプレイ・システムは、表面上にあり、全ての電子機器を１つのボックス内に収容しており、数フィートの高さであり、該ボックスの上部に水平スクリーンを有する。しかし、該インタラクティブ・ビデオ・ディスプレイ・システムは、斜めの、垂直のまたは湾曲したディスプレイを形成するのに用いることもできる。

【００４３】

上記インタラクティブ・ビデオ・ディスプレイ・システムにより占有される物理的スペースの一部は、単にデッドスペースであり、上記スクリーン上に適度に大きなイメージを有するためには、上記プロジェクタは、該スクリーンからかなりの距離にあることが必要である。この距離は、ミラーの使用によって減らすことができ、このことは、該プロジェクタのビームの方向を変えること、およびより小さなスペースに収めることを可能にする。一実施形態において、上記カメラは、上記ボックス内の異なる箇所に設けることができ、また、該スクリーンがクリアな視野を有する限り、ミラーを通して該スクリーンを見ることができる。一実施形態において、赤外光イルミネータは、対象を該ボックスの上に照らす限り、該ボックス内のどこにでも、または、該ボックスの表面にも設けることができる。

【００４４】

図３は、上記システムのいくつかの他の可能な構成の断面図を示す。全てのパーツを容易に固定することができるので、図示のデザインは、どの方向にも回転させることができる。ディスプレイ３１０は、図１で説明したインタラクティブ・ビデオ・ディスプレイを示す。ディスプレイ３２０及び３３０は、上記プロジェクタのビームの方向を変えるミラーを用いてよりコンパクトになっているインタラクティブ・ビデオ・ディスプレイを示す。ディスプレイ３４０及び３５０は、角度をつけたカメラを用い（ディスプレイ３４０）、該プロジェクタのビームの方向を変えるミラーを用いて（ディスプレイ３５０）角度がつ

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けられたインタラクティブ・ビデオ・ディスプレイを示す。ディスプレイ３６０は、該プロジェクタのビームの方向を変える多数のミラーを用いたインタラクティブ・ビデオ・ディスプレイを示す。

【００４５】

インタラクティブ・ビデオ・ディスプレイの追加的な構成

本発明の一つの態様によれば、スクリーンの前の領域を照らす多数の例示的な方法が提供される。内蔵型インタラクティブ・ビデオ・ディスプレイにおいて、赤外光カメラ、赤外光イルミネータ及び可視光プロジェクタは、全てスクリーンの一方側にあり、一方、ユーザは、他方側にいる。所望の機能性を実行するために、使用される該スクリーンの材料は、可視光に対してほとんど半透過性であり（しかし、わずかに透過性であってもよい）、及び、好ましくは、赤外光に対してほとんど透過性である（本明細書において、以後、“赤外光透過・可視光半透過性スクリーン（ＩＲ－Ｔｒａｎｓｐａｒｅｎｔ　ＶＩＳ－Ｔｒａｎｓｌｕｃｅｎｔ　ｓｃｒｅｅｎ）”または“メインスクリーン”と呼ぶ）。上記赤外光イルミネータにより放射された光は、該スクリーンを通過する際に、ある程度散乱する。この光は、上記カメラによって獲得され、該カメラのイメージを低コントラスト及び色あせたものにする可能性がある。その結果として、該スクリーンの向こうの対象に関する該カメラの視野を妨げる可能性があり、このことは、低下した動作特性をもたらすことになる。

【００４６】

本発明は、上記の問題を多くの方法で対処する。一実施形態において、上記赤外光イルミネータは、可能な限り上記スクリーンに近づけて配置することができる。例えば、該イルミネータは、境界に沿って該スクリーンと直接対向して配置してもよい。この構成を図４Ａに示す。（図４Ａにおいて、“イルミネータのためのカバー４０２”と呼ぶ）該イルミネータの前の材料は、赤外光に対して、少なくともやや半透過性であり、または透過性である何らかの材料を含んでもよい。イルミネータのためのカバー４０２の材料に対するオプションは、該メインスクリーン材料、透き通った透過性材料、または、赤外光に対して透過性である黒い不透明材料を含む。後の図におけるイルミネータのためのカバーに対する説明は、同様の意味を有する。上記メインスクリーン上への赤外光の漏れを防ぐために、物理的ブロックを用いてもよい。

【００４７】

しかし、上記の実施形態は、上記スクリーンの近くで、かつ該スクリーンの中心の近くにある対象の不十分な照明を生じる可能性がある。これは、たいていの物質に斜角で照射された光が、通過するのではなく、該物質の表面で反射する傾向があり、例えば、該物質の透過性が機能的に低下しているためである。このことに対処する一つの方法は、該スクリーンを単に上記ディスプレイの表面から後ろへ動かすことであり、それによって、赤外線イルミネータがより小さな斜角で該スクリーンを通して照射することが可能になる。この構成を図４Ｂに示す。

【００４８】

別の実施形態においては、上記イルミネータは、該イルミネータが、上記スクリーンの前の全ての領域を容易に照らせることができるような方法で、該スクリーンの前に配置することができる。該イルミネータが該スクリーンの前から突出している一つの構成を図５Ａに示す。ディスプレイの表面が凹んだ別の構成は図５Ｂに示されている。図４Ａ、図４Ｂ、図５Ａ及び図５Ｂに示す実施形態においては、該イルミネータは、連続線内に、または有利な配置で、該スクリーンの周りに等間隔で配置することができる。図４Ａ、図４Ｂ、図５Ａ及び図５Ｂに示すこれらの照明方法は、該スクリーンの後ろにあり、かつ該スクリーンを通して照射するイルミネータと組合わせることもできる。

【００４９】

軸外し（ｏｆｆ－ａｘｉｓ）投影

本発明の別の態様によれば、軸外し投影は、上記内蔵型インタラクティブ・ビデオ・ディスプレイ・システムの性能を改善するのに用いられる。軸外しビデオプロジェクタは、矩

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形状ビデオイメージを斜角で平面上に投影することが可能である。これらの軸外しプロジェクタは、該システム全体のサイズを大幅に縮小できるようにし、また、グレアを低減できるようにするので、インタラクティブ・ディスプレイにとって非常に重要である。

【００５０】

図６Ａ及び図６Ｂは、軸外しプロジェクタを用いた内蔵型インタラクティブ・ビデオ・ディスプレイの２つの構成を示す。軸外しプロジェクタを有する赤外線透過、可視光半透過性スクリーンを用いた場合、グレアは低減される。該スクリーンは、可視光に対して完全に半透過性ではない（赤外光に対して完全に透過性ではない）ため、ある程度の可視光は、該スクリーンを通過することになる。該スクリーンが厚い場合には、いっそう多くの残りの可視光が散乱されることになり、グレアが低減される。また、該スクリーンをより厚く形成することは、該スクリーンが、赤外光に対して完全には透過性ではないため、該スクリーンの赤外線に対する透過性を小さくする。しかし、可視光が、直角ではなく、斜角で該スクリーンを通過する場合、該光は、より多くの距離を該スクリーンを通して進まなければならず、グレアの量が低減される。例えば、該スクリーンと平行に３０度で該スクリーンを通過する光は、該スクリーンに対して直角な角度で通過する光の２倍の量、スクリーン材料を通過する必要がある。従って、赤外線カメラが、該スクリーンを直接見ると共に、上記可視光プロジェクタが光を斜角で該スクリーン上に照射する場合、該赤外線カメラの最大透過性及び該可視光プロジェクタの最大半透過性を得ることができる。

【００５１】

透過性フラットパネルディスプレイ

上記内蔵型インタラクティブ・ビデオ・ディスプレイは、ビデオプロジェクタ以外のディスプレイ技術で実施することができる。上記メインスクリーンの代わりに該ディスプレイを使用する場合、上記カメラに見える光に対して少なくとも部分的に透過性であるフラットパネルディスプレイを実施することができる。例えば、Ｐｒｏｖｉｓｉｏｎにより販売されているＬＣＤパネルの形態の透過イメージングマトリックスを、該カメラが近赤外線カメラである実施形態におけるディスプレイに用いることができる。この形態のＬＣＤパネルは、表示される色が白色の場合、クリアでありかつ透過性である。また、該ディスプレイは、どんな色が表示されていようとも、近赤外線で透過性である。ノート型ＰＣモニタに使用される透過性ＬＣＤパネル、フラットパネルＬＣＤコンピュータモニタ及びフラットパネルＬＣＤ　ＴＶスクリーンを含む多くの種類のＬＣＤパネルも、近赤外線で透過性である特性を有する。

【００５２】

上記カメラに見える光に対して少なくとも部分的に透過性である上記フラットパネルディスプレイは、この文書では、“透過性フラットパネルディスプレイ”と呼ぶ。本明細書で説明した実施例は、赤外線が完全に透過性である透過性フラットパネルディスプレイと赤外線カメラとを含むが、該実施は、異なる波長範囲で機能するカメラ、及び該カメラにより検知可能な光に対して完全に透過性である透過性フラットパネルディスプレイに対して、同様に当てはまる。

【００５３】

透過型ＬＣＤパネルまたは赤外線に対して少なくとも部分的に透過性である他のフラットパネルディスプレイ技術を用いると、インタラクティブ・フラットパネル・ディスプレイを、赤外線カメラを用いて構成することができる。透過型ＬＣＤは、典型的には、それ自体の照度が不足しているため、外部光源により照射する必要がある。一実施形態において、この外部光源は、該ＬＣＤパネルの後方の白色可視光イルミネータを含む。一実施形態において、上記カメラに対して透過性であるが、可視光イルミネータを散乱させるスクリーンは、該イルミネータの光をより容易に拡散するように、該ＬＣＤパネルのすぐ後ろに配設される。

【００５４】

図７Ａは、本発明の一実施形態による例示的な透過型インタラクティブ・フラットパネル・ディスプレイ・システム７００を示す。一実施形態において、ディスプレイ７００の外

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観は、赤外線透過・可視光半透過性スクリーン７２０材料を透過型フラットパネルディスプレイ７１０の後ろに配置することにより、改善されている。それに伴って、どのような光をスクリーン７２０に照射しても、より多く拡散してディスプレイ７１０が照らされることになる。スクリーン７２０のライティングを最大限に拡散させるために、システム７００は、斜角で該スクリーン上に照射する光７３０または独立した拡散板７４０を該光の前に有する光７３０を用いてもよい。拡散板７４０は、カメラ７６０の視野を遮らないことに注意する。図７Ｂは、透過型フラットパネルディスプレイ７１０及びスクリーン７２０を取り除いた状態の平面切り欠き図における同じ構成を示す。可視光イルミネータ７３０は、ＬＥＤ、蛍光灯、ネオン管、エレクトロルミネセントワイヤまたはシート、ハロゲン光及び白熱電球を含む、可視光を生成可能な何らかのライティング技術を含んでもよい。赤外線イルミネータ７５０は、ＬＥＤ、加熱ランプ、ハロゲンランプまたは白熱ランプを含む、上記カメラに見える赤外光を生成することが可能な何らかのライティング技術を含んでもよい。赤外光及び可視光は、両方とも、同じ光源によって生成してもよい。代替的に、赤外光のより良好な制御に対しては、可視光に対して透過性であるが、赤外光に対しては不透明であるフィルムを、可視光イルミネータ７３０を覆って設けてもよい。

【００５５】

「指向性周囲赤外線」の章で述べたストロービング技術を含むプロジェクタをベースとするシステムに対して言及した改良、「物理的構成」の章で述べた物理的構成及び「インタラクティブ・ビデオ・ディスプレイの追加的な構成」の章で述べた上記イルミネータの配置は、全て、この章で述べた透過型フラットパネルディスプレイをベースとするシステムに適用可能である。

【００５６】

プロジェクタではなく透過型フラットパネルディスプレイの使用は、上記インタラクティブ・ビデオ・ディスプレイのサイズを著しく低減することを可能にする。しかし、このことは、上記スクリーンを通して見ることができなければならないコンピュータ視覚システムに対して問題を引き起こす。該スクリーンとディスプレイボックスの背面との間にわずかな距離しかない場合、カメラ７６０は、スクリーン７２０の前の全領域、すなわち、ユーザの手等の該システムが検知すべき対象の位置を見るために、極端に広い角度にしなければならなくなる。このことは、斜角で該スクリーンを通してみる際の困難性のため、問題を引き起こす可能性がある。

【００５７】

斜角での照射の問題を解決する一つの方法は、スクリーン７２０を通過する光に影響を及ぼすことなくスクリーン７２０で反射される赤外光をなくすための、カメラ７６０の周囲での偏光材料の使用である。該スクリーン面で反射する光は、該スクリーン面に対して平行に強度に偏光する傾向があるため、該スクリーン面と直角にカメラ７６０を取り囲み、かつそのスクリーン面と直角な偏光を有する偏光子は、スクリーン７２０の後ろの赤外線イルミネータ７５０からのほとんどまたは全ての迷反射光をなくさなければならない。

【００５８】

歪への対処

カメラ視野歪みの問題は、本明細書に記載した全ての内蔵型インタラクティブ・ビデオ・ディスプレイ（例えば、投影システム及び透過型フラットパネルディスプレイをベースとするシステム）に存在する可能性がある。たいていの場合、上記スクリーンの上の領域のカメラの２次元視野は、激しい歪みを有する可能性がある。例えば、図７Ａにおいて、対象７１２及び対象７１４は、スクリーン７２０の前の全く異なる位置にあるにもかかわらず、カメラ７６０には同じ位置にあるように見える。スクリーン７２０の上の相互作用に対して正確に感知するためには、この歪みは補正する必要がある。

【００５９】

歪みのない環境においては、物理的対象に対応するスクリーン７２０上の仮想位置は、該対象の輪郭のスクリーン７２０上への垂直投影である。フレネルレンズ等の平坦な補正光学系を、該スクリーンと直角である入射光の向きをカメラ７６０の方へ変えるように、ス

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クリーン７２０の上または近傍に配置することができる。それに伴って、カメラ７６０は、対象を、スクリーン７２０の表面に対して正しい位置に見る。図８Ａは、プロジェクタをベースとするインタラクティブ・ビデオ・ディスプレイ・システム８００に対するこの構成の例示的な実施形態を断面で示す。カメラ８１０は、垂直方向からスクリーン８３０上に照射する光線の向きをカメラ８１０に向けさせるフレネルレンズ８２０の焦点距離に配置されている。その結果として、対象が位置８０２から位置８０４へ移動した場合、カメラ８１０に対するその視位置は変わらない。従って、所望の効果が実現され、すなわち、スクリーン８２０の上の対象は、スクリーン８２０の上の該対象の輪郭の垂直投影である仮想位置を有する。該カメラのレンズの光学系は、特別に配慮する価値があり、ピンホールレンズは、理想的な焦点深度及び画像明瞭をもたらすが、無限領域に焦点を合わせる能力を有する広角レンズは、焦点深度及び写像性をある程度犠牲にして、より明るいイメージを可能にすることになる。歪みをなくすフレネルレンズ方法は、投影型及び透過型のフラットパネルディスプレイをベースとするインタラクティブシステムと共に用いることができることを認識すべきである。

【００６０】

内蔵型プロジェクタディスプレイに対して上記フレネルレンズを使用する場合、該レンズの前の赤外線透過・可視光半透過性スクリーンは、該プロジェクタの光を散乱させ、また、このスクリーンと該フレネルレンズとの間の距離はほとんどゼロであり、そのため投影イメージの歪はないので、該フレネルレンズは、該投影イメージに影響を及ぼさない。

【００６１】

透過型フラットパネルディスプレイに対して上記フレネルレンズを使用する場合、該透過型フラットパネルディスプレイは、ビューワに近づけて、上記赤外線透過・可視光半透過性スクリーン及びフレネルレンズの前に配置することができる。該フレネルレンズは、白色光によるバックライトが、既に拡散されているか、または、該フレネルレンズと透過型フラットパネルディスプレイとの間の材料によって拡散されるため、該ディスプレイの照明に影響を及ぼさない。

【００６２】

代替的に、上記歪みは、図８Ｂに示すように、上記ディスプレイの背面に一連のミラーストリップを用いることにより、なくすことができる。これらのミラーストリップ９１０は、該ディスプレイ上に垂直に照射する光の向きをカメラ９２０の方へ変えるようにデザインされている。該カメラは、光に干渉しないように、該ディスプレイの側に配設されている。ミラーストリップ９１０の実際の数は、非常に多くの数とすることができ、また、該ストリップ自体は、非常に薄くすることができる。一実施形態においては、スクリーン９３０の背面からの光を通過させて照射できるようにするミラーストリップ９１０の間の十分な空間が形成される。しかし、カメラ９２０は、その視野により、それらの光を見ることができず、この領域のカメラ９２０の視野は、全てミラーストリップ９１０である。スクリーン９３０と直角な方向で見た場合、ミラーストリップ９１０は、各円の中心がカメラ９２０の位置にある円曲線を形成する。

【００６３】

プロジェクタは、ミラーストリップ９１０を通して容易に照射することができないため、本実施形態は、該プロジェクタが、該ミラーストリップと該スクリーンとの間の空間を通して該スクリーン上に投影する、透過型フラットパネルディスプレイまたは軸外し投影ディスプレイを用いてより有効にすることができる。しかし、これは、該ミラーストリップを通して照射するプロジェクタの使用を排除しない。ある程度の光は失われるが、該プロジェクタの光は、この時点で焦点が合わず、それに伴って、最終的な投影イメージが影響を受けない。

【００６４】

代替的に、見られるシーンに関する深度情報（各ピクセルで見られる上記カメラから対象までの距離）を得ることができる場合、該カメラにより見られる対象ごとの各ピクセルによって占められる該スクリーンの上の位置のｘ－ｙ－ｚ座標を（単純な座標変換によって

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）再構成することができ、それに伴って、該カメラの歪んだ視野を補正することができる。このような深度情報は、限定するものではないが、ステレオカメラ、タイムオブフライト型カメラ及びパターン化した照射を含む様々な手段を用いて得ることができる。

【００６５】

上記カメラのイメージの各ピクセルに対するｘ－ｙ－ｚ座標を用いた歪みのない３次元（３Ｄ）視野を再構成する能力は、単純なデータの重ね合わせにより、多数のカメラのデータの、上記スクリーンの前の対象の単一の統合視野への結合も可能にするであろう。多数のカメラ（または、立体視を３Ｄに用いる場合、多数の組のカメラ）の使用は、該カメラに対して、より狭小な視野を用いて、上記ディスプレイを一様に平坦に形成できるようにするであろう。この場合、該カメラまたはカメラの組は、該カメラが、該スクリーンの後ろの領域を一様にカバーするように、理想的に配置される。例えば、該カメラは、該スクリーンの後ろに格子状に配置することができる。

【００６６】

散乱偏光子スクリーンを用いたイメージの投影及びキャプチャ

次に、別のスクリーン材料について説明する。このスクリーン材料は、本願においてすでに説明したプロジェクタベースの及び透過型フラットパネルディスプレイベースのシステムに用いられる“赤外線透過・可視光半透過性スクリーン”に対する代替例として機能する。該スクリーンは、対象と、上記インタラクティブ・ディスプレイ・システムとの間に配置されているため、該スクリーンは、投影イメージを透過すると共に、照明源及びカメラが該スクリーンを通して明瞭に見ることができるようにする。一実施形態において、該スクリーンは、表示イメージチャネルのための透過拡散板として機能すると共に、該カメラのキャプチャリングチャネルのためのウィンドウとしても機能する。該スクリーンに対する追加的な必要条件は、ビューワをグレア、すなわち、直接的なまたは十分に散乱していないプロジェクタ光による不快な視覚刺激から防ぐことである。

【００６７】

場合によっては、小粒子散乱は、単一粒子散乱に対してλ^4波長依存を有するが、たいていの拡散板は、多重散乱を利用して適切な拡散を実施する。多重散乱においては、散乱光の波長依存性は、ミルクの色によって実演されるように、よりはるかに中立である。小粒子によってコヒーレントに散乱された光の強度は、$(n-1)^2$に比例することが分かっており、ただし、ｎは、該粒子とホストマトリクスとの間の相対屈折率である。本発明において、それは、キャプチャリングチャネルにおける透過性及び表示チャネルにおけるぼやけを可能にするように活用されるこの散乱の特性である。ここで用いる方法は、限定するものではないが、該キャプチャリングチャネルにおける赤外線の使用と矛盾しない。一般的なポリマー材料の散乱は、可視光と近赤外光との間のコントラストを生成するには不十分である。その代わり、本発明者らは、該キャプチャリングチャネルを偏光状態の１つの状態に分類し、該表示チャネルを直交する状態に分類する。また、発明者等は、偏光の１つの状態に対するマトリクスと散乱分子との間の屈折率整合（ｎ＝１）及び直交状態に対する屈折率不整合（ｎ≠１）という特性を有するスクリーンを用いる。このようにして、該スクリーンは、該表示チャネルに対して実質的なぼやけを、該キャプチャリングチャネルに対して実質的な透過性を有することになる。材料は、非常に狭小なスペクトル（２０ｎｍ程度）を有することができる該キャプチャリングチャネルにおいてほぼ完璧な屈折率整合を実施するように調整することができる。２つの主要なマトリクスは、この種のスクリーンのパフォーマンス、すなわち、シングルピース透過（ｔｈｅ ｓｉｎｇｌｅ ｐｉｅｃｅ ｔｒａｎｓｍｉｓｓｉｏｎ；Ｔｓｐ）及び偏光子効率（ｐｏｌａｒｉｚｅｒ ｅｆｆｉｃｉｅｎｃｙ；ＰＥ）を規定するのに用いることができる。これらの量は、次のように等式１及び等式２で定義される。

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【数１】

$$T_{sp}=(T_{\parallel}+T_{\perp})/2 \qquad (1)$$

$$PE=|(T_{\parallel}-T_{\perp})/(T_{\parallel}+T_{\perp})| \qquad (2)$$

ただし、$T_{\parallel}$及び$T_{\perp}$は、上記２つの状態における直接（例えば、散乱していないまたは小角散乱した）透過率である。

【００６８】

完全な偏光子の場合、T_{SP}＝０．５及びＰＥ＝１である。実際の偏光子の場合、上記スクリーンの厚さまたは粒子濃度が一定の有効範囲を超えると、多重散乱によりT_{SP}は減少し、かつＰＥは増加することになる。これら２つのパフォーマンスマトリクスは、所定の散乱システムの材料及び処理パラメータを調節することにより、所定の用途に対して最適化することができる。高いT_{SP}は、上記カメラにおいて主として高い解像力をもたらし、高いＰＥは、主として低いグレアをもたらす。

【００６９】

一実施形態において、上記プロジェクタの光は、上記スクリーンの半透過状態で偏光される。ＬＣＤプロジェクタの場合、これは、非常に低い損失で配置することができる。投影されたイメージ光の一部は後方散乱され、また一部は、前方領域で選択的に散乱される。上記カメラに用いられる照明は、迷光を回避するために、優先的に偏光される。このことは、フィルム型吸収偏光子を用いて容易に実現することができる。照らされた対象は、該光を拡散的に反射し、またほぼ同等の部分が、透過性及び散乱に対応して偏光状態で生成される（例えば、偏光は保たれない）。該カメラは、上記対象からの直接光のみが撮像されるように、吸収型の偏光フィルタを備えている。また、該カメラは、ビデオフィードバック及び周囲光からの干渉を避けるために、ランプスペクトルに整合する狭帯域フィルタを備えてもよい。該散乱偏光子が、該散乱光が入射光の偏光を維持する別の特性を有する場合、周囲光の反射は低減されることになり、より高いコントラストがもたらされる。図９Ａ及び図９Ｂは、本発明の一実施形態による、散乱偏光子スクリーンを有するインタラクティブ・ビデオ・ディスプレイ・システムの概略的レイアウトを示す。斜めの矢印及び双方向矢印は、偏光の状態を表す。

【００７０】

典型的なＬＣＤプロジェクタは、その投射レンズから偏光した光を放射する。しかし、ほとんどの一般的なタイプの３重パネルＬＣＤプロジェクタの場合、緑原色の偏光は、赤原色及び青原色の偏光に対して直角である。（これは、Ｘ立方体コンバイナデザインの結果である。）そのため、３原色全てを同じ偏光で投影するには、緑色は、他の２色と同様にしなければならない。このことは、（例えば、日本のＰｏｌａｔｅｃｈｎｏ Ｃｏｒｐ．から入手可能な）リターダ・スタックを用いることにより、非常に低い損失で実現することができ、該スタックは、赤色及び青色のリターダンスと比較して、半波長のリターダンスを緑色チャネルに付加する。このスタックコンポーネントは、該コンバイナ立方体と投影レンズとの間に、または、該レンズと該スクリーンとの間に配置することができる。高ルーメン出力を維持し、かつ画像アーチファクトを避けるためには、偏光保存性の投影レンズアセンブリを用いることが必要である。

【００７１】

内蔵型インタラクティブ投影型ディスプレイの代替構成

ＨｏｌｏＣｌｅａｒ、Ｄａｉ Ｎｉｐｐｏｎ Ｐｒｉｎｔｉｎｇにより製造されているホログラフィックスクリーン等の部分的に透過性であるが、光がスクリーン上に特定の角度で投射したときには半透過性であるスクリーン材料は、該ディスプレイのコンテナ内部がユーザに対して完全に暗くなるような方法で、該内蔵型インタラクティブ・ディスプレイ

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に用いることができる。このことは、上記赤外線カメラ及びイルミネータの前に、赤外線に対して透過性である黒ウィンドウを用いて、該コンテナの全ての内面を黒にすることにより、実現することができる。該スクリーン材料は、部分的に透過性であるため、該カメラは、該スクリーン越しに対象を見ることができる。しかし、該プロジェクタは、適当な角度（ＨｏｌｏＣｌｅａｒの場合は３５度）でオフセットされているため、該プロジェクタからの光は完全に拡散され、グレアがなくなる。該ディスプレイのユーザは、その内部が真っ暗であるため、該部分的に透過性のスクリーン越しに何かが見えなくてもよい。

【００７２】

別の実施形態においては、現在、インテリアデザイナー向けに市販されている“プライバシーガラス”製品等の、電流が印加されたときに、瞬時にクリアから半透過性に切り替わることができるスクリーン材料を用いることができる。この材料は、本明細書において、（例えば、時間により透過性あるいは半透過性になる）時間ベースの材料と呼ぶことにする。この材料は、波長または偏光選択性スクリーンの代わりに用いることができる。カメラの露出は、非常に短い（例えば、１秒間に約１００マイクロ秒で３０回）。上記カメラが露出しているときに、該スクリーン材料はクリアであり、該カメラが該スクリーンを通して見ることができるようになる。プロジェクタシステムの場合、電子（例えば、高速液晶シャッター）または機械的シャッターは、該プロジェクタの光出力を遮断することができ、該プロジェクタがこの間にユーザの目に照射しないことを実現する。該カメラが露出していないときには、該スクリーン材料は、半透過性に変わり、該プロジェクタの光またはバックライトの光が散乱できるようになる。バックライトという用語は、上記フラットパネルディスプレイを可視光で照らす照明源を指すことを認識すべきである。

【００７３】

インタフェースの全般的な説明

本明細書において本文により暗に説明したが、このシステムは、内蔵型ディスプレイシステムに対するインタフェースについて記述する。このインタフェースは、位置、輪郭の感知、および場合によっては該ディスプレイの前の（人であるユーザを含む）対象の距離、及びこの感知に基づく実時間効果の表示を可能にする。これらの実時間効果は、該ディスプレイの仮想空間における対応する位置における動作の効果に対する該ディスプレイの前の物理的空間における動作のマッピングを含んでもよい。換言すれば、該システムは、ユーザの手等の物理的対象が、該ディスプレイ上の仮想対象の位置に位置している場合に、該ディスプレイ上の仮想対象との相互作用が起きるように較正することができる。このディスプレイは、何らかの検出装置の可視的な標示がない、すなわち、該ディスプレイ自体が可視的であるという物理的特性を有する。本願において後述するウィンドウ・ディスプレイ・システムの場合、該インタフェースは、上記内蔵型ディスプレイに対して説明したのと同様であるが、該ディスプレイは、該ユーザと同じ該ウィンドウの側に装置が配置されていないウィンドウディスプレイの形態をとる。

【００７４】

本発明の多くの実施形態において、ビデオカメラは、検出装置として使用される。該カメラのイメージは、実時間での静止背景から該カメラのイメージにおける（人等の）前景対象を分離するコンピュータ視覚システムへの入力となる。この前景－背景の識別は、上記表示スクリーンに表示されるイメージを生成するインタラクティブ・ビデオ・ディスプレイ・アプリケーションへの入力になる。これらのイメージは、該インタラクティブ・アプリケーションの表示されたイメージに対する対象の効果が、該対象と同じ物理的位置にあるように較正することができる。このことは、拡張現実感の錯覚をもたらし、人は、ピックアップ、押しまたは引き等の普通の体の動きによって、該スクリーン上のイメージまたは対象と相互に作用することができ、実際の対象またはイメージを操作するという錯覚が可能になる。

【００７５】

透過性ディスプレイスクリーン

上記システムの一実施形態においては、ＬＣＤスクリーンまたは他のそのような透過性ス

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クリーンがディスプレイ装置として用いられる。上記カメラは、人であるユーザの動きを検知するものであり、該スクリーンの後ろに配置されている。それに伴って、該カメラの視野は、該スクリーンを通して見ることにより、該スクリーンの前の領域を見る。人であるユーザ及び対象を該カメラによって検知することができる該スクリーンの前のこの領域は、インタラクティブ領域と呼ばれる。そのため、該スクリーンは、該カメラによって見られる光の波長に対して、少なくとも部分的に透過性である。

【００７６】

上記スクリーン上に表示されている内容が、該スクリーンの向こうの対象の上記カメラのイメージに影響を及ぼすのを防ぐために、該カメラは、（黒色を含む）どんな内容が表示されていようとも、該スクリーンが部分的に透過性である光の波長で作動する。理想的には、該スクリーン上の内容は、該カメラによって見られる光の波長において、該スクリーンの光特性に対する影響を有するべきではない。ノート型及びフラットパネルコンピュータディスプレイに用いられるＬＣＤモニタの場合、該ＬＣＤスクリーンは、典型的には、該スクリーンを通して該カメラが見ることが９２０ｎｍ以上の光の波長に対してのみ感度が良い場合に、この特性を実現する。しかし、いくつかのＬＣＤパネルは、８００ｎｍ等の可視光に近い波長でもこの特性を実現する。また、該ＬＣＤスクリーンにおける偏光子は、それらの波長で光を偏光しない。

【００７７】

上記ＬＣＤまたは他の透過性ディスプレイスクリーンは、ビューワが該スクリーン上の内容を見ることができるように照らされる。理想的には、この光は、明るくかつ該スクリーンの全域に一様に拡がるようにすべきである。典型的なＬＣＤディスプレイは、様々なバックライト及びエッジライトソリューションのうちのいずれか一つを用いる。しかし、それらのソリューションは、典型的には、散乱、反射または不透過性材料からなるいくつかの層を該スクリーンの後ろに設けることを伴い、それらは、該スクリーンの後ろのカメラが、該スクリーンの前の領域を見えるようにはしない。しかし、本発明は、該カメラが、該スクリーンの前の領域を見えるようにすると共に、該スクリーンの前の領域の明るさ及び一様な照射も実現できるいくつかの選択的散乱材料についても説明する。

【００７８】

次のソリューションにおいては、バックライティングまたはエッジライティングのための照射源は、好ましくは、蛍光灯または白色ＬＥＤ等の長寿命の効率的な白色可視光エミッタであるが、何らかの可視光源であってもよい。

【００７９】

１．レイリー散乱材料

一つのソリューションは、上記スクリーンの背面に、強力なレイリー散乱を有する材料のシートを配置することと、白色バックライティングまたはエッジライティングを用いて上記表示スクリーンを照らすことと、近赤外線検知カメラを用いて該スクリーンを通して見ることとを含む。レイリー散乱は、散乱される光の波長の出力の逆数の４乗に比例するため、ほとんど全ての白色光は、該レイリー材料によって散乱され、該スクリーンの一様な照射が実現できる。しかし、該カメラによって見られる赤外光の比較的わずかな部分だけが、赤外線が、可視光よりも長い波長からなるため、散乱されることになる。

【００８０】

２．ざらつきのある材料

別のソリューションは、平坦領域の間に散在されたバンプ、隆起、くぼみ、溝からなる物理的構成を有する材料の平坦シートを形成することを含む。この材料は、上記表示スクリーンの背面に配置することができる。この材料は、該材料を通過する全ての光を視射角で散乱させると共に、該材料を通過する光のほんの一部を垂直に散乱させるという効果を有することができる。いくつかのそのような材料を図１０Ａ及び図１０Ｂに示す。図１０Ａは、光を散乱する微小バンプまたは隆起１０１０を有する材料１０００の単純化した断面を示す。該散乱は、光を散乱する材料の外部に該隆起またはバンプを形成することにより、または、他の方法によって、隆起またはバンプ１０１０の表面をテクスチャー加工する

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ことにより、実現することができる。図１０Ｂは、光を散乱する微小な溝またはくぼみ１０６０を有する材料１０５０の単純化した断面を示す。該散乱は、溝またはくぼみ１０６０の表面をテクスチャー加工することにより、溝またはくぼみ１０６０に、光を散乱する物質を充填することにより、または、他の方法によって実現することができる。全ての場合において、該材料の表面に対してほぼ垂直に通過する光のかなりの部分は散乱されず、視射角で通過して表面に達する光のほぼ全てが散乱されることになる。

【００８１】

従って、上記スクリーンがエッジライティングによって照らされる場合、上記表示スクリーンは、一様かつ明るく照らすことができると共に、上記カメラが該スクリーンと通して見ることができるようになる。図１１は、本発明の一実施形態による、内蔵型エッジライティング・インタラクティブ・ディスプレイの断面の単純化した概略図を示す。エッジライティング１１１０は、表示スクリーン１１４０（例えば、ＬＣＤ）を照らす可視照明を形成する。スクリーン１１５０は、表示スクリーン１１４０に隣接して配置されており、視射角（例えば、エッジライティング１１１０の角度）で該スクリーンに当たる光を散乱させるように機能する。イルミネータ１１２０は、カメラ１１３０の視野の対象を照らす。イルミネータ１１２０からの光は、垂直な角度またはほぼ垂直な角度で表示スクリーン１１４０に当たり、散乱されない。

【００８２】

３．散乱偏光子

別の実施形態においては、“散乱偏光子スクリーンを用いたイメージ投影及びキャプチャ”の章で述べたような散乱偏光子が、上記表示スクリーンの背面に配置されている。この散乱偏光子は、一方の偏光の光を散乱させ、反対の偏光の光を散乱させない。該表示スクリーンは、バックライティングを用いて、該バックライトを該散乱偏光子上の散乱方向と同じ方向に直線偏光させることにより一様に照らすことができる。従って、全てのバックライトは、該表示スクリーンを通過する前に散乱される。

【００８３】

代替的に、該バックライトは偏光させないことができ、直線偏光子は、該偏光子の偏光を、光を散乱する散乱偏光子における方向と同じ方向に向けた状態で、該散乱偏光子と該表示スクリーンとの間に配置してもよい。それに伴って、該散乱偏光子により散乱されない該バックライトからのいかなる光も、直線偏光とは反対の偏光からなり、該光は吸収される。このことは、該表示スクリーンに対する照射を一様にし、ユーザの目における厄介なグレアがなくなる。

【００８４】

上記表示スクリーンがＬＣＤスクリーンである場合、該ＬＣＤスクリーンの背面に形成された直線偏光があるため、該バックライトは偏光される必要がない。この場合、一様な照明は、単に、該散乱偏光子を、該散乱偏光子における最大散乱の方向が、該ＬＣＤスクリーンの裏面の直線偏光子の偏光と平行になるように向けて、該ＬＣＤスクリーンの裏面に該散乱偏光子を配置することにより、散乱されないバックライトによって実現することができる。従って、該散乱偏光子によって散乱される光のみが、該ＬＣＤスクリーンを通過できるようになる。

【００８５】

フラットパネルディスプレイスクリーン

表示スクリーンを用いた内蔵型ディスプレイ１２００の例示的な実施形態の単純化した断面図を図１２Ａに示す。該ディスプレイは、白色可視光１２２０によってバックライティングされるＬＣＤスクリーン１２１０を用いて形成される。散乱偏光子１２１５は、この光全てを散乱させ、ビューワにとって一様な照明を実現できる。該内蔵型ユニットの側部のミラー１２２５は、光１２２０からの白色の迷光を反射して表示スクリーン１２１０の方へ戻し、その明るさを増す。９２０ｎｍ～９６０ｎｍの近赤外光に対してのみ感度が良いビデオカメラ１２３０は、“カメラの視野”と呼ばれる、ＬＣＤスクリーン１２１０の前の領域を見る。この視野内の対象は、カメラ１２３０に見えることになる。該カメラの

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視野に対する照射は、赤外線ＬＥＤクラスタ１２４０のセットから来て、該クラスタは、カメラ１２３０によって見える波長で上記ボックスの裏側に光を生成する。明るい鏡面反射性ハイライトが、該カメラのイメージに現れるのを防ぐために、これらのＬＥＤ１２４０からの光は、ＬＣＤスクリーン１２１０に到達する前に拡散スクリーン１２４５によってわずかに散乱される。フレネルレンズ１２５０は、ＬＣＤスクリーン１２１０の前の領域の該カメラの視野の歪みを低減するのに用いられる。

【００８６】

次に、図１２Ａの例示的な実施形態を介した可視光及び赤外光の光路について説明する。本発明者らは、光の２つの垂直な偏光を偏光Ａ及び偏光Ｂと呼ぶことにする。

【００８７】

白色光イルミネータ１２２０からの可視光は、非偏光を始め、拡散材料１２４５により散乱させる、フレネルレンズ１２５０により向きを変える、あるいは、その光路上のミラー１２２５で反射してスクリーン１２１０へ向けることができる。次いで、この光は、散乱偏光子１２１５を通過し、該偏光子は、偏光Ａの全ての光を散乱させ、かつ偏光Ｂの光を散乱させない（ここで、Ａ及びＢは、２つの垂直偏光を指す）。散乱された光は、散乱後のその偏光を保つ。そして、この光は、ＬＣＤスクリーン１２１０を通過し、該スクリーンは、偏光Ｂの全ての光を吸収し、偏光Ａの全ての光を伝達する。従って、ＬＣＤスクリーン１２１０は、散乱光のみを用いて照らされ、ビューワは、一様に照らされたスクリーンを見る。

【００８８】

赤外線イルミネータ１２４０から放射された赤外光は、非偏光を始めなくてもよい。状況に応じて、改善された明瞭性のため、この光は、該光が散乱偏光子１２１５によってあまり散乱されないように、まず赤外線直線偏光子１２６０を通過して、該光を偏光Ｂで偏光させることができる。次に、該赤外光は、拡散材料１２４５により散乱させる、フレネルレンズ１２５０により向きを変える、あるいは、その光路上のミラー１２２５で反射させてスクリーン１２１０へ向けることができる。該光が偏光されない場合、その一部は、散乱偏光子１２１５を通過する際に散乱されることになるが、偏光Ｂの光は、散乱偏光子１２１５を通過して散乱されない。該赤外光の波長は十分に長いため、該赤外光は、影響を受けずにＬＣＤスクリーン１２１０を通過し、人の手等の、該スクリーンの前の対象を照らすことができる。

【００８９】

上記表示スクリーンの前からカメラ１２３０に向かって戻ってくる赤外光は、ＬＣＤスクリーン１２１０の影響を受けない。しかし、該光が散乱偏光子１２１５を通過する際、偏光Ａの光は散乱し、偏光Ｂの光は散乱しないままとなる。次に、該光は、フレネルレンズ１２５０を通過するが、偏光に顕著な影響は及ぼさない。カメラ１２３０は、該カメラの直前に赤外線直線偏光子１２６０を有し、この偏光子１２６０は、偏光Ａの光を吸収し、偏光Ｂの光を伝達する。従って、カメラ１２３０は、散乱偏光子１２６０によって散乱されないままであった偏光Ｂの光を見るのみである。このことは、カメラ１２３０に、該スクリーンの該領域のクリアで高コントラストのイメージをもたらす。

【００９０】

ＬＣＤをベースとするインタラクティブ・ディスプレイの別の例示的な実施形態を断面で図１２Ｂに示す。該システム全体は、楔状である。該システムデザインは、図１２Ａで示しかつ説明したデザインと同様のものである。しかし、赤外線イルミネータは、カメラ１２６２へのグレアを最小化するように配置されている。上記スクリーンの上及び該スクリーン近傍の対象は、内側赤外線イルミネータ１２６４によって照らされ、該イルミネータは、散乱偏光子１２６６及びＬＣＤパネル１２６８を通して照射する。しかし、該イルミネータは、カメラ１２６２に対するグレアの影響を低減するために、フレネルレンズ１２７６を通して照射しない。フレネルレンズ１２７６は、内側赤外線イルミネータ１２６４のための空間を設けるために、ＬＣＤパネル１２６８の表面及び散乱偏光子１２６６から引っ込められている。外側の赤外線イルミネータ１２７０は、該スクリーンからさらに離

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れている対象を照らす。赤外線イルミネータ１２７０は、ＬＣＤパネル１２６８または散乱偏光子１２６６（を通してではなく）周辺を照射し、グレアをさらに低減できるようにする。白色可視光イルミネータ１２７２は、該システムのベースの側部に沿って配置されており、バックライトカバー１２７４によって覆われている。バックライトカバー１２７４は、該スクリーン上の周囲赤外線の存在を低減して、カメラ１２６２によってキャプチャされたイメージのコントラストを改善するために、近赤外線を吸収するが、可視光を伝達する材料で構成してもよい。

【００９１】

散乱偏光子を用いた投影型ディスプレイスクリーン

上記インタラクティブ・ビデオ・ディスプレイの別の実施形態においては、プロジェクタ及び投影スクリーンが、ディスプレイ装置として用いられる。人であるユーザの動きを検知するのに用いられる上記カメラは、該スクリーンの後ろに配置されている。それに伴って、該カメラは、該スクリーンを通して見ることにより、該スクリーンの前方の領域を見る。そのため、該スクリーンは、該カメラによって見られる光の波長に対して、少なくとも部分的に透過性である。上記散乱偏光子は、このシステムにおける投影スクリーンとして機能することができる。

【００９２】

上記散乱偏光子は、完全に作動しなくてもよいことを認識すべきである。散乱されることになっている該偏光における少量の光は、散乱されなくてもよい。プロジェクタが直接見られたときの該プロジェクタの極度の明るさのため、該プロジェクタのレンズの内側の明るい光源は、該散乱偏光子を通して直接見ることができるが、該プロジェクタの光は、最大の散乱のために適切な方向に偏光することができる。この明るいグレアのスポットは、散乱されないプロジェクタの光が吸収されるように、該散乱偏光子の前に直線偏光子を用いることによりなくすことができる。また、該プロジェクタ光が、完全に偏光されない場合、同様の問題が生じることになる。この問題は、該散乱偏光子の後ろに直線偏光子を用いることにより緩和することができる。どちらの場合においても、それらの偏光子は、該プロジェクタ光と平行に向けられている。上記カメラが、近赤外線または他の非可視光波長である場合、該可視光偏光子は、該カメラが、その影響を受けないように選択することができる。従って、該カメラは、該スクリーンを通して見ることができる。

【００９３】

鏡面反射をなくすこと

また、上記カメラのイルミネータからの鏡面反射は、該カメラのイメージに有害な影響を及ぼす可能性がある。これらの影響は、反射防止膜を、上記表示スクリーンの一方の面または両面に、およびレイリー散乱材料、テクスチャー加工された材料、散乱材料またはフレネルレンズを含む、該スクリーンの後ろの何らかの表面に施すことにより、軽減することができる。また、これらの影響は、該カメラの照射から該カメラに戻る鏡面反射がないように、該イルミネータから来る光をある角度に向けることにより軽減することができる。

【００９４】

このような構成の一実施例を図１３に示す。この構成は、カメラ１３２０から離れており、かつスクリーン１３３０に垂直に照射するスポットイルミネータ１３１０を用い、カメラ１３２０へのいかなる鏡面反射も防ぐ。これらのイルミネータによってカバーされていない領域は、スクリーン１３３０への視射角で照射するイルミネータ１３４０によって照射され、反射光がカメラ１３２０に戻って照射されることを防ぐ。

【００９５】

別の実施形態においては、図１４に示すように、カメラのイルミネータ１４４０の鏡面反射がカメラ１４３０から離れてはね返るように、散乱偏光子１４１０または他の選択性散乱材料をわずかに傾けることができる。図に示すように、イルミネータ１４４０からの鏡面反射は、該ボックスの側部の方へ向きが変えられる。別の実施形態においては、カメラへの鏡面反射を和らげるために、拡散材料を該カメラのイルミネータの前に配置すること

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ができる。これらのイルミネータからの光は、該ディスプレイの裏からそれらの光を跳ね返させることによっても拡散させることができる。

【００９６】

図１５は、本発明の一実施形態による、タイムオブフライト型カメラ１５３０を用いたインタラクティブ・ビデオ・ディスプレイ・システム１５００の例示的な構成を示す。典型的なデザインにおいては、該カメラ及び該カメラのイルミネータは、互いに近接させて配置しなければならず、また、該イルミネータからの光は散乱させることができないため、鏡面反射は、タイムオブフライト型カメラ１５３０に対して問題を引き起こす。従って、上述したアプローチは、該スクリーンの裏から該カメラに戻る反射によって激しいグレアを引き起こす該カメラのイルミネータにより、タイムオブフライト型カメラを用いる実施においては、うまくいかないことになる。しかし、上記コンピュータ視覚システムは、３Ｄカメラの情報を用いて、所望の座標系への座標変換を実行することができるため、該カメラは、該スクリーンの中心の後ろに配置する必要はなく、また、多数のカメラからのデータを融合することができる。従って、例えば、２つのカメラ１５３０が異なる時間に露出を行うかぎりにおいて、それらのイルミネータからのいかなる鏡面反射も避けるために、２つのタイムオブフライト型カメラ１５３０を、スクリーン１５１０の前の領域をある角度で見るのに用いることができる。この構成において、カメラは、その内蔵されているイルミネータの鏡面反射も見ることができない。

【００９７】

タッチスクリーン・インタフェースの付加

上述したシステムは、上記スクリーンから数インチ離れた対象やジェスチャーを認識するが、タッチスクリーンの反応も同様に実行することができ、ユーザは、該スクリーンに本当に触って、動作を起こせるようにしなければならない。このことは、該システムが、追加的な様々なユーザインタフェースをサポートできるようにすることになる。例えば、このインタフェースは、ユーザが、該スクリーンの上で両手をそろえてカップ状にすることにより、該スクリーン上の仮想対象を“集める”ことができるようにするが、そのイメージに触れることにより仮想対象を“ピックアップ”した後、該スクリーン上の別の箇所に触れることにより該対象を“落とす”こともできるようにする。

【００９８】

このタッチスクリーンの作用は、いくつかの方法のうちの１つで実施することができる。この章及び後の章で説明する該タッチスクリーンの実施例は、プロジェクタをベースとするインタラクティブ・ビデオ・システム及び透過型フラットパネルディスプレイをベースとするインタラクティブ・ビデオ・システムの両方と適合する。現在のタッチスクリーン技術は、上記表示スクリーンを覆う部分が上記カメラに対して透過性である限り、該システムのスクリーンと一体化することができる。これは、抵抗性タッチスクリーン、容量性タッチスクリーン、赤外線格子タッチスクリーン及び表面弾性波タッチスクリーンを含む。しかし、これらスクリーンの全ては、該スクリーンへの一本指によるタッチングしか検知することができず、また、短時間のタップと対照的に、連続的なタッチングまでも検知することができないという欠点を有する。上記の欠点を克服するいくつかの解決法があり、そのほとんどは、上記システムが、対象と該スクリーンとの間の距離に関する情報をキャプチャできるようにする。この３Ｄデータは、ジェスチャー認識等の高レベルの視覚処理にとって有用である。

【００９９】

マルチユーザ・タッチスクリーン及び３Ｄデータ：ステレオカメラ

このシステムに対して、いくつかのわずかな変更を行うことにより、複数の人が上記スクリーンを同時に使用できるようにするマルチユーザ・タッチスクリーンを形成することができる。一実施形態において、ステレオカメラを単一のカメラに代えて用いることができる。該ステレオカメラは、単一のカメラシステムと同じ波長感度及びフィルタ構成を有するであろう。しかし、上記コンピュータは、該ステレオカメラから２つのイメージを取得することができ、また、マー・ポジオ（Ｍａｒｒ－Ｐｏｇｇｉｏ）アルゴリズム等のいく

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つかの周知の立体視アルゴリズムのうちのいずれか１つを用いて、スクリーン上に見える対象のための距離情報を導出することができる。該スクリーンまでの距離は分かっているので、該コンピュータは、該対象の距離情報と該スクリーンまでの距離とを比較することにより、何らかの対象が該スクリーンに触れているか否かを識別することができる。

【０１００】

マルチユーザ・タッチスクリーン及び３Ｄデータ：１カメラステレオ

図１６は、本発明の一実施形態による、ミラーを用いて３Ｄ情報を得る構成１６００を示す。ステレオデータは、ミラー１６２０を上記ボックスの内側側部に配置することにより、１つのカメラ１６１０のみを用いて取得することができる。従って、カメラ１６１０は、直接的に及びある角度でスクリーン１６３０を見ることになる。スクリーン１６３０に触れている対象は、該カメラのメインイメージ及び反射イメージの両方において、ミラー１６２０の縁部から同じ距離に現れることになる。しかし、スクリーン１６３０の上の対象は、該メインイメージ及び反射イメージにおいて、ミラー１６２０の縁部から異なる距離にあることになる。これらのイメージを比較することにより、上記コンピュータは、各対象がスクリーン１６３０に触れているか否かを論理的に推理することができる。

【０１０１】

マルチユーザ・タッチスクリーン及び３Ｄデータ：パターン化した照射

図１７は、本発明の一実施形態による、パターン化した照射を用いて３Ｄ情報を得る別の構成１７００を示す。光パターンを投影するパターン化赤外線イルミネータ１７１０は、通常の赤外線イルミネータの代わりに用いることができる。このシステムは、スクリーン１７２０上の対象とスクリーン１７２０の上方の対象を識別することができる。しかし、このシステムの精度は、パターン化赤外線イルミネータ１７１０をある角度でスクリーン１７２０上に照射させることにより、ある場合においては、ミラー１７３０から上記ボックス内部の側部にはね返すことにより、改善することができる。対象に対するパターン化した光の位置は、スクリーン１７２０から離れてまたは該スクリーンの方へ短距離移動する際に、劇的に変化し、該対象とスクリーン１７２０との距離を、コンピュータ１７４０によって容易に判断できるようにする。

【０１０２】

マルチユーザ・タッチスクリーン及び３Ｄデータ・タイムオブフライト型システム

上記カメラは、Ｃａｎｅｓｔａおよび３ＤＶ　ｓｙｓｔｅｍｓから入手可能なモデル等のタイムオブフライト型赤外線カメラとすることができる。このカメラは、そのイメージの各ピクセルのための距離情報を検知する、本来備わった機能を有する。この種のカメラを使用する場合、上記スクリーンからの全ての赤外線グレアをなくすことが非常に重要であり、さもなければ、該カメラは、該スクリーン上の上記イルミネータの反射を実際の対象と間違えることになる。赤外線グレアをなくす方法は上述している。

【０１０３】

マルチユーザ・タッチスクリーン：複数波長

タッチスクリーンの機能は、それぞれのカメラとイルミネータとの組を異なる赤外線周波数とした状態で、２つのカメラ及び２つのイルミネータを有することにより実現することができる。例えば、一方のカメラ‐イルミネータの組は、８００ｎｍの光を用い、他方の組は、１１００ｎｍの光を用いることができる。該スクリーンの散乱は、該波長の逆数の４乗に比例するため、該８００ｎｍのカメラは、該１１００ｎｍのカメラよりも遥かに小さい、該スクリーンの向こうにあるものを見る能力を有することになる。その結果として、該スクリーンに触れている、または、触れそうになっている対象のみが、該８００ｎｍのカメラに見えることになり、一方、１１００ｎｍのカメラは、該スクリーンから数インチ離れている対象を見ることができることになる。両カメラ共、それらのデータを上記コンピュータに入力して、独立した視覚システムを介して実行する。該８００ｎｍのデータは、上記タッチスクリーンインターフェースへの入力となり、一方、１１００ｎｍのカメラは、該スクリーンの上の対象を検知することができるため、ジェスチャー入力に用いられるであろう。

【０１０４】
マルチユーザ・タッチスクリーン：ディスプレイ面上の狭小ビーム
図１８Ａは、本発明の一実施形態による、追加的なイルミネータを用いて３Ｄ情報を得る構成１８００及び１８５０を示す。第２のイルミネータ１８１０は、該ディスプレイ面上または該ディスプレイ面に近接している対象のみを照らすのに用いることができる。例えば、ＬＥＤまたはレーザ等の狭角イルミネータが、スクリーン１８２０とほぼ平行に向けられて、スクリーン１８２０のすぐ内側または外側に配置されている場合、スクリーン１８２０に隣接する対象は、上記カメラのイメージに非常に明るく現れることになる。円筒形レンズまたは他の手段を、該イルミネータの光を垂直ではなく水平方向に拡大するのに用いることができ、該光が該スクリーンの全領域をカバーするのを可能にする。それに伴って、上記視覚システムは、該非常に明るい対象が、スクリーン１８２０に近接しているかまたは該スクリーンに触れていることを論理的に推理することができる。

【０１０５】
別の実施形態においては、上記ビームは、上記ディスプレイ面の内側に照射することができる。図１８Ｂに示すそのような一実施形態の照射システム。透過性パネル１８６０は、メイン表示スクリーン１８５５の前に配置されている。イルミネータ１８７０は、狭小ビームを透過性パネル１８６０の縁部に照射する。急峻な入射角のため、光１８７０は、透過性パネル１８６０の境界内で完全に反射する。しかし、対象１８７５が該スクリーンに触れている場合には、光１８７０は散乱することができ、該光が、透過性パネル１８６０の境界から抜け出すことが可能になる。その結果、この光１８８０は、カメラ１８８５により検知することができる。このことは、カメラ１８８５が、対象１８７５またはユーザが該スクリーンに触れているときを検知することができるようにする。

【０１０６】
上記スクリーンの表面または該表面近傍に、イルミネータの第２のセットを用いるこれらのアプローチの場合、これらは上記システムが、上記メインイルミネータからの光と第２のイルミネータからの光とを識別できるようになっているいくつかのデザインである。この識別は、該システムが、単に該スクリーンの前にある対象とは別に、該スクリーンに触れている対象を検知できるようにするので重要である。

【０１０７】
まず、イルミネータの２つの組は、交互のカメラ露出の間に作動させることができ、上記システムが、各イルミネータにより照らされるときに、上記スクリーンの前の領域を見ることができるようにする。代替的に、該システムは、各カメラ‐イルミネータの組を異なる波長で作動させた状態で、２つのカメラを用いることができる。また、該システムは、２つのカメラを用いることができるが、各カメラ‐イルミネータの組を異なる時間にストロボさせることができる。

【０１０８】
マルチユーザ・タッチスクリーン及び３Ｄデータ：輝度比
タッチスクリーンの動作は、異なるイルミネータを、該スクリーンに対して異なる距離に配置することにより、実現することができる。イルミネータＡが、該スクリーンから２フィート離れており、イルミネータＢが該スクリーンから１フィート離れていると仮定する。照明源の明るさは、該照明源からの距離の逆二乗に比例する。すなわち、対象に対するＡ及びＢからの光の割合は、その距離が変化するにつれて変わる。この割合は、上記コンピュータが、対象が該スクリーン上にあるか否かを判断できるようにする。表１は、Ａ及びＢからの光の割合がどのように該スクリーン上の対象と該スクリーンの１インチ上の対象とを識別できるかという実施例を示す。

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【表１】

対象の位置	（１フィート離れたときと比較した）イルミネータＡからの光	（１フィート離れたときと比較した）イルミネータＢからの光	Ａからの光に対するＢからの光の比
スクリーンに触れている	０．２５	１	４－１
１インチ上	０．２３	０．８５	３７－１
スクリーンの１フィート上	０．１１	０．２５	２．３－１

表１

【０１０９】
上記比は、対象が完全な黒色でない限り、どんな色の対象物であろうとも有効である。また、上記ＬＥＤの光は非均一であるため、該スクリーンに触れている対象の比は、該対象が、該スクリーンのどの部分に触れているかにより、変化する可能性がある。しかし、該比は、較正プロセス中に確立することができ、また、該スクリーンの各箇所で最近観測した最大比を記録することにより、長い間に再確認することができる。

【０１１０】
イルミネータＡとイルミネータＢは、区別することができる。一実施形態においては、２つのカメラ及びイルミネータが使用され、“マルチユーザ・タッチスクリーン：複数波長”の見出しのところで説明したように、異なる波長に対して調整される。すなわち、イルミネータＡは、カメラＡだけに見え、イルミネータＢは、カメラＢだけに見える。

【０１１１】
別の実施形態においては、イルミネータＡ及びイルミネータＢは、同じ波長を有するが、異なる時間にオンされる。１つのカメラがある場合、イルミネータＡ及びイルミネータＢは、ＡがオンでＢがオフの間に、全ての偶数番のカメラ露出が行われ、ＡがオフでＢがオンの間に、全ての奇数番のカメラ露出が行われるように、交互に作動させることができる。このことは、有効フレームレートを２倍減らすが、１つのカメラが、Ａ及びＢにより別々に照らされたイメージをキャプチャできるようにする。そして、上記コンピュータは、該２つのイメージを比較して、各箇所における輝度比を計算し、対象が上記スクリーンに触れたときを判断することができる。該カメラの同期信号を読取りまたは生成する回路を形成することにより、該イルミネータを該カメラと同期させることは容易である。

【０１１２】
別の実施形態においては、２つの別々のカメラは、上記イルミネータが、対応するカメラが露出を行うときにのみ作動するようにストロボされ、該２つのカメラの露出が、オーバーラップしないようにずらされる限り、（両方共、同じ波長で）イルミネータＡ及びイルミネータＢに連係させることができる。

【０１１３】
全ての場合において、上記コンピュータは、Ａによって照らされた上記スクリーンのイメージと、Ｂによって照らされた上記スクリーンのイメージとを比較して、各箇所における輝度比を判断し、それによって、対象の該スクリーンからの距離を判断することができる。Ａを該スクリーンから２フィート離し、Ｂを該スクリーンから１フィート離した実施例は、単に一つの実施形態であり、他の距離の比または配置も役に立つ。

【０１１４】
タイリング（ＴＩＬＩＮＧ）
上記システムは、内蔵型ボックス内にあり、また、上記スクリーンは、該スクリーンの全ての側部を占めることができるので、より大きなスクリーンを形成するために、スクリーンは、全てのスクリーンを同じ側部にした状態で、格子状にまとめて重ねることができる

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。各システムにおける上記コンピュータがネットワーク化されている場合、該システムは、リアルタイムの視覚信号及び内容に関する情報を共有することができ、該スクリーンが１つの大きなシームレススクリーンとして機能できるようにする。美観的理由により、個々のタイルを張るように並べられたユニットのスクリーンは、１つの非常に大きなスクリーンと替えてもよい。

【０１１５】

ぼやけの量からの距離情報の取得

あるスクリーン材料及び構造は、典型的な散乱の角度が小さい入射光の散乱を引き起こす可能性がある。すなわち、該スクリーン材料を通過する光の大部分は、方向をわずかに変える。図１９Ａは、わずかに散乱することの概念的実施例を示し、各光の散乱線に対する矢印の長さは、その方向に散乱した光の部分を表し、有限数の矢印が示されているが、散乱角度の分布は連続的である。

【０１１６】

この形態の散乱は、いくつかの方法で実現することができる。強度のミー散乱を伴う材料は、この特性を呈する。また、テクスチャー加工された表面を有する材料も、所望の方法で光の向きをわずかに変える。理想的には、該テクスチャーは、該光路において、小さな平均偏差及び確率的に滑らかな偏差をもたらすであろう。図１９Ｂは、そのようなテクスチャーの一実施例を示す。該テクスチャーのサイズは、投影イメージの視野からそれないように十分小さい。この散乱の効果は、強度のミー散乱またはテクスチャー加工された表面を有するように、メインスクリーンの材料を変更することによって実現することができる。代替的に、これらの特性は、該メインスクリーン材料とともに挟み込まれている第２のスクリーン材料に付加してもよい。

【０１１７】

このような材料の上記スクリーンの一部としての使用は、上記カメラによる景色の見方に影響を及ぼすことになる。該カメラによって見られる全ての対象は、該材料の散乱特性によってぼやけることになる。しかし、ぼやけの量は距離に依存する。該スクリーンに触れている対象は、ぼやけていないままであるが、離れていく対象は、徐々にさらにぼやけることになる。これは、該スクリーン表面で所定の角度で光線を散乱させることは、該スクリーンから該光線までの距離に比例する散乱の物理的距離を意味するからである。例えば、４５度だけ水平方向に光線を散乱させることは、該光線を、該スクリーンから１フィートの距離において、その水平方向の位置で１フィートそらさせるが、該それは、該スクリーンから２フィートの距離においては、２フィートである。

【０１１８】

そして、上記視覚システムは、このぼやけたイメージを用いて、シャープなエッジ及びぼやけたエッジの両方を検出し、かつ各エッジに対してぼやけの量の推定を実行できるエッジ検出技術の利用を含む多くの方法により、該距離を再構成することができる。Ｅｌｄｅｒ－Ｚｕｃｋｅｒアルゴリズムは、そのようなエッジ検出技術の一つである。ぼやけの量が一旦、分かると、該スクリーンからの該対象のエッジの距離を判断することができ、ぼやけの量は、該距離に比例するので、該視覚システムに、該対象に関する３Ｄ情報を与えられる。

【０１１９】

上記視覚システムのタスクは、規則的な赤外線照射の代わりにまたは該赤外線照射に加えて、上記カメラに見える赤外線パターンを投影するパターン化照明源を用いることにより、単純化することができる。このパターンは、ドット、ライン、あるいは、シャープなエッジを有する他のテクスチャーを含んでもよい。該パターンは、該スクリーンを通すことを含むいくつかの方向から投影することができる。該パターンが該スクリーンを通して投影される場合、散乱の量は２倍になるが、距離依存の散乱の効果は変わらない。

【０１２０】

上記スクリーン上の全ての対象をパターンで照らすことにより、上記視覚システムの性能は向上する。パターン化された照明を用いない場合、該イメージのどの位置における３Ｄ

情報も判断することが困難であり、この場合、均一な輝度の対象の中間等のエッジはない。しかし、全ての対象をこの投影パターンでカバーする場合、該イメージのどの位置におけるぼやけ情報も得ることが容易である。

【０１２１】

投影されたテクスチャーを用いて、異なる方法を、ぼやけの量を推定するのに用いることができる。ソーベルフィルタまたはピラミッド分解等の画像コンボリューションは、異なるスケールにおける信号強度及び階調度に関する情報を得るのに用いることができる。該テクスチャーがドットパターンである場合、該ドットに相当するイメージにおける箇所は、局所最大値を探すことにより見つけることができる。そして、各局所最大値周辺の領域の階調度の強度を調べることにより、どの程度ぼやけが発生しているかを判断することができる。該ドットのエッジにおける階調度は、ぼやけの量にほぼ反比例する。そのため、各ドットにおける階調度は、上記スクリーンからの距離に関連付けることができる。

【０１２２】

カメラ構成

上記システムの一実施形態において、上記カメラは、人の目には見えない波長の光に対して感度が良い。不可視波長の光を放出するイルミネータを付け加えることにより、該カメラは、光をユーザの目に照射することなく、暗い室内で上記表示スクリーンの前の領域の良好に照らされたイメージを取得することができる。また、選択した光の波長により、該表示スクリーンの内容は、該カメラに見えない可能性もある。例えば、９２０ｎｍ～９６０ｎｍの波長の光に対してのみ感度が良いカメラは、ＬＣＤスクリーン上にどのようなイメージが表示されていようとも、該ＬＣＤスクリーンを透過性のものとして見ることになる。

【０１２３】

上記システムの別の実施形態においては、上記カメラは、狭い範囲の波長の近赤外線に対してのみ感度が良く、この場合、該範囲内の最も短い波長は、少なくとも９２０ｎｍである。上記スクリーンの前の領域は、この波長範囲の光を放射する赤外線ＬＥＤからなるクラスタによって照らされる。該カメラは、該ＬＥＤによって生成された波長の光のみを伝達する帯域通過フィルタを備えた近赤外線に感度が良いモノクロＣＣＤである。さらなるイメージ品質の向上及び周囲光の排除のために、該カメラとＬＥＤとを一緒にストロボさせることができる。

【０１２４】

上記システムの一実施形態において、上記カメラは、上記スクリーンの前の領域の比較的歪んでいない視野を有する。歪みを低減するために、該カメラは、該スクリーンから有効な距離に配置することができる。代替的に、該カメラは、該スクリーンに近づけて配置することができ、フレネルレンズを該スクリーン上または該スクリーンの後ろに配置することができる。図２０Ａは、該カメラを該スクリーンに近接させた高歪み構成を示す。図２０Ａにおいては、対象２０１０及び対象２０２０が、該カメラの視野からは同じ位置に見えるが、該スクリーンの非常に異なる部分の上にあることに注意する。図２０Ｂ、図２１Ａ及び図２１Ｂは、歪みが低減された幾つかの構成を示す。図２０Ｂは、該カメラが該スクリーンから離れており、該カメラの視野を反射させることにより、ディスプレイ全体をコンパクトに保つことができる低歪み構成を示す。図２０Ｂにおいては、対象２０３０及び対象２０４０が、該カメラの視野からは同じ位置に見え、該スクリーンの上の同様の位置を占めていることに注意する。図２１Ａ及び図２１Ｂは、それぞれ、歪みを低減またはなくすフレネルレンズの使用を示す。

【０１２５】

フレネルレンズは、複数のカメラを上記システムにおいて使用できるようにするためにも用いることができる。図２１Ｃは、２カメラシステムにおいて歪みをなくすフレネルレンズの使用を示す。各カメラは、該カメラの視野に対する歪みをなくすフレネルレンズを有する。該２つのカメラの視野が、交差することなくわずかに接するため、対象は、一方のカメラの視野から他方のカメラの視野へ途切れなく通過することができる。この方法は、

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多くのカメラに恩恵を及ぼし、カメラからなる格子を該スクリーンの後ろに配置することができるようにする。この方法は、上記インタラクティブ・ディスプレイを奥行きのないものにすることができ、該ディスプレイに、フラットパネルディスプレイと同様の形状要素を与える。同様に、歪みをなくすフレネルレンズの使用は、全てのディスプレイからの複数のカメラを、継ぎ目なく一緒にタイル張りのように並べることができるように、複数の内蔵型ディスプレイを一緒にタイル張りのように並べることができるようにする。

【０１２６】

上記カメラからの３Ｄイメージを取得するのにある方法を用いる場合、該カメラの位置は、座標変換を実行することにより、歪みをソフトウェアで補正することができるため、重要性が小さくなる。例えば、各ピクセルに対する該カメラの深度測定値は、（ｘ，ｙ，ｚ）座標に変換することができ、ここで、ｘ及びｙは、該箇所に最も近い該表示スクリーン上の位置に対応し、ｚは、該箇所に対する該スクリーン上の位置（ｘ，ｙ）からの距離に対応する。３Ｄイメージは、数あるソフトウェアをベースとする及びハードウェアをベースとするアプローチの中でも、タイムオブフライト型カメラを用いることにより、ハードウェアで取得することができる。タイムオブフライト型カメラの製造者は、Ｃａｎｅｓｔａおよび３ＤＶ　Ｓｙｓｔｅｍｓを含む。上述したアプローチは、ほとんどのタイムオブフライト型カメラが赤外線イルミネータを用いるため、タイムオブフライト型カメラを上記スクリーンの後ろに配置することと両立する。

【０１２７】

カメラのためのイルミネータ

上記カメラの波長を考慮して上記スクリーンの前のインタラクティブ領域を照らすイルミネータは、該スクリーンの周囲、該スクリーンの後ろまたはその両方に配置することができる。

【０１２８】

それらのイルミネータが該スクリーンの周囲に配置されている場合、該イルミネータは、上記インタラクティブ領域を直接照らし、それらの明るさを最大限にできるようにする。しかし、この構成は、信頼できるものではなく、ユーザが該イルミネータの光路を遮断する可能性があり、該インタラクティブ領域内のいくつかの対象が照らされることが妨げられる可能性がある。また、この構成は、該スクリーンに触れている対象を照らすことを困難にする。

【０１２９】

上記スクリーン周辺に配置されたイルミネータについての上述した問題は、該イルミネータを該スクリーンの後ろに配置することにより解決され、上記カメラの近傍のイルミネータの場合、該カメラに見えるいかなる対象も照らされることになる。しかし、それらのイルミネータからの光は、レイリー散乱物質、テクスチャー加工された材料、または、該スクリーンの後ろの散乱偏光子によって後方散乱する可能性がある。この後方散乱は、該カメラのイメージのコントラストを著しく低下させ、上記視覚システムが該カメラのイメージを解読することを困難にする。

【０１３０】

光が散乱偏光子によって散乱されている場合、上記カメラは、近赤外光に対して感度が良く、上記イルミネータは近赤外光を放射し、それに伴って、上述したコントラストの損失は、赤外光を直線偏光させる赤外線直線偏光子を用いることによって低減することができる。偏光方向を、散乱偏光子が透過性である方向に対して平行にした状態で、該カメラの前に赤外線直線偏光子を配置することは、後方散乱を著しく低減し、かつコントラストを改善することになる。また、偏光方向を、該散乱偏光子が透過性である方向に対して平行にした状態で、該赤外線イルミネータの前に赤外線直線偏光子を配置することも、後方散乱を低減し、かつコントラストを改善することになる。

【０１３１】

ウィンドウディスプレイ

本発明の別の態様によれば、上記内蔵型インタラクティブ・ビデオ・ディスプレイは、ウ

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ィンドウディスプレイと共に使用することができる。内蔵型インタラクティブ・ビデオ・ディスプレイは、様々な物理的構成、例えば、上記スクリーンを水平、垂直または対角線状に配置することで、配置することができる。しかし、そのようなディスプレイをウィンドウ上に配置した場合には、いくつかの追加的な実行可能な構成がある。

【０１３２】

図２２は、本発明の一実施形態による、インタラクティブ・ウィンドウ・ディスプレイ２２００の例示的な構成を示す。一実施形態においては、内蔵型とする代わりに、コンポーネントを物理的に分離することができる。スクリーン２２１０は、ウィンドウ２２２０面に直接貼ることができ、あるいは、ウィンドウ２２２０の後ろに独立して設けることができる。カメラ２２３０、プロジェクタ２２４０及びイルミネータ２２５０は、近くに、または、別々の位置に配置することができ、また、床、天井またはウィンドウ２２２０からの様々な距離の間のどこかに設けることができる。場合によっては、赤外線イルミネータ２２５０を、該イルミネータが、スクリーン２２１０を通してではなく、対象を直接照射するように、スクリーン２２１０の側に配置することができる。また、場合によっては、カメラ２２３０とコンピュータ２２６０との間、または、コンピュータ２２６０とプロジェクタ２２４０との間の通信をワイヤレスにしてもよい。

【０１３３】

ウィンドウディスプレイ内の該カメラは、一般に、水平方向に向けられている。その結果として、該カメラは、通常、上記スクリーンから任意の距離で人を見る。視覚ソフトウェア、スクリーン材料または他のシステムを、過大な距離における対象を識別及び除去するのに用いることができるが、より遠くの対象が、それらを見るカメラのために、一定の最小高さからなる必要があるように、該カメラを上方へ傾けることも可能である。それに伴って、数フィートのスクリーンの範囲内の人のみが該スクリーンと相互に作用することができる。そのようなディスプレイに近づいてくるユーザは、該スクリーンの底部に最初に現れ、その後、該ユーザが該スクリーンに近づくにつれて、段々浮かび上がってくる仮想的な存在に気付くことになる。図２２は、このように上方に傾けたカメラ２２３０を示す。

【０１３４】

グレアは、ウィンドウディスプレイにおける課題である。しかし、ウィンドウディスプレイのユーザが、典型的に、該スクリーンを見る角度は限られる。そういう人たちは、おそらく、該ディスプレイ上の対象を指差す空間を有するように、該ディスプレイから少なくとも数（例えば、２）フィートの距離を保つため、一般に、斜角で該スクリーンを見ることはないであろう。目線以下のディスプレイの場合、人は、特に、斜角で該ディスプレイを見上げることはないであろう。該プロジェクタが、そのビームを斜角で下方へ投影する状態で、該スクリーンに極端に近づけてかつ該スクリーンの上部の上に配置されている場合には、この低グレア状態が実現されるであろう。代替的に、該ディスプレイが目線以上になるように配置されている場合、該プロジェクタを該スクリーンの下に近づけて配置して、斜角で上方に投影することにより、同様のグレアの低減を達成することができる。軸外しプロジェクタは特に、この種の構成に特に有用であることに注意する。

【０１３５】

ウィンドウユニット：代替構成

上記スクリーンの可視光透過性は、内蔵型ユニットよりもウィンドウユニットにおいてより望ましい。従って、ウィンドウディスプレイは、特定の角度で該スクリーン上に照射される光に対して半透過性である部分的に透過性のスクリーンを用いて形成することができる。該部分的に透過性のスクリーンを形成するのに用いることができる一つの材料は、Ｄａｉ Ｎｉｐｐｏｎ Ｐｒｉｎｔｉｎｇにより製造されて“ＨｏｌｏＣｌｅａｒ”の商品名で市販されており、このような材料は、３５度の角度で該スクリーンに照射される光に対して半透過性である。このスクリーンは、上記赤外線透過・可視光半透過性スクリーンまたは散乱偏光子スクリーンの代わりになる。上記プロジェクタが、該角度で該スクリーン上に光を照射した場合、該プロジェクタからのグレアは生じないであろう。上記カメラ

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が、該プロジェクタから（該スクリーンに対して）著しく異なる角度にある限り、上記システムは、正しく機能することができるであろう。

【０１３６】

ウィンドウユニットに対するインタフェース

上記ウィンドウユニットに対するインタフェースは、ステレオカメラ、タイムオブフライト型カメラ及びこの特許の“タッチスクリーン”の章で説明した技術の使用を含む、上記内蔵型ユニットと同様の方法を用いて、距離に依存して形成することができる。一実施形態において、該ウィンドウユニットとの相互作用は、全身のインタラクションと、指差し等のより厳密なジェスチャーとの混合を含む。

【０１３７】

深度情報を抽出する視覚システムの場合、いくつかの方法によって、指差しジェスチャーと他の手の動きとを分離することが可能である。まず、上記カメラのイメージは、全身のインタラクションに対する１つの距離範囲と、指差しジェスチャーに対する別の（おそらくより近い）距離範囲とを用いて、いくつかの距離範囲に分けることができる。後者の距離範囲における対象は、ポインタとして追跡され、その位置は、該ディスプレイ上で実行されるアプリケーションに対する入力として作用する。代替的に、該スクリーンから特定の距離に満たない全ての対象は、該スクリーンに最も近い該対象内の箇所を見つけるために分析することができる。該箇所が、少なくとも特定の閾値だけ、該対象の残りよりも該スクリーンに近い場合、該箇所は、指差しジェスチャーのための入力になる。該スクリーン上の視覚フィードバックは、何らかの検出された手の動きの位置を示すように実行することができる。

【０１３８】

グレアを低減する方法

ビューワが常に、特定の角度範囲から上記プロジェクタのグレアを見るようにする場合、該グレアは、該光景の該カメラの視野に有害な影響を及ぼすことなく、さらに低減することができる。図２３Ａ、図２３Ｂ及び図２３Ｃは、それぞれ、本発明の異なる実施形態による、グレアを低減する様々な方法を示す単純化した概略図である。図２３Ａは、プリーツ付きのスクリーン材料を示す。該スクリーンは、斜角で来る光線が、スクリーンのいくつかの層を通過しなければならず、ほぼ直線状に来る光線が、通常、１つの層のみを通過するように、プリーツが付けられていると仮定する。該プロジェクタの光が斜角で来て、該カメラがほぼ平行に該スクリーンを見る場合、該プロジェクタの光の散乱の量は、該カメラの視野に有害な影響を及ぼすことなく、大幅に増加することになる。図２３Ａにおいて、該カメラの視野の大部分は、１つの層を通過するのみであるが、投射された光の全ては、複数の層を通過する。

【０１３９】

所望の効果を実現するには、いくつかの方法がある。プリーツ付きスクリーンの代わりに、図２３Ｂに示すように、プリーツ付きスクリーンと同じ効果を生成するマイクロルーバー材料を有する平坦なスクリーンを代替使用することができる。代替的に、図２３Ｃに示すように、スクリーン材料の小さく、平坦なシート状粒子を、（全て水平方向に向けて）透過性基板に付加することができる。全ての場合において、斜角で該スクリーンに近づく典型的な光線は、該材料と垂直な典型的な光線よりもより多くの散乱材料に遭遇する。

【０１４０】

全ての場合における上記スクリーンのテクスチャーは、ビューワがそれに気付かないくらい十分に小さくすべきである。この方法は、軸外しプロジェクタを使用する場合に最も有用であるが、該プロジェクタ及びカメラが異なる角度で該スクリーンを見るどのような状況においても有用である。

【０１４１】

上記赤外線光源が上記スクリーンを照射すること及びコントラストを低下させることを防ぐことが重要である。すなわち、赤外線イルミネータが該スクリーンの後ろに配置されている場合、該スクリーンの散乱が最小化される角度で該赤外線イルミネータを配置するこ

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とが有利である。

【０１４２】

代替的に、狭い範囲の視角で半透過性であり、かつ他の全ての角度で透過性である（Ｌｕｍｉｓｔｙ等の）視界制御フィルム製品は、場合によっては、グレアを低減するのを促進することができる。

【０１４３】

上記プロジェクタを、上記スクリーンに対して特定の角度で配置することにより、該プロジェクタのビームを直接見る誰かが、上記視界制御フィルムが半透過性になる角度で該スクリーンを見ることになるようにすることができる。図２４Ａ及び図２４Ｂは、視界制御フィルムがグレアを低減することができる一つの方法を示す。図２４Ａは、１種類の視界制御フィルムを通して光を見る人（またはカメラ）の体験を示す。該半透過性領域からの光は拡散され、この領域内の光源からのいかなるグレアも低減されまたはなくなる。２つの透過性領域からの光源は拡散されず、人またはカメラが、それらの領域内で対象を見ることができるようになる。視界制御フィルムの領域の境界は、多くの場合、一方向に沿った光線と該視界制御フィルムの表面との間の角度に対する値の範囲によって定義される。図２４Ｂは、インタラクティブ・ウィンドウ・ディスプレイ上のグレアを低減する、単純化した構成の視界制御フィルムを示す。該視界制御フィルムは、上記赤外線透過・可視光半透過性スクリーンと共に使用される。該プロジェクタの角度のため、該視界制御フィルムが光を拡散させる角度である状態を要することなく、該プロジェクタのビームを直接見ることが可能である。しかし、上記カメラは、該視界制御フィルムが透過性である角度で向けられているため、該視界制御フィルムを通して対象を見ることができる。従って、グレアは、光景を見る該カメラの能力に影響を及ぼすことなく低減される。

【０１４４】

例示的な構成

ウィンドウディスプレイ２５００の一つの例示的な実施形態は、図２５に示すように、散乱偏光子をスクリーンとして用いる。この実施形態は、該ディスプレイを作動させるのに必要な全ての検知及び表示コンポーネントが、ウィンドウ２５０５の後ろに配置されているインタラクティブ・ウィンドウ・ディスプレイ２５００である。ウィンドウディスプレイ２５００は、ウィンドウ２５０５の前のユーザが、自然な身体動作によって、ウィンドウ２５０５上に表示されたビデオイメージと対話できるようになっている。

【０１４５】

一実施形態において、表示されたイメージは、ＬＣＤプロジェクタ２５１０によって生成される。ほとんどのＬＣＤプロジェクタにおいては、赤色及び青色の光が一方向に偏光され、緑色は、垂直方向に偏光される。ＣｏｌｏｒＬｉｎｋ　Ｃｏｒｐｏｒａｔｉｏｎによって生み出された位相差板スタック“ＣｏｌｏｒＳｅｌｅｃｔ”技術等の色選択性偏光回転子２５１５は、緑色の光の偏光を９０度回転させるのに用いられる。代替的に、赤色及び青色の光の偏光は、同じ効果を実現するために、９０度だけ回転させることができる。プロジェクタ２５１０の前に色選択性偏光回転子２５１５を配置することにより、全てのプロジェクタの光は、同じ偏光になる。散乱偏光子２５２５は、最大散乱の方向が該プロジェクタの光と平行になるように方向付けられている。従って、このプロジェクタの光が散乱偏光子２５２５に達すると、該光は全て散乱され、該スクリーンの他方側のユーザに対するイメージが生成される。

【０１４６】

近赤外光のみに感度が良いビデオカメラ２５３０は、“カメラの視野”と呼ばれる、該スクリーンの前の領域を見る。この視野内の対象は、カメラ２５３０に見えることになる。該カメラの視野のための照明は、赤外線ＬＥＤクラスタ２５３５からなるセットから来て、該クラスタは、カメラ２５３０により見える波長の光を該スクリーンの裏側に生成する。該カメラの視野は、該スクリーン近傍にいる人のみが、該視野の範囲内にあるように、上方に傾斜されている。このことは、該スクリーンから離れた対象が、カメラ２５３０を入力として用いるインタラクティブ・アプリケーションに影響を及ぼすことを防止する。

【０１４７】
次に、図２５の例示的な実施形態を介した可視光及び赤外光の経路について説明する。光の２つの垂直な偏光は、偏光Ａ及び偏光Ｂと呼ぶ。
【０１４８】
可視光は、赤色光及び青色光が偏光Ａで緑色が偏光Ｂの状態でＬＣＤプロジェクタ２５１０から現れる。この光は、まず、色選択性偏光回転子２５１５を通過し、該回転子は、赤色光及び青色光を散乱させずに、緑色光が偏光Ａになるように、該緑色光の偏光を回転させる。次に、この光は、直線偏光子２５２０を通過し、該偏光子は、偏光Ａの光を伝達し、偏光Ｂの光を吸収する。この直線偏光子２５２０は、該光を“浄化し”、すなわち、該偏光子は、まだＢで偏光されている該プロジェクタの光を吸収する。次いで、該光は、散乱偏光子２５２５を通過し、該偏光子は、偏光Ａの光を散乱させ、偏光Ｂの光を伝達するような方向に配置されている。すなわち、該プロジェクタの光のほぼ全てが散乱される。この散乱光は、その偏光Ａを保つことに注意する。状況に応じて、該光は、その後、偏光Ａの光を伝達し、かつ偏光Ｂの光を吸収する直線偏光子２５４０を通過してもよい。この偏光子は、イメージ品質の改善に役立つ。
【０１４９】
赤外線イルミネータ２５３５から放射された赤外光は、非偏光を始める可能性がある。状況に応じて、改善された明瞭度のために、この光は、少量の該光が散乱偏光子２５２５により散乱されるように、まず、赤外線直線偏光子を通過して該光を偏光Ｂに偏光させることができる。該光が偏光されない場合、該光の一部は、該光が散乱偏光子２５２５を通過する際に散乱されることになるが、偏光Ａの光は、散乱されずに散乱偏光子２５２５を通過することになる。該赤外光の波長は十分に長いため、該光は、影響を受けずにいずれかの可視光直線偏光子２５４０を通過し、人であるユーザ等の上記スクリーンの前の対象を照らすことができる。
【０１５０】
ウィンドウ２５０５の前からカメラ２５３０の方へ戻ってくる赤外光は、直線偏光子２５４０の影響を受けない。しかし、該光が散乱偏光子２５２５を通過する際に、偏光Ａの光は散乱し、偏光Ｂの光は散乱されないままとなる。カメラ２５３０は、その直前に赤外線直線偏光子２５４５を有し、この偏光子２５４５は、偏光Ａの光を吸収し、かつ偏光Ｂの光を伝達する。従って、カメラ２５３０は、散乱偏光子２５４５によって散乱されていない偏光Ｂの光のみを見る。このことは、カメラ２５３０に、該スクリーンの前の領域の明瞭で高コントラストのイメージを与える。
【０１５１】
プリズムフィルムの使用
一般的なインタラクティブ投影型ウィンドウディスプレイにおいては、該ウィンドウディスプレイの下の領域をクリアにし、上記カメラが見る領域が上方に傾斜するように該カメラを配置することが望ましいことが多い。この状況は、プリズムフィルムを通過する全ての光の向きを特定の角度に向け直すプリズムフィルムの使用によって実現することができる。例えば、３Ｍにより製造されているＶｉｋｕｉｔｉ　ＩＤＦ　ｆｉｌｍは、入射光の向きを２０度変える。１つ以上のそれらのフィルムを上記投影スクリーンのいずれかの面に配置して、光を上方へ向け直すことにより、該カメラは、図２６に示すように、該スクリーンと比較してより高く配置することができる。
【０１５２】
小型化
上記システムの全体のサイズは、ミラーを用いて小型化することができる。図２７は、上記カメラ及びプロジェクタが、上記ウィンドウから離れる方向に向けられて、該ウィンドウに隣接して配置されており、ミラーが該光ビームを反射して該ウィンドウの方へ戻す構成を示す。
【０１５３】
カメラの改良

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さらなるイメージ品質の向上及び周囲光の排除のために、上記カメラと該カメラのイルミネータとを、一緒にストロボさせることができる。このアプローチは、３Ｄイメージングのための様々なソフトウェア及びハードウェアアプローチの利用と完全に適合する。特に、このデザインのカメラ及びイルミネータは、タイムオブフライト型カメラと置き換えることができる。

【０１５４】

可視光システム

（図２５に示すように）直線偏光子が散乱偏光子に隣接して付加されていない場合、該デザインは、赤外線カメラの使用を必要としない。偏光方向を、該散乱偏光子が透過性になる方向と平行にした状態で、該カメラの直前に可視光直線偏光子がある限り、カラーまたは白黒の可視光カメラは、上記スクリーンの前の領域を撮像することができる。従って、投影されたイメージは、該カメラによって見られず、該カメラが、妨げられていない該スクリーンの前の領域を見ることができるようになる。このカメラは、現在ある周囲光によって、または、該スクリーンの前のユーザ及び対象を照らすために該ディスプレイの近くに配置された追加的な可視光によって作動することができる。追加的な可視光を付加した場合、該カメラ及び光は、該カメラのイメージの品質を向上させ、かつ周囲光及び該イメージに対するプロジェクタの光の影響を制限するために、本願の“方向性周囲赤外線”の章で説明したように、一緒にストロボしてもよい。

【０１５５】

さらなるイメージ品質の向上に対しては、高速開口を上記プロジェクタのレンズの前に配置することができる。この開口は、機械的または電子的なものにすることができ、すなわち、１つの利用可能な電子的開口は、Ｍｅａｄｏｗｌａｒｋ　Ｏｐｔｉｃｓによって製造されている、液晶をベースとするＶｅｌｏｃｉｔｙ　Ｓｈｕｔｔｅｒである。一実施形態において、このシャッタは、ほとんど常に開いたままであり、該プロジェクタの光が通過できるようになっている。該シャッタは、該プロジェクタの光を遮断し、上記カメラが写真を撮るためだけに閉じる。該カメラの露出時間が短い場合、該プロジェクタの輝度は、ほとんど影響を受けないことになる。該カメラの露出中に該プロジェクタの光を遮断する速度シャッタの使用も、可視光カメラを、投影型インタラクティブフロアまたはウォールディスプレイの前で使用できるようにすることに注意する。

【０１５６】

インタラクティブ・ビデオ・プロジェクション・システムにおける可視光カメラの使用の場合、各ピクセルを前景または背景として分類する視覚信号に加えて、上記スクリーンの前の人（該システムのユーザ）のリアルタイムの写真が得られることに注意する。このことは、該視覚システムが、該システムのユーザの写真と、除去される静止背景とを分離することを可能にする。この情報は、該システムが、人為的に生成されたイメージを該ユーザの上または周囲に挿入した状態で、該ユーザのカラーイメージを、表示する該イメージ中に配置できるようにする。このシステムが正確に較正されている場合、ユーザは、該スクリーンに触れることができ、該ユーザの表示されたイメージは、該スクリーン上の同じ位置に同時に触れることになる。これらの特徴は、例えば、ユーザが、インタラクティブな内容に配置されたユーザ自身を事実上見ることができることを含む、このディスプレイ上で実行するインタラクティブなアプリケーションの品質の著しい向上を実現できる。

【０１５７】

上記カメラからの可視光イメージは、該ミラーは、実際のミラーのように見えかつ作用する仮想ミラーを形成するのに用いることができるが、該ミラーイメージは、電子的に操作することができる。例えば、該イメージは、非反転ミラーを形成するように水平方向に裏返すことができ、この場合、ユーザは、他の人が該ユーザのイメージを見る様に、該ユーザ自身のイメージを見る。代替的に、該イメージは、人が、自身の背中を見るために振り返ることができるように、遅延させることができる。従って、このシステムは、例えば、ドレッシングルームを含む、ミラーが使用される環境における用途を有することができる。

【０１５８】
タイムオブフライト型カメラ・インタラクティブ・ディスプレイ
本発明の実施形態は、タイムオブフライト型カメラを用いて実施することができる。タイムオブフライト型カメラは、そのイメージの各ピクセルのための距離情報を検知する予め組込まれた性能を有する。タイムオブフライト型カメラを使用すると、変更されたディスプレイに対する必要性が排除される。換言すれば、該タイムオブフライト型カメラは、変更を要することなく、何らかのディスプレイ（例えば、ＬＣＤパネル、ブラウン管ディスプレイ等）と共に機能してもよい。単一のタイムオブフライト型カメラを用いてもよい。しかし、単一のタイムオブフライト型カメラは、該カメラに近接している対象によって遮られている対象を検知することができない可能性がある。そのため、本発明の実施形態は、図２８に示すように、複数のタイムオブフライト型カメラを用いる。
【０１５９】
カメラの冗長性を用いれば、他方の対象を遮る一方の対象のため、もはや、全ての対象を検知できない１つのカメラのことを気にする必要はない。例えば、図２９に示すように、４つのタイムオブフライト型カメラを、１つのディスプレイの角部に配置して、該ディスプレイの全体の領域がインタラクティブにすることができる。複数のカメラに対してこのタイムオブフライト型の実施を用いるために、座標変換が各タイムオブフライト型カメラの各ピクセルに対して実行されて、各ピクセルが共通の座標空間内に入れる。１つのこのような空間は、（ｘ，ｙ）、すなわち、該ディスプレイ面に垂直に投影されるポイントの位置と、（ｚ）、すなわち、該ディスプレイからの距離とによって定義される。この座標空間の変換は、上記スクリーンに対する各カメラの角度（及び位置）で見ることにより決定することができる。代替的に、該変換は、既知のサイズ、形状及び位置の対象が、該スクリーンの前に配置されている較正プロセスによって決定することができる。該カメラの各々に対象を撮像させることにより、適切な変換機能を、各カメラによって見られるポイントから該共通の座標空間内のポイントへ確定することができる。該カメラの座標変換がリアルタイムで行われる場合、３Ｄの該カメラの前の領域のリアルタイムの写真が実現される。
【０１６０】
利用法
上記インタラクティブ・ビデオ・ディスプレイ・システムは、多くの異なる用途に用いることができる。タッチスクリーンのような動作及び全体または部分的な輪郭相互作用を有する該システムの能力は、ボタン及び対象のより厳密な選択及び操作を要する情報インタフェースに対するそのアピールを増す。
【０１６１】
透過性ディスプレイスクリーンをベースとする及びプロジェクタをベースとするインタラクティブ・ディスプレイ・システムは、限定するものではないが、ユーザが自身の体を動かしてゲームをプレイするインタラクティブ・ビデオゲーム、インタラクティブメニュー、カタログ、及びジェスチャーを用いて、情報内容のページをユーザに検索させる検索システム、ユーザが、自身のイメージを用いて衣服を試着できるようにするシステム、ユーザのイメージまたは輪郭が、ビデオ・エフェクト・システムへの入力として作用するピュア・エンタテインメント用途、該スクリーンの前のユーザの動きと相互作用するインタラクティブ・キャラクター、及びユーザが体を動かすことによって相互作用する仮想遊園地及び童話を含む。
【０１６２】
本発明の他の利用法は、限定するものではないが、ユーザが、ディスプレイ上で製品をカスタマイズする使用可能なオプションをカスタマイズするまたは見ることを可能にすること、ディスプレイ上の製品を、ディスプレイインタフェース、キーボード、クレジットカードの読取り、または、これら３つの組合せを用いて、該ディスプレイで注文できるようにすること、該ディスプレイ上の複数の製品の特徴を比較すること、該ディスプレイ上の複数の製品間の組合せまたは互換性を示すこと、及び製品を異なる仮想背景（例えば、水

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、森、アスファルト等）内に置いて、その特徴を説明することを含む。

【０１６３】

周辺装置

透過性ディスプレイスクリーンをベースとする及びプロジェクタをベースとするインタラクティブ・ディスプレイ・システムは、限定するものではないが、マイクロフォン、タッチスクリーン、キーボード、マウス、ＲＦＩＤタグ、圧力パッド、携帯電話の信号、ＰＤＡ及びスピーカを含む追加的な入力装置及び出力装置を組み込むことができる。

【０１６４】

透過性ディスプレイスクリーンをベースとする及びプロジェクタをベースとするインタラクティブ・ディスプレイ・システムは、一緒にタイル張りのように並べて、単一のより大きなスクリーンまたはインタラクティブ領域を形成することができる。また、タイル張りのように並べられたスクリーンまたは物理的に独立したスクリーンもネットワーク化することができ、一方のスクリーン上のアクションが他方のスクリーン上のイメージに影響を及ぼすことを可能にする。

【０１６５】

例示的な実施において、本発明は、統合する方法またはモジュラー化する方法で、制御論理のかたちでハードウェアとソフトウェアの組合せを用いて実施される。本明細書に記載した開示及び教示に基づいて、当業者は、本発明を実施する他の手段および／または方法を理解するであろう。

【０１６６】

概して、この文書は、内蔵型インタラクティブ・ビデオ・ディスプレイ・システムについて開示している。フラットパネル・ディスプレイ・スクリーンは、該フラットパネル・ディスプレイ・スクリーンの前面のユーザに対する提示のために視覚イメージを表示する。第１のイルミネータは、可視光で該フラットパネル・ディスプレイ・スクリーンを照らす。第２のイルミネータは、対象を照らす。カメラは、照らされた対象と該視覚イメージとの相互作用を検知し、該カメラは、該フラットパネル・ディスプレイ・スクリーンを通して該対象を見ることができるように機能する。コンピュータシステムは、上記プロジェクタに、該相互作用に応じて該視覚イメージを変えるように指示する。

【０１６７】

一つの例示的な態様において、上述したように本発明は、カメラが、ディスプレイの前の領域を見ることができるようになっているシステムを実現できる。関連する発明において、システムは、該ディスプレイの前に反応性空間を生成するように形成される。本発明は、該反応性空間から情報を取得するのに用いることができる。

【０１６８】

本明細書に記載した実施例及び実施形態が、単に説明のためのものであり、また、それを踏まえて様々な変更または変形が、当業者に思いつかれ、この出願の趣旨及び範囲内に及び添付の請求項の範囲内に含まれるべきであることは言うまでもない。本明細書において引用した全ての出版物、特許及び特許出願は、それらの全体が参照により本明細書に組み込まれる。

【０１６９】

本発明の様々な実施形態、すなわち、内蔵型インタラクティブ・ビデオ・ディスプレイ・システムはこのように説明された。本発明を特定の実施形態において説明してきたが、本発明は、そのような実施形態によって限定されるものと解釈すべきではなく、むしろ以下の請求項に従って解釈すべきであることを正しく認識すべきである。

【図面の簡単な説明】

【０１７０】

この明細書の一部に組み込まれており、かつ該明細書の一部を構成する添付図面は、本発明の実施形態を示し、また、説明と共に本発明の原理を説明するのに役立つ。

【図１】図１は、本発明の一実施形態によるインタラクティブ・ビデオ・システムのコンポーネントの一つの物理的構成を示す。

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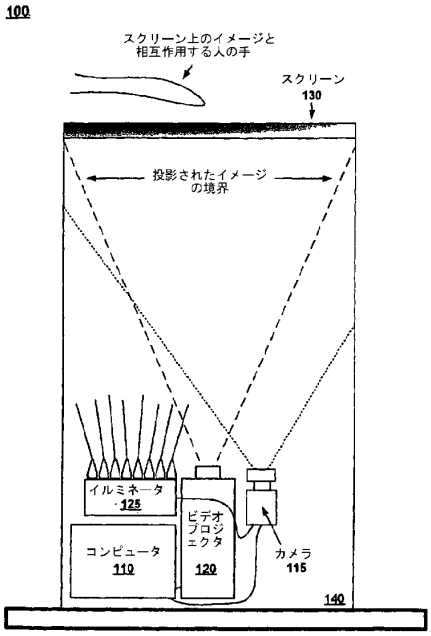
【図２】図２は、本発明の一実施形態による、直線偏光シートが、グレアをなくすまたは低減するのに用いられるスクリーンの一つの構成を示す。
【図３】図３は、本発明の様々な実施形態による、インタラクティブ・ビデオ・システムのいくつかの他の構成の断面図を示す。
【図４Ａ】図４Ａは本発明の実施形態によるインタラクティブ・ビデオ・システムの実施形態を示す概略図である。
【図４Ｂ】図４４Ｂは、本発明の実施形態によるインタラクティブ・ビデオ・システムの実施形態を示す概略図である。
【図５Ａ】図５Ａは、本発明の実施形態によるインタラクティブ・ビデオ・システムの実施形態を示す概略図である。
【図５Ｂ】図５Ｂは、本発明の実施形態によるインタラクティブ・ビデオ・システムの実施形態を示す概略図である。
【図６Ａ】図６Ａは、本発明の実施形態による軸外し投影の２つの構成を示す概略図である。
【図６Ｂ】図６６Ｂは、本発明の実施形態による軸外し投影の２つの構成を示す概略図である。
【図７Ａ】図７Ａは、本発明の一実施形態による、インタラクティブ・フラットパネル・ディスプレイ・システムを示す概略図である。
【図７Ｂ】図７Ｂは、本発明の一実施形態による、インタラクティブ・フラットパネル・ディスプレイ・システムを示す概略図である。
【図８Ａ】図８Ａは、本発明の一実施形態による、フレネルレンズを用いてイメージ歪みを低減する技術を示す概略図である。
【図８Ｂ】図８Ｂは、本発明の一実施形態による、一連のミラーストリップを用いてイメージ歪みを低減する技術を示す概略図である。
【図９Ａ】図９Ａは、本発明の一実施形態による、散乱偏光子スクリーンを有するインタラクティブ・ビデオ・ディスプレイ・システムの概略レイアウトを示す。
【図９Ｂ】図９Ｂは、本発明の一実施形態による、散乱偏光子スクリーンを有するインタラクティブ・ビデオ・ディスプレイ・システムの概略レイアウトを示す。
【図１０Ａ】図１０Ａは、本発明の一実施形態による、微小散乱隆起部またはバンプを有するスクリーンの断面を示す。
【図１０Ｂ】図１０Ｂは、本発明の一実施形態による、微小散乱ピットまたは溝を有するスクリーンの断面を示す。
【図１１】図１１は、本発明の一実施形態による、エッジライティングのためのサンプルの構成を示す。
【図１２Ａ】図１２Ａは、本発明の一実施形態によるフラットパネルディスプレイの断面を示す。
【図１２Ｂ】図１２Ｂは、本発明の別の実施形態によるフラットパネルディスプレイの断面を示す。
【図１３】図１３は、本発明の一実施形態によるカメラ及び照明サブシステムを示す。
【図１４】図１４は、本発明の一実施形態による、傾けた散乱偏光子を用いた、カメラのための照明サブシステムを示す。
【図１５】図１５は、本発明の一実施形態による、タイムオブフライト型カメラのためのカメラ及び照明サブシステムを示す。
【図１６】図１６は、本発明の一実施形態による、３Ｄデータをキャプチャする第１の構成を示す。
【図１７】図１７は、本発明の一実施形態による、３Ｄデータをキャプチャする第２の構成を示す。
【図１８Ａ】図１８Ａは、本発明の一実施形態による、３Ｄデータをキャプチャする２つの追加的な構成を示す。
【図１８Ｂ】図１８Ｂは、本発明の一実施形態による、３Ｄデータをキャプチャする別の

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構成を示す。
【図１９Ａ】図１９Ａは、本発明の一実施形態による、光散乱を示す概略図である。
【図１９Ｂ】図１９Ｂは、本発明の一実施形態による、光散乱を示す概略図である。
【図２０Ａ】図２０Ａは、本発明の一実施形態による、高歪みを示す。
【図２０Ｂ】図２０Ｂは、本発明の一実施形態による、ディスプレイスクリーンからカメラを遠ざけたことによる低減された歪みを示す。
【図２１Ａ】図２１Ａは、本発明の一実施形態による、フレネルレンズを用いた歪み低減を示す。
【図２１Ｂ】図２１Ｂは、本発明の一実施形態による、フレネルレンズを用いた歪み排除を示す。
【図２１Ｃ】図２１Ｃは、本発明の一実施形態による、２カメラシステムにおいて歪みをなくすフレネルレンズの使用を示す。
【図２２】図２２は、本発明の一実施形態による、ウィンドウディスプレイを示す概略図である。
【図２３Ａ】図２３Ａは、本発明の異なる実施形態による、グレアを低減する様々な技術を説明する概略図である。
【図２３Ｂ】図２３Ｂは、本発明の異なる実施形態による、グレアを低減する様々な技術を説明する概略図である。
【図２３Ｃ】図２３Ｃは、本発明の異なる実施形態による、グレアを低減する様々な技術を説明する概略図である。
【図２４Ａ】図２４Ａは、本発明の実施形態による、視界制御フィルムを用いてグレアを低減する技術を説明する概略図である。
【図２４Ｂ】図２４Ｂは、本発明の実施形態による、視界制御フィルムを用いてグレアを低減する技術を説明する概略図である。
【図２５】図２５は、本発明の一実施形態による、散乱偏光子を用いたウィンドウディスプレイの一つの構成の断面を示す。
【図２６】図２６は、本発明の一実施形態による、散乱偏光子及びマイクロプリズム材料を用いたウィンドウディスプレイの一つの構成の断面を示す。
【図２７】図２７は、本発明の一実施形態による、簡潔化目的のためにミラーを用いたウィンドウディスプレイの一つの構成の断面を示す。
【図２８】図２８は、本発明の一実施形態による、多数のタイムオブフライト型カメラを含むインタラクティブ・ディスプレイの側面を示す。
【図２９】図２９は、本発明の一実施形態による、多数のタイムオブフライト型カメラを含むインタラクティブ・ディスプレイの平面を示す。

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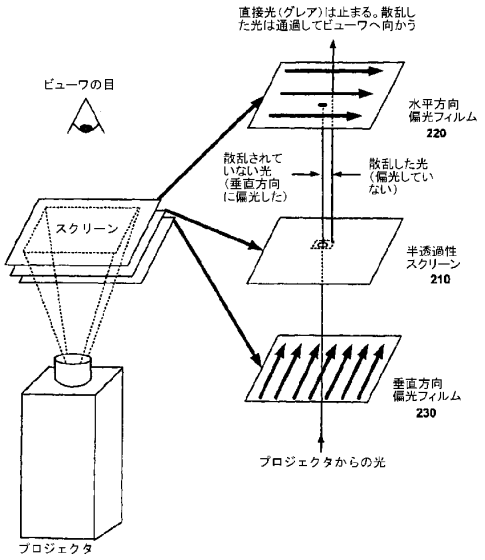
【図１】



基本ハードウェア構成

FIGURE 1

【図２】



偏光フィルタを通したグレアの排除

FIGURE 2

【図３】

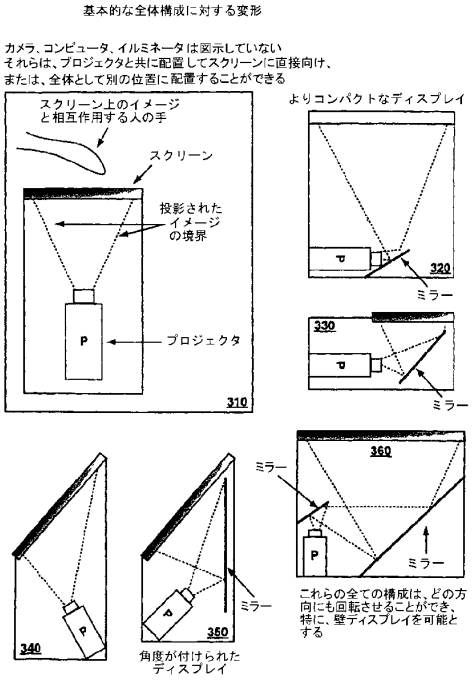


FIGURE 3

【図４Ａ】

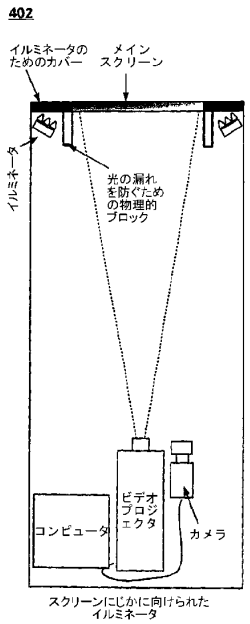


FIGURE 4A

【図４Ｂ】

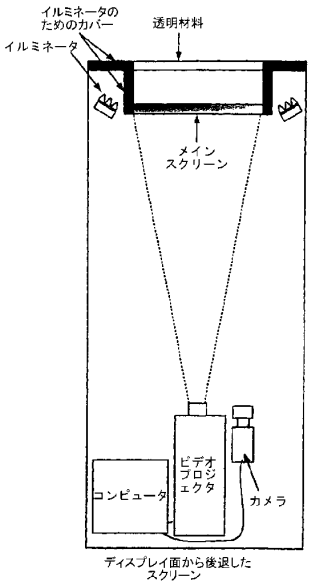


FIGURE 4B

【図５Ａ】

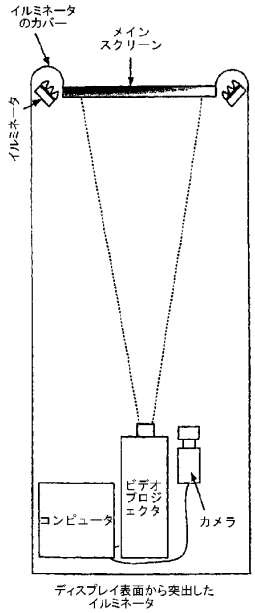


FIGURE 5A

【図５Ｂ】

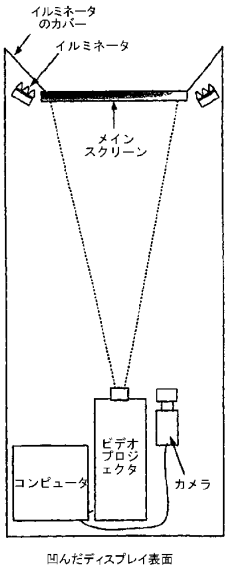


FIGURE 5B

【図６Ａ】

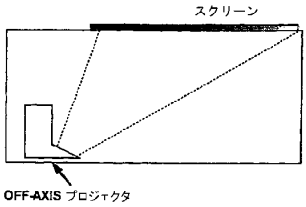


FIGURE 6A

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【図６Ｂ】

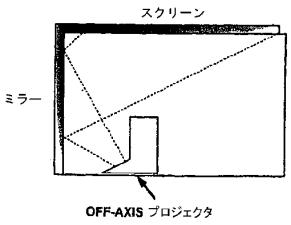
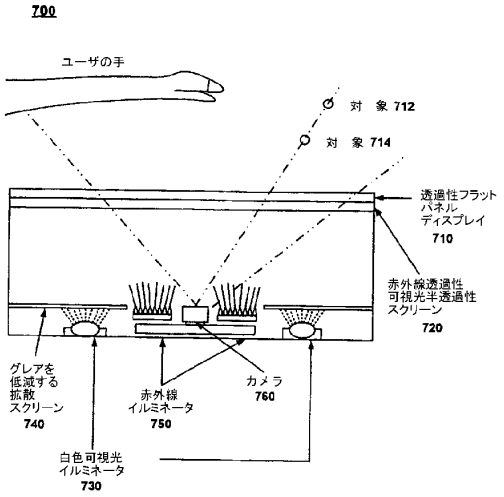


FIGURE 6B

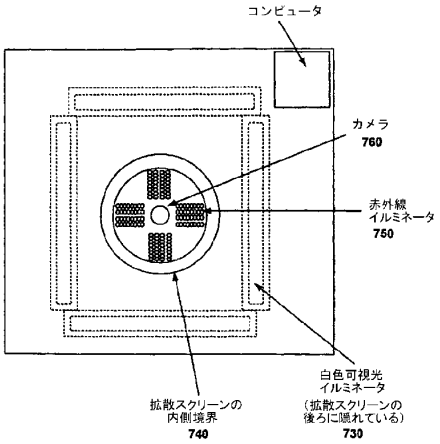
【図７Ａ】



フラットパネルディスプレイ
断面

FIGURE 7A

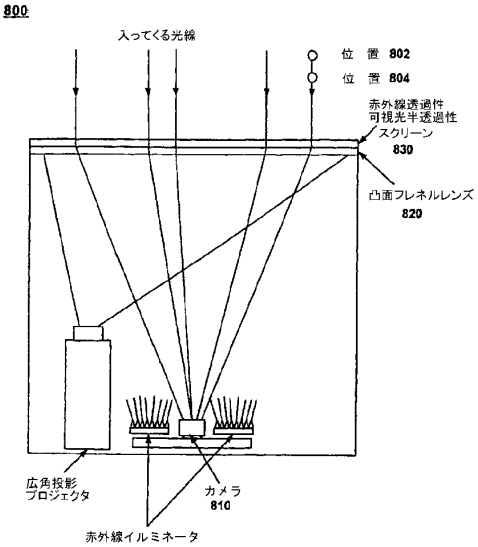
【図７Ｂ】



フラットパネルディスプレイ
平面切り欠き図

FIGURE 7B

【図８Ａ】

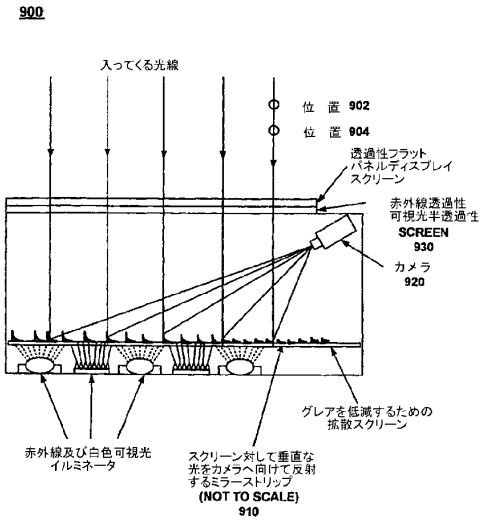


フレネルレンズを用いた内蔵型投
影型ディスプレイにおける歪み補正

FIGURE 8A

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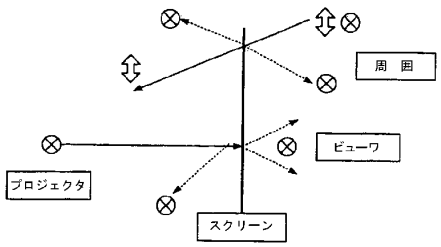
【図８Ｂ】



ミラーストリップを用いた
歪みの補正

FIGURE 8B

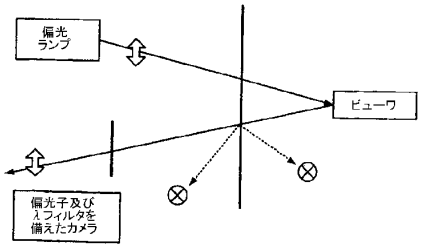
【図９Ａ】



ディスプレイ(及び周囲)チャネル

FIGURE 9A

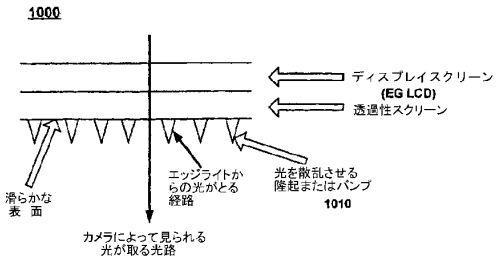
【図９Ｂ】



照明及びキャプチャチャネル

FIGURE 9B

【図１０Ａ】

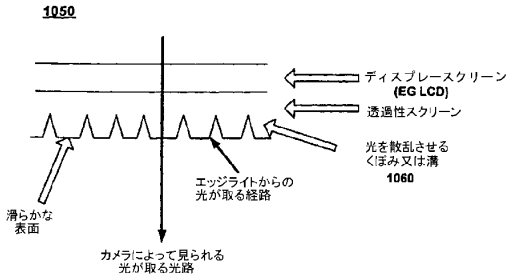


微小隆起あるいはバンプを
有するスクリーンの断面図
(NOT TO SCALE)

FIGURE 10A

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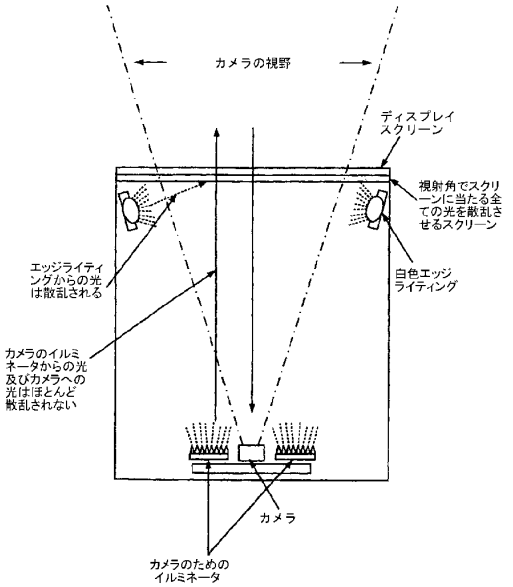
【図１０Ｂ】



微小散乱くぼみ又は溝を有する
スクリーンの断面図
(NOT TO SCALE)

FIGURE 10B

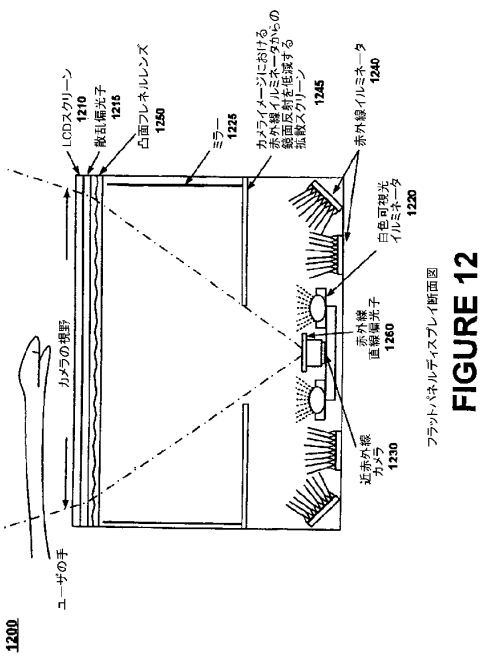
【図１１】



エッジライティングのためのサンプル構成

FIGURE 11

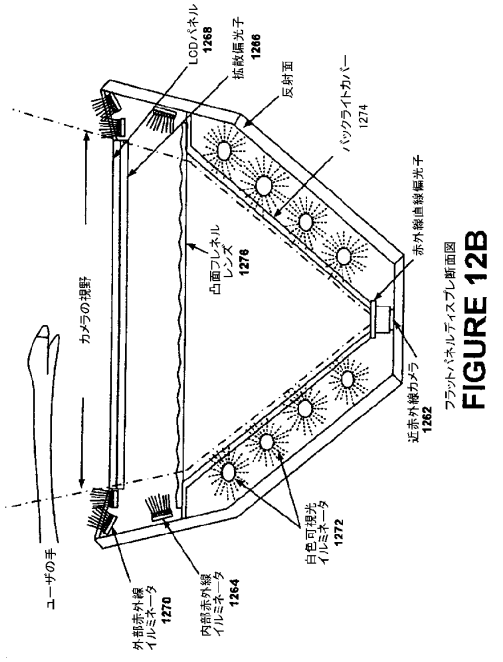
【図１２Ａ】



フラットパネルディスプレイ断面図

FIGURE 12

【図１２Ｂ】

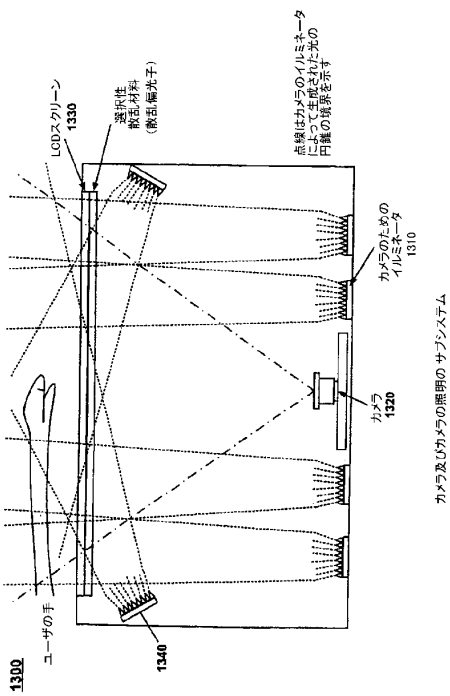


フラットパネルディスプレイ断面図

FIGURE 12B

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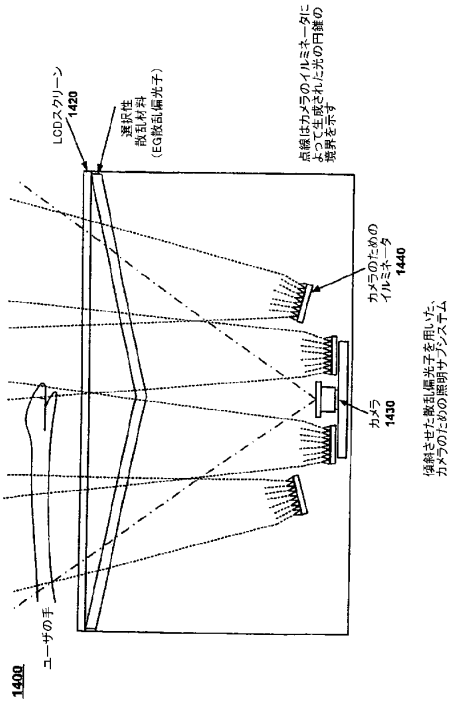
【図１３】



カメラ及びカメラの照明のサブシステム

FIGURE 13

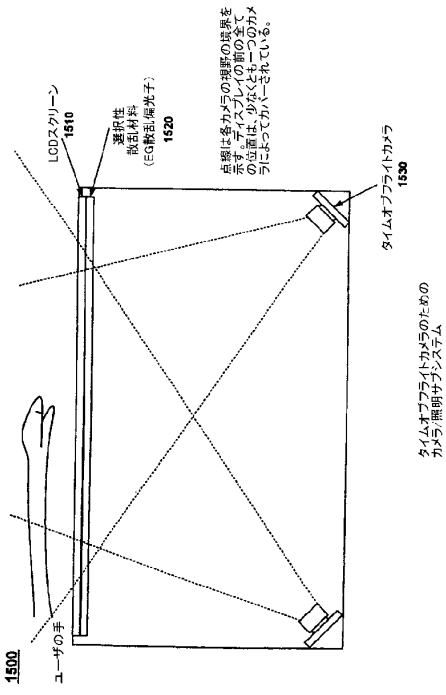
【図１４】



傾斜させた散乱偏光子を用いたカメラのための照明サブシステム

FIGURE 14

【図１５】



タイムオブフライトカメラのためのカメラ照明サブシステム

FIGURE 15

【図１６】

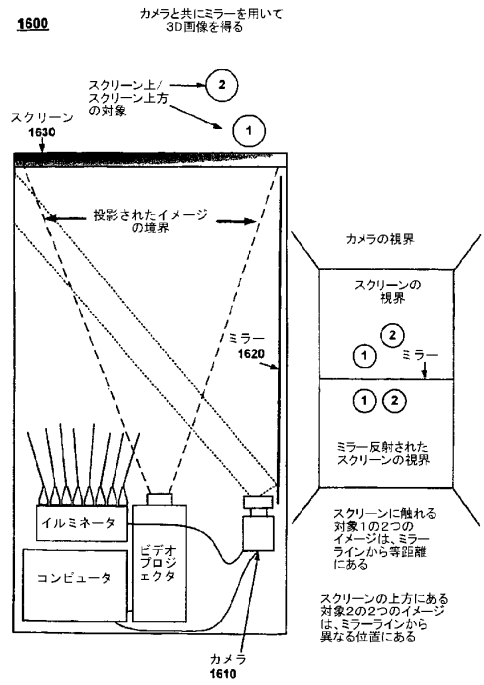


FIGURE 16

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【図１７】

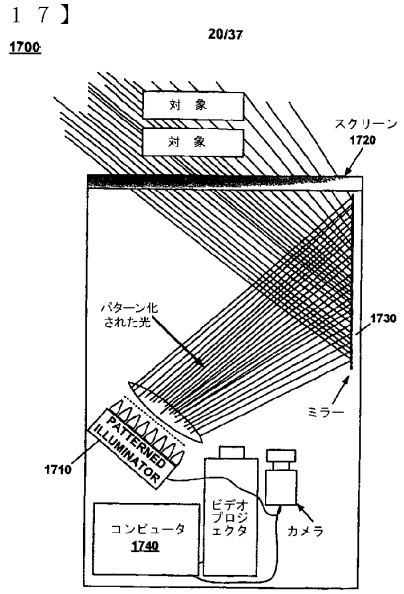


FIGURE 17

【図１８Ａ】

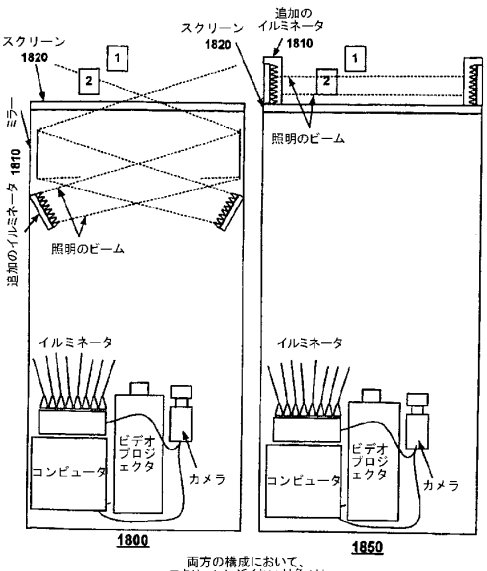


FIGURE 18A

【図１８Ｂ】

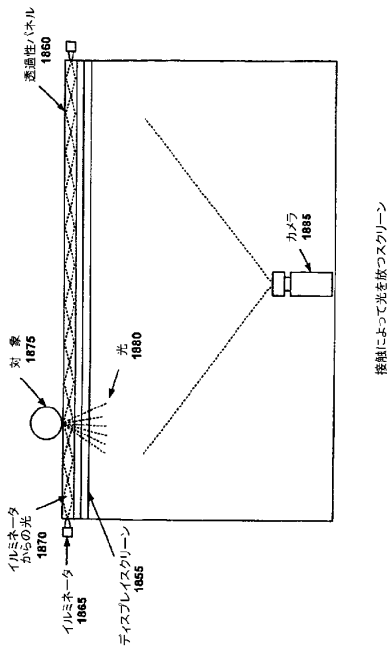


FIGURE 18B

【図１９Ａ】

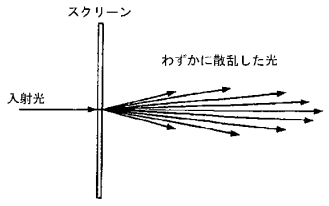
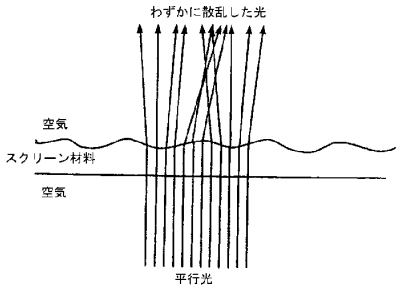


FIGURE 19A

【図１９Ｂ】



テクスチャー加工したスクリーンの拡大断面図
SCREEN THICKNESS, TEXTURE NOT TO SCALE

FIGURE 19B

【図２０Ａ】

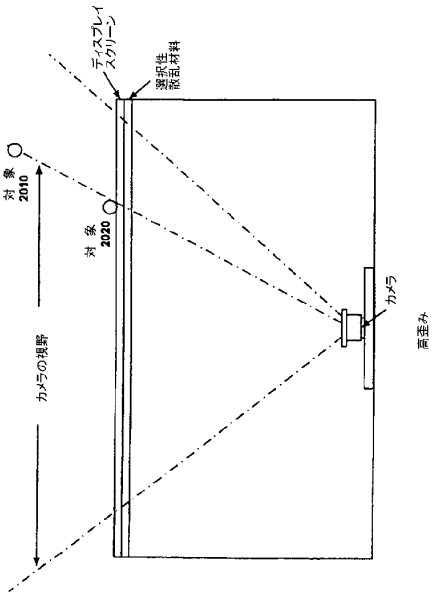
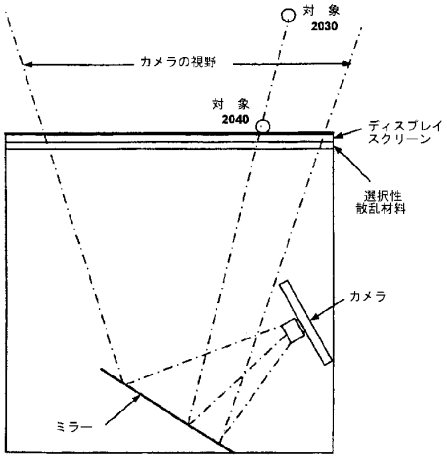


FIGURE 20A

【図２０Ｂ】



ディスプレイスクリーンからカメラを離すことにより低減された歪み

FIGURE 20B

【図２１Ａ】

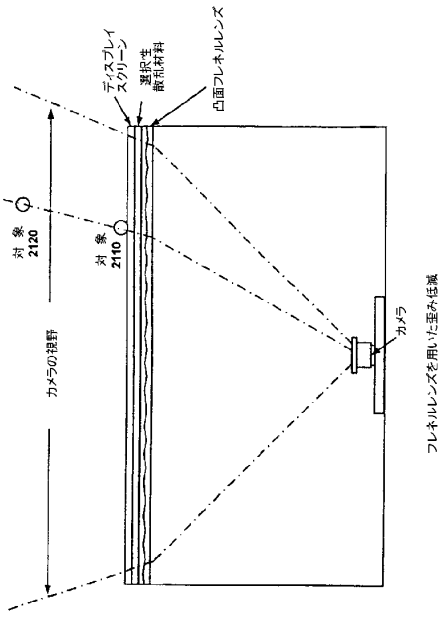


FIGURE 21A

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【図２１Ｂ】

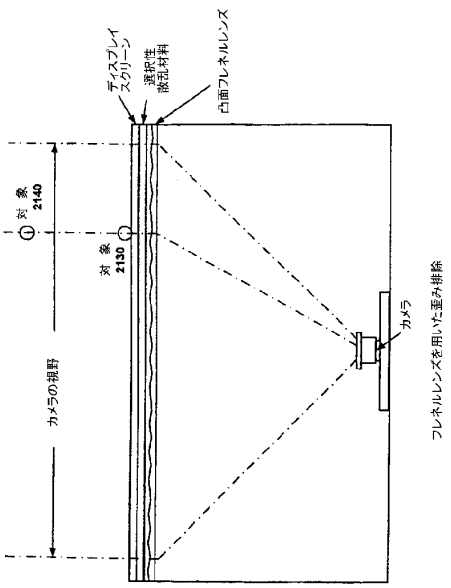


FIGURE 21B

【図２１Ｃ】

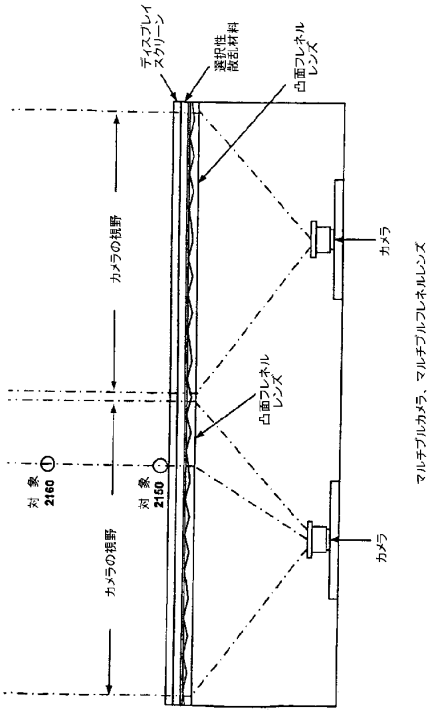
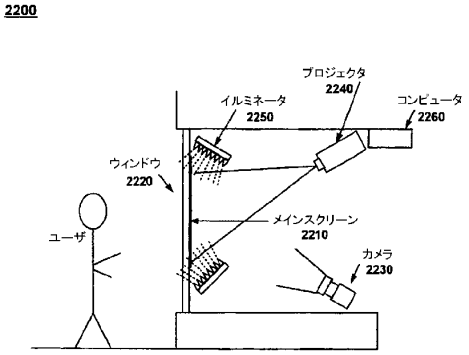


FIGURE 21C

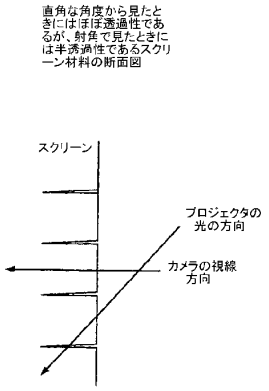
【図２２】



インタラクティブ・ウィンドウ・ディスプレイ

FIGURE 22

【図２３Ａ】

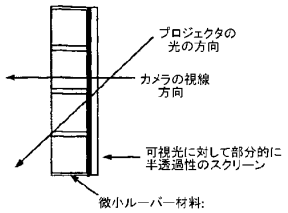


プリーツ付きスクリーンの断面の拡大図

FIGURE 23A

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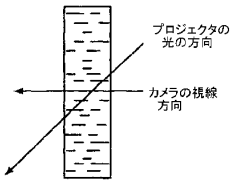
【図２３Ｂ】



プリーツ付きスクリーンの拡大図

FIGURE 23B

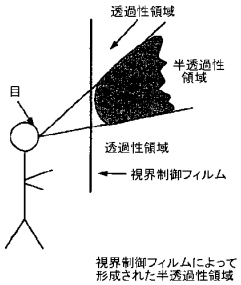
【図２３Ｃ】



シート状半透過性材料が埋め込
まれた透過性スクリーンの断面
の拡大図

FIGURE 23C

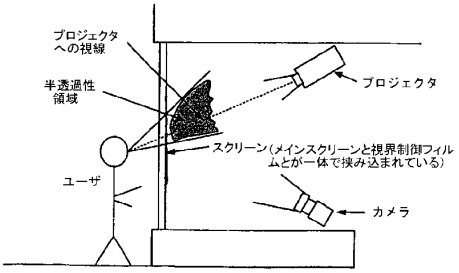
【図２４Ａ】



視界制御フィルムによって
形成された半透過性領域

FIGURE 24A

【図２４Ｂ】

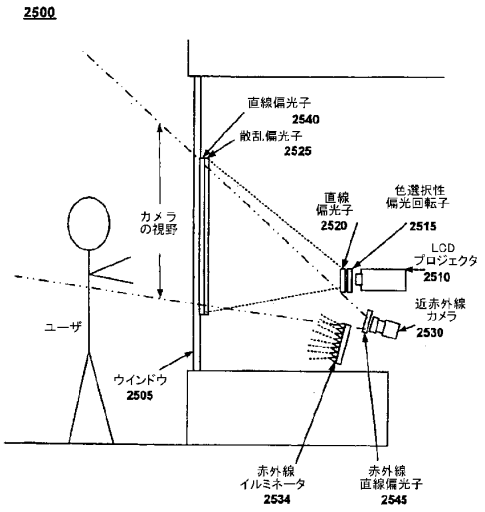


インタラクティブ・ウィンドウ・ディスプレイに
視界制御フィルムを用いた一つの構成

FIGURE 24B

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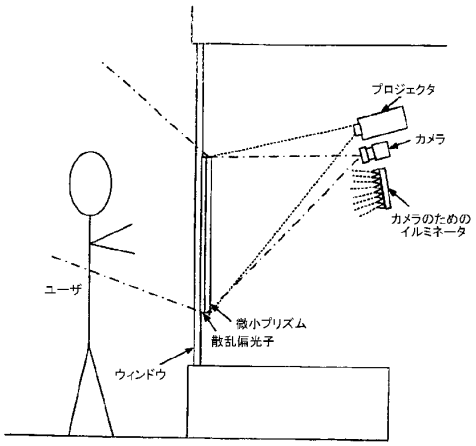
【図２５】



散乱偏光子を用いたウィンドウディスプレイの一構成の断面図

FIGURE 25

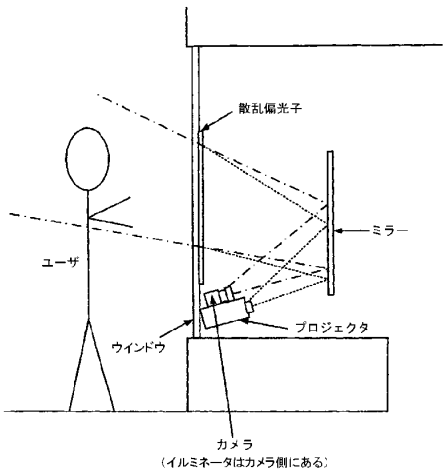
【図２６】



ウィンドウディスプレイにおける微小プリズム材料の使用を示す簡略化した断面図

FIGURE 26

【図２７】



ウインドウディスプレイのサイズを小型化するためのミラーの使用を示す簡略化した断面図

FIGURE 27

【図２８】

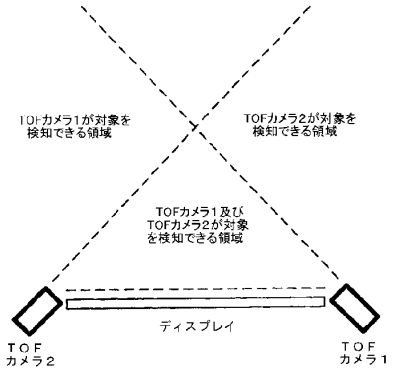


FIGURE 28

【図２９】

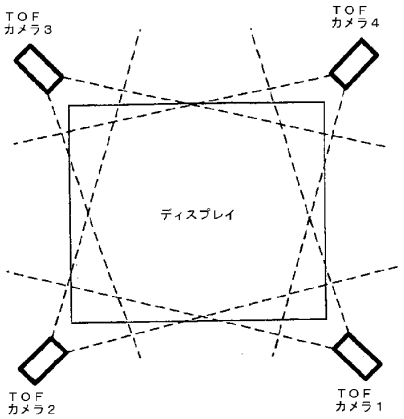


FIGURE 29

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【国際調査報告】

INTERNATIONAL SEARCH REPORT

Internal application No
PCT/US2004/041320

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06F3/00 G06F3/033

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ, IBM-TDB, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2001/012001 A1 (REKIMOTO JUNICHI ET AL) 9 August 2001 (2001-08-09) paragraphs '0042! - '0072! paragraphs '0088! - '0104! paragraphs '0119! - '0172! figures 1,2,5,12,13,20-23 ----- -/--	1-10, 13-15, 22-24, 27-30, 33-36, 38-40, 42,43, 45-47, 50-60, 63-65, 72-74, 77-80

[X] Further documents are listed in the continuation of box C. [X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 August 2005	25/08/2005

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Baldan, M

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 339 748 B1 (HIRAMATSU KAZUNORI) 15 January 2002 (2002-01-15) column 5, line 40 - column 12, line 5 column 13, line 44 - column 15, line 5 figures 1-11,15	1-10, 13-15, 21-23, 27-29, 33-36, 38-40, 42-46, 50-52, 54-60, 63-65, 71-73, 77-79
X	LEIBE B ET AL: "TOWARD SPONTANEOUS INTERACTION WITH THE PERCEPTIVE WORKBENCH" IEEE COMPUTER GRAPHICS AND APPLICATIONS, IEEE INC. NEW YORK, US, vol. 20, no. 6, November 2000 (2000-11), pages 54-64, XP000969594 ISSN: 0272-1716 the whole document	1,2,33, 34,54,55

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Volkswagen v. Longhorn - IPR2025-00925

INTERNATIONAL SEARCH REPORT

Information on patent family members

Inter Application No
PCT/US2004/041320

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 2001012001	A1	09-08-2001	JP	11024839 A	29-01-1999
US 6339748	B1	15-01-2002	JP	11224160 A	17-08-1999
			TW	396318 B	01-07-2000

Form PCT/ISA/210 (patent family annex) (January 2004)

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Volkswagen v. Longhorn - IPR2025-00925

フロントページの続き

(81)指定国 AP(BW,GH,GM,KE,LS,MW,MZ,NA,SD,SL,SZ,TZ,UG,ZM,ZW),EA(AM,AZ,BY,KG,KZ,MD,RU,TJ,TM),EP(AT,BE,BG,CH,CY,CZ,DE,DK,EE,ES,FI,FR,GB,GR,HU,IE,IS,IT,LT,LU,MC,NL,PL,PT,RO,SE,SI,SK,TR),OA(BF,BJ,CF,CG,CI,CM,GA,GN,GQ,GW,ML,MR,NE,SN,TD,TG),AE,AG,AL,AM,AT,AU,AZ,BA,BB,BG,BR,BW,BY,BZ,CA,CH,CN,CO,CR,CU,CZ,DE,DK,DM,DZ,EC,EE,EG,ES,FI,GB,GD,GE,GH,GM,HR,HU,ID,IL,IN,IS,JP,KE,KG,KP,KR,KZ,LC,LK,LR,LS,LT,LU,LV,MA,MD,MG,MK,MN,MW,MX,MZ,NA,NI,NO,NZ,OM,PG,PH,PL,PT,RO,RU,SC,SD,SE,SG,SK,SL,SY,TJ,TM,TN,TR,TT,TZ,UA,UG,UZ,VC,VN,YU,ZA,ZM,ZW

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Ｆターム(参考) 2H021 BA21 BA27
2K103 AA05 AA17 AA21 AA22 AA25 BA02 BA04 BB05 BC14 BC19
BC24 BC41 CA01 CA10 CA26 CA35 CA46 CA53 CA54 CA71
CA75
5B087 AA09 AE03 BC06 BC11 BC12 BC32

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(43) 国際公開日
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PCT

(10) 国際公開番号
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(21) 国際出願番号: PCT/JP2004/006643

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(30) 優先権データ:
特願2003-193738 2003 年7 月8 日 (08.07.2003) JP

(71) 出願人 (米国を除く全ての指定国について): 株式会社ソニー・コンピュータエンタテインメント (SONY COMPUTER ENTERTAINMENT INC.) [JP/JP]; 〒1070062 東京都港区南青山二丁目６番２１号 Tokyo (JP). ソニー株式会社 (SONY CORPORATION) [JP/JP]; 〒1410001 東京都品川区北品川６−７−３５ Tokyo (JP).

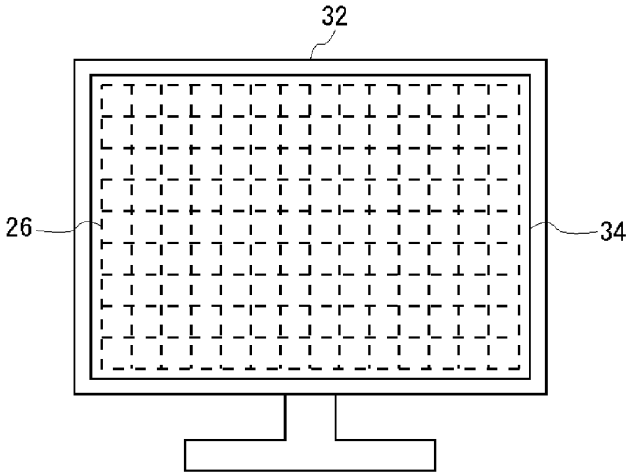
(72) 発明者; および

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/続葉有/

(54) Title: CONTROL SYSTEM AND CONTROL METHOD

(54) 発明の名称: 制御システムおよび制御方法



(57) Abstract: A user interface is provided which is excellent in operability. In a control system, there is provided, on the inner side of a display screen (34) of a display device (32), a noncontact input device (26) that determines a shape or action of an input part including at least a part of the body of a user or at least a part of an object operated by the user or determines a distance to the input part. An analyzing part analyzes the shape or action of the input part or the distance thereto determined by the noncontact input device (26) to determine an user's instruction. A control part executes a function corresponding to the user's instruction determined by the analyzing part.

/続葉有/

WO 2005/003948 A1

京都品川区東五反田３－１４－１３ 株式会社ソニーコンピュータサイエンス研究所内 Tokyo (JP).

(74) 代理人: 森下 賢樹 (MORISHITA, Sakaki); 〒1500021 東京都渋谷区恵比寿西２－１１－１２ Tokyo (JP).

(81) 指定国 (表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

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添付公開書類:
— 国際調査報告書

２文字コード及び他の略語については、定期発行される各*PCT*ガゼットの巻頭に掲載されている「コードと略語のガイダンスノート」を参照。

(57) 要約: 操作性に優れたユーザインタフェイスを提供する。 制御システムにおいて、ユーザの体の少なくとも一部又はユーザにより操作される物体の少なくとも一部を含む入力部位の形状又は動作、又は入力部位までの距離を検知する非接触型入力装置２６が、表示装置３２の表示画面３４の内側に設けられる。解析部は、非接触型入力装置２６により検知された入力部位の形状又は動作、又は前記入力部位までの距離を解析して、ユーザの指示を判別し、制御部は、解析部により判別されたユーザの指示に対応する機能を実行する。

明 細 書

制御システムおよび制御方法

技術分野

[0001] 本発明は、電子機器などの制御技術に関し、とくに、ユーザの体の一部や、ユーザにより操作される物体などを含む入力部位の形状又は動作、又は入力部位までの距離などによりユーザの指示を入力することが可能なユーザインタフェイスを備えた制御システム及び方法に関する。

背景技術

[0002] ITの発達に伴い、高度な機能を有する電子機器が多数登場している。電子機器の機能が高度になるにつれて、ユーザが電子機器に機能を実行させるための指示の内容も多様化しており、分かりやすく操作性に優れたユーザインタフェイス(User Interface:UI)の必要性が増している。たとえば、パーソナルコンピュータ(Personal Computer:PC)においては、以前は、ユーザがキーボードによりコマンド文字列を入力するキャラクタベースのユーザインタフェイスが主に採用されていたが、現在では、アイコンやウィンドウなどの画像を表示画面に提示し、表示画面上のポインタをユーザがマウスなどのポインティングデバイスにより操作して指示を入力するグラフィカル・ユーザインタフェイス(Graphical User Interface:GUI)が主流となっている。

発明の開示

発明が解決しようとする課題

[0003] GUIの登場により、ユーザは、所望の機能をPCに実行させるためのコマンド文字列を覚え、入力する煩わしさから解放された。しかし、PCが広く大衆に普及したとは言え、子供や高齢者などを中心に、マウスなどの操作に慣れておらず、抵抗感を感じるユーザもいる。また、より現実世界に近い感覚で指示を入力することが可能なUIを求める声もある。今後、PCなどの電子機器が更に生活の中に浸透し、より多様なユーザ層により使用されることが予想されるため、より直感的で分かりやすく、操作性に優れたUIの開発が望まれる。

[0004] 本発明はこうした状況に鑑みてなされたものであり、その目的は、操作性に優れた

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ユーザインタフェイスの提供にある。

課題を解決するための手段

[0005] 本発明のある態様は、制御システムに関する。この制御システムは、ユーザの体の少なくとも一部又はユーザにより操作される物体の少なくとも一部を含む単数又は複数の入力部位の形状又は動作、又は前記入力部位までの距離を検知する検知部と、入力部により検知された入力部位の形状又は動作、又は入力部位までの距離を解析して、ユーザの指示を判別する解析部と、解析部により判別されたユーザの指示に対応する機能を実行する制御部と、を備えることを特徴とする。

[0006] 検知部は、入力部位までの距離情報を取得可能な撮像装置であってもよい。検知部は、複数の電極を含み、入力部位の接近による前記電極間の静電容量の変化を検知する入力装置であってもよい。

[0007] なお、以上の構成要素の任意の組合せ、本発明の表現を方法、装置、システム、記録媒体、コンピュータプログラムなどの間で変換したものもまた、本発明の態様として有効である。

発明の効果

[0008] 本発明によれば、操作性に優れたユーザインタフェイスを提供することができる。

発明を実施するための最良の形態

[0009] (第1の実施の形態)

図1は、第1の実施の形態に係る制御システム10の構成を示す。制御システム10は、ユーザからの指示を入力する入力装置20と、入力装置20から入力される指示に応じてアプリケーションなどの動作を制御する制御装置40と、制御装置40から出力される画像を表示する表示装置30とを備える。本実施の形態の制御システム10は、ユーザが、指、手、足、頭など、体の一部を使って、動作(ジェスチャー)により指示を入力することが可能なユーザインタフェイス(以下、「ジェスチュラルインタフェイス」という)を提供する。これにより、ユーザが、現実世界と同様な動作で表示画面に表示されたオブジェクトを扱ったり、アプリケーションに指示を入力したりすることを可能とし、直感的に分かりやすく、操作性に優れたユーザインタフェイスを実現することができる。本実施の形態において、入力装置20は、ユーザの体の少なくとも一部を含む入力

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部位の形状又は動作、又は入力部位までの距離を検知する検知部の機能を有する。

[0010] 図2は、実施の形態に係る入力装置20および表示装置30の構成例を示す。図2に示した例では、表示装置30として、液晶ディスプレイ装置、プラズマディスプレイ装置、陰極線管（Cathord Ray Tube：CRT）ディスプレイ装置などの任意の表示装置32が用いられ、入力装置20として、表示装置32と一体的に、または別体として設けられた、測距機能を有する撮像装置22が用いられる。制御装置40は、撮像装置22により撮影されたユーザの動作を画像処理により解析し、ユーザが行ったジェスチャーを判別し、ユーザの指示を取得する。この構成例によれば、ユーザの体の広い範囲を撮影して、その動作を判別することができるので、ユーザは、指だけでなく、手や足などを用いたジェスチャーにより指示を行うことができる。この方式は、撮像装置22からある程度離れた位置でユーザがジェスチャーを行う場合に適している。ユーザとの距離に依存しない方式のジェスチュラルインタフェイスを採用する場合は、入力装置20として、測距機能を有しない撮像装置を用いてもよいが、後述するように、ユーザが表示画面上のオブジェクトを指などを用いて扱うことが可能なジェスチュラルインタフェイスを提供するためには、測距機能を有する撮像装置22を用いるのが好ましい。

[0011] 図3は、実施の形態に係る入力装置20および表示装置30の他の構成例を示す。図3に示した例では、表示装置30として、スクリーン38に画像を投影するプロジェクタ36が用いられ、入力装置20として、測距機能を有する撮像装置22が用いられる。図3の例では、ユーザの後方上部に設けられたプロジェクタ36により、ユーザの前方に設けられたガラスなどの透明または半透明のスクリーン38に画像を投影し、スクリーン38に表示された画像に向かってジェスチャーを行うユーザを、スクリーン38の反対側に設けられた撮像装置22により撮影している。この構成例によれば、ユーザの体の広い範囲の動作を取得できるとともに、ユーザがスクリーン38に投影された画像に直接触れながら、または画像の近傍で動作を行うことができるので、スクリーン38に投影されたオブジェクトなどを手などで直接扱っているような操作感をユーザに与えることができる。また、撮像装置22をスクリーン38から離れた位置に配置することができるので、スクリーン38の近傍でユーザがジェスチャーを行っても、ユーザの体の部

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位までの距離を精度良く検知することができる。

[0012] 図4は、実施の形態に係る入力装置20および表示装置30のさらに別の構成例を示す。図4に示した例では、表示装置30として、液晶ディスプレイ装置、プラズマディスプレイ装置、CRTディスプレイ装置などの任意の表示装置32が用いられ、入力装置20として、表示装置32の表示画面34の内側に設けられたタッチパネル24が用いられる。または、プロジェクタによりタッチパネル24の表面に画像を投影する構成であってもよい。タッチパネル24は、抵抗感圧方式、赤外線検出方式など、任意の方式のタッチパネルであってよい。この構成例によれば、ユーザは、表示画面34に表示されているオブジェクトなどに直接触れつつ指示を入力することができる。

[0013] 図5は、実施の形態に係る入力装置20および表示装置30のさらに別の構成例を示す。図5に示した例では、表示装置30として、液晶ディスプレイ装置、プラズマディスプレイ装置、CRTディスプレイ装置などの任意の表示装置32が用いられ、入力装置20として、表示装置32の表示画面34の内側に設けられた非接触型入力装置26が用いられる。または、プロジェクタにより非接触型入力装置26の表面に画像を投影する構成であってもよい。この非接触型入力装置26は、ユーザの指先などの物体が接近したときに、その物体の形状や物体までの距離などを検知可能な入力装置であり、たとえば、特開2002−342033号公報に開示された入力装置を利用可能である。特開2002−342033号公報に開示された非接触型入力装置は、縦横に配列された複数の線状の電極を備え、ユーザの指先などの導電性の物体が電極に近づいたときに、その接近の程度に応じた静電容量の変化を検知し、入力装置の近傍にある物体の3次元位置情報を取得する。この構成例によれば、非接触型入力装置26を表示画面34に近接して設けることができ、表示画面34の近傍におけるユーザの動作や体の部位の形状を精度良く検知することができるので、ユーザは、表示画面34に表示された画像を見ながら、その画像の近傍で指などの入力部位により指示を入力することができる。非接触型入力装置26では、ユーザの体のうち、入力装置の近傍に接近した部位のみが検出されるので、動作を解析するために特定の部位を抽出する手間が省け、処理を簡略化することができる。また、接近させただけで、形状や距離を検知することができるので、表示画面34に触れなくても指示入力が可能であり

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、表示画面34に直接触ることに抵抗を感じるユーザであっても快適に使用することができる。さらに、表示画面34を強く押す必要が無く、ユーザが表示画面34に触れる前から接近を検知することができるので、反応性が良く、操作感に優れたユーザインタフェイスを提供することができる。

[0014] 上述した複数の構成例のうち、いずれの構成を採用するかは、本制御システム10を設置する場所の環境、制御するアプリケーションやコンテンツなどの種類などに応じて決定されてもよい。たとえば、複数のユーザが一つの表示装置30を共有して利用するようなアプリケーションの場合、または、映画などのコンテンツを再生するアプリケーションの場合、ユーザが表示装置30から比較的距離をとって指示を入力することが想定されるので、図2または図3に示した構成例を採用してもよい。また、一人のユーザが個人的に利用するようなアプリケーションの場合、たとえば、画像や文書などのデータを編集する場合、ユーザと表示装置30との間の距離は比較的短いことが想定されるので、図4または図5に示した構成例を採用してもよい。複数の構成例を併用した制御システム10を構築する場合は、アプリケーションやコンテンツごとに、いずれの方式のジェスチュラルインタフェイスを採用するかを選択し、入力装置20を適宜切り替えて利用してもよい。

[0015] 図6は、制御装置40の内部構成を示す。この構成は、ハードウエア的には、任意のコンピュータのCPU、メモリ、その他のLSIで実現でき、ソフトウエア的にはメモリにロードされたプログラムなどによって実現されるが、ここではそれらの連携によって実現される機能ブロックを描いている。したがって、これらの機能ブロックがハードウエアのみ、ソフトウエアのみ、またはそれらの組合せによっていろいろな形で実現できることは、当業者には理解されるところである。制御装置40は、入力装置20により検知された入力信号を取得する取得部42と、取得部42が取得した入力信号からユーザの動作を解析してユーザの指示を判別する解析部44と、解析部44により判別されたユーザの指示に対応する機能を実行する制御部46とを含む。

[0016] 入力装置20が測距機能付き撮像装置であった場合、解析部44は、撮像装置が撮影した距離情報を有する画像を取得して、画像処理によりユーザの動作を判別する。解析部44は、形状認識技術によりユーザの体の一部、たとえば、頭、目、手、指、

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足などを抽出し、抽出した体の部位の動きを解析することにより、ユーザの動作を判別してもよい。入力装置20がタッチパネルであった場合、解析部44は、入力信号の形状や時間変化を解析することにより、ユーザの動作を判別してもよい。入力装置20が非接触型入力装置であった場合、解析部44は、入力信号の形状や距離、それらの時間変化を解析することにより、ユーザの動作を判別してもよい。

[0017] 図7は、制御装置40のハードウェアコンポーネントを示す。制御装置40は、CPU120、入力インタフェイス122、表示インタフェイス124、メモリ130、ハードディスク132、およびドライブ装置128を備える。これらの構成は、バス126などの信号伝送路により電気的に接続されている。

[0018] 入力インタフェイス122は、入力装置20が検知した入力信号を取得する。表示インタフェイス124は、表示装置30に表示する画像信号を出力する。ハードディスク132は、大容量の磁気記憶装置であり、各種ファイルなどを記憶する。記録媒体140は、上述した制御装置40の機能を、CPU120に実現させるためのプログラムを記録する。記録媒体140がドライブ装置128に挿入されると、そのプログラムは、メモリ130またはハードディスク132に読み出され、CPU120は、読み出されたプログラムにより本実施の形態の制御処理を行う。この記録媒体140は、CD−ROM、DVD、FDなどのコンピュータ読み取り可能な媒体である。

[0019] ここでは、プログラムが記録媒体140に記録されている例について説明したが、別の例においては、このプログラムは、無線、有線を問わず、外部のサーバから送信されてもよい。図7に示したハードウェア構成において、プログラムは、コンピュータに本実施の形態の制御機能を実現させればよいのであって、外部から供給される場合だけでなく、予めハードディスク132に格納されていてよいことも当業者には理解されるところである。

[0020] 制御部46の機能は、コンピュータのCPUなどにより実行されるオペレーティング・システム（Operating System：OS）や、入出力制御用のアプリケーションなどにより実現されてもよい。たとえば、ウィンドウシステムなどのGUIを採用したOSの場合は、ユーザの指などの入力部位が接近した場所の近傍の位置で最上位にあるウィンドウのアプリケーションにユーザの指示が通知され、そのアプリケーションがユーザの指示に

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対応づけられた機能を実行してもよい。その位置にウィンドウがない場合は、OSまたは入出力制御用アプリケーションがその指示に対応づけられた機能を実行してもよい。

[0021] 1．複数点による指示入力の例

従来のポインティングデバイスを利用したユーザインタフェイスでは、1点のポインタにより指示入力を行っていたが、本実施の形態の制御システム10が提供するジェスチュラルインタフェイスによれば、ユーザが指、手、足などを用いて、複数点の入力部位により指示を行うことができる。

[0022] 図8および図9は、ユーザの複数の指の動きにより指示を入力する例を説明するための図である。図8に示すように、ユーザが親指と人差し指を閉じた状態で、表示装置30の画面上に表示されたアイコン200上に指を近づけ、図9に示すように、親指と人差し指を開く動作を行ったとする。このとき、取得部42は、入力装置20が検知した入力信号を解析部44に送り、解析部44は、ユーザの指の動きを解析して、ユーザが指を開く指示を行ったことを判別する。

[0023] 入力装置20が測距機能付きカメラであった場合、解析部44は、形状認識などの技術によりユーザの手を抽出して指の動きを追跡し、ユーザが指を開く動作を行ったことを判別する。入力装置20がタッチパネルまたは非接触型入力装置であった場合、解析部44は、表示画面上のアイコン200の近傍の座標に接近した、または触れた一かたまりの入力部位が二つに分かれ、それぞれが離れる方向に移動したときに、ユーザが指を開く動作を行ったと判定する。一かたまりの入力部位が二つに分かれる場合だけでなく、2つの入力部位が互いに離れる方向に移動したときにも、ユーザが指を開く動作を行ったと判定してもよい。

[0024] ユーザが指を開く動作を行ったとき、制御部46は、指を開く動作に対応づけられた機能を実行する。たとえば、制御部46は、ユーザの指の近傍に表示されているアイコン200に対応づけられたアプリケーションを起動する機能を実行してもよい。そのアイコン200が、ファイルに対応づけられていた場合は、そのファイルを扱うことが可能なアプリケーションを起動して、そのファイルを開く機能を実行してもよい。このように、「指を開く」動作と、「アプリケーションを開く」、「ファイルを開く」などの機能を対応づけ

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ることで、ユーザの動作とアプリケーションの動作が感覚的に一致するので、より直感的に分かりやすく、親和性の高いユーザインタフェイスを実現することができる。

[0025] 指を開く動作と、「開始する」、「決定する」、「確定する」などの機能を対応づけてもよい。その他、各アプリケーションが、指を開く動作に対応した機能を実装してもよい。たとえば、画像処理用のアプリケーションにおいて、ユーザが画像上で指を開く動作を行ったとき、その部分を拡大する、またはその部分を指を開いた方向に伸ばす機能を実行してもよい。

[0026] 逆に、ユーザが、図9に示すように、親指と人差し指を開いた状態で、表示装置30の画面上に表示されたアイコン200上に指を近づけ、図8に示すように、親指と人差し指を閉じる動作を行ったとき、解析部44が、ユーザがアイコン200上で指を閉じる動作を行ったと判定し、制御部46が、指を閉じる動作に対応づけられた機能を実行してもよい。たとえば、制御部46は、ユーザの指の近傍に表示されているアイコン200又はウィンドウに対応づけられたアプリケーションを終了する機能を実行してもよいし、アイコン200又はウィンドウに対応づけられたファイルを閉じる機能を実行してもよい。また、画像処理用のアプリケーションにおいて、ユーザが画像上で指を閉じる動作を行ったとき、その部分を縮小する、またはその部分を指を閉じた方向に縮める機能を実行してもよい。

[0027] 上述の例では、指を開く又は閉じる動作について説明したが、その他、制御部46は、ユーザの指や手などを含む複数の入力部位を用いた指示を受け付けて、その動作に対応づけられた機能を実行してもよい。たとえば、本を閲覧するアプリケーションにおいて、ユーザが表示された本のページの角をつまむ動作を行ったとき、そのページを記憶して、「しおりを挟む」機能を実行してもよい。また、ロールプレイングゲームにおいて、ユーザが表示されたアイテムの近傍に指をおいて、そのアイテムをつかむ動作を行ったとき、そのアイテムを「拾う」機能を実行してもよい。

[0028] 2. 形状を利用した指示入力の例

図10は、ユーザの手の形状により指示を入力する例を説明するための図である。図9に示したように、ユーザが手を開いた状態で表示画面上に手の平を置いたとする。入力装置20が測距機能付きカメラであった場合、解析部44は、形状認識などの技

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術によりユーザの手を抽出して手の形状を判別する。入力装置20がタッチパネルまたは非接触型入力装置であった場合、解析部44は、表示画面上に接近した、または触れた物体の形状から、既知の技術により特徴点を抽出して、または所定の評価式により評価して、物体の形状を判別する。一般的な手の形状をデータベースに保持しておき、データベースに照合して一致する形状を抽出することにより、手の形状を判別してもよい。検出した物体の面積に基づいて形状を判定してもよい。たとえば、ユーザが手を表示画面上に置いたとき、手を開いた状態が最も面積が大きくなり、手を握った状態が最も面積が小さくなる。このことを利用して、手の形状を判別してもよい。ユーザが手を開いた状態で画面上に手の平を置いたとき、制御部46は、その形状に対応する機能、たとえば、手の平を置いた位置において最上位に表示中のウィンドウ210に対応するアプリケーションを「終了する」機能を実行する。「手の平を置く」という動作と、「停止する」、「終了する」などの機能を対応づけることで、直感的に分かりやすく、操作性の良いユーザインタフェイスを実現することができる。

[0029] 図11は、手の形状に対してオブジェクトをマッピングする例を説明するための図である。図11に示したように、ユーザが一方の手、ここでは左手で特定の形状を作り、他方の手、ここでは右手で表示画面上のオブジェクト220の位置から左手の方向へ指をずらす動作を行ったとする。手の形状の判別方法は、上述した例と同様である。このとき、制御部46は、左手の形状に対応するハードディスク132の格納場所に、右手の指で移動させたオブジェクト220に対応するファイルを格納する機能を実行する。左手の形状に対応する格納場所は、ファイルシステムにおけるディレクトリまたはフォルダなどであってもよいし、仮想的なフォルダであってもよい。また、手の形状にファイル自身を対応づけてもよい。一つの形状に対して一つの格納場所を対応づけるだけでなく、たとえば、開いた手の各指に対してそれぞれ格納場所を対応づけてもよい。

[0030] 図12は、手の形状に対してオブジェクトをマッピングするためのテーブルの例を示す。テーブル230は、制御装置40のメモリ130またはハードディスク132などに保持される。テーブル230には、形状欄232、格納場所欄234が設けられている。形状欄232は、手の形状を表す画像、パラメータなどを保持する。手の形状を画像として認

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識する場合は、その画像ファイルのファイル名などを保持してもよいし、手の形状を特徴点または評価式などでパラメータ化して認識する場合は、そのパラメータ、またはパラメータが格納されたファイルのファイル名などを保持してもよい。格納場所欄234は、オブジェクトの格納場所を保持する。手の形状と、その形状に対応する格納場所は、予め登録されていてもよいし、ユーザが図11に示した操作を行ったときに、手の形状が未登録の形状であった場合、制御部46が、その手の形状と格納場所をテーブル230に登録してもよい。このとき、ユーザが格納場所を指示してもよいし、自動的に適当な格納場所を割り当ててもよい。手の形状にファイル自身を対応づける場合は、格納場所欄234は、そのファイルのファイル名を保持する。

[0031] 図13は、図11に示した操作により格納されたオブジェクトを取り出す例を説明するための図である。図13に示したように、ユーザが一方の手、ここでは左手で取り出したいオブジェクトの格納場所に対応する手の形状を作り、他方の手、ここでは右手で左手の近傍の位置から離れる方向へ指をずらす動作を行う。このとき、制御部46は、左手の形状に対応する格納場所に格納されたオブジェクトを特定し、表示画面上に表示する。制御部46は、このオブジェクトに対応するファイルを開く機能を実行してもよい。

[0032] 3. 距離に応じた指示入力の例

図2および図3に示した測距機能付きの撮像装置22を用いた構成例、および図5に示した非接触型入力装置26を用いた構成例では、表示装置30からユーザの体の部位までの距離を検知することができる。以下、距離に応じた指示入力の例について説明する。

[0033] 図14は、距離に応じた指示入力の例を説明するための図である。図14に示した例では、制御部46が表示装置に魚が泳いでいる動画像を表示している。ここで、ユーザが表示画面に手を近づけたときに、表示画面からユーザの手までの距離が所定のしきい値を下回ると、制御部46は、ユーザの手の近傍から魚が逃げる動画像に表示を切り替える。これにより、現実に生きた魚が表示画面中を泳いでいるような臨場感を与えることができる。後述の例4に関連するが、ユーザの手が近づくときの速度を算出し、速度が速いときは、表示を切り替えるしきい値を大きくして、手が遠い位置にある

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ときから魚が逃げ始めるようにし、速度が遅いときは、しきい値を小さくして、手が近い位置に来るまで魚が逃げないようにしてもよい。制御部46は、ユーザの手と表示画面との間の距離が所定値以上であるときは、魚が自由に泳いでいる動画像を表示し、距離が所定値を下回っているときは、魚がユーザの手の位置を避けて泳ぐ動画像を表示してもよい。非接触型入力装置は、表示画面の近傍の距離情報を精度良く検知することができるので、この例では、入力装置20として非接触型入力装置を用いることがより好ましい。

[0034] 入力装置20として撮像装置を用いる場合は、測距機能や画像処理の精度の関係から、ユーザが撮像装置から離れすぎていると正確にユーザの指示を判別できない恐れがある。また、入力装置20として非接触型入力装置を用いる場合は、ユーザの手などの部位が入力装置20に近づかないと、静電容量の変化が起こらず検知できない。このように、入力装置20の特性に応じて、ユーザが指示入力を行うことが可能な距離の上限値が存在するので、上述の魚が泳ぐ動画像の例を、指示入力の可否を提示する手段として利用してもよい。たとえば、ユーザの手の位置が入力装置20から離れすぎていて指示入力が不可能な距離であるときには、魚が自由に泳ぎ回っている動画像を表示して、入力が不可能であることをユーザに提示し、ユーザが入力装置に近づいて指示入力が可能な距離になったときに、ユーザの手の回りを魚が避けるように泳ぐ動画像を表示して、入力が可能であることをユーザに提示してもよい。制御部46は、入力装置20に対する指示入力の可否を判断するための距離のしきい値を予め保持しておいてもよい。

[0035] 4. 移動量、速度、加速度に応じた指示入力の例

図15および図16は、画面上に表示されたオブジェクトを移動する機能について説明するための図である。図15および図16の例では、ユーザが表示装置30に表示されたオブジェクトを指でずらして移動させようとしている。このとき、制御部46は、ユーザの指などの部位の移動量、速度、加速度を検知して、それに応じてオブジェクトの移動量を決定する。たとえば、オブジェクトごとに重さ、すなわちオブジェクトを移動させるために必要な仮想的なエネルギー値を予め設定しておき、そのエネルギー値と、ユーザがオブジェクトを移動させようと指を動かすときの移動量、速度、または加速

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度に基づいて、オブジェクトの移動状態を制御する。制御部46は、軽いオブジェクトについては、図15に示すように、ユーザが素早く指をずらした場合にも、それに追随してオブジェクトを移動させるが、重いオブジェクトについては、図16に示すように、ユーザが素早く指をずらした場合にはオブジェクトを移動させない。重いオブジェクトは、初めはユーザがゆっくりと指をずらすことで移動し始め、徐々に指を早く移動させると、それに追随して移動するようにする。これにより、現実の静止摩擦および動摩擦抵抗を模した移動状況を擬似的に再現することができ、ユーザにオブジェクトの重みを反映した操作感を与えることができる。この例で説明した技術は、従来のポインティングデバイスを用いたユーザインタフェイスにおいても利用可能である。

[0036] 制御部46は、ユーザがオブジェクトに与える力の大きさを判定して、その力の大きさに応じてオブジェクトの移動状態を制御してもよい。入力装置20として撮像装置または非接触型入力装置を用いる場合は、入力装置20とユーザの手の間の距離に基づいて力の大きさを判定してもよい。たとえば、ユーザの手が表示画面に近いほど大きな力をオブジェクトに与えることができるようにしてもよい。入力装置20としてタッチパネルを用いる場合は、押圧する力の大きさに基づいて力の大きさを判定してもよい。従来のポインティングデバイスを用いる場合は、感圧式マウスなどの押圧の度合いにより力の大きさを判定してもよい。

[0037] 図17は、紙を扱う機能について説明するための図である。図17では、制御部46が本を開いた画像を表示装置30に表示している。ユーザがページの上に指をおき、ゆっくり指をずらすと、制御部46は、ユーザの指の動きに追随してページが徐々にめくれていき、所定の位置を超えるとページがめくれて次のページにうつるような画像を表示する。ユーザが素早く指を動かした場合は、制御部46は、紙が指の動きに追随できずに、途中までめくれて元に戻るような画像を表示する。これにより、現実に本を読んでいるような臨場感をユーザに与えることができる。制御部46は、紙がユーザの動きに追随できるか否かを判断するために用いる速度のしきい値を予め保持してもよい。その他、紙を扱う例として、制御部46は、ユーザの指の動きが早過ぎた場合に、紙がしわを作る様子を表示したり、ユーザが紙をつまむ、破る、などの動作を行ったときに、紙に凹凸をつけたり、紙が破れた様子を表示したりしてもよい。

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[0038] 移動量、速度、加速度に応じた指示入力の他の例として、ユーザがあるオブジェクトを指などにより移動させ、他のオブジェクトの上を通過させたとき、移動速度に応じて他のオブジェクトに所定の処理を行ってもよい。たとえば、移動中のオブジェクトに対応するファイルを、通過したオブジェクトに対応するアプリケーションにより開く機能を実行してもよい。

[0039] 5．3次元オブジェクトに対する指示入力の例

従来、3次元オブジェクトを表示画面上に表示し、ユーザから3次元オブジェクトの移動、回転などの操作を受け付ける場合、ポインタの動きが2次元的であるから、3次元的な指示入力が困難であるという問題があった。図2および図3に示した測距機能付きの撮像装置22を用いた構成例、および図5に示した非接触型入力装置26を用いた構成例では、ユーザの体の部位の動きを3次元的に取得することができるので、3次元空間を扱うのに適したジェスチュラルインタフェイスを提供することができる。

[0040] 図18は、3次元オブジェクトを扱う例を説明するための図である。制御部46が表示装置30に表示した3次元オブジェクト240の近傍で、ユーザがオブジェクト240をつかんで紙面奥方向へ回すジェスチャーを行うと、制御部46は、ユーザが手を回した方向と同じ方向に3次元オブジェクト240を回転させる。このように、本実施の形態のジェスチュラルインタフェイスによれば、3次元オブジェクトを実際に手で扱っているような操作感を与えることができ、3次元空間を扱うためのユーザインタフェイスの操作性を飛躍的に向上させることができる。

[0041] （第2の実施の形態）

第2の実施の形態では、ユーザの体の一部ではなく、ユーザにより操作される物体の形状又は動作、又は物体までの距離により指示を入力する技術について説明する。本実施の形態の制御システム10の全体構成、入力装置20、表示装置30、制御装置40の内部構成は、それぞれ第1の実施の形態と同様である。本実施の形態では、主に、図5に示した非接触型入力装置26を用いた構成例について説明するが、他の構成例を用いた場合についても同様である。静電容量の変化を検知する非接触型入力装置26の場合、導電性の物体を表示画面上に置き、その物体にユーザが触れると、静電容量が変化して物体の形状が検知される。これを利用して、導電性物体

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の形状や動きに所定の機能を対応づけてユーザインタフェイスを構築することができる。

[0042] 図19は、物体の形状や動きにより指示を入力する例を説明するための図である。図19に示した例では、表示装置30に、制御部46により制御される音楽再生アプリケーションのウインドウ250が表示されている。このとき、ユーザが、音量調節機能に対応づけられた形状を有する音量調節ユニット260を表示画面上に置いて、ツマミ262を左右に動かしたとする。解析部44は、入力信号の形状を解析して、これが音量調節ユニット260であることを検知し、さらにツマミ262の動きを解析して制御部46に伝える。制御部46は、ツマミ262の移動量に応じて、音楽再生アプリケーションにおける音量を制御する。

[0043] 静電容量の変化を検知する非接触型入力装置は、導電性物体のみを検知するので、絶縁性物体の底面に導線により特定の形状を描き、その形状と所定の機能とを対応づけてもよい。

[0044] 以上、本発明を実施の形態をもとに説明した。この実施の形態は例示であり、それらの各構成要素や各処理プロセスの組合せにいろいろな変形例が可能なこと、またそうした変形例も本発明の範囲にあることは当業者に理解されるところである。

[0045] 実施の形態では、制御システム10がパーソナルコンピュータなどの電子機器に相当する例について説明した。他の例では、入力装置20として非接触型入力装置26を用い、テーブルの天板に表示装置30および入力装置20を設け、その上でゲームなどを楽しめるように構成してもよい。また、通路の床などに表示装置30および入力装置20を設け、ユーザが歩いた足跡を表示したり、ユーザの行き先を画像や光などでナビゲーションするように構成してもよい。

産業上の利用可能性

[0046] 本発明は、電子機器などを制御するためのユーザインタフェイスに適用できる。

図面の簡単な説明

[0047] [図1]実施の形態に係る制御システムの構成を示す図である。

[図2]実施の形態に係る入力装置および表示装置の構成例を示す図である。

[図3]実施の形態に係る入力装置および表示装置の他の構成例を示す図である。

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[図4]実施の形態に係る入力装置および表示装置のさらに別の構成例を示す図である。

[図5]実施の形態に係る入力装置および表示装置のさらに別の構成例を示す図である。

[図6]制御装置の内部構成を示す図である。

[図7]制御装置のハードウェアコンポーネントを示す図である。

[図8]ユーザの複数の指の動きにより指示を入力する例を説明するための図である。

[図9]ユーザの複数の指の動きにより指示を入力する例を説明するための図である。

[図10]ユーザの手の形状により指示を入力する例を説明するための図である。

[図11]手の形状に対してオブジェクトをマッピングする例を説明するための図である。

[図12]手の形状に対してオブジェクトをマッピングするためのテーブルの例を示す図である。

[図13]図11に示した操作により格納されたオブジェクトを取り出す例を説明するための図である。

[図14]距離に応じた指示入力の例を説明するための図である。

[図15]画面上に表示されたオブジェクトを移動する機能について説明するための図である。

[図16]画面上に表示されたオブジェクトを移動する機能について説明するための図である。

[図17]紙を扱う機能について説明するための図である。

[図18]3次元オブジェクトを扱う例を説明するための図である。

[図19]物体の形状や動きにより指示を入力する例を説明するための図である。

符号の説明

[0048] 10・・・制御システム、20・・・入力装置、22・・・撮像装置、24・・・タッチパネル、26・・・非接触型入力装置、30・・・表示装置、40・・・制御装置、42・・・取得部、44・・・解析部、46・・・制御部。

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請求の範囲

[1] ユーザの体の少なくとも一部又はユーザにより操作される物体の少なくとも一部を含む複数の入力部位の動作を検知する検知部と、

前記検知部により検知された前記入力部位の動作を解析して、ユーザの指示を判別する解析部と、

前記解析部により判別されたユーザの指示に対応する機能を実行する制御部と、を備えることを特徴とする制御システム。

[2] 前記制御部は、ユーザが指を開く又は閉じる動作を行ったときに、その動作に対応づけられた機能を実行することを特徴とする請求項1に記載の制御システム。

[3] ユーザに画像を提示するための表示部を更に備え、

前記制御部は、前記表示部に表示されたオブジェクトの近傍でユーザが指を開く又は閉じる動作を行ったときに、そのオブジェクトに対応づけられたアプリケーションに、指を開く又は閉じる動作に対応づけられた機能を実行させることを特徴とする請求項2に記載の制御システム。

[4] ユーザの体の少なくとも一部又はユーザにより操作される物体の少なくとも一部を含む入力部位の形状又は動作、又は前記入力部位までの距離を検知する検知部と、

前記検知部により検知された前記入力部位の形状又は動作、及び前記入力部位までの距離を解析して、ユーザの指示を判別する解析部と、

前記解析部により判別されたユーザの指示に対応する機能を実行する制御部と、を備えることを特徴とする制御システム。

[5] 前記制御部は、前記入力部位の形状とデータの格納場所を対応づけ、ユーザからデータの格納要求があったときに、前記検知部により検知された前記入力部位の形状に対応する格納場所にそのデータを格納することを特徴とする請求項1に記載の制御システム。

[6] 前記制御部は、ユーザからデータの読み出し要求があったときに、前記検知部により検知された前記入力部位の形状に対応する格納場所からデータを読み出すことを特徴とする請求項5に記載の制御システム。

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[7] ユーザに画像を提示するための表示部を更に備え、

前記制御部は、前記入力部位までの距離が所定のしきい値以上であったときに、その旨を示す画像を前記表示部に表示し、前記入力部位までの距離が所定のしきい値を下回ったときに、その旨を示す画像に切り替えることを特徴とする請求項4に記載の制御システム。

[8] 前記しきい値は、前記検知部が検知した入力部位の情報を前記解析部が解析する際の精度に基づいて定められることを特徴とする請求項7に記載の制御システム。

[9] 前記制御部は、前記入力部位の移動量、速度、又は加速度を算出し、それらのうちの少なくとも一つに基づいて、前記機能を制御することを特徴とする請求項1に記載の制御システム。

[10] ユーザに画像を提示するための表示部を更に備え、

前記制御部は、前記表示部に表示されたオブジェクトをユーザが移動させるために、そのオブジェクトの近傍に前記入力部位を接近させて移動させたときに、前記入力部位の移動量、速度、又は加速度に応じて、オブジェクトの移動量を決定することを特徴とする請求項9に記載の制御システム。

[11] 前記制御部は、前記表示部に表示されたオブジェクトに対して、そのオブジェクトの重さを表すパラメータを設定し、前記パラメータを更に考慮してオブジェクトの移動量を決定することを特徴とする請求項10に記載の制御システム。

[12] 前記検知部は、前記入力部位までの距離情報を取得可能な撮像装置であることを特徴とする請求項1から11のいずれかに記載の制御システム。

[13] 前記検知部は、複数の電極を含み、前記入力部位の接近による前記電極間の静電容量の変化を検知する入力装置であることを特徴とする請求項1から11のいずれかに記載の制御システム。

[14] ユーザの体の少なくとも一部又はユーザにより操作される物体の少なくとも一部を含む入力部位の形状又は動作、又は前記入力部位までの距離を検知するステップと、

検知された前記入力部位の形状又は動作、又は前記入力部位までの距離を解析して、ユーザの指示を判別するステップと、

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判別されたユーザの指示に対応する機能を実行するステップと、

を含むことを特徴とする制御方法。

[15] ユーザの体の少なくとも一部又はユーザにより操作される物体の少なくとも一部を含む入力部位の形状又は動作、又は前記入力部位までの距離を検知する検知部から、検知された情報を取得し、前記情報を解析して、ユーザの指示を判別する機能と、

判別されたユーザの指示に対応する機能を実行する機能と、

をコンピュータに実現させることを特徴とするコンピュータプログラム。

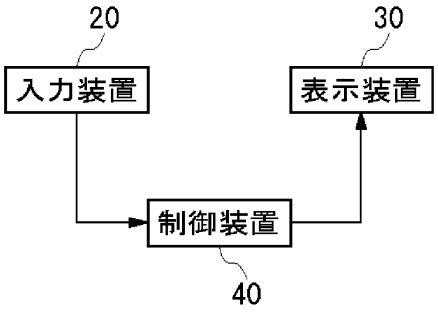
[16] ユーザの体の少なくとも一部又はユーザにより操作される物体の少なくとも一部を含む入力部位の形状又は動作、又は前記入力部位までの距離を検知する検知部から、検知された情報を取得し、前記情報を解析して、ユーザの指示を判別する機能と、

判別されたユーザの指示に対応する機能を実行する機能と、

をコンピュータに実現させるためのプログラムを記録したコンピュータ読み取り可能な記録媒体。

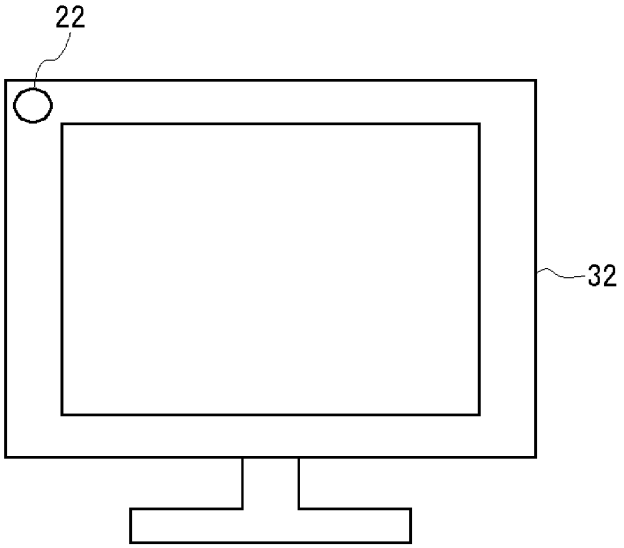
Volkswagen Exhibit 1037, Page 300 of 2532
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[図1]

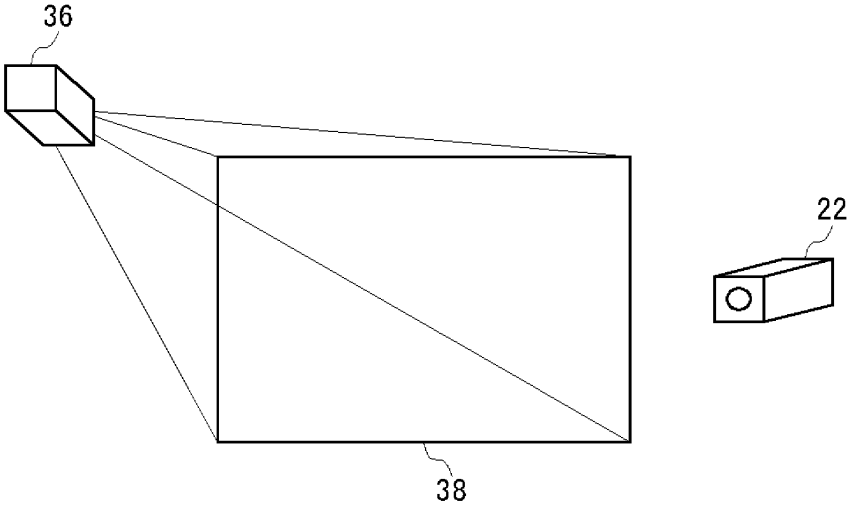


10

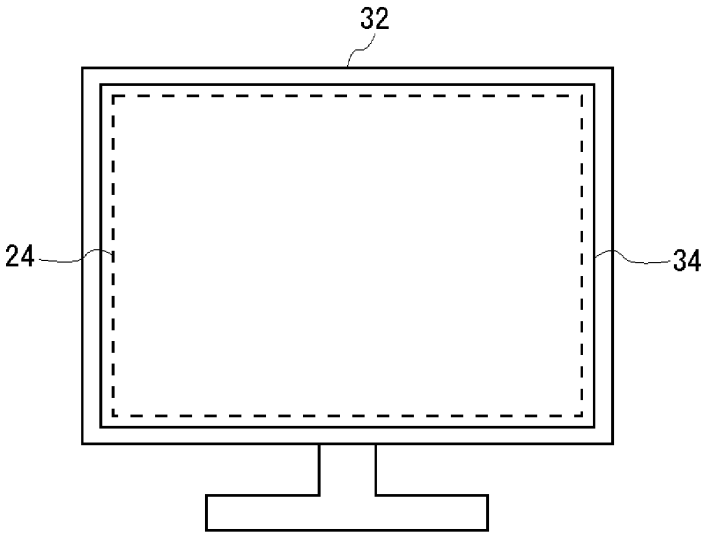
[図2]



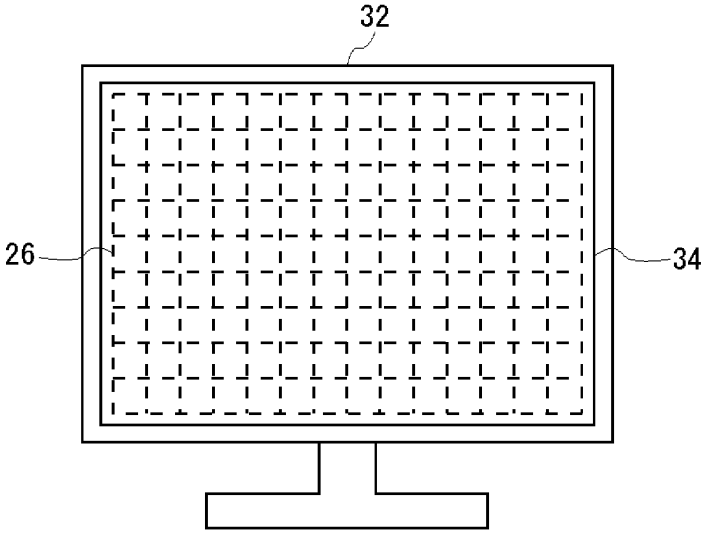
[図3]



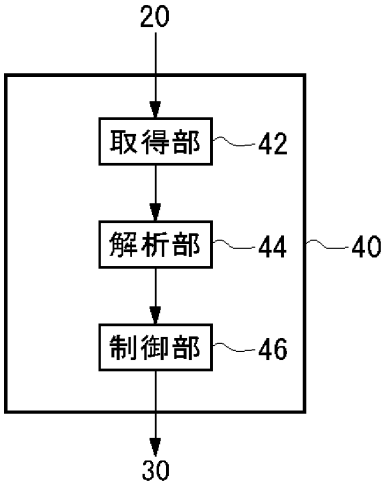
[図4]



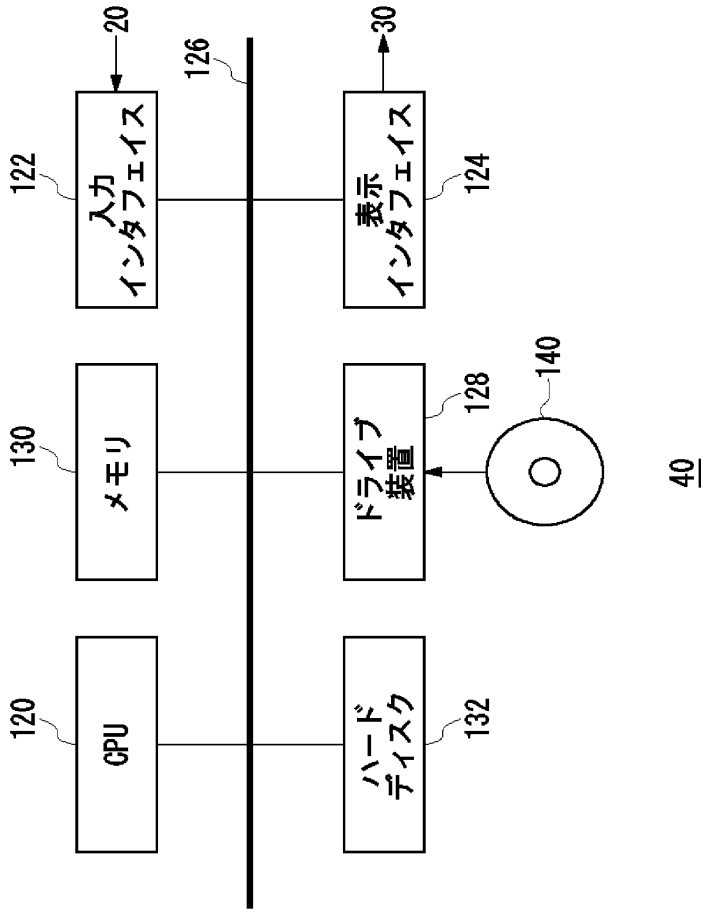
[図5]



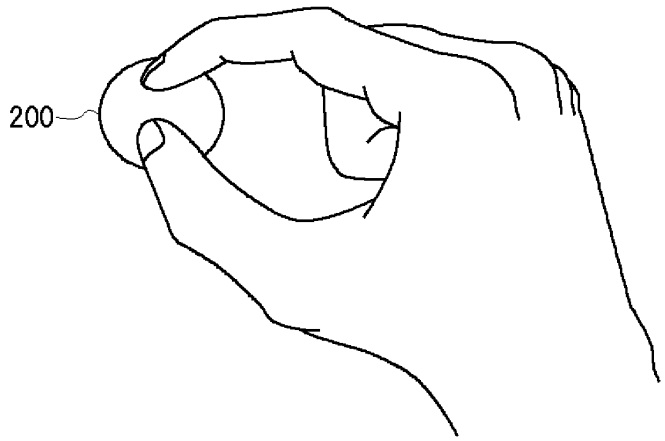
[図6]



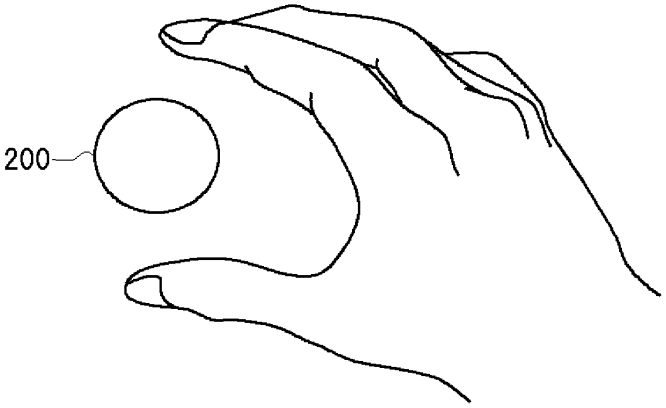
[図7]


20
126
30
122
入力インタフェース
表示インタフェース
124
130
メモリ
ドライブ装置
128
140
40
120
CPU
ハードディスク
132

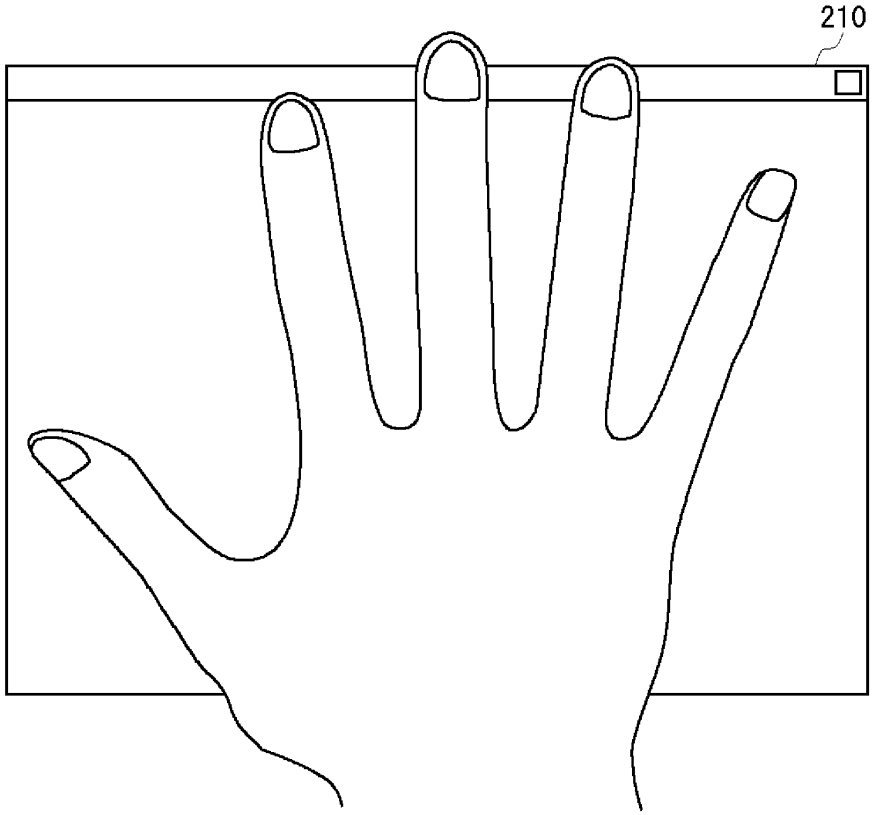
[図8]


200

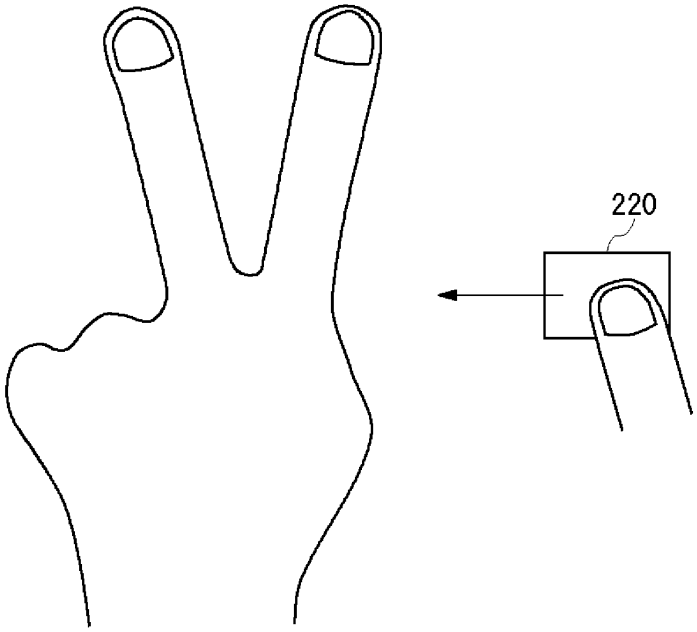
[図9]



[図10]



[図11]



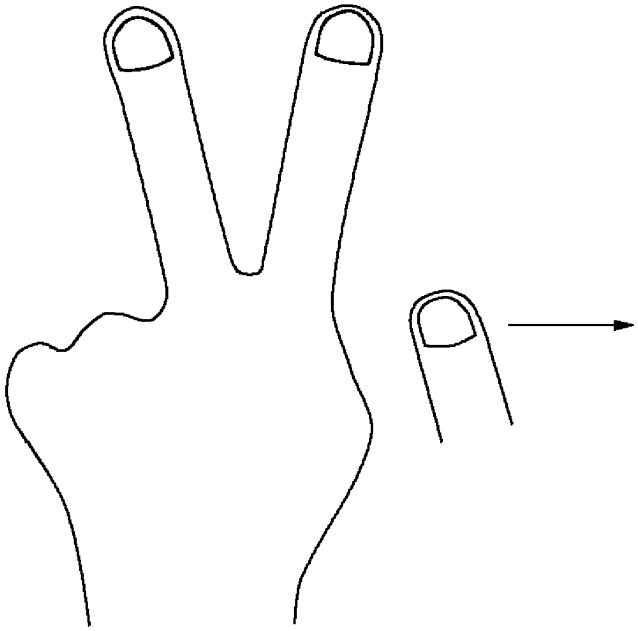
[図12]

232 234

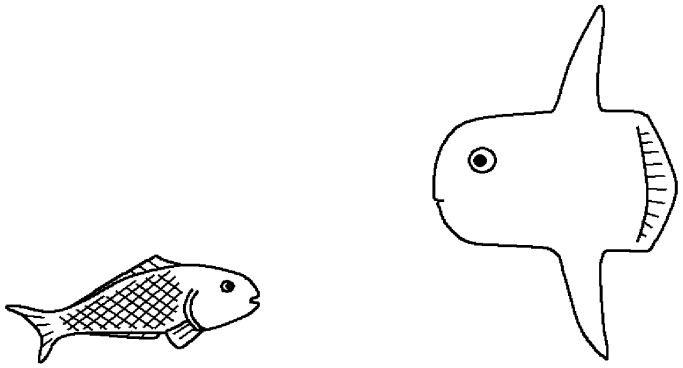
形状	格納場所
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⋮	⋮

230

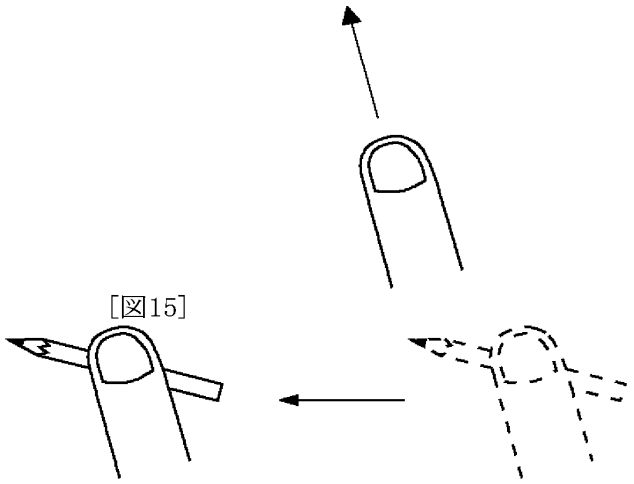
[図13]



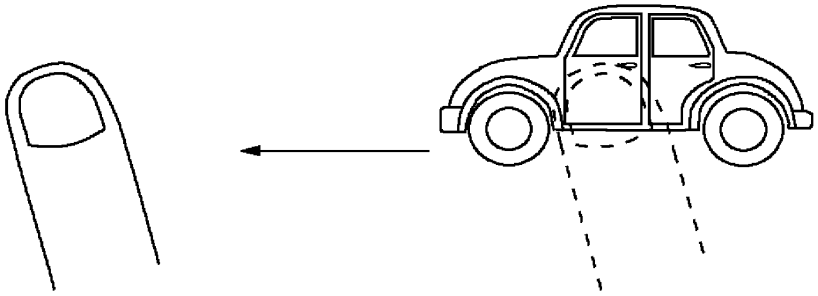
[図14]



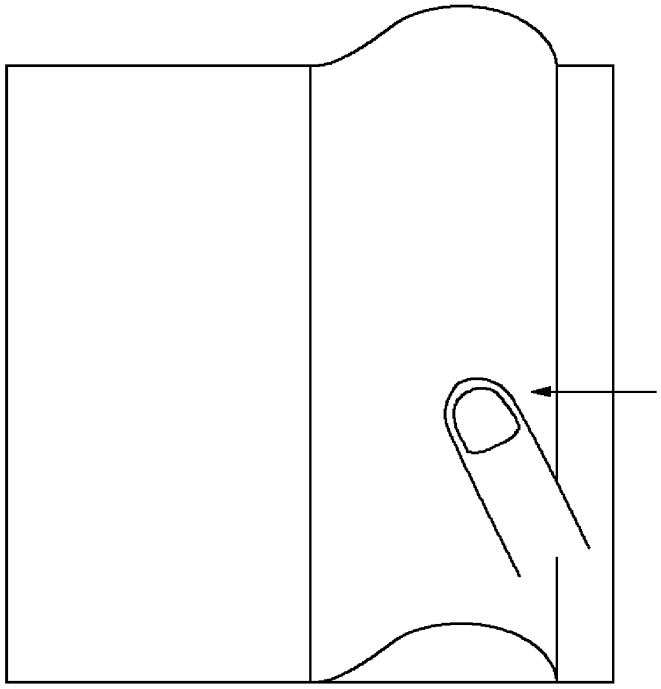
[図15]



[図16]

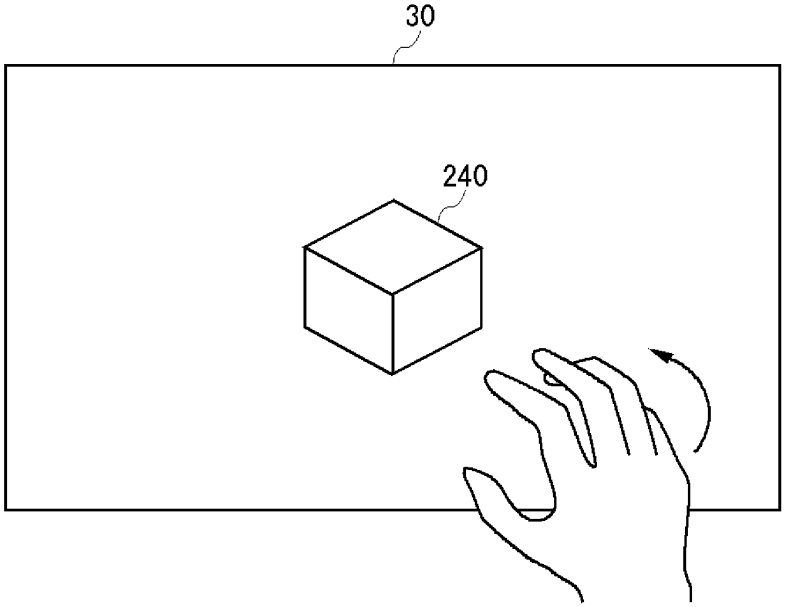


[図17]

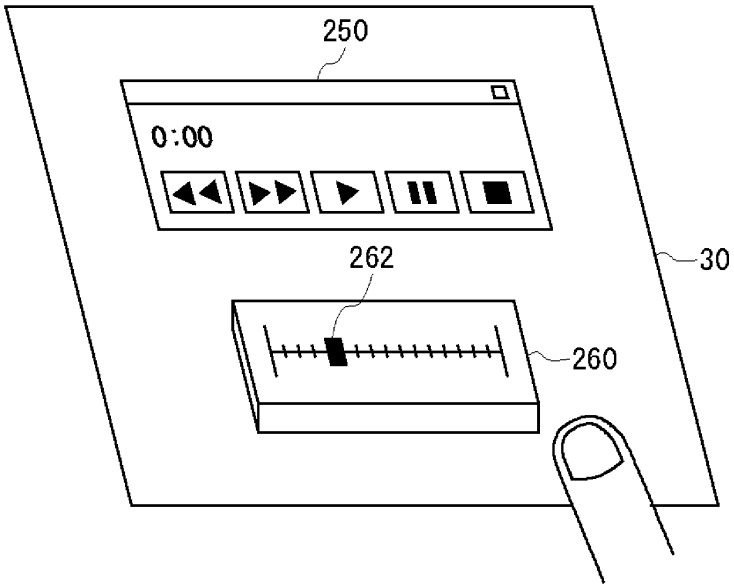


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[図18]



[図19]



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/006643

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] G06F3/033, 3/03, 3/00, G06T7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] G06F3/033-3/037, 3/03, 3/00, G06T7/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Toroku Jitsuyo Shinan Koho 1994-2004
Kokai Jitsuyo Shinan Koho 1971-2004 Jitsuyo Shinan Toroku Koho 1996-2004

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5483261 A (Taizo YASUTAKE), 09 January, 1996 (09.01.96), Column 3, line 40 to column 6, line 19; Figs. 1, 4a to 4c & JP 07-182101 A	1-2,4,14-16
X Y	JP 2000-163031 A (Seiko Epson Corp.), 16 June, 2000 (16.06.00), Par. Nos. [0047] to [0075], [0099] to [0121]; Figs. 1 to 11, 19 to 22, 28 (Family: none)	3,9-10 5-6
Y	JP 2001-216069 A (Toshiba Corp.), 10 August, 2001 (10.08.01), Par. Nos. [0040] to [0065], [0085] to [0090]; Figs. 1 to 4 (Family: none)	5-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
17 June, 2004 (17.06.04)	06 July, 2004 (06.07.04)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2004/006643

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 11-038949 A (Sony Corp.), 12 February, 1999 (12.02.99), Par. Nos. [0014] to [0051]; Figs. 1 to 6 (Family: none)	7-8,12
X	EP 0536715 A2 (FUJITSU LTD.), 14 April, 1993 (14.04.93), Column 2, line 57 to column 9, line 11; Figs. 2 to 10 & JP 05-100809 A	11
X	JP 2002-342033 A (Sony Corp.), 29 November, 2002 (29.11.02), Par. Nos. [0012] to [0074]; all drawings & WO 02/095563 A1	13

LAG-VW00000310

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Volkswagen v. Longhorn - IPR2025-00925

国際調査報告

国際出願番号　ＰＣＴ／ＪＰ２００４／００６６４３

A.　発明の属する分野の分類（国際特許分類（ＩＰＣ））

Ｉｎｔ．Ｃｌ⁷　Ｇ０６Ｆ　３／０３３，３／０３，３／００，　Ｇ０６Ｔ　７／２０

B.　調査を行った分野

調査を行った最小限資料（国際特許分類（ＩＰＣ））

Ｉｎｔ．Ｃｌ⁷　Ｇ０６Ｆ　３／０３３－３／０３７，３／０３，３／００，　Ｇ０６Ｔ　７／２０

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報　　１９２２－１９９６年
日本国公開実用新案公報　１９７１－２００４年
日本国登録実用新案公報　１９９４－２００４年
日本国実用新案登録公報　１９９６－２００４年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

C.　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
X	ＵＳ　５４８３２６１　Ａ（Taizo Yasutake） １９９６．０１．０９， 第３欄第４０行－第６欄第１９行，第１，４ａ－４ｃ図 ＆ＪＰ　０７－１８２１０１　Ａ	1-2，4， 14-16
X Y	ＪＰ　２０００－１６３０３１　Ａ（セイコーエプソン株式会社） ２０００．０６．１６， 段落【００４７】－【００７５】，【００９９】－【０１２１】， 第１－１１，１９－２２，２８図 （ファミリーなし）	3，9-10 5-6

☒ Ｃ欄の続きにも文献が列挙されている。　　☐ パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー
「Ａ」特に関連のある文献ではなく、一般的技術水準を示すもの
「Ｅ」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの
「Ｌ」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）
「Ｏ」口頭による開示、使用、展示等に言及する文献
「Ｐ」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献
「Ｔ」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの
「Ｘ」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの
「Ｙ」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの
「＆」同一パテントファミリー文献

国際調査を完了した日 １７．０６．２００４	国際調査報告の発送日　06.7.2004
国際調査機関の名称及びあて先 日本国特許庁（ＩＳＡ／ＪＰ） 郵便番号１００－８９１５ 東京都千代田区霞が関三丁目４番３号	特許庁審査官（権限のある職員）　５Ｅ　９５６５ 圓道　浩史 電話番号　０３－３５８１－１１０１　内線　３５２０

Ｃ（続き）．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
Ｙ	ＪＰ ２００１－２１６０６９ Ａ（株式会社東芝） ２００１．０８．１０， 段落【００４０】－【００６５】，【００８５】－【００９０】， 第１－４図 （ファミリーなし）	5-6
Ｘ	ＪＰ １１－０３８９４９ Ａ（ソニー株式会社） １９９９．０２．１２，段落【００１４】－【００５１】，第１－６図 （ファミリーなし）	7-8, 12
Ｘ	ＥＰ ０５３６７１５ Ａ２（FUJITSU LIMITED） １９９３．０４．１４，第２欄第５７行－第９欄第１１行， 第２－１０図 ＆ＪＰ ０５－１００８０９ Ａ	11
Ｘ	ＪＰ ２００２－３４２０３３ Ａ（ソニー株式会社） ２００２．１１．２９，段落【００１２】－【００７４】，全図 ＆ＷＯ ０２／０９５５６３ Ａ１	13

Volkswagen Exhibit 1037, Page 312 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Patent Application Fee Transmittal	
Application Number:	13448321
Filing Date:	16-Apr-2012
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Filer:	Christopher M. DiLeo/Jennifer Stedman
Attorney Docket Number:	KM2326.007D1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1200**

Volkswagen Exhibit 1037, Page 314 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt	
EFS ID:	15997673
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Christopher M. DiLeo/Adriana Perez
Filer Authorized By:	Christopher M. DiLeo
Attorney Docket Number:	KM2326.007D1
Receipt Date:	10-JUN-2013
Filing Date:	16-APR-2012
Time Stamp:	18:17:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1200
RAM confirmation Number	5829
Deposit Account	111410
Authorized User	KNOBBE MARTENS OLSON AND BEAR
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	KM2326007D1_SIGNED_RCE.pdf	697810 782e77caf415e919130bbb8c09d27912d421758e	no	3
Warnings:					
Information:					
2		KM2326-007D1-AMEND.pdf	248705 d4b0ed6cd34135522607d450868ab032001a5ca3	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	8

Warnings:					
Information:					
3		KM2326-007D1-IDS.pdf	88220 6fd266c0d6313c920cbe1c275a908a1e11b30abd	yes	3

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Transmittal Letter	1	2
	Information Disclosure Statement (IDS) Form (SB08)	3	3

Warnings:					
Information:					
4	Foreign Reference	JP-2004-246578-w-Abs.pdf	566620 14d45af282ef621bd59f1c206507756028bfd757	no	12
Warnings:					
Information:					
5	Foreign Reference	JP-2007-514242-w-Abs.pdf	3662210 b8b11346dae3433e8175072837a14802319a2f8b	no	61
Warnings:					
Information:					

6	Foreign Reference	WO-2005-003948.pdf	1336881 1adbd5a530c91656272bb5299b69090282 68eb53	no	32
Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	30076 8fc240701548c9f00f04a89ea35ebe0ac7feb 788	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	6630522	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 06/24/2013

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

NOTIFICATION DATE	DELIVERY MODE
06/24/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

jayna.cartee@knobbe.com
efiling@knobbe.com

Office Action Summary	Application No. 13/448,321	Applicant(s) BELL, MATTHEW	
	Examiner GORDON STOCK JR	Art Unit 2886	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 June 2013*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) *1,2,4-9,11-14 and 21-25* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *1,2,4-9,11-14 and 21-25* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *06 November 2012* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some * c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Interim copies:

a)☐ All b)☐ Some c)☐ None of the: Interim copies of the priority documents have been received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20130610*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after allowance or after an Office action under *Ex Parte Quayle*, 25 USPQ 74, 453 O.G. 213 (Comm'r Pat. 1935). Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on June 10, 2013 has been entered.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. **Claims 1, 2, 4-9, 11-14, 21-25** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2005/0110964)-cited by applicant** in view of **Troxell et al. (2008/0245952)-previously cited** and in view of **Franck (2006/0078015)-previously cited.**

As for **claims 1, 8, 21, 23, 24, and 25,** Bell discloses the following: a system for projecting a pattern of infrared light (Fig. 17: 1700, IR LED array: 1710), the system comprising: a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern (Fig. 17: IR LED array: 1710); a camera configured to detect the pattern of light on an object illuminated by at least a portion of the pattern of light (Fig. 17: camera); and a

computing device configured to determine a location of the object in space utilizing at least the detected pattern of light on the object by analyzing images of the pattern of light on the object (Fig. 17: 1740; paragraph 0158, paragraph 0162).

As for a cluster of lenses located in front of the light source, the cluster of lenses configured to focus and project light from the emitters in a plurality of directions, the focused and projected light forming a pattern of light**,** Bell does not explicitly state this. Though, he does suggest that there is a cluster of lenses by showing conical shapes above the illuminator (Fig. 17: 1710) as well as showing that the rays from the illuminator are in different directions (Fig. 17: patterned light as well see Fig. 16: light rays diverging from illuminator). Nevertheless, Troxell teaches that lens clusters are typically used with emitters arrays (Figs. 8-9) Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have a cluster of lenses located in front of the light source, the cluster of lenses configured to focus and project light from the emitters in a plurality of directions, the focused and projected light forming a pattern of light in order to direct and focus the light from the light source into a predetermined pattern of light.

As for a condenser lens located between the light source and the cluster of lens, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses, Bell in view of Troxell are silent. Nevertheless, Franck in a zonal lenslet array teaches having a condenser lens in front of the light source to focus the light source to the center of lenslet array (Fig. 1: laser source, master lens, lenslet array).

Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to have a condenser lens located between the light source and the cluster of lens,

wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses in order to project a pattern of lights that emerge from the light emitter array in different directions onto the screen in order to determine a location with interaction of the screen by a user.

As for **claims 2, 9, and 22,** Bell in view of Troxell and Franck discloses everything as above (see **claims 1, 8, and 21**). In addition, Bell discloses wherein the plurality of emitters infrared light emitting diodes (Fig. 17: 1710) and suggests it is configured to generate infrared light that is detectable by the camera but not by the eye of a human observer interacting with an object illuminated by at least a portion of the pattern of light (paragraph 0057).

As for **claims 4 and 11**, Bell in view of Troxell and Franck disclose everything as above (see **claims 1 and 8**). In addition, in view of Troxell and Franck it is disclosed the cluster of lenses is a Fresnel lens (Troxell: paragraph 0024 and Franck: Fig. 1: master lens concentrating to center of lenslet array).

As for **claims 5, 7, 12, and 14,** Bell in view of Troxell and Franck discloses everything as above (see **claims 1 and 8**). In addition, Bell suggests the emitters are arranged in an irregular pattern and thereby suggesting being aperiodic along at least one dimension (Bell: paragraphs 0074 and 0156)

As for **claims 6 and 13**, Bell in view of Troxell and Franck disclose everything as above (see **claims 1 and 8**). And it is suggested in view of Troxell wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses of the cluster of lenses (paragraph 0058).

Conclusion

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4. Examiner apologizes for the inconvenience, but upon further consideration of the prior art of record in view of the amendment to the claims new grounds of rejection have been made.

5. Examiner invites the applicant to initiate an interview prior to applicant formally submitting a response to this Office Action.

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by fax transmission. The fax phone number for Patent Technology Center 2800 is 571-273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock whose telephone number is (571) 272-2431. The examiner can normally be reached on Monday-Friday, 8:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tarifur R. Chowdhury, can be reached at 571-272-2287.

Information regarding the status of an application may be obtained from the Patent Application lnformation Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

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Volkswagen v. Longhorn - IPR2025-00925

applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private Pair system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Gordon J Stock/

Primary Examiner, Art Unit 2886

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Volkswagen v. Longhorn - IPR2025-00925

/GS/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L69	2102	(led near array) near5 lens	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2013/06/17 11:56
L70	5	69 near5 microlens	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2013/06/17 11:56

6/17/2013 12:02:32 PM
C:\Users\gstock\Documents\EAST\Workspaces\13448321update.wsp

Volkswagen Exhibit 1037, Page 325 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/30/2012	06/17/2013							
	1	✓	✓							
	2	✓	✓							
	3	✓	-							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	-							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	-							
	16	✓	-							
	17	✓	-							
	18	✓	-							
	19	✓	-							
	20	✓	-							
	21		✓							
	22		✓							
	23		✓							
	24		✓							
	25		✓							

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2886
(Multiple sheets used when necessary)	Examiner	Stock Jr, Gordon J.
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	6,351,222	02-26-2002	Swan et al.	
	2	8,018,579	09-13-2011	Krah	
	3	2008/0036732	02-14-2008	Wilson et al.	
	4	2012/0287044 (KM2326.008D1)	11-15-2012	Bell et al.	
	5	2012/0317511 (KM2326.015C1)	12-13-2012	Bell et al.	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T[1]
	6	JP 2004-246578	09-02-2004	Nippon Telegr & Teleph Corp. (NTT)		X-Abs
	7	JP 2007-514242	05-31-2007	Bell et al.		X-Abs
	8	WO 2005/003948	01-13-2005	Sony Computer Entertainment Inc.		X-Abs

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[1]

15559476

Examiner Signature	/Gordon Stock Jr/	Date Considered	06/17/2013

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	Art Unit
	GORDON STOCK JR	2886

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
east (uspat, usocr, uspgpub, epo, jpo,derwent, ibm_tdb, fprs) see search history printout	6/17/13	gjs

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 08/22/2013

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FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

NOTIFICATION DATE	DELIVERY MODE
08/22/2013	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

jayna.cartee@knobbe.com
efiling@knobbe.com

Applicant-Initiated Interview Summary	**Application No.** 13/448,321	**Applicant(s)** BELL, MATTHEW	
	Examiner GORDON J STOCK JR	**Art Unit** 2886	

All participants (applicant, applicant's representative, PTO personnel):

(1) *GORDON J STOCK, JR*. (3) *ATTORNEY RUSSEL JEIDE*.

(2) *ATTORNEY CHRISTOPHER DILEO*. (4)_____.

Date of Interview: *08 August 2013*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1*.

Identification of prior art discussed: *Troxell et al. (2008/0245952); Franck (2006/0078015; Magarill (7,390,097); Shimizu et al. (5,662,401); Kanamori et al. (6,559,900)*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

See Continuation Sheet.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/GORDON J STOCK JR/ Primary Examiner, Art Unit 2886	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Examiner noted that Shimizu et al. (5,662,401): Figs. 3-4 and Kanamori et al. (6,559,900): Fig. 7 demonstrated 'a cluster of lenses;' and noted that Magarill (7,390,097): Fig. 3c: 352, 368, and 370 were relevant to claim 1.

As for the attached proposed amendment to claim 1 Examiner mentioned that 'the conical nature of focused light beams' would appear to read on 'a plurality of directions' with regards to lines 6-7 of attached proposed claim 1 by referring to Franck: Figs. 1, 5-7 as well as referring to Magarill Fig. 3c in view of Figs. 3b and 5.

The following proposed amendment to claim 1 was introduced in view of 'the conical nature of focused light beams' and 'a plurality of directions:'

1. (Currently Amended) A system for projecting a pattern of light, the system comprising:
a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern;
a cluster of lenses located in front of the light source, wherein each lens of the cluster of lenses is configured to receive light from each of the plurality of emitters and the cluster of lenses is configured to concurrently focus and project light from each of the emitters in a plurality of directions, the focused and projected light forming the pattern of light; and
a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses.

The Examiner stated the proposed amendment to claim 1 above overcomes the previous art of record, but further search would be required.

Examiner stated that he would initiate an interview if necessary after a formal response to Action: 20130617 was filed to promote compact prosecution.

Knobbe Martens
INTELLECTUAL PROPERTY LAW

KNOBBE MARTENS OLSON & BEAR LLP

12790 El Camino Real, San Diego, CA 92130
T (858) 707-4000

Christopher DiLeo
Chris.DiLeo@knobbe.com

FACSIMILE TRANSMITTAL SHEET

CONFIRMATION COPY WILL FOLLOW VIA:

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- o INTERNATIONAL AIRMAIL
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TO:	Examiner Gordon Stock, Jr.		
FIRM:	USPTO		
FACSIMILE NO.:	571-273-2431		
OUR REF.:	KM2326.007D1		
YOUR REF.:	U.S. Application No.13/448,321		
FROM:	Knobbe Martens Olson & Bear		
OPERATOR:	CHRISTOPHER DILEO	NO. OF PAGES: 3	(incl. cover sheet)
DATE:	August 7, 2013	TIME: **	

IF YOU DID NOT RECEIVE ALL OF THE PAGES PLEASE CALL BACK IMMEDIATELY
OPERATOR PHONE NO.: (858) 707-4000 FACSIMILE NO.: (949) 760-9502

MESSAGE: PLEASE SEE THE ATTACHED AGENDA ALONG WITH PROPOSED AMENDMENTS FOR THE INTERVIEW ON AUGUST 8, 2013 AT 5:00 PM (EST).

13982374

INFORMAL COMMUNICATION – DO NOT ENTER
Patent Application No.: 13/448,321 Atty. Docket No.: KM2326.007D1

TO: Examiner Gordon J. Stock Jr., U.S. Patent and Trademark Office

FROM: Christopher M. DiLeo, Reg. No. 61,738

RE: Interview Agenda for Application No. 13/448,321

FOR DISCUSSION ONLY - DO NOT ENTER INTO FILE

Dear Examiner Stock,

Thank you for agreeing to conduct an interview for the above referenced application.

We are scheduled to meet on Thursday August 8, 2013 at 2:00 PM (Pacific) / 5:00 PM (Eastern). Russell Jeide (Reg. No. 54,198) and Christopher DiLeo scheduled to attend telephonically.

Unless instructed otherwise, we will call you at (571) 272-2431 at the appointed time.

Here is a brief agenda of the topics we would like to discuss:

1. Brief overview of subject matter in the application
2. Discuss the distinctions between proposed Claim 1 (below) and Bell, Troxell, and Franck as applied under 35 U.S.C. § 103

We look forward to speaking with you about this application.

Draft Amendment for Discussion Purposes

1. (Currently Amended) A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern;

a cluster of lenses located in front of the light source, the cluster of lenses configured to concurrently focus and project light from each of the emitters in a plurality of directions~~, the focused and projected light forming the pattern of light~~; and

a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses.

Christopher M. DiLeo
Associate - U.S. Reg. No. 61,738
Chris.DiLeo@knobbe.com
858-707-4000 **Main Office**

INFORMAL COMMUNICATION – DO NOT ENTER
Patent Application No.: 13/448,321 Atty. Docket No.: KM2326.007D1

858-707-4241 Direct Dial
Knobbe Martens
INTELLECTUAL PROPERTY LAW
five decades. one focus.
12790 El Camino Real
San Diego, CA 92130
www.knobbe.com/chris-dileo

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Volkswagen Exhibit 1037, Page 335 of 2532
Volkswagen v. Longhorn - IPR2025-00925

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Bell, Matthew
	Art Unit	2886
(Multiple sheets used when necessary)	Examiner	Stock, Jr., Gordon J.
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	2002/0032906 A1	03-14-2002	Grossman, Avram S.	
	2	2003/0078840 A1	04-24-2003	Strunk et al.	
	3	2004/0165006 A1	08-26-2004	Kirby et al.	
	4	2006/0294258 A1	12-28-2006	Powers-Boyle et al.	
	5	2007/0199035 A1	08-23-2007	Schwartz et al.	
	6	2007/0209009 A1	09-06-2007	Huang, Chih-Li	
	7	2009/0106785 A1	04-23-2009	Pham, Art	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T^1

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T^1

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Examiner Signature	Date Considered
***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	

T^1 - Place a check mark in this area when an English language Translation is attached.

Electronic Patent Application Fee Transmittal	
Application Number:	13448321
Filing Date:	16-Apr-2012
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Filer:	Christopher M. DiLeo/Norman Green
Attorney Docket Number:	KM2326.007D1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Volkswagen Exhibit 1037, Page 338 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt	
EFS ID:	16689565
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Christopher M. DiLeo/Norman Green
Filer Authorized By:	Christopher M. DiLeo
Attorney Docket Number:	KM2326.007D1
Receipt Date:	26-AUG-2013
Filing Date:	16-APR-2012
Time Stamp:	18:00:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	5988
Deposit Account	111410
Authorized User	KNOBBE MARTENS OLSON AND BEAR
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		IDS_KM2326_007D1_08_26_2013.pdf	91524 371cff6f103a5c6e04dcea5a7d3ca7badec84350	yes	2

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Transmittal Letter	1	1
Information Disclosure Statement (IDS) Form (SB08)	2	2

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30122 29ea9990612a595ca4fc09eaa9f1575ddcb1908e	no	2

Warnings:

Information:

Total Files Size (in bytes):	121646

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

INFORMATION DISCLOSURE STATEMENT

Inventor	:	Bell, Matthew
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr, Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Submitted herewith in the above-identified application is an Information Disclosure Statement listing references for consideration. Copies of any listed foreign and non-patent literature references are being submitted.

Pursuant to 37 C.F.R §§ 1.97(g) and (h), Applicant makes no representation that the information is considered to be material to patentability. Additionally, inclusion on this list is not an admission that any of the cited documents are prior art in this application. Further, Applicant makes no representation regarding the completeness of this list, or that better art does not exist.

This Information Disclosure Statement is being filed after receipt of a First Office Action, but before the mailing date of a Final Action and before the mailing date of a Notice of Allowance. This Statement is accompanied by the fees set forth in 37 C.F.R. § 1.17(p). The Commissioner is hereby authorized to charge any additional fees which may be required or to credit any overpayment to Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 26-AUG-2013

By: /CHRISTOPHER M. DILEO/
Christopher M. DiLeo
Registration No. 61,738
Attorney of Record
Customer No. 20,995
(858) 707-4000

16071104 // 082213

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Bell, Matthew
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr., Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

OFFICE ACTION RESPONSE

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Non-Final Office Action mailed June 24, 2013, Applicant respectfully submits the following:

Amendments to the Claims as reflected in the listing of claims which begins on page 2 of this paper;

Interview Summary beginning on page 5 of this paper; and

Remarks beginning on page 6 of this paper.

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AMENDMENTS TO THE CLAIMS

The listing of claims below replaces and supersedes all previous listing of claims in this application.

LISTING OF CLAIMS:

1. (**Currently Amended**) A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern;

a cluster of lenses located in front of the light source, wherein each lens of the cluster of lenses is configured to receive light from the plurality of emitters and the cluster of lenses is configured to concurrently focus and project light from each of the emitters in a plurality of directions~~, the focused and projected light forming the pattern of light~~; and

a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses.

2. (**Currently Amended**) The system of claim 1, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is detectable by a camera but not by an eye of a human observer interacting with an object illuminated by at least a portion of the ~~pattern of~~ light.

3. (Canceled).

4. (Previously Presented) The system of claim 1, wherein the cluster of lenses includes a Fresnel lens.

5. (Original) The system of claim 1, wherein the emitters are arranged in an irregular pattern.

6. (Original) The system of claim 1, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

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Volkswagen v. Longhorn - IPR2025-00925

7. (**Currently Amended**) The system of claim 1, wherein ~~the~~ a pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

8. (**Currently Amended**) A method comprising:

emitting a plurality of lights arranged in a pattern;

concentrating the plurality of lights towards a central location;

receiving light from the plurality of emitters at a plurality of points; and

concurrently focusing the ~~emitted~~ light from each of the plurality of lights in a plurality of directions from the central location~~, the focused light forming a pattern of light~~.

9. (**Currently Amended**) The method of claim 8, wherein said emitting includes generating infrared light that is not detectable by an eye of a human observer interacting with an object illuminated by at least a portion of the ~~pattern of~~ light.

10. (Canceled).

11. (Previously Presented) The method of claim 8, wherein said concentrating comprises concentrating the plurality of lights towards a center of a cluster of lenses including a Fresnel lens.

12. (**Currently Amended**) The method of claim 8, wherein the focused ~~pattern of~~ light comprises an irregular pattern.

13. (**Currently Amended**) The method of claim 8, wherein the focused ~~pattern of~~ light includes a first pattern of light overlapping with a second pattern of light.

14. (**Currently Amended**) The method of claim 8, wherein the focused ~~pattern of~~ light includes a pattern which is aperiodic along at least one dimension.

15–20. (Canceled).

21. (**Currently Amended**) A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light;

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a cluster of lenses, each lens included in the cluster of lenses being configured to receive the emitted light from each of the plurality of emitters; and

a condenser lens located between said light source and said cluster of lenses, the condenser lens concentrating light from each of the plurality of emitters towards the center of the cluster of lenses;

~~wherein the light source and cluster of lenses are configured to generate a pattern of light~~.

22. (**Currently Amended**) The system of claim 21, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is not detectable by an eye of a human observer ~~interacting with the object~~.

23. (**Currently Amended**) The system of claim 21, further comprising a computing device configured to analyze images of ~~the~~ a pattern formed by ~~of~~ light projected from each of the emitters on an object to determine a location of the object in space based on at least the pattern of light on the object.

24. (**Currently Amended**) The system of claim 1, further comprising:

a camera configured to detect ~~the~~ a pattern of light on an object illuminated by at least a portion of the pattern of light; and

a computing device configured to determine a location of the object in space based on at least the detected pattern of light on the object.

25. (**Currently Amended**) The method of claim 8, further comprising:

detecting ~~the~~ a pattern of light on an object illuminated by at least a portion of the pattern of light; and

determining a location of the object in space based on at least the detected pattern of light on the object

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INTERVIEW SUMMARY

A telephonic interview was conducted on August 8, 2013 and attended by Examiner Gordon J. Stock Jr. and Applicants' representatives Russell Jeide and Christopher DiLeo.

Proposed amendments to Claim1 were discussed in view of the Bell, Troxell, and Franck references as applied under 35 U.S.C. § 103. It was agreed that the proposed amendments appear to overcome the 103 rejections over the art of record, but the Examiner would need to perform further searching.

Applicant requests that this paper constitute the Interview Summary. If the Examiner notices any deficiencies in this regard, the Examiner is encouraged to contact the undersigned representative to correct such deficiencies.

LAG-VW00000346

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REMARKS

In the Non-Final Office Action dated June 24, 2013, the Examiner rejected Claims 1, 2, 4–9, 11–14, 21–25.

By this paper, Claims 1, 2, 7–9, 12–14, and 21–25 are amended. The amendments are supported at least by the previously pending claims. No new matter is added. Applicant requests reconsideration of the claims in light of the amendments above and remarks that follow.

Discussion of Claim Rejections – 35 U.S.C. § 103

Claims 1, 2, 4–9, 11–14, and 21–25 stand rejected under 35 U.S.C. § 103 over U.S. Patent Pub. No. 2005/0110964 to Bell *et al.* (hereinafter Bell) in view of U.S. Patent Pub. No. 2008/0245952 to Troxell *et al.* (hereinafter Troxell) and in view of U.S. Patent Pub. No. 2006/0078015 to Franck (hereinafter Franck).

With regards to the art rejections, during the interview, proposed amendments were discussed to distinguish from the applied art. The Examiner indicated that the proposed amendments to Claim 1 distinguish over the art of record such that an updated search would be required. Thus, the Examiner requested that the claim amendments be filed in a formal amendment. In this regard, by this paper Applicant has amended independent Claim 1 to incorporate similar features to those discussed in the interview, as well as other minor amendments. Claims 8 and 21 are amended to recite certain features similar to those in Claim 1 and, thus, are believed to be distinguishable over the art of record at least for the reasons discussed with reference to Claim 1, where applicable.

Discussion of Dependent Claims

The remaining claims each depend directly or indirectly from one of the independent claims discussed above. Applicant respectfully submits that these dependent claims are in condition for allowance for at least the same reasons discussed with respect to the independent claims, and for their own patentable features.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

Conclusion

In view of the forgoing, Applicant respectfully submits that the Claims, as presented herein, define subject matter that is patentable over the references of record. Accordingly, Applicant respectfully submits that the indicated claims are in condition for immediate allowance and such prompt allowance of the same is respectfully requested. If the Examiner finds any remaining impediment to the prompt allowance of these claims that could be clarified with a telephone conference, the Examiner is respectfully requested to initiate the same with the undersigned.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: September 23, 2013

By: _____

Christopher M. DiLeo
Registration No. 61,738
Attorney of Record
Customer No. 20,995
(858) 707-4000

16078099 // 082313

Volkswagen Exhibit 1037, Page 348 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt

EFS ID:	16930007
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Christopher M. DiLeo/Gustavo Lopez
Filer Authorized By:	Christopher M. DiLeo
Attorney Docket Number:	KM2326.007D1
Receipt Date:	23-SEP-2013
Filing Date:	16-APR-2012
Time Stamp:	19:07:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		KM2326007D1.pdf	77322 aea0743e367abee97feb5cc4ade9cd5eccabc911	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	4
	Applicant summary of interview with examiner	5	5
	Applicant Arguments/Remarks Made in an Amendment	6	7
Warnings:			
Information:			
	Total Files Size (in bytes):	77322	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/448,321	Filing Date 04/16/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT **09/23/2013**

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0	X $80 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	0

AMENDMENT

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))						
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
					TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/SUSAN FORD/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 01/17/2014

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

NOTIFICATION DATE	DELIVERY MODE
01/17/2014	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

jayna.cartee@knobbe.com
efiling@knobbe.com

Office Action Summary	Application No. 13/448,321	Applicant(s) BELL, MATTHEW	
	Examiner GORDON J. STOCK JR	Art Unit 2886	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *9/23/13*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *1,2,4-9,11-14 and 21-25* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☒ Claim(s) *1,2,4-7 and 24* is/are allowed.

7)☒ Claim(s) *8,9,11-14 and 25* is/are rejected.

8)☒ Claim(s) *21-23* is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *11/6/12* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *20130826*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

2. The Amendment received on September 23, 2013 has been entered into the record.

Claim Objections

3. **Claim 21** is objected to for the following: it appears on line 8 that 'the center' should read –a center-. Correction is required. **Claims 22-23** are objected to for their dependence from **claim 21.**

4. **Claim 25** is objected to for the following: it appears that on line 3 'the pattern of light' should read -a pattern of light-. In addition, **claim 25** is missing a period following 'object' on line 5. Corrections are required.

Claim Rejections - 35 USC § 112

5. The following is a quotation of 35 U.S.C. 112(b):
(b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. **Claims 8, 9, 11-13, and 25** are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 8 recites the limitation "'the plurality of emitters" in line 4. There is insufficient antecedent basis for this limitation in the claim. **Claims 9, 11-13, and 25** are rejected due to their dependency from **claim 8.**

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Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. **Claims 8, 9, 11-13, and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bell et al. (2005/0110964)-cited by applicant** in view of **Troxell et al. (2008/0245952)-previously cited** and in view of **Franck (2006/0078015)-previously cited.**

As for **claim 8 and 25,** Bell discloses the following: a system for projecting a pattern of infrared light which at least suggests an apparatus for the practice of a method of projecting a light pattern (Fig. 17: 1700, IR LED array: 1710), the system comprising: a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern thereby emitting a plurality of lights arranged in a pattern (Fig. 17: IR LED array: 1710); a camera configured to detect a pattern of light on an object illuminated by at least a portion of a pattern of light thereby detecting a pattern of light on an object illuminated by at least a portion of a pattern of light (Fig. 17: camera); and a computing device configured to determine a location of the object in space utilizing at least the detected pattern of light on the object by analyzing images of the pattern of light on the object thereby determining a location of the object in space based on at least the detected pattern of light on the object (Fig. 17: 1740; paragraph 0158, paragraph 0162).

As for receiving light from the plurality of emitters at a plurality of points and concurrently focusing the light from each of the plurality of lights in a plurality of directions. Bell does not explicitly state this. Though, he does suggest that there is a cluster of lenses by showing conical shapes above the illuminator (Fig. 17: 1710) as well as showing that the rays from the illuminator are in different directions (Fig. 17: patterned light as well see Fig. 16: light rays diverging from illuminator). Nevertheless, Troxell teaches that lens clusters are typically used with emitters arrays and through the conical nature of light beams as well as due to the diffractive nature of Fresnel lenses suggests a plurality of points as well as a plurality of directions focused from the lens cluster (Figs. 8-9) Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to receive light from the plurality of emitters at a plurality of points and concurrently focusing the light from each of the plurality of lights in a plurality of directions as by virtue of lens cluster in order to direct and focus the light from the light source into a predetermined pattern of light for identification by a camera for object positional determination.

As for a 'concentrating the plurality of lights towards a central location such as to the lens cluster central location,' Bell in view of Troxell are silent. Nevertheless, Franck in a zonal lenslet array teaches having a condenser lens in front of the light source to focus the light source to the center of lenslet array (Fig. 1: laser source, master lens, lenslet array).

Therefore, it would be obvious to one of ordinary skill in the art at the time the invention was made to concentrate the plurality of lights towards a central location such as to the lens cluster central location such as by a condenser lens located between the light source and the cluster of lens in order to project a pattern of lights that emerge from the light emitter array in

different directions onto the screen in order to determine a location with interaction of the screen by a user.

As for 'a plurality of directions from the central location,' this is met by Bell in view of Troxell and in view of Franck with regards to 'concentrating the plurality of lights towards a central location such as to the lens cluster central location' stated above.

As for **claim 9,** Bell in view of Troxell and Franck discloses everything as above (see **claim 8**). In addition, Bell discloses wherein the plurality of emitters infrared light emitting diodes (Fig. 17: 1710) and suggests it is configured to generate infrared light that is detectable by a camera but not by the eye of a human observer interacting with an object illuminated by at least a portion of the light (paragraph 0057).

As for **claim 11**, Bell in view of Troxell and Franck disclose everything as above (see **claim 8**). In addition, in view of Troxell and Franck it is disclosed the cluster of lenses is a Fresnel lens (Troxell: paragraph 0024 and Franck: Fig. 1: master lens concentrating to center of lenslet array).

As for **claim 12 and 14,** Bell in view of Troxell and Franck discloses everything as above (see **claim 8**). In addition, Bell suggests the emitters are arranged in an irregular pattern and thereby suggesting being aperiodic along at least one dimension and thereby the focused light comprising an irregular pattern/a pattern which is aperiodic along at least one dimension (Bell: paragraphs 0074 and 0156)

As for **claim 13**, Bell in view of Troxell and Franck disclose everything as above (see **claim 8**). And it is suggested in view of Troxell wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by

another of the lenses of the cluster of lenses thereby the focused light includes a first pattern of light overlapping with a second pattern (paragraph 0058).

Allowable Subject Matter

9. **Claims 1, 2, 4-7, and 24** are allowed. And **claims 21-23** would be allowed if rewritten to overcome the objections above.

As to **claim 1**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a system for projecting a pattern of light 'a cluster of lenses located in front of the light source, wherein each lens of the cluster of lenses is configured to receive light from the plurality of emitters and the cluster of lenses is configured to concurrently focus and project light from each of the emitters in a plurality of directions,' in combination with the rest of the limitations of **claim 1. Claims 2, 4-7, and 24** are allowable by virtue of their dependency from **claim 1.**

As to **claim 21**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a system for projecting a pattern of light 'a cluster of lenses, each lens included in the cluster of lenses being configured to receive the emitted light from each of the plurality of emitters' in combination with the rest of the limitations of **claim 21. Claims 22 and 23** are allowable by virtue of their dependency from **claim 21.**

Response to Arguments

10. As for applicant's remarks filed on September 23, 2012 page 5 Examiner agrees that the amendment to **claims 1 and 21** overcome the prior art of record. However, Examiner disagrees that the amendment to **claim 8** overcomes the prior art of record primarily due to **claim 8's** construction is not the same in scope as **claims 1 and 21**. Though **claims 1 and 21** relate to an

apparatus for the practice of **claim 8**, **claim 8** appears distinct from **claims 1 and 21** due to it being able to be performed by a materially different apparatus (by virtue of **claim 8** being rejected and **claims 1 and 21** not being rejected).

Examiner welcomes an interview in response to the receipt of this office action.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by fax transmission. The fax phone number for Patent Technology Center 2800 is 571-273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock, Jr. whose telephone number is (571) 272-2431. The examiner can normally be reached on Monday-Friday, 8:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tarifur R. Chowdhury, can be reached at 571-272-2287.

Information regarding the status of an application may be obtained from the Patent Application lnformation Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private Pair system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/GORDON J STOCK JR/

Primary Examiner, Art Unit 2886

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PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Bell, Matthew
	Art Unit	2886
(Multiple sheets used when necessary)	Examiner	Stock, Jr., Gordon J.
SHEET 1 OF 1	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS					
Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	1	2002/0032906 A1	03-14-2002	Grossman, Avram S.	
	2	2003/0078840 A1	04-24-2003	Strunk et al.	
	3	2004/0165006 A1	08-26-2004	Kirby et al.	
	4	2006/0294258 A1	12-28-2006	Powers-Boyle et al.	
	5	2007/0199035 A1	08-23-2007	Schwartz et al.	
	6	2007/0209009 A1	09-06-2007	Huang, Chih-Li	
	7	2009/0106785 A1	04-23-2009	Pham, Art	

FOREIGN PATENT DOCUMENTS						
Examiner Initials	Cite No.	Foreign Patent Document *Country Code-Number-Kind Code* Example: JP 1234567 A1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear	T^1

NON PATENT LITERATURE DOCUMENTS			
Examiner Initials	Cite No.	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	T^1

16070680
082213

Examiner Signature	/Gordon Stock Jr/	Date Considered	01/12/2014

*Examiner: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T^1 - Place a check mark in this area when an English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	Art Unit
	GORDON STOCK JR	2886

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	07/30/2012	06/17/2013	01/13/2014						
	1	✓	✓	=						
	2	✓	✓	=						
	3	✓	-	O						
	4	✓	✓	=						
	5	✓	✓	=						
	6	✓	✓	=						
	7	✓	✓	=						
	8	✓	✓	✓						
	9	✓	✓	✓						
	10	✓	-	-						
	11	✓	✓	✓						
	12	✓	✓	✓						
	13	✓	✓	✓						
	14	✓	✓	✓						
	15	✓	-	-						
	16	✓	-	-						
	17	✓	-	-						
	18	✓	-	-						
	19	✓	-	-						
	20	✓	-	-						
	21		✓	O						
	22		✓	O						
	23		✓	O						
	24		✓	=						
	25		✓	✓						

LAG-VW00000362

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	Art Unit
	GORDON STOCK JR	2886

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
east (uspat, usocr, uspgpub, epo, jpo,derwent, ibm_tdb, fprs) see search history printout	1/13/14	gjs
356/600-624,3-22 (text only) see search history printout	1/13/14	gjs
359/454,455,721,737,796,797 (text only) see search history printout	1/13/14	gjs
362/221,235,236,244,242,299,308,309,326-340 (text only) see search history printout	1/13/14	gjs
382/151,159 (text only) see search history printout	1/13/14	gjs
348/135-142,169-172 (text only) see search history printout	1/13/14	gjs
353/79-81 (text only) see search history printout	1/13/14	gjs
250/203.1-203.7,202,341.7 (text only) see search history printout	1/13/14	gjs

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

/GS/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S252	1758	(lenslet cluster microlens) near5 (lens near5 (condens$5 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:17
S253	67	S252 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:19
S254	7791	(lenslet cluster microlens lenticular) same (lens near5 (condens$5 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:20
S255	322	S254 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:20
S256	30317	(lenslet cluster microlens lenticular (lens near4 (array fragment$3 segment$5))) same (lens near5 (condens$5 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:23
S257	3347	S256 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:23
S258	774	S256 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:23
S259	103	S258 same project$3	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:25

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/GS/

S261	14673	(356/600-624,3-22).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 00:49
S262	1840	(359/454,455,721,737,796,797).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 00:49
S263	11661	(362/221,235,236,244,242,299,308,309,326-340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 00:49
S264	2390	(382/151,159).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 00:50
S265	3659	(348/135,142,169-172).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 00:50
S266	1460	(353/79-81).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 00:50
S267	2880	(250/203.1-203.7,202,341.7).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 00:50
S268	139	S257 and (S261 S262 S263 S264 S265 S266 S267)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 00:51
S269	30317	(lenslet cluster microlens lenticular (lens near4 (array fragment$3 segment$5))) same (lens near5 (condens$5 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 08:53
S270	3347	S269 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 08:53
S271	532	S270 same project$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 08:53
S272	146	S271 and (pattern$3 near4 (light$3 illuminat$3 beam ray spot))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 08:54
S275	14673	(356/600-624,3-22).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 09:18

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S276	1840	(359/454,455,721,737,796,797).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 09:18
S277	11661	(362/221,235,236,244,242,299,308,309,326-340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 09:18
S278	2390	(382/151,159).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 09:18
S279	3659	(348/135,142,169-172).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 09:18
S280	1460	(353/79-81).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 09:18
S281	2880	(250/203.1-203.7,202,341.7).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/01/13 09:18
S282	139	S270 and (S275 S276 S277 S278 S279 S280 S281)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 09:18
S283	119	S282 not S272	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/01/13 09:18

1/13/2014 10:15:44 AM
C:\Users\gstock\Documents\EAST\Workspaces\13448321update.wsp

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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 03/10/2014

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

NOTIFICATION DATE	DELIVERY MODE
03/10/2014	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

jayna.cartee@knobbe.com
efiling@knobbe.com

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/448,321	BELL, MATTHEW	
	Examiner	Art Unit	
	GORDON J. STOCK JR	2886	

All participants (applicant, applicant's representative, PTO personnel):

(1) *GORDON J. STOCK JR*. (3)_____.

(2) *ATTORNEY CHRISTOPHER DILEO*. (4)_____.

Date of Interview: *28 February 2014*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *1 and 8*.

Identification of prior art discussed: *(in brief) Bell et al. (2005/0110964); Troxell et al. (2008/0245952); Franck (2006/0078015)*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Examiner suggested filing the formal response to the final rejection under the After Final Consideration Pilot at least in view of the proposed amendment to claim 8 because claim 8 at least as drafted would require further search and consideration. The Examiner welcomed an interview after the filing of a formal response to the final rejection to promote compact prosecution. The prior art was mentioned in passing by the Examiner with regards to the proposed draft claim 8 (see attached) by stating that it appeared to not overcome the three references. The Examiner suggested to cancel 'at least a portion of' on line 5 to prevent possible issues under 35 USC 112(a)-first paragraph. The Examiner suggested drafting claim 8 in view of claim 1 in a one-to-one relationship so that the inventions of claims 8 and 1 are indistinct as method and apparatus for its practice. The Examiner stated that further search would be required of claim 8 by virtue of 'a light source' of line 2 not precluding a lighting device with a dispersive element such as a prism to produce 'a plurality of lights arranged in pattern' such as a rainbow pattern or a lighting device with a slit/pinhole array. As well Examiner mentioned that the concentrating step with regards to a further search may include refractive (dioptric) elements, a combination of refractive and reflective (catadioptric) elements, and reflective (catoptric) elements. .

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/GORDON J STOCK JR/ Primary Examiner, Art Unit 2886	

U.S. Patent and Trademark Office

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

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INFORMAL COMMUNICATION – DO NOT ENTER

Patent Application No.: 13/448,321 Atty. Docket No.: KM2326.007D1

TO: Examiner Gordon J. Stock Jr., U.S. Patent and Trademark Office

FROM: Christopher M. DiLeo, Reg. No. 61,738

RE: Interview Agenda for Application No. 13/448,321

FOR DISCUSSION ONLY - DO NOT ENTER INTO FILE

Dear Examiner Stock,

Thank you for agreeing to conduct an interview for the above referenced application.

We are scheduled to meet via telephone on Friday February 28, 2014 at 1:30 PM (Pacific) / 4:30 PM (Eastern). Unless instructed otherwise, we will call you at (571) 272-2431 at the appointed time.

Here is a brief agenda of the topics we would like to discuss:

1. Brief overview of subject matter in the application
2. Discuss the distinctions between proposed Claim 8 (below) and Bell, Troxell, and Franck as applied under 35 U.S.C. § 103
3. Address outstanding 35 U.S.C. § 112 rejection of Claim 8 in view of the proposed amendment below

We look forward to speaking with you about this application.

Draft Amendment for Discussion Purposes

8. A method comprising:

emitting, from a light source, a plurality of lights arranged in a pattern;

concentrating the plurality of lights towards a central location of a cluster of lenses;

receiving at least a portion of the concentrated light ~~from the plurality of emitters~~ at a plurality of points within the cluster of lenses; and

concurrently focusing, from the cluster of lenses, the received and concentrated light ~~from each of the plurality of lights~~ in a plurality of directions ~~from the central location~~.

Christopher M. DiLeo
Associate - U.S. Reg. No. 61,738
Chris.DiLeo@knobbe.com
858-707-4000 Main Office
858-707-4241 Direct Dial

17362601
022714

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Bell, Matthew
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr., Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

RESPONSE UNDER AFTER FINAL CONSIDERATION PILOT 2.0

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Final Office Action mailed January 17, 2014, Applicant respectfully submits the following:

Amendments to the Claims as reflected in the listing of claims which begins on page 2 of this paper;

Interview Summary beginning on page 5 of this paper; and

Remarks beginning on page 6 of this paper.

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AMENDMENTS TO THE CLAIMS

The listing of claims below replaces and supersedes all previous listing of claims in this application.

LISTING OF CLAIMS:

1. (Previously Presented) A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light, the plurality of emitters arranged in a pattern;

a cluster of lenses located in front of the light source, wherein each lens of the cluster of lenses is configured to receive light from the plurality of emitters and the cluster of lenses is configured to concurrently focus and project light from each of the emitters in a plurality of directions; and

a condenser lens located between the light source and the cluster of lenses, wherein the condenser lens is configured to concentrate light from each of the plurality of emitters towards a center of the cluster of lenses.

2. (Previously Presented) The system of claim 1, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is detectable by a camera but not by an eye of a human observer interacting with an object illuminated by at least a portion of the light.

3. (Canceled).

4. (Previously Presented) The system of claim 1, wherein the cluster of lenses includes a Fresnel lens.

5. (Original) The system of claim 1, wherein the emitters are arranged in an irregular pattern.

6. (Original) The system of claim 1, wherein a first pattern of light projected by one of the lenses from the cluster of lenses overlaps with a second pattern of light projected by another of the lenses from the cluster of lenses.

7. (Previously Presented) The system of claim 1, wherein a pattern of light projected by the cluster of lenses is aperiodic along at least one dimension.

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8. (**Currently Amended**) A method comprising:

emitting, from a plurality of emitters, a plurality of lights arranged in a pattern;

concentrating, via a condenser lens, the plurality of lights towards a central location of a cluster of lenses;

receiving the concentrated light ~~from the plurality of emitters~~ at a plurality of points within the cluster of lenses; and

concurrently focusing, from the cluster of lenses, the received and concentrated light from ~~each of~~ the plurality of emitters ~~lights~~ in a plurality of directions ~~from the central location~~.

9. (Previously Presented) The method of claim 8, wherein said emitting includes generating infrared light that is not detectable by an eye of a human observer interacting with an object illuminated by at least a portion of the light.

10. (Canceled).

11. (Previously Presented) The method of claim 8, wherein said concentrating comprises concentrating the plurality of lights towards a center of a cluster of lenses including a Fresnel lens.

12. (Previously Presented) The method of claim 8, wherein the focused light comprises an irregular pattern.

13. (Previously Presented) The method of claim 8, wherein the focused light includes a first pattern of light overlapping with a second pattern of light.

14. (Previously Presented) The method of claim 8, wherein the focused light includes a pattern which is aperiodic along at least one dimension.

15–20. (Canceled).

21. (**Currently Amended**) A system for projecting a pattern of light, the system comprising:

a light source including a plurality of emitters configured to emit light;

a cluster of lenses, each lens included in the cluster of lenses being configured to receive the emitted light from each of the plurality of emitters; and

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a condenser lens located between said light source and said cluster of lenses, the condenser lens concentrating light from each of the plurality of emitters towards [[the]] a center of the cluster of lenses.

22. (Previously Presented) The system of claim 21, wherein the plurality of emitters includes light emitting diodes configured to generate infrared light that is not detectable by an eye of a human observer.

23. (Previously Presented) The system of claim 21, further comprising a computing device configured to analyze images of a pattern formed by light projected from each of the emitters on an object to determine a location of the object in space based on at least the pattern of light on the object.

24. (Previously Presented) The system of claim 1, further comprising:

a camera configured to detect a pattern of light on an object illuminated by at least a portion of the pattern of light; and

a computing device configured to determine a location of the object in space based on at least the detected pattern of light on the object.

25. (**Currently Amended**) The method of claim 8, further comprising:

detecting a pattern of light on an object illuminated by at least a portion of ~~the~~ a pattern of light; and

determining a location of the object in space based on at least the detected pattern of light on the object.

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INTERVIEW SUMMARY

A telephonic interview was conducted on February 28, 2014 and attended by Examiner Gordon J. Stock Jr. and Applicants' representative Christopher DiLeo.

Proposed amendments to Claim 8 were discussed in view of the allowed subject matter indicated in the Office Action and in further view of the Bell, Troxell, and Franck references as applied under 35 U.S.C. § 103. It was agreed that the proposed amendments appear to overcome the 103 rejections over the art of record, but the Examiner would need to perform further searching.

Applicant requests that this paper constitute the Interview Summary. If the Examiner notices any deficiencies in this regard, the Examiner is encouraged to contact the undersigned representative to correct such deficiencies.

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REMARKS

In the Final Office Action dated January 17, 2014, the Examiner allowed claims 1, 2, 4–7 and 24, rejected Claims 8, 9, 11–14, and 25, and objected to Claims 21–23.

Applicant thanks the Examiner for the courtesy extended during the interview and for the identification in the Office Action of the allowable subject matter for the present application.

By this paper, Claims 8, 21, and 25 are amended. The amendments are supported at least by the previously pending claims. No new matter is added. Applicant requests reconsideration of the claims in light of the amendments above and remarks that follow.

Discussion of Claim Objections

Claim 21 is objected to for reciting "the center" without previous introduction of this feature. Claim 21 is amended to recite "a center." Claims 22 and 23 are objected to by virtue of depending from Claim 21.

Claim 25 is objected to for reciting "the pattern of light" without previous introduction of this feature. Claim 25 is amended to recite "a pattern of light."

Upon entry of the amendments, Applicant respectfully requests withdrawal of the objections of Claims 21–23 and 25.

Discussion of Claim Rejections – 35 U.S.C. § 112

Claims 8, 9, 11–13, and 25 stand rejected under 35 U.S.C. § 112(b), second paragraph for lacking antecedent basis for the recitation of "the plurality of emitters" in Claim 8. Applicant submits an amendment to Claim 8 to strike this feature and thus mooting this rejection at this time. Upon entry of the amendments, Applicant respectfully requests withdrawal of these rejections under 35 U.S.C. § 112.

Discussion of Claim Rejections – 35 U.S.C. § 103

Claims 8, 9, 11–13, and 25 stand rejected under 35 U.S.C. § 103 over U.S. Patent Pub. No. 2005/0110964 to Bell *et al.* (hereinafter Bell) in view of U.S. Patent

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Pub. No. 2008/0245952 to Troxell *et al.* (hereinafter Troxell) and in view of U.S. Patent Pub. No. 2006/0078015 to Franck (hereinafter Franck).

With regards to the art rejections, during the interview, proposed amendments were discussed to distinguish from the applied art. The Examiner indicated that the proposed amendments to Claim 8 would likely distinguish Claim 8 over the art of record but an updated search would be required. Thus, the Examiner requested that the claim amendments be filed in as part of the After Final Consideration 2.0 Pilot program.

In this regard, by this paper, Applicant has amended independent Claim 8 to incorporate similar features to those discussed in the interview, as well as other minor amendments.

Discussion of Dependent Claims

The remaining rejected claims each depend directly or indirectly from one of the independent claims discussed above. Applicant respectfully submits that these dependent claims are in condition for allowance for at least the same reasons discussed with respect to the independent claims, and for their own patentable features.

No Disclaimers or Disavowals

Although the present communication may include alterations to the application or claims, or characterizations of claim scope or referenced art, Applicant is not conceding in this application that previously pending claims are not patentable over the cited references. Rather, any alterations or characterizations are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the present disclosure, including subject matter found to be specifically disclaimed herein or by any prior prosecution. Accordingly, reviewers of this or any parent, child or related prosecution history shall not reasonably infer that Applicant has made any disclaimers or disavowals of any subject matter supported by the present application.

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Conclusion

In view of the forgoing, Applicant respectfully submits that the Claims, as presented herein, define subject matter that is patentable over the references of record. Accordingly, Applicant respectfully submits that the indicated claims are in condition for immediate allowance and such prompt allowance of the same is respectfully requested. If the Examiner finds any remaining impediment to the prompt allowance of these claims that could be clarified with a telephone conference, the Examiner is respectfully requested to initiate the same with the undersigned.

Please charge any additional fees, including any fees for additional extension of time, or credit overpayment to Deposit Account No. 11-1410.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: March 14, 2014

By: /CHRISTOPHER M. DILEO/
Christopher M. DiLeo
Registration No. 61,738
Attorney of Record
Customer No. 20,995
(858) 707-4000

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LAG-VW00000379

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Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

Practitioner Docket No.:	Application No.:	Filing Date:
KM2326.007D1	13/448,321	APRIL 16, 2012
First Named Inventor:	**Title:**	
BELL	LENS SYSTEM	

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
   - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
   - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
     - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
     - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
       - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
       - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

Signature	Date
/CHRISTOPHER M. DILEO/	MARCH 14, 2014
Name (Print/Typed) CHRISTOPHER M. DILEO	**Practitioner Registration No.** 61,738

Note: *This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.*

[✓] * Total of 1 forms are submitted.

Privacy Act Statement

The **Privacy Act of 1974** (**P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	18477538
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Christopher M. DiLeo/ThuyQuyen Nguyen
Filer Authorized By:	Christopher M. DiLeo
Attorney Docket Number:	KM2326.007D1
Receipt Date:	14-MAR-2014
Filing Date:	16-APR-2012
Time Stamp:	17:25:13
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		KM2326007D1_response.pdf	44229 0a8bf1383971b62ccab073c39eb1236b297b2521	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Claims	2	4
	Applicant summary of interview with examiner	5	5
	Applicant Arguments/Remarks Made in an Amendment	6	8

Warnings:					
Information:					
2	After Final Consideration Program Request	afcr_1.pdf	214903 a3862d47296ed7c69a2237ff9b538a6a0adfeb60	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	259132		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/448,321	Filing Date 04/16/2012	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	03/14/2014	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 17	Minus	** 20	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/LAJUAN HICKSON/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

20995 7590 04/16/2014

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER
STOCK JR, GORDON J

ART UNIT	PAPER NUMBER
2886	

DATE MAILED: 04/16/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

TITLE OF INVENTION: LENS SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	07/16/2014

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 02/11)

LAG-VW00000385

Volkswagen Exhibit 1037, Page 385 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

20995 7590 04/16/2014
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

TITLE OF INVENTION: LENS SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	07/16/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
STOCK JR, GORDON J	2886	356-614000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

LAG-VW00000386

Volkswagen Exhibit 1037, Page 386 of 2532
Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

20995 7590 04/16/2014

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

EXAMINER	
STOCK JR, GORDON J	

ART UNIT	PAPER NUMBER
2886	

DATE MAILED: 04/16/2014

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 5 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 5 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

LAG-VW00000387

Volkswagen Exhibit 1037, Page 387 of 2532
Volkswagen v. Longhorn - IPR2025-00925

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
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9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Examiner-Initiated Interview Summary	**Application No.** 13/448,321	**Applicant(s)** BELL, MATTHEW	
	Examiner GORDON J. STOCK JR	**Art Unit** 2886	

All participants (applicant, applicant's representative, PTO personnel):

(1) *GORDON J. STOCK JR*. (3)_____.

(2) *ATTORNEY CHRISTOPHER DILEO*. (4)_____.

Date of Interview: *03 April 2014*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *8*.

Identification of prior art discussed: *Franck (20060078015)*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Examiner stated that the amendment to claim 8 received on March 14, 2014 did not appear to overcome the prior art of record. Examiner pointed to Fig. 9 showing a condenser lens focusing light onto a lens cluster. Examiner suggested drafting claim 8 similarly in scope to claim 1. It was discussed to have the last 3 lines of claim 8 read -concurrently focusing, from each lens of the cluster of lenses, the received and concentrated light from each of the plurality of emitters in a plurality of directions-. Attorney would have to consult applicants for approval of proposed amendment to claim 8..

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☐ Attachment

/GORDON J STOCK JR/ Primary Examiner, Art Unit 2886	

Notice of Allowability	Application No. 13/448,321	Applicant(s) BELL, MATTHEW	
	Examiner GORDON J. STOCK JR	Art Unit 2886	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *amendment received on March 14, 2014*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1,2,4-9,11-14 and 21-25*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☐ All b) ☐ Some *c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20140409* .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

DETAILED ACTION

1. The present application is being examined under the pre-AIA first to invent provisions.

2. The Amendment received on March 14, 2014 has been entered into the record.

EXAMINER'S AMENDMENT

3. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given by telephone by Attorney Christopher DiLeo on April 8, 2014. **Claim 8** will be amended. Please refer to attached PTOL-413B.

The Application has been amended as follows:

Claim 8 lines 8-10 is amended from 'concurrently focusing, from the cluster of lenses, the received and concentrated light from the plurality of emitters in a plurality of directions.' to read -concurrently focusing, from each lens of the cluster of lenses, the received and concentrated light from each of the plurality of emitters in a plurality of directions.-

Allowable Subject Matter

4. **Claims 1, 2, 4-9, 11-14, and 21-25** are allowed.

The following is an examiner's statement of reasons for allowance:

As to **claim 1**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a system for projecting a pattern of light 'a cluster of lenses located in front of the light source, wherein each lens of the cluster of lenses is configured to receive light from the plurality of emitters and the cluster of lenses is configured to concurrently focus and project light from each of the emitters in a plurality of directions,' in combination with the rest of the limitations of **claim 1. Claims 2, 4-7, and 24** are allowed by virtue of their dependency from **claim 1.**

As to **claim 8**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a method 'concurrently focusing, from each lens of the cluster of lenses, the received and concentrated light from each of the plurality of emitters in a plurality of directions,' in combination with the rest of the limitations of **claim 8. Claims 9, 11-14, and 25** are allowed by virtue of their dependency from **claim 8.**

As to **claim 21**, the prior art of record, taken alone or in combination, fails to disclose or render obvious in a system for projecting a pattern of light 'a cluster of lenses, each lens included in the cluster of lenses being configured to receive the emitted light from each of the plurality of emitters' in combination with the rest of the limitations of **claim 21. Claims 22 and 23** are allowed by virtue of their dependency from **claim 21.**

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

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Volkswagen v. Longhorn - IPR2025-00925

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: please refer to attached PTO-892.

Fax/Telephone Numbers

If the applicant wishes to send a fax dealing with either a proposed amendment or a discussion with a phone interview, then the fax should:

1) Contain either a statement "DRAFT" or "PROPOSED AMENDMENT" on the fax cover sheet; and

2) Should be unsigned by the attorney or agent.

This will ensure that it will not be entered into the case and will be forwarded to the examiner as quickly as possible.

Papers related to the application may be submitted to Group 2800 by fax transmission. The fax phone number for Patent Technology Center 2800 is 571-273-8300.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gordon J. Stock, Jr. whose telephone number is (571) 272-2431. The examiner can normally be reached on Monday-Friday, 8:00 a.m. - 6:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tarifur R. Chowdhury, can be reached at 571-272-2287.

Information regarding the status of an application may be obtained from the Patent Application lnformation Retrieval (PAIR) system. Status information for published applications

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Volkswagen v. Longhorn - IPR2025-00925

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private Pair system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/GORDON J STOCK JR/

Primary Examiner, Art Unit 2886

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Examiner-Initiated Interview Summary	**Application No.** 13/448,321	**Applicant(s)** BELL, MATTHEW	
	Examiner GORDON J. STOCK JR	**Art Unit** 2886	

All participants (applicant, applicant's representative, PTO personnel):

(1) *GORDON J. STOCK JR*. (3)_____.

(2) *ATTORNEY CHRISTOPHER DILEO*. (4)_____.

Date of Interview: *03 April 2014*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *8*.

Identification of prior art discussed: *Franck (20060078015)*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

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☐ Attachment

/GORDON J STOCK JR/ Primary Examiner, Art Unit 2886	

Notice of References Cited	Application/Control No. 13/448,321	Applicant(s)/Patent Under Reexamination BELL, MATTHEW	
	Examiner GORDON J. STOCK JR	Art Unit 2886	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2004/0156130	08-2004	Powell et al.	359/845
*	B	US-2003/0128543	07-2003	Rekow, Mathew N.	362/259
*	C	US-7,331,681	02-2008	Pohlert et al.	362/18
*	D	US-7,142,285	11-2006	Antoni et al.	355/67
*	E	US-6,939,027	09-2005	Harumoto, Yuko	362/336
*	F	US-6,412,953	07-2002	Tiao et al.	353/98
*	G	US-5,997,150	12-1999	Anderson, Charles H.	362/227
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

/GS/

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S286	7915	(lenslet cluster microlens lenticular) same (lens near5 (condens$5 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:03
S287	329	S286 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:03
S288	30835	(lenslet cluster microlens lenticular (lens near4 (array fragment$3 segment$5))) same (lens near5 (condens$5 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:05
S289	787	S288 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:05
S290	787	S289	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:05
S291	106	S289 same project$3	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:05
S292	106	S291	FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:05
S293	3396	S288 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:08
S294	14869	(356/600-624,3-22).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:08
S295	1852	(359/454,455,721,737,796,797).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:08

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S296	11872	(362/221,235,236,244,242,299,308,309,326-340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:08
S297	2468	(382/151,159).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:08
S298	3795	(348/135,142,169-172).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:08
S299	1476	(353/79-81).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:08
S300	2906	(250/203.1-203.7,202,341.7).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:08
S301	143	S293 and (S294 S295 S296 S297 S298 S299 S300)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:08
S302	30835	(lenslet cluster microlens lenticular (lens near4 (array fragment$3 segment$5))) same (lens near5 (condens$5 converg$4 focus$4))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:11
S303	3396	S302 same ((led ld (light near emitt$3) (laser near diode)) near4 (plural$3 group$3 set two three four array$3))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:11
S304	539	S303 same project$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:11
S305	149	S304 and (pattern$3 near4 (light$3 illuminat$3 beam ray spot))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:11
S306	149	S304 and (pattern$3 near4 (light$3 illuminat$3 beam ray spot))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:13
S307	14869	(356/600-624,3-22).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:13

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Volkswagen v. Longhorn - IPR2025-00925

S308	1852	(359/454,455,721,737,796,797).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:13
S309	11872	(362/221,235,236,244,242,299,308,309,326-340).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:13
S310	2468	(382/151,159).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:13
S311	3795	(348/135,142,169-172).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:13
S312	1476	(353/79-81).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:13
S313	2906	(250/203.1-203.7,202,341.7).CCLS.	US-PGPUB; USPAT; USOCR	OR	OFF	2014/04/08 15:13
S314	143	S303 and (S307 S308 S309 S310 S311 S312 S313)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:13
S315	122	S314 not S306	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/04/08 15:13

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S316	223	(condens$3 and cluster).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:13
S317	28	S316 and pattern$3.clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:14
S318	938	(prismlet lenslet (segment$3 near lens) ((micro$1lens lens) near (array cluster$3)) lenticule lenticular).clm. and condens$3.clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:20
S319	19276	((((plural$3 array$3) near5 (emitt$4 led (light near diode) lamp illuminator laser ((light$3 illuminat$3) near5 source))) and pattern$3).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:22
S320	91	S318 and S319	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:22
S321	938	(prismlet lenslet (segment$3 near lens) ((micro$1lens lens) near (array cluster$3))	US-PGPUB;	OR	ON	2014/04/08 15:32

LAG-VW00000399

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Volkswagen v. Longhorn - IPR2025-00925

		lenticule lenticular).clm. and condens$3.clm.	USPAT; UPAD			
S322	19276	(((plural$3 array$3) near5 (emitt$4 led (light near diode) lamp illuminator laser ((light$3 illuminat$3) near5 source))) and pattern$3).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:32
S323	91	S321 and S322	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:32
S324	45	S323 and (center$3 mid$1point midpoint axis ax$1s axial$2 central$3 centro$).clm.	US-PGPUB; USPAT; UPAD	OR	ON	2014/04/08 15:32

4/9/2014 5:47:47 PM
C:\Users\gstock\Documents\EAST\Workspaces\13448321update.wsp

LAG-VW00000400

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Volkswagen v. Longhorn - IPR2025-00925

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	Art Unit
	GORDON STOCK JR	2886

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES		
Search Notes	Date	Examiner
east (uspat, usocr, uspgpub, epo, jpo,derwent, ibm_tdb, fprs) see search history printout	4/8/14	gjs
356/600-624,3-22 (text only) see search history printout	4/8/14	gjs
359/454,455,721,737,796,797 (text only) see search history printout	4/8/14	gjs
362/221,235,236,244,242,299,308,309,326-340 (text only) see search history printout	4/8/14	gjs
382/151,159 (text only) see search history printout	4/8/14	gjs
348/135-142,169-172 (text only) see search history printout	4/8/14	gjs
353/79-81 (text only) see search history printout	4/8/14	gjs
250/203.1-203.7,202,341.7 (text only) see search history printout	4/8/14	gjs

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	interference search printout	4/8/14	gjs

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

CPC		
Symbol	**Type**	**Version**

CPC Combination Sets				
Symbol	**Type**	**Set**	**Ranking**	**Version**

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	17	
/GORDON STOCK JR/ Primary Examiner.Art Unit 2886	04/09/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

US ORIGINAL CLASSIFICATION						INTERNATIONAL CLASSIFICATION										
CLASS			SUBCLASS			CLAIMED						NON-CLAIMED				
356			614			G	0	1	B	11 / 14 (2006.01.01)						
CROSS REFERENCE(S)						F	2	1	V	1 / 00 (2006.01.01)						
						F	2	1	V	5 / 00 (2006.01.01)						
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					F	2	1	V	7 / 00 (2006.01.01)						
362	235	236	242	244	308	F	2	1	V	11 / 00 (2006.01.01)						
362	309	326	332	333	336	F	2	1	V	13 / 00 (2006.01.01)						

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	17	
/GORDON STOCK JR/ Primary Examiner.Art Unit 2886	04/09/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	4

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13448321	BELL, MATTHEW
	Examiner	**Art Unit**
	GORDON STOCK JR	2886

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1		17												
2	2		18												
	3		19												
3	4		20												
4	5	15	21												
5	6	16	22												
6	7	17	23												
8	8	7	24												
9	9	14	25												
	10														
10	11														
11	12														
12	13														
13	14														
	15														
	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 17	
/GORDON STOCK JR/ Primary Examiner.Art Unit 2886 (Primary Examiner)	04/09/2014 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4

KM2326.007D1 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Bell, Matthew
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr., Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

RESPONSE UNDER AFTER FINAL CONSIDERATION PILOT 2.0

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

In response to the Final Office Action mailed January 17, 2014, Applicant respectfully submits the following:

Amendments to the Claims as reflected in the listing of claims which begins on page 2 of this paper;

Interview Summary beginning on page 5 of this paper; and

Remarks beginning on page 6 of this paper.

OK TO ENTER: /G.S./
04/09/2014

LAG-VW00000405

Volkswagen Exhibit 1037, Page 405 of 2532
Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 3370

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/448,321	04/16/2012 RULE	356	2886	KM2326.007D1

APPLICANTS

INVENTORS

Matthew Bell, Palo Alto, CA;

**** CONTINUING DATA ***************************

This application is a DIV of 12/269,849 11/12/2008 PAT 8159682 *
which claims benefit of 60/987,315 11/12/2007
(*)Data provided by applicant is not consistent with PTO records.

ok /GS/ 4/9/14

**** FOREIGN APPLICATIONS *************************** none /GS/ 4/9/14

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

04/26/2012

Foreign Priority claimed	☐ Yes ☑ No	☐ Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
35 USC 119(a-d) conditions met	☐ Yes ☑ No		CA	~~4~~ 5	~~20~~ 17	3
Verified and Acknowledged	/GORDON J STOCK JR/ Examiner's Signature	Initials				

ADDRESS

/GS/ 4/9/14 /GS/ 4/9/14

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614
UNITED STATES

TITLE

LENS SYSTEM

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
1250	No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

20995 7590 04/16/2014
KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	04/16/2012	Matthew Bell	KM2326.007D1	3370

TITLE OF INVENTION: LENS SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	07/16/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
STOCK JR, GORDON J	2886	356-614000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 Knobbe Martens Olson
2 & Bear LLP
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Intellectual Ventures Holding 67 LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Las Vegas, NV

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): (**Please first reapply any previously paid issue fee shown above**)
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 11-1410 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature: Christopher M. DiLeo
Date: 15-JUL-14
Typed or printed name: Christopher M. DiLeo
Registration No. 61,738

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

LAG-VW00000407

Volkswagen Exhibit 1037, Page 407 of 2532
Volkswagen v. Longhorn - IPR2025-00925

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant	:	Bell, Matthew
App. No.	:	13/448,321
Filed	:	April 16, 2012
For	:	LENS SYSTEM
Examiner	:	Stock Jr., Gordon J.
Art Unit	:	2886
Conf. No.	:	3370

COMMENTS ON THE EXAMINER'S REASONS FOR ALLOWANCE

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

Applicant takes no position regarding any reasons for allowance presented by the examiner (in the notice of allowance and/or elsewhere in the application's file history) other than the positions applicant may have previously taken during prosecution. Therefore, the examiner's reasons for allowance should not be attributed to applicant as an indication of the basis for applicant's belief that the claims are patentable. Furthermore, applicant respectfully asserts that there may also be additional reasons for patentability of the claimed subject matter not explicitly stated in this record and applicant does not waive its rights to such arguments by not further addressing such reasons herein.

Applicant also respectfully reserves the right to traverse the characterizations of what any particular reference shows or teaches, of what any combination of references shows or teaches, or the appropriateness of combining references. Further, by making certain amendments to the claims, applicant is not conceding that previously pending

Volkswagen Exhibit 1037, Page 408 of 2532
Volkswagen v. Longhorn - IPR2025-00925

claims are not patentable. Rather, the amendments are being made to facilitate expeditious prosecution of this application. Applicant reserves the right to pursue at a later date any previously pending or other broader or narrower claims that capture any subject matter supported by the application's disclosure. Accordingly, reviewers of this or any child or related prosecution history shall not reasonably infer that the applicant has made any disclaimers or disavowals of any subject matter.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: 15 Jul 14

By: _____

Christopher M. DiLeo
Registration No. 61,738
Attorney of Record
Customer No. 20,995
(858) 707-4000

17884433

Volkswagen Exhibit 1037, Page 409 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Patent Application Fee Transmittal	
Application Number:	13448321
Filing Date:	16-Apr-2012
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Filer:	Christopher M. DiLeo/Serina Anderson
Attorney Docket Number:	KM2326.007D1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**960**

Volkswagen Exhibit 1037, Page 411 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt	
EFS ID:	19583341
Application Number:	13448321
International Application Number:	
Confirmation Number:	3370
Title of Invention:	LENS SYSTEM
First Named Inventor/Applicant Name:	Matthew Bell
Customer Number:	20995
Filer:	Christopher M. DiLeo/Christina Graul
Filer Authorized By:	Christopher M. DiLeo
Attorney Docket Number:	KM2326.007D1
Receipt Date:	15-JUL-2014
Filing Date:	16-APR-2012
Time Stamp:	14:48:45
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$960
RAM confirmation Number	890
Deposit Account	111410
Authorized User	KNOBBE MARTENS OLSON AND BEAR
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	km2326_issuefee.pdf	86211 fc2873efcc1ebf7b0e5dc1bd993f74d7c05c227d	no	1
Warnings:					
Information:					
2	Post Allowance Communication - Incoming	km2326_comments.pdf	67548 4860520194408533c5f59ce51e6f9f701cde9856	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30027 51ab10700b4001cda7f4f88e39c8111e0e364a88	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	183786		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Volkswagen Exhibit 1037, Page 413 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 8 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	205	2006/0242145	10-26-2006	Krishnamurthy et al.	
	206	2006/0256382	11-16-2006	Matraszek et al.	
	207	2006/0258397	11-16-2006	Kaplan et al.	
	208	2006/0294247	12-28-2006	Hinckley et al.	
	209	2007/0002039	01-04-2007	Pendleton et al.	
	210	2007/0019066	01-25-2007	Cutler	
	211	2007/0285419	~~02-13-2007~~	Givon	December 13, 2007
	212	2008/0013826	01-17-2008	Hillis et al.	
	213	2008/0018595	01-24-2008	Hildreth et al.	
	214	2008/0030460	02-07-2008	Hildreth et al.	
	215	2008/0040692	02-14-2008	Sunday et al.	
	216	2008/0062123 (KM2326.3CP4CP1)	03-13-2008	Bell	
	217	2008/0062257	03-13-2008	Corson	
	218	2008/0090484	04-17-2008	Lee et al.	
	219	2008/0150890 (KM2326.3CP3C1)	06-26-2008	Bell et al.	
	220	2008/0252596 (KM2326.006A)	10-16-2008	Bell et al.	
	221	2009/0027337	01-29-2009	Hildreth	
	222	2009/0079813	03-26-2009	Hildreth	
	223	2009/0102788	04-23-2009	Nishida et al.	
	224	2009/0172606	07-02-2009	Dunn et al.	
	225	2009/0235295 (KM2326.001C1)	09-17-2009	Bell et al.	
	226	2010/0026624 (KM2326.011C1)	02-04-2010	Bell et al.	
	227	2010/0039500 (KM2326.013A)	02-18-2010	Bell et al.	
	228	2010/0060722 (KM2326.015A)	03-11-2010	Bell et al.	
	229	2010/0121866 (KM2326.012A)	05-13-2010	Bell et al.	

Change(s) applied to document, /D.D./ 4/12/2013

FOREIGN PATENT DOCUMENTS

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

PTO/SB/08 Equivalent

INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Application No.	13/448,321
	Filing Date	April 16, 2012
	First Named Inventor	Matthew Bell
	Art Unit	2875
(Multiple sheets used when necessary)	Examiner	Unknown
SHEET 4 OF 19	Attorney Docket No.	KM2326.007D1

U.S. PATENT DOCUMENTS

Examiner Initials	Cite No.	Document Number *Number - Kind Code (if known)* Example: 1,234,567 B1	Publication Date MM-DD-YYYY	Name of Patentee or Applicant	Pages, Columns, Lines Where Relevant Passages or Relevant Figures Appear
	91	6,661,918	12-09-2003	Gordon et al.	
	92	6,677,969	01-13-2004	Hongo	
	93	6,707,054	03-16-2004	Ray	
	94	6,707,444	03-16-2004	Hendriks et al.	
	95	6,712,476	03-30-2004	Ito et al.	
	96	6,720,949	04-01-2004	Pryor et al.	
	97	6,732,929	05-11-2004	Good et al.	
	98	6,747,666	06-08-2004	Utterback	
	99	6,752,720	06-22-2004	Clapper et al.	
	100	6,754,370	06-22-2004	Hall-Holt et al.	
	101	6,791,700	09-14-2004	Omura et al.	
	102	6,808,293	10-26-2004	Watanabe et al.	
	103	6,826,727	11-30-2004	Mohr et al.	
	104	6,831,664	12-14-2004	Marmaropoulos et al.	
	105	6,871,982	03-29-2005	Holman et al.	
	106	6,877,882	04-12-2005	Haven et al.	
	107	6,912,313	06-28-2005	Li	
	108	6,965,693	11-15-2005	Kondo et al.	
	109	6,975,360	12-13-2005	Slatter	
	110	6,999,600	02-14-2006	Venetianer	
	111	7,015,894	03-21-2006	Morohoshi	
	112	7,042,440	~~06-27-2006~~	Pryor et al.	May 9, 2006
	113	7,054,068	05-30-2006	Yoshida et al.	
	114	7,058,204	06-06-2006	Hildreth et al.	
	115	7,068,274	06-27-2006	Welch et al.	
	116	7,069,516	06-27-2006	Rekimoto	
	117	7,084,859	08-01-2006	Pryor et al.	
	118	7,088,508	08-08-2006	Ebina et al.	
	119	7,129,927	10-31-2006	Mattsson	
	120	7,149,262	12-12-2006	Nayar et al.	

Change(s) applied to document, /D.D./ 4/12/2013

Examiner Signature	/Gordon Stock Jr/	Date Considered	07/28/2012

***Examiner:** Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

T[1] - Place a check mark in this area when an English language Translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /G.S./

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/448,321	08/19/2014	8810803	KM2326.007D1	3370

20995 7590 07/30/2014

KNOBBE MARTENS OLSON & BEAR LLP
2040 MAIN STREET
FOURTEENTH FLOOR
IRVINE, CA 92614

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 5 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Matthew Bell, Palo Alto, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

PTO/SB/05 (09-04)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

22764 U.S.PTO 093004

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	BRV.10002
First Inventor	Stéphane BONNET et al.
Title	Method of Reconstructing an Image With Data Acquisition According to Several Imagery Modes...
Express Mail Label No.	EV 613 035 543 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✓] **Fee Transmittal Form** (e.g., PTO/SB/17)
   (Submit an original and a duplicate for fee processing)
2. [ ] **Applicant claims small entity status.** See 37 CFR 1.27.
3. [✓] **Specification** [*Total Pages* 22]
   Both the claims and abstract must start on a new page
   (For information on the preferred arrangement, see MPEP 608.01(a))
4. [✓] **Drawing(s)** (*35 U.S.C. 113*) [*Total Sheets* 2]
5. **Oath or Declaration** [*Total Sheets*]
   a. [ ] Newly executed (original or copy)
   b. [ ] A copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 18 completed)
   i. [ ] DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. [ ] **Application Data Sheet.** See 37 CFR 1.76
7. [ ] **CD-ROM or CD-R** in duplicate, large table or Computer Program *(Appendix)*
   [ ] Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission**
   (if applicable, items a. – c. are required)
   a. [ ] Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO: **Commissioner for Patents**
P.O. Box 1450
Alexandria VA 22313-1450

17858 U.S. PTO 10/955037 093004

ACCOMPANYING APPLICATION PARTS

9. [ ] **Assignment Papers** (cover sheet & document(s))
   Name of Assignee
10. [ ] **37 CFR 3.73(b) Statement** *(when there is an assignee)* [ ] **Power of Attorney**
11. [ ] **English Translation Document** *(if applicable)*
12. [ ] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
13. [✓] **Preliminary Amendment**
14. [✓] **Return Receipt Postcard** (MPEP 503)
    (Should be specifically itemized)
15. [✓] **Certified Copy of Priority Document(s)**
    (if foreign priority is claimed)
16. [ ] **Nonpublication Request** under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. [✓] Other: Unexecuted Combined Declaration/Power of Attorney (2 pages)

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No.: .....

Prior application information: *Examiner* _____ *Art Unit:* _____

19. CORRESPONDENCE ADDRESS

[✓] The address associated with Customer Number: 45473 ***OR*** [ ] Correspondence address below

Name	Hutchison & Mason PLLC				
Address	P.O. Box 31686				
City	Raleigh	State	NC	Zip Code	27612
Country	US	Telephone	+1.919.829.9600	Fax	919-829-4332

Signature	Joshua T. Elliott	Date	September 30, 2004
Name (Print/Type)	Joshua T. Elliott	Registration No. (Attorney/Agent)	43,603

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR § 1.10 on the date indicated above and is addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Express Mail Label No. EV613 035 543 US Date of Deposit: 9/30/04

(Jennie Snead)

PTO/SB/17 (10-03)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 770.00

Complete if Known	
Application Number	Unassigned
Filing Date	September 30, 2004
First Named Inventor	Stéphane BONNET et.al
Examiner Name	Unknown
Art Unit	Unknown
Attorney Docket No.	BRV.10002

METHOD OF PAYMENT *(check all that apply)*

☐ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☑ Deposit Account:

Deposit Account Number: 50-3218

Deposit Account Name:

The Director is authorized to: *(check all that apply)*

☑ Charge fee(s) indicated below ☐ Credit any overpayments

☑ Charge any additional fee(s) or any underpayment of fee(s)

☐ Charge fee(s) indicated below, **except for the filing fee** to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	770.00
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($) 770.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

		Extra Claims		Fee from below	Fee Paid
Total Claims	8.00	-20** = 0.00	X	18.00	= 0.00
Independent Claims	1.00	- 3** = 0.00	X	86.00	= 0.00
Multiple Dependent				0.00	= 0.00

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) 0.00%

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 0.00

SUBMITTED BY				(Complete *(if applicable)*)	
Name (Print/Type)	Joshua T. Elliott	*Registration No. (Attorney/Agent)*	43,603	*Telephone*	+1.919.829.9600
Signature	Joshua T. Elliott			*Date*	September 30, 2004

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR § 1.10 on the date indicated above and is addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Express Mail Label No. EV 603 035 543 US Date of Deposit: 9/30/04

Jennie Snead

(Jennie Snead)

PTO/SB/05 (09-04)
Approved for use through 07/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office. U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	BRV.10002
First Inventor	Stéphane BONNET et al.
Title	Method of Reconstructing an Image With Data Acquisition According to Several Imagery Modes...
Express Mail Label No.	EV 613 035 543 US

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. [✓] **Fee Transmittal Form** (e.g., PTO/SB/17)
   (Submit an original and a duplicate for fee processing)
2. [ ] **Applicant claims small entity status.** See 37 CFR 1.27.
3. [✓] **Specification** [*Total Pages* 22]
   Both the claims and abstract must start on a new page
   (For information on the preferred arrangement, see MPEP 608.01(a))
4. [✓] **Drawing(s)** (*35 U.S.C. 113*) [*Total Sheets* 2]
5. **Oath or Declaration** [*Total Sheets*]
   a. [ ] Newly executed (original or copy)
   b. [ ] A copy from a prior application (37 CFR 1.63(d))
   (for continuation/divisional with Box 18 completed)
   i. [ ] DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) name in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
6. [ ] **Application Data Sheet.** See 37 CFR 1.76
7. [ ] **CD-ROM or CD-R** in duplicate, large table or Computer Program *(Appendix)*
   [ ] Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission**
   (if applicable, items a. – c. are required)
   a. [ ] Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. [ ] CD-ROM or CD-R (2 copies); or
      ii. [ ] Paper
   c. [ ] Statements verifying identity of above copies

ADDRESS TO:

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Alexandria VA 22313-1450

ACCOMPANYING APPLICATION PARTS

9. [ ] **Assignment Papers** (cover sheet & document(s))
   Name of Assignee
10. [ ] **37 CFR 3.73(b) Statement** *(when there is an assignee)* [ ] **Power of Attorney**
11. [ ] **English Translation Document** *(if applicable)*
12. [ ] **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    [ ] Copies of citations attached
13. [✓] **Preliminary Amendment**
14. [✓] **Return Receipt Postcard** (MPEP 503)
    (Should be specifically itemized)
15. [✓] **Certified Copy of Priority Document(s)**
    (if foreign priority is claimed)
16. [ ] **Nonpublication Request** under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. [✓] Other: Unexecuted Combined Declaration/Power of Attorney (2 pages)

18. If a CONTINUING APPLICATION, *check appropriate box, and supply the requisite information below and in the first sentence of the specification following the title, or in an Application Data Sheet under 37 CFR 1.76:*

[ ] Continuation [ ] Divisional [ ] Continuation-in-part (CIP) of prior application No.: .....

Prior application information: *Examiner* _____ *Art Unit:* _____

19. CORRESPONDENCE ADDRESS

[✓] The address associated with Customer Number: 45473 ***OR*** [ ] Correspondence address below

Name	Hutchison & Mason PLLC				
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Signature	Joshua T. Elliott	Date	September 30, 2004
Name (Print/Type)	Joshua T. Elliott	Registration No. (Attorney/Agent)	43,603

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Express Mail Label No. EV613 035 543 US Date of Deposit: 9/30/04

(Jennie Snead)

22764 U.S.PTO 093004
10/955037 17858 U.S. PTO 093004

Volkswagen Exhibit 1037, Page 419 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/17 (10-03)
Approved for use through 07/31/2006. OMB 0651-0032
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FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 770.00

Complete if Known	
Application Number	Unassigned
Filing Date	September 30, 2004
First Named Inventor	Stéphane BONNET et.al
Examiner Name	Unknown
Art Unit	Unknown
Attorney Docket No.	BRV.10002

METHOD OF PAYMENT *(check all that apply)*

☐ Check ☐ Credit card ☐ Money Order ☐ Other ☐ None

☑ Deposit Account:

Deposit Account Number: 50-3218

Deposit Account Name:

The Director is authorized to: *(check all that apply)*

☑ Charge fee(s) indicated below ☐ Credit any overpayments

☑ Charge any additional fee(s) or any underpayment of fee(s)

☐ Charge fee(s) indicated below, **except for the filing fee** to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	770.00
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	

SUBTOTAL (1) ($) 770.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

		Extra Claims		Fee from below	Fee Paid
Total Claims	8.00	-20** = 0.00	X	18.00	= 0.00
Independent Claims	1.00	- 3** = 0.00	X	86.00	= 0.00
Multiple Dependent				0.00	= 0.00

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

***or number previously paid, if greater; For Reissues, see above*

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
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Other fee (specify) 0.00%

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 0.00

SUBMITTED BY				(Complete *(if applicable)*)	
Name (Print/Type)	Joshua T. Elliott	*Registration No. (Attorney/Agent)*	43,603	*Telephone*	+1.919.829.9600
Signature	Joshua T. Elliott			*Date*	September 30, 2004

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Express Mail Label No. EV 603 035 543 US Date of Deposit: 9/30/04

Jennie Snead

(Jennie Snead)

METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES

This invention relates to a method in which an image of an object is estimated using two series of data that are combined by synchronisation.

Images may be taken inside objects, and particularly living beings, using several types of methods. Some are attenuative, in other words the attenuation of radiation passing through the object is measured, and others are emissive, in other words ionising particles originating from a radioactive liquid previously swallowed by the organism to be studied, are collected. In both cases, detector networks rotating around the object or covering the periphery of the object collect radiation, and images of the object are obtained by combining measurements of detectors taken at different angles using well-known computed tomography methods (see "Tomography", directed by P. Grangeat Paris: Hermès Science Publications 2002 ibsn 2.7462-0356-1).

Some methods are better than others for obtaining specific result types. Typically, images obtained by attenuation can indicate the composition of the object at each location and thus enable an accurate drawing of the organs of a living being and their contours. This is not usually possible with images obtained by emission, but they can be used to distinguish healthy tissues that are only slightly emissive, from diseased tissues, for

example cancers tissues that are strongly emissive. The first images can be qualified as anatomic and the second images as functional. They are complementary and superposition of the two images can be very helpful in the diagnostic. Prior art also includes devices for simultaneously acquiring both types of images (as in the article "Attenuation correction for a combined 3D PET/CT scanner" by Kinahan et al., Med. Phys. 25(10), October 1998, p. 2046-2053).

One purpose that should be considered applies to movements of living beings during the measurements. Obviously, the mix of measurements made while the object is moving can only produce blurred images, if no precautions are taken. Many studies have been carried out on this problem for several years, and several types of solutions have been suggested. Some consist of taking the measurements as quickly as possible, for example making use of a network of a large number of detectors that completely surround the object to be studied, instead of moving around the object. Another method consists of making the measurements only at an approximately invariable state of the object, for example for the same state of the heart or breathing cycle, or another periodic biological cycle. The first of these methods is obviously expensive in equipment and the second method is difficult to apply, and will not work for non-periodic movements (for example a moving animal). Another type of method involves digital correction of the measurements and images, taking account of displacements of the object

between each series of measurements. Object movements are then estimated by displacement fields of their points. These displacement fields can be determined by making estimates on the first images, possibly including assumptions about the movements. The latter method is most likely to give good results. French patent 2 826 157 describes an example.

Image correction methods by estimating the displacement field have been applied primarily to attenuation images that can be taken quickly and for which the more distinct contents provide more details about object movements. Emission images have less abundant contents due to the fact that the measurements are more dispersed in time and they are not as easily recognisable since different categories of tissues are not as clearly distinguished. Therefore, it is difficult to establish a displacement field so that it can be used to compensate for object movements and regularise its image.

However, this document proposes to apply such an image reconstruction method to emission techniques, with compensation of object movements, using the methods described below

Images of the object are taken using an emission technique and an attenuation technique. Ordinary movement estimating methods are applied to the images obtained by attenuation, by reconstituting a series of images of the object studied using measurement sets taken at different times and therefore providing blurred images if no

movement compensation is made, due to the small movement of the object, but clearly representative of the state of the object at different times. The result is displacement fields of points on the object to obtain these first images.

These displacement fields are then applied to measurements taken using the emission technique in general after having been modified or adapted by processes that will be described in detail in the remainder of this document. Thus, these emission measurements may be corrected to compensate for the movement and obtain an improved final functional image. All that is necessary is to synchronise measurements made using the two techniques on a common time base.

Known installations in which both types of images were obtained do not use any analogue combination of measurement sets, and make use of a simple juxtaposition of two types of images obtained independently by superposition, or at the most use the attenuation image for a correction of another type of emission measurements, compensating for attenuations through the object being studied, which also affect these measurements.

Although the invention is useful at the moment in the special context of acquisition pairs by attenuation and emission, it could be easily be generalised to include any pair of measurement acquisitions and is not limited to the embodiments described below.

We will now describe the invention in more detail with reference to the attached figures, in which Figure 1 is a general flowchart and Figure 2 is a time diagram.

This invention is particularly applicable to medical imagery, therefore it will be assumed that a patient is being examined. He is instructed to breathe normally and regularly during the examination. In methods in which no movement compensation is made, he is asked to hold his breath or to stop breathing in the same state before each measurement. He has also ingested a radio-pharmaceutical substance such as FDG (fluoro-deoxy-glucose) by intravenous injection. This substance is used to monitor the cellular metabolism of glucose using an emission technique. Other emissive substances are used for other applications.

Attenuation and emission measurements are made in steps Et1 and Et2 in Figure 1. For each measurement category, measurement sets are taken at successive instants, which are usually not simultaneous for the two measurement categories. However, a time synchronisation of measurement sets is usually necessary, within the two series and between the two series after step Et3. One useful method for achieving this may be to measure a patient movement using an independent sensor such as a breathing sensor, a pressure sensor or an electrocardiogram. Each measurement set is then associated with a determined state of the patient during which a measurement of his movement was made. If this measurement relates to a cyclic phenomenon such as

breathing, the measurement sets may be associated with time phases of this movement as suggested in the diagram in Figure 2, in which six measurement sets M1 to M6 taken over a breathing cycle are associated with average phases $\varphi 1$ to $\varphi 6$.

Steps Et11 and Et12 in Figure 1 illustrate such uses of sensors. Movement or position sensors are usually suitable for this method. There may be an arbitrary number of these sensors. Some may be associated with the attenuation measurements and others with emission measurements. When a measurement set is taken, the associated sensors record the movement signal, etc., that they receive. When all measurement sets have been taken, comparisons between signals recorded by the different sensors may be used to place the two measurement sets at determined locations on a common time scale. Times at which measurements are made may be determined if some sensors also measure the time, or if an independent time measurement signal is taken and measured. In the method illustrated, two time measurement signals are taken at preliminary steps Et13 and Et14, and are used to determine times at which measurements are made with the two techniques, and times at which measurements are made by sensors, respectively.

Finally, the time may be synchronised by correlation processes between image projections. The article entitled "Kymogram detection and Kymogram-correlated image reconstruction from subsecond spiral computed tomography

scans of the heart", by Kachelriess et al., Med. Phys. 29 (7), July 2002, p. 1489 to 1503, gives an example.

After these measurement set collection and time synchronisation steps Et1, Et2 and Et3, at least a partial image reconstruction is carried out for the patient by multiple states in steps Et4 and Et5 for each measurement technique. This means that each measurement set such as M1 is used to give a particular image assuming that the patient is motionless throughout the time that the measurement sets are being taken. Conventional digital means such as filtering and back projection are applied. The partial images thus obtained are usually based on data that are too incomplete to be precise, but in any case they are sufficiently detailed so that they can be compared with each other to determine the patient's movements between two phases. For further information, refer to the previous state of the art described by P. Grangeat, A. Koenig, T. Rodet and S. Bonnet in "Theoretical framework for a dynamic cone-beam reconstruction algorithm based on a dynamic particle model", Phys. Med. Biol., vol. 47, No. 15, pp. 2611-2625, August 2002 for an attenuation technique, and D. R Gilland, B.A. Mair, J.E. Bowsher and R.J. Jaszczak, "Simultaneous reconstruction and motion estimation for gated cardiac ECT", IEEE Trans. Nucl. Sci., vol. 49, No. 5, pp. 2344-2349, October 2002, for an emission technique.

Steps Et15 and Et16 show that patient states can also be defined at these same states using information output by the sensors.

Time synchronisation could then have been applied to these state images rather than to measurement sets.

Spatial synchronization is undertaken in step Et6. It is an adjustment of at least partial image categories and information from sensors in which corresponding points (in other words points corresponding to the same point on the patient) must appear at the same position on the two image categories. The two image categories are compared with each other in this step that is not innovative, and the invention is not applicable to it.

It consists of determining a deformation operator D defined by parameters to change from a coordinate system associated with the attenuation images to the coordinate system associated with the emission images.

This operator is assumed to be invariable throughout the examination period. It is also assumed that the time synchronisation is sufficiently precise and that the patient's movements (physiological) are reproducible.

The result is that at time t, there is an attenuation image f_t and an emission image g_t. The next step is to identify the deformation operator D assuming consistency between the two images f_t and g_t on the measurement points.

$$D = \arg\min [E_{ima}(f_t, g_t, D)]$$

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where

$$E_{ima}\ (f_t, g_t, D) = \Sigma\ \phi\ (f_t(r)\ -\ g_t[D(r)])$$

where ϕ is a convex function and i denotes the position of the pixel in the image.

To be general, measurements obtained by micro-systems that provide information about the position of the patient at the sensors (or checkpoints) can also be introduced. Consider the case in which images of the position of these checkpoints are available for each acquisition type (attenuation and emission). These measurement sets output by position sensors are denoted h^{att} and $h^{émi}$. These sensors use optical systems, unlike movement sensors that are based on accelerometer based systems.

It would also be possible to consider using imagery systems to position these sensors by varying their attenuation and incorporating radioactive sources into them for the emission part.

If this additional information h_t^{att} and $h_t^{émi}$ is available at time t, then the complete set can be minimised into a single function.

$$D = \arg\min\ [E_{ima}(f_t, g_t, D)\ +\ \alpha\ E_{capt}(h_t^{att},\ h_t^{émi},\ D)]$$

where α is a weighting factor.

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Since D is assumed to be constant throughout the examination period, its determination is not limited to a set of images at time t, but it covers all available times.

D may be a solid movement (translation if the patient is not at exactly the same height, rotation if the patient has turned slightly) or for example an affine movement. The deformation D may also be interpreted by analogy to deformation grids of checkpoints using free form deformation techniques.

The simple case is then the case in which the patient does not move between the attenuation and emission techniques and therefore in which D = identity.

The next steps Et7 and Et8 relate to an estimate of the patient's movement between two phases for each of the two measurement categories. Once again, known methods are used, particularly as described in French patent 2 736 454 or the article by Gilland mentioned above. The result is displacement fields of points of the object from one phase to the next. Dense displacement fields may be obtained for attenuation measurements that reproduce details of images very well. In general, they cannot be reproduced with emission measurements; they can be completed using other information (for example from movement sensors located on the patient) or by making assumptions about object movements, such as lack of deformation (movements are reduced to translations and rotations), or a deformation without a volume variation,

or a deformation obeying determined parameters. Heart muscle and thorax cage movements can thus be easily used.

Another method of completing displacement fields is more particular to the invention and is particularly important. It relates to cyclic movements such as breathing or heart beats. Attenuation measurements are usually made quickly, in a few breathing cycles or even a single cycle, while emission measurements are made much more slowly, ten minutes often being necessary. The invention then includes grouping of measurement sets, particularly emission measurements, using the phases φ considered in a single movement cycle, even if these measurements actually concern different cycles. This is illustrated in Figure 2, in which measurement sets subsequent to the measurements in the previous breathing cycle (M7, M8, etc.) will be associated with phases $\varphi 1$ and $\varphi 2$, etc. already mentioned rather than with phases $\varphi 7$ and $\varphi 8$, etc., that are deduced by an angle of 2π or a multiple of an angle of 2π. A small number of partial images are richer in contents.

Although this synchronisation method using a small number of phases is very practical, it is not essential for use of this invention that can be applied to a patient subjected to an arbitrary movement or a cyclic movement.

Steps E17 and E18 illustrate that displacement fields can also be calculated using sensor measurements.

The next step Et9 is one of the most important steps in the invention. It consists of obtaining a displacement field, said to be enhanced, by a combination of two movement estimates Et7 and Et8 obtained previously and possibly using other contributions originating from different measurements or assumptions.

We will now describe the calculation of the enhanced displacement field, this time attempting to be as general as possible.

To be more general, it is also possible to introduce micro-system measurements that would both be obtained either by attenuation or by emission or both, and a deformation operator D configured to make the conversion from the attenuation coordinate system to the emission coordinate system and for movements m_{att} in the attenuation coordinate system and $m_{émi}$ in the PET emission coordinate system, such that

$$m_{att}(i) = m_{émi}(D(i)) = m_{émi} \circ D^{-}(i)$$

The formula to minimize information obtained no longer only by imagery systems, but also by micro-systems providing information about the position and / or movement of the patient at the sensors (or also at checkpoints) is explicitly added.

As explained above, we will consider the case in which a measurement set output by these sensors is available for each attenuation or emission acquisition. However, a distinction is made between the case in which

position images output by the sensor are available (used for adjustment).

$$\begin{cases} h_1^{att} & h_2^{att} \\ h_1^{émi} & h_2^{émi} \end{cases} \text{ at times } t_1 \text{ and } t_2$$

and the case in which displacement fields are directly available at some points in space (such as checkpoints)

$$\begin{cases} m_{att} \\ m_{émi} \end{cases} \text{ between times } t_1 \text{ and } t_2,$$

the two fields being related by the previously determined relation

$$m_{att} = m_{émi} \circ D$$

Finally, an attempt is made to make the following consistency:

$$\text{On medical images } \begin{vmatrix} (f_1, f_2, moD)(g_1, g_2, m) \\ (mf, moD)\ (mg, m) \end{vmatrix};$$

E1 is a function expressing consistency between two at least partial emission images g1 and g2 obtained in step Et5, and the displacement field m that must relate them, and that can be expressed by $E1(g1, g2, m) = \Sigma\phi1[g1(r) - g2(r+m(r))]$ where $\phi1$ is a convex function and r denotes the position of the pixel

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considered on the image; E9 is the a priori knowledge about the regularity of the displacement field, for example with $E9(m) = \Sigma\phi g(m(r))$; and E3 and E4 reflect the consistency of the displacement field m with respect to estimated displacement fields for the two techniques, using the formulas $E3(mg,m) = \Sigma\phi 3(m(r)-mg(r))$ and $E4(mF,moD) = \Sigma\Phi 4(moD(r)-mf(r))$. Functions $\phi 1$, $\phi 2$, $\phi 3$ and $\phi 4$ are chosen fairly freely and may consist of convex positive polynomials, the essential requirement being that it is easy to use digital analysis procedures to find a displacement field m that satisfactorily reconciles existing results and that can thus be applied to at least partial emission images.

In particular, consistency between two attenuation images f_1 and f_2 obtained in step Et4 and the displacement field m defining a relation between them, is explicitly introduced.

Considering data for micro-systems

$$\begin{vmatrix} (h_1^{att}, h_2^{att}, moD) & (h_1^{émi}, h_2^{émi}, m) \\ (m_{att}, moD) & (m_{émi}, m) \end{vmatrix}$$

with some regularity on m.

The set can be minimized in a single function $(m,D) = \arg\min$.

$$\left\{\begin{array}{l} a\ E_1(g_1, g_2, m_{émi}) + b\ E_2\ (f_1, f_2, mvD) + c\ E_3(mg, m) + d\ E_4(mf, mvD) \\ + e\ E_5(h_1^{émi}, h_2^{émi}, m) + f\ E_6(h_1^{att}, h_2^{att}, mvD) + g\ E_7(m_{émi}, m) + h\ E_8(m_{att}, mvD) \\ + i\ E_9(m) \end{array}\right\}$$

where m, is the enhanced displacement field.

The unknowns are m and the parameters of the deformation D.

This deformation is precisely the deformation required during the spatial synchronisation step.

Therefore, it will be possible to separate the problem firstly by identifying D to ensure that (h_1^{att}, $h_1^{émi}$, D), (h_2^{att}, $h_2^{émi}$, D), etc., are consistent.

This partial minimisation has been described above.

As a result, the function then becomes applicable only to the unknown m.

Microsystems can perform two roles:

- make the two acquisition techniques correspond to each other;

- remove some ambiguities on the calculation of the displacement and trajectory field for at least one of the two acquisition techniques.

In any case, the use of another reference imagery method remains necessary to compensate for the poor spatial resolution and the mediocre image quality (noisy and defined only in regions in which the radioactive product is fixed) which characterise emission images and would result in poor quality displacement fields for areas of interest.

Failure to use sensors imposes e = f = g = h = 0 and the result is a function based only on information obtained using imagery systems.

In the particular case in which there are no position and / or movement sensors, this enhanced displacement field is denoted m, and the displacement fields obtained in steps Et7 and Et8 are denoted mf and mg, and the formula can be simplified and becomes:

$M=\arg\min\{aE1(g1,g2,m) + bE2(f1,f2,moD) + cE3(mg,m) + dE4(mF,moD)+iEg(m)\}$; where a, b, c and d are weighting factors.

One important case corresponds to a = b = d = 0: displacement fields estimated by the attenuation technique would then be applied unchanged to partial images estimated by the emission technique; since as mentioned, the displacement field obtained by the attenuation technique is usually much more precise and accurate.

The displacement field calculated in steps Et17 and Et18 can also contribute to the calculation of the displacement field enhanced by the use of other weighting factors. However, it must be emphasized that the use of independent sensors is not essential if the measurement sets can be placed otherwise (in steps Et13 and Et14) in a same time scale; steps Et11 and Et12, Et15, Et16, Et17 and Et18 can then be eliminated from the method.

The method is completed by use of this enhanced displacement field to reconstruct at least a final image of the patient according to step Et10. To achieve this,

the partial images are combined by addition, taking account of displacements of their points from one phase to the next so as to make additions only on successive states of the same points. Weighting factors expressing the confidence assigned to each point or to each partial image may be applied. The final image obtained is sharper than the partial images (and composed of entire complete acquisitions of the patient). The improvement achieved with the invention is expressed primarily on the image obtained by emission techniques. However, if the acquisition was long (in other words made over several cycles), a single image is not necessarily reconstructed, instead a series of images is created each corresponding to a state in the breathing cycle (for example), and the estimate of the enhanced displacement fields and movement compensation are applied to these state images. This method reduces the influence of an overall cyclic movement of the patient and can give better quality results than a single image obtained with all measurement sets accumulated during the cycle and that could better reduce the measurements noise compared with the useful signal, but would cause blur due to this overall movement.

Images using the emission technique may be also corrected in a known manner by correction of emission data with or without movement corrections, as a function of the attenuation made to them and that can be deduced from attenuation images.

Attenuation and emission techniques that could be used with the invention include CT (X-ray tomography) and MRI (nuclear magnetic resonance imagery) for attenuation, and SPECT (Single Photon Emission Computed Tomography) or TEP (position emission tomography) for emission.

The use of position and movement micro-sensors may be used with one of the techniques, or it may replace one of them in order to provide a reference on the displacement field to be applied finally on the images obtained by emission techniques.

The advantage of the invention is obvious for pairs of measurements including an attenuation technique and a radiation emission technique, but it can also be applied to other double measurement situations.

CLAIMS

1. Method of reconstruction of an image of a mobile object by a first measurement acquisition technique, comprising at least partial reconstruction of images of the object at corresponding movement states of the object, an estimate of the object movement between the states and a combination of state images by making compensations of the object movement according to the estimate, characterised in that object movement estimate at least uses partially other images of the object, obtained for the said states using a second measurement acquisition technique.

2 Method of reconstruction of an image according to claim 1, characterised in that the at least partial image reconstruction of the object at corresponding states of the object movement comprises a time synchronisation step applied to measurements originating from the second acquisition technique.

3. Method of reconstruction of an image according to claim 2, characterised in that the estimate of the object movement between the states comprises a spatial synchronisation step applied to at least partial images of the object at corresponding states of the object movement.

4. Method of reconstruction of an image according to claim 1, 2 or 3, characterised in that the first measurement acquisition technique is a functional radiation emission imagery technique and the second measurement acquisition technique is an anatomic radiation attenuation imagery technique.

5. Method of reconstruction of an image according to claims 1 to 4, characterised in that it comprises a measurement of a cyclic element of the object movement to synchronise the states on periodic states of the cyclic element.

6. Method of reconstruction of an image according to claim 5, characterised in that the periodic states group measurements made on several phases associated with different periods of the movement cyclic element, at least for measurements acquired by the first technique.

7. Method of reconstruction of an image according to any one of the previous claims, characterised in that it comprises the use of independent movement or position sensors to evaluate the movement of the object and / or to place the measurements by the two acquisition techniques and the states of the object on a common time scale.

8. Method of reconstruction of an image according to claim 7, characterised in that the object movement is

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Volkswagen v. Longhorn - IPR2025-00925

also compensated with the movement estimated by the independent sensors.

ABSTRACT OF THE DISCLOSURE

METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES

Measurements of a mobile object and particularly a living being are made using two techniques, normally radiation attenuation and radiation emission, in synchronisation to provide images of the object state. Movement displacement fields from one phase to the next are estimated for both techniques, but the final images obtained by the emission technique are improved by the knowledge of the displacement field obtained by the other technique that is more precise.

1 / 2

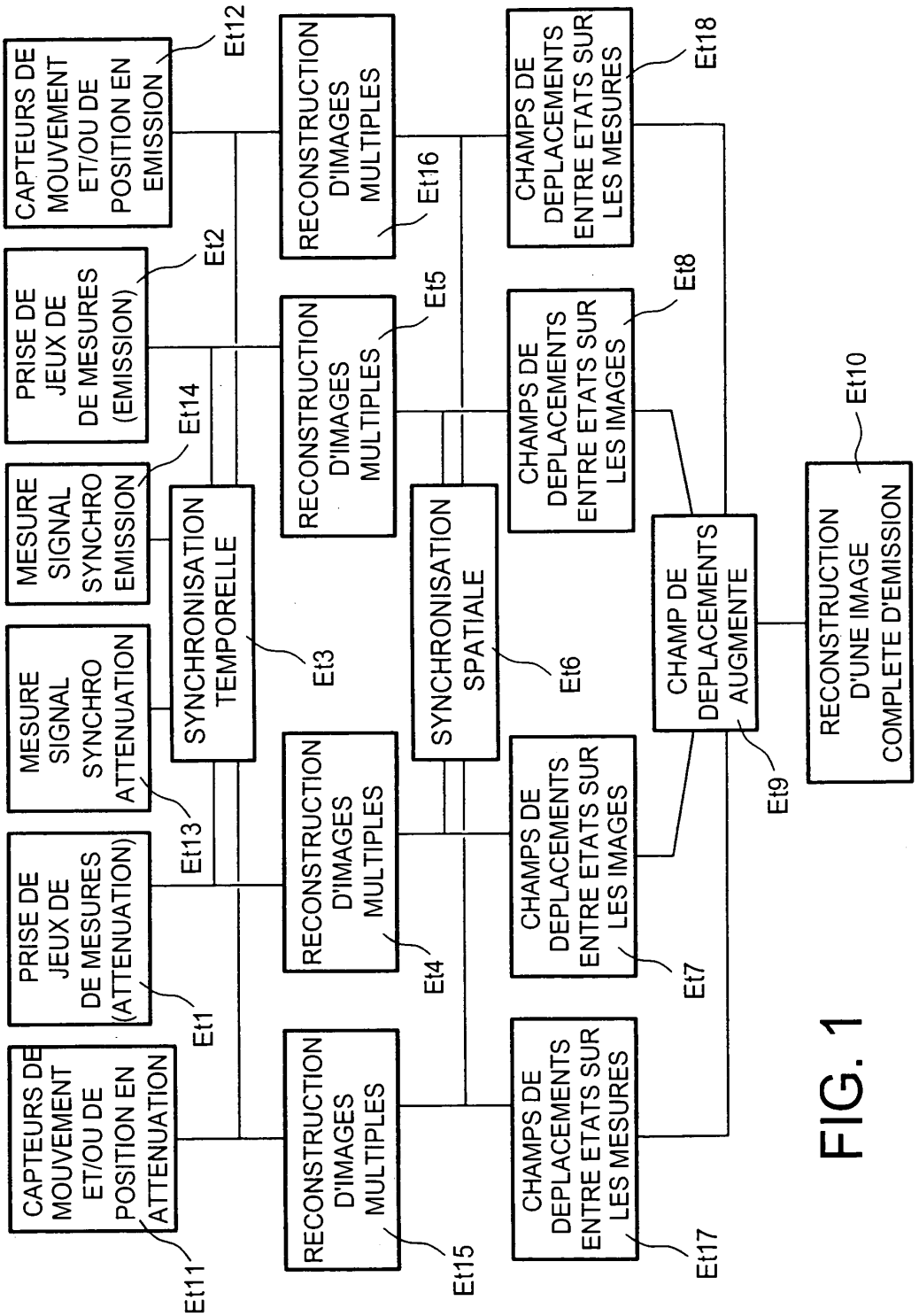

CAPTEURS DE MOUVEMENT ET/OU DE POSITION EN EMISSION
Et12
PRISE DE JEUX DE DE MESURES (EMISSION)
Et2
MESURE SIGNAL SYNCHRO EMISSION
Et14
MESURE SIGNAL SYNCHRO ATTENUATION
Et13
PRISE DE JEUX DE DE MESURES (ATTENUATION)
Et1
CAPTEURS DE MOUVEMENT ET/OU DE POSITION EN ATTENUATION
Et11
SYNCHRONISATION TEMPORELLE
Et3
RECONSTRUCTION D'IMAGES MULTIPLES
Et16
RECONSTRUCTION D'IMAGES MULTIPLES
Et5
RECONSTRUCTION D'IMAGES MULTIPLES
Et4
RECONSTRUCTION D'IMAGES MULTIPLES
Et15
SYNCHRONISATION SPATIALE
Et6
CHAMPS DE DEPLACEMENTS ENTRE ETATS SUR LES MESURES
Et18
CHAMPS DE DEPLACEMENTS ENTRE ETATS SUR LES IMAGES
Et8
CHAMPS DE DEPLACEMENTS ENTRE ETATS SUR LES IMAGES
Et7
CHAMPS DE DEPLACEMENTS ENTRE ETATS SUR LES MESURES
Et17
CHAMP DE DEPLACEMENTS AUGMENTE
Et9
RECONSTRUCTION D'UNE IMAGE COMPLETE D'EMISSION
Et10

FIG. 1

2 / 2

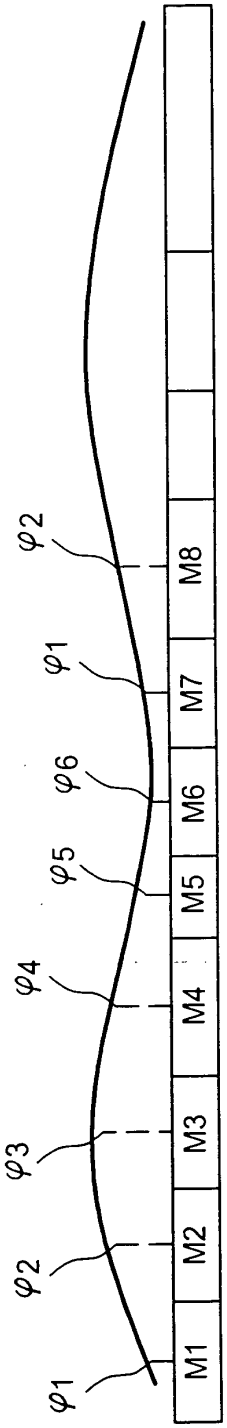


FIG. 2

Attorney Docket No. BRV.10002

COMBINED DECLARATION AND POWER OF ATTORNEY FOR UTILITY OR DESIGN PATENT APPLICATION

I hereby declare that:

Each inventor's residence, mailing address, and citizenship are as stated below next to their name.

I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES

the specification of which

☒ is attached hereto

OR

☐ was filed on_____as United States Application Number or PCT International Application Number _____ and was amended on (mm/dd/yyyy) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (mm/dd/yyyy)	Priority Claimed?
03 50631	FR	10/01/2003	☒ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
☐ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.			

Volkswagen Exhibit 1037, Page 445 of 2532
Volkswagen v. Longhorn - IPR2025-00925

I hereby appoint the attorneys and agents associated with the following PTO Customer Number of Hutchison & Mason PLLC to prosecute the application identified above and to transact all business in the United States Patent and Trademark Office connected therewith:

Address all correspondence to:

Customer Number: 45473
Hutchison & Mason PLLC
P.O. Box 31686
Raleigh, North Carolina 27612
(919) 829-9600

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
FULL NAME OF SOLE OR FIRST INVENTOR	Stéphane BONNET
Signature	
Date	
Residence (City, State, Country)	Grenoble, France
Citizenship	France
Mailing Address	42 rue Claude Genin
City, State, ZIP, Country	38100 Grenoble, France
FULL NAME OF SECOND INVENTOR	Pierre GRANGEAT
Signature	
Date	
Residence (City, State, Country)	Saint Ismier, France
Citizenship	France
Mailing Address	136 Allée Vignes du Persan
City, State, ZIP, Country	38330 Saint Ismier, France
FULL NAME OF THIRD INVENTOR	
Signature	
Date	
Residence (City, State, Country)	
Citizenship	
Mailing Address	

PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

10/05/2004 EHAILE1 00000068 503218 10955037
01 FC:1001 770.00 DA

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 489-267/69033

Volkswagen Exhibit 1037, Page 447 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2003

Application or Docket Number: 10955032

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	8	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	8 minus 20=	* —
INDEPENDENT CLAIMS	1 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	385.00	OR	BASIC FEE	770.00
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL		OR	TOTAL	720

CLAIMS AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
AMENDMENT A	Total	*	Minus	**	=
	Independent	*	Minus	***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
AMENDMENT B	Total	*	Minus	**	=
	Independent	*	Minus	***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

		OR		
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
AMENDMENT C	Total	*	Minus	**	=
	Independent	*	Minus	***	=
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

		OR		
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 10/03) Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

Patent
Attorney Docket No. BRV.10002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Stéphane BONNET et al.

Application No.: Unassigned

Group Art Unit: Unassigned

Filing Date: September 30, 2004

Examiner: Unassigned

Title: Method of Reconstructing an Image With Data Acquisition According to Several Imagery Modes and Synchronisation of Image Series

Confirmation No.: Unassigned

PRELIMINARY AMENDMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Prior to examination, please amend this application as follows:

Amendments to the Claims begin on page 2 of this paper; and

Remarks being on page 4 of this paper.

Volkswagen Exhibit 1037, Page 449 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (Original): Method of reconstruction of an image of a mobile object by a first measurement acquisition technique, comprising at least partial reconstruction of images of the object at corresponding movement states of the object, an estimate of the object movement between the states and a combination of state images by making compensations of the object movement according to the estimate, characterised in that object movement estimate at least uses partially other images of the object, obtained for the said states using a second measurement acquisition technique.

Claim 2 (Original): Method of reconstruction of an image according to claim 1, characterised in that the at least partial image reconstruction of the object at corresponding states of the object movement comprises a time synchronisation step applied to measurements originating from the second acquisition technique.

Claim 3 (Original): Method of reconstruction of an image according to claim 2, characterised in that the estimate of the object movement between the states comprises a spatial synchronisation step applied to at least partial images of the object at corresponding states of the object movement.

Claim 4 (Currently amended): Method of reconstruction of an image according to claim 1, ~~2 or 3,~~ characterised in that the first measurement acquisition technique is a functional radiation emission imagery technique and the second measurement acquisition technique is an anatomic radiation attenuation imagery technique.

Claim 5 (Currently amended): Method of reconstruction of an image according to ~~claims 1 to 4~~ claim 1, characterised in that it comprises a measurement of a cyclic element of the object movement to synchronise the states on periodic states of the cyclic element.

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Volkswagen v. Longhorn - IPR2025-00925

Claim 6 (Original): Method of reconstruction of an image according to claim 5, characterised in that the periodic states group measurements made on several phases associated with different periods of the movement cyclic element, at least for measurements acquired by the first technique.

Claim 7 (Currently amended): Method of reconstruction of an image according to ~~any one of the previous claims~~ claim 1, characterised in that it comprises the use of independent movement or position sensors to evaluate the movement of the object and / or to place the measurements by the two acquisition techniques and the states of the object on a common time scale.

Claim 8 (Currently amended): Method of reconstruction of an image according to claim 7, characterised in that the object movement is also compensated with the movement estimated by the independent sensors.

REMARKS

The claims have been amended to place the application in better form for examination. Entry of the amendment and favorable consideration are requested.

If any questions arise, the Examiner is invited to phone the undersigned at the below listed number.

Respectfully submitted,

HUTCHISON & MASON PLLC

Date: September 30, 2004

By: _____
Joshua T. Elliott
Registration No. 43,603

P.O. Box 31686
Raleigh, NC 27612
+1.919.829.9600

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR § 1.10 on the date indicated above and is addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Express Mail Label No. EV 613 035 543 US

Date of Deposit: September 30, 2004

Jennie Snead
(Typed Name of Person Signing Certificate)

_____
(Signature of Person Signing Certificate)

Date of Signing: 9/30/04

Patent
Attorney Docket No. BRV.10002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Stéphane BONNET et al.

Application No.: Unassigned

Group Art Unit: Unassigned

Filing Date: September 30, 2004

Examiner: Unassigned

Title: Method of Reconstructing an Image With Data Acquisition According to Several Imagery Modes and Synchronisation of Image Series

Confirmation No.: Unassigned

SUBMISSION OF CERTIFIED COPY OF PRIORITY DOCUMENTS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

The benefit of the filing date of the following priority foreign application in the following foreign country is hereby requested, and the right of priority provided in 35 U.S.C. § 119 is hereby claimed.

Country: France

Patent Application No.: 03 50631

Filed: October 1, 2003

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Volkswagen Exhibit 1037, Page 454 of 2532
Volkswagen v. Longhorn - IPR2025-00925

In support of this claim, enclosed is a certified copy of the foreign application. Said prior foreign application is referred to in the oath or declaration. Acknowledgement of receipt of the certified copy is requested.

Respectfully submitted,

HUTCHISON & MASON PLLC

Date: September 30, 2004

By: Joshua T. Elliott
Joshua T. Elliott
Registration No. 43,603

P.O. Box 31686
Raleigh, NC 27612
+1.919.829.9600

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR § 1.10 on the date indicated above and is addressed to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Express Mail Label No. EV 613 035 543 US

Date of Deposit: September 30, 2004

Jennie Snead
(Typed Name of Person Signing Certificate)

(Signature of Person Signing Certificate)

Date of Signing: September 30, 2004

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Volkswagen Exhibit 1037, Page 456 of 2532
Volkswagen v. Longhorn - IPR2025-00925

R E P U B L I Q U E F R A N Ç A I S E

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Fait à Paris, le 08 SEP. 2004

Pour le Directeur général de l'Institut
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Le Chef du Département des brevets

Martine PLANCHE

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Volkswagen Exhibit 1037, Page 458 of 2532
Volkswagen v. Longhorn - IPR2025-00925

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BREVET D'INVENTION
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Code de la propriété intellectuelle-livreVI

REQUÊTE EN DÉLIVRANCE

DATE DE REMISE DES PIÈCES: N° D'ENREGISTREMENT NATIONAL: DÉPARTEMENT DE DÉPÔT: DATE DE DÉPÔT:	Jean LEHU BREVATOME 3, rue du Docteur Lancereaux 75008 PARIS France
Vos références pour ce dossier: B14387JCI-DD2548	

1 NATURE DE LA DEMANDE			
Demande de brevet			
2 TITRE DE L'INVENTION			
	PROCEDE DE RECONSTRUCTION D'IMAGE AVEC ACQUISITION DE DONNEES SELON PLUSIEURS MODES D'IMAGERIE ET SYNCHRONISATION DES SERIES D'IMAGES.		
3 DECLARATION DE PRIORITE OU REQUETE DU BENEFICE DE LA DATE DE DEPOT D'UNE DEMANDE ANTERIEURE FRANCAISE	Pays ou organisation	Date	N°
4-1 DEMANDEUR			
Nom	COMMISSARIAT A L'ENERGIE ATOMIQUE		
Rue	31-33, rue de la Fédération		
Code postal et ville	75752 PARIS 15ème		
Pays	France		
Nationalité	France		
Forme juridique	Etablissement Public de Caractère Scientifique, technique et Ind		
5A MANDATAIRE			
Nom	LEHU		
Prénom	Jean		
Qualité	Liste spéciale: 422-5 S/002, Pouvoir général: 7068		
Cabinet ou Société	BREVATOME		
Rue	3, rue du Docteur Lancereaux		
Code postal et ville	75008 PARIS		
N° de téléphone	01 53 83 94 00		
N° de télécopie	01 45 63 83 33		
Courrier électronique	brevets.patents@brevalex.com		
6 DOCUMENTS ET FICHIERS JOINTS	Fichier électronique	Pages	Détails
Texte du brevet	textebrevet.pdf	20	D 17, R 2, AB 1
Dessins	dessins.pdf	2	page 2, figures 2, Abrégé: page 1, Fig.1
Pouvoir général			

7 MODE DE PAIEMENT				
Mode de paiement	Prélèvement du compte courant			
Numéro du compte client	024			
8 RAPPORT DE RECHERCHE				
Etablissement immédiat				
9 REDEVANCES JOINTES	Devise	Taux	Quantité	Montant à payer
062 Dépôt	EURO	0.00	1.00	0.00
063 Rapport de recherche (R.R.)	EURO	320.00	1.00	320.00
Total à acquitter	EURO			320.00

La loi n°78-17 du 6 janvier 1978 relative à l'informatique aux fichiers et aux libertés s'applique aux réponses faites à ce formulaire. Elle garantit un droit d'accès et de rectification pour les données vous concernant auprés de l'INPI.

Signé par
Signataire: FR, Brevatome, J.Lehu
Emetteur du certificat: DE, D-Trust GmbH, D-Trust for EPO 2.0
Fonction
Mandataire agréé (Mandataire 1)

1er dépôt

R E P U B L I Q U E F R A N C A I S E

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BREVET D'INVENTION
CERTIFICAT D'UTILITE

Réception électronique d'une soumission

Il est certifié par la présente qu'une demande de brevet (ou de certificat d'utilité) a été reçue par le biais du dépôt électronique sécurisé de l'INPI. Après réception, un numéro d'enregistrement et une date de réception ont été attribués automatiquement.

Demande de brevet : X
Demande de CU :

DATE DE RECEPTION	1 octobre 2003	
TYPE DE DEPOT	INPI (PARIS) - Dépôt électronique	**Dépôt en ligne: X**
		Dépôt sur support CD:
N° D'ENREGISTREMENT NATIONAL ATTRIBUE PAR L'INPI	0350631	
Vos références pour ce dossier	B14387JCI-DD2548	

DEMANDEUR

Nom ou dénomination sociale	COMMISSARIAT A L'ENERGIE ATOMIQUE
Nombre de demandeur(s)	1
Pays	FR

TITRE DE L'INVENTION

PROCEDE DE RECONSTRUCTION D'IMAGE AVEC ACQUISITION DE DONNEES SELON PLUSIEURS MODES D'IMAGERIE ET SYNCHRONISATION DES SERIES D'IMAGES.

DOCUMENTS ENVOYES

package-data.xml	Requetefr.PDF	fee-sheet.xml
Design.PDF	ValidLog.PDF	textebrevet.pdf
FR-office-specific-info.xml	application-body.xml	request.xml
dessins.pdf	indication-bio-deposit.xml	

EFFECTUE PAR

Effectué par:	J.Lehu
Date et heure de réception électronique:	1 octobre 2003 15:52:21
Empreinte officielle du dépôt	81:81:EC:47:39:9A:7E:AB:95:B4:BE:37:30:F4:0E:63:8C:21:CD:32

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PROCEDE DE RECONSTRUCTION D'IMAGE AVEC ACQUISITION DE DONNEES SELON PLUSIEURS MODES D'IMAGERIE ET SYNCHRONISATION DES SERIES D'IMAGES

DESCRIPTION

Cette invention ressortit à un procédé dans lequel une image d'un objet est estimée au moyen de deux séries de données, qu'on combine en faisant une synchronisation.

La prise d'images de l'intérieur d'objets et notamment d'êtres vivants peut se faire par plusieurs genres de procédés. Certains sont de nature atténuative, c'est-à-dire qu'on mesure l'atténuation d'un rayonnement traversant l'objet, et d'autres sont de nature émissive, c'est-à-dire qu'on recueille des particules ionisantes provenant d'un liquide radioactif ingéré préalablement par l'organisme à étudier. Dans les deux cas, des réseaux de détecteurs tournant autour de l'objet ou couvrant le tour de l'objet recueillent le rayonnement, et des images de l'objet sont obtenues en combinant les mesures des détecteurs prises à des angles différents selon des méthodes bien connues de reconstruction tomographique "La tomographie" sous la direction de P.Grangeat Paris : Hermès Science Publications 2002 ibsn 2.7462-0356-1).

Certaines méthodes conviennent mieux pour obtenir certains genres de résultats. De façon typique, des images obtenues par atténuation peuvent indiquer la composition de l'objet à chaque endroit et permettre ainsi de bien dessiner les organes d'un être vivant et leurs contours. Les images obtenues par émission n'ont

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généralement pas cette possibilité mais permettent de distinguer les tissus sains, qui sont faiblement émissifs, des tissus malades, cancéreux par exemple, qui sont fortement émissifs. On peut qualifier les premières images d'anatomiques et les secondes de fonctionnelles. Elles sont complémentaires et leur superposition peut aider grandement au diagnostic. L'art antérieur comprend ainsi des dispositifs pour acquérir simultanément les deux genres d'images (comme dans l'article « Attenuation correction for a combined 3D PET/CT scanner » de Kinahan et autres, Med. Phys. 25(10), octobre 1998, p.2046 - 2053).

Un aspect qu'il convient de considérer concerne le mouvement des êtres animés au cours des mesures. Il est évident que le mélange de mesures prises pendant que l'objet bouge ne peut produire que des images brouillées si aucune précaution n'est prise. On s'est beaucoup intéressé à ce problème depuis plusieurs années, et plusieurs genres de solutions ont été proposés. Les unes consistent à prendre les mesures aussi vite que possible, en recourant par exemple à un réseau de détecteurs particulièrement nombreux qui entoure complètement l'objet à étudier, au lieu de se déplacer autour de lui. Un autre procédé consiste à s'arranger pour ne prendre des mesures qu'à un état à peu près invariable de l'objet, par exemple pour un même état du cycle cardiaque ou respiratoire ou d'un autre cycle biologique périodique. La première de ces méthodes est évidemment coûteuse en matériel et la deuxième est difficile à bien appliquer, et inopérante pour des mouvements non périodiques (animal bougeant,

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par exemple). Un autre genre de méthodes implique une correction numérique des mesures et des images en tenant compte du déplacement de l'objet entre chaque série de mesures. Les mouvements de l'objet sont estimés alors par des champs de déplacements de leurs points. Ces champs de déplacements peuvent être obtenus par des estimations sur des premières images en incluant éventuellement des hypothèses sur les mouvements. Cette dernière méthode est la plus susceptible de donner de bons résultats. Le brevet français 2 826 157 décrit un exemple.

Les méthodes de correction des images par estimation du champ de déplacements ont été appliquées avant tout aux images d'atténuation qui peuvent être prises rapidement et dont le contenu plus distinct donne plus de détails sur les mouvements de l'objet. Les images d'émission ont un contenu moins abondant du fait que les mesures sont plus dispersées dans le temps, et elles sont moins reconnaissables puisque les différentes catégories de tissus sont moins distinguées. Il est donc difficile de bien établir un champ de déplacements afin de s'en servir pour compenser les mouvements de l'objet et régulariser son image.

Il est pourtant proposé ici d'appliquer aux techniques d'émission une telle méthode de reconstruction d'images avec une compensation du mouvement de l'objet, grâce aux modalités ci-dessous.

Des images de l'objet sont prises à la fois par une technique d'émission et une technique d'atténuation. Les procédés ordinaires d'estimation du

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mouvement sont appliqués aux images obtenues par atténuation, en reconstituant une série d'images de l'objet étudié au moyen de jeux de mesures pris à des instants respectifs et fournissant donc des images floues, si elles ne sont pas compensées en mouvement, à cause du faible mouvement de l'objet, mais bien représentatives de l'état de l'objet à des instants respectifs. Les champs de déplacements des points de l'objet pour arriver à ces premières images sont obtenus.

Ces champs de déplacements sont ensuite appliqués aux mesures prises par la technique d'émission en général après avoir été modifiés ou adaptés par des procédés qui seront détaillés dans la suite de ce document. Ainsi, ces mesures d'émission peuvent aussi être corrigées pour compenser le mouvement et obtenir une image fonctionnelle finale améliorée. Il est simplement nécessaire de synchroniser les prises des mesures par les deux techniques sur une base de temps commune.

Les installations connues dans lesquelles les deux genres d'images ont été obtenus n'utilisent aucune combinaison analogue des jeux de mesures, et recourent à une simple juxtaposition des deux genres d'images obtenues indépendamment par superposition, ou utilisent tout au plus l'image d'atténuation pour une correction d'un autre genre des mesures d'émission, en compensant les atténuations à travers l'objet étudié, qui affectent aussi ces mesures.

Quoique l'invention soit aujourd'hui utile surtout dans le contexte particulier des couples

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d'acquisitions par atténuation et émission, elle peut être généralisée sans difficulté à n'importe quel couple d'acquisitions de mesures et ne saurait donc être limitée par les réalisations décrites ici.

On va maintenant décrire l'invention plus dans le détail en recourant aux figures jointes, dont la figure 1 est un organigramme général et la figure 2 un diagramme temporel.

Cette invention concernant surtout l'imagerie médicale, l'hypothèse de l'examen d'un patient sera retenue ici. Il reçoit la consigne de respirer normalement et régulièrement pendant l'examen. Dans les procédés où aucune compensation de mouvement n'est faite, on lui demande au contraire de retenir sa respiration ou de l'arrêter à même état avant chaque mesure. Il a aussi ingéré un corps radio-pharmaceutique comme le FDG (fluoro-deoxy-glucose) par injection intraveineuse. Ce corps permet de suivre le métabolisme cellulaire du glucose en technique d'émission. D'autres corps émissifs sont utilisés pour d'autres applications.

Les mesures d'atténuation et d'émission sont entreprises aux étapes Et1 et Et2 de la figure 1. Pour chacune des catégories de mesures, des jeux de mesures sont pris à des instants successifs, qui ne sont pas généralement simultanés pour les deux catégories de mesures. Il est cependant nécessaire d'accomplir une synchronisation temporelle des jeux de mesures, au sein des deux séries et entre les deux séries d'après l'étape Et3. Un procédé utile pour cela peut consister en la mesure d'un mouvement du patient

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par un capteur indépendant tel qu'un capteur de respiration, un capteur de pression ou un electro-cardiogramme. Chacun des jeux de mesures est alors associé à un état déterminé du patient pendant lequel une mesure de son mouvement a été entreprise. Si cette mesure concerne un phénomène cyclique comme la respiration, les jeux de mesures peuvent être associés à des phases temporelles de ce mouvement comme le suggère le diagramme de la figure 2, dans laquelle six jeux de mesures M1 à M6 pris sur un cycle respiratoire sont associés à des phases moyennes $\varphi 1$ à $\varphi 6$.

Les étapes Et11 et Et12 de la figure 1 illustrent de telles utilisations de capteurs. Les capteurs de mouvements ou de position en général conviennent à ce procédé. Ils peuvent être en nombre quelconque. Certains peuvent être associés aux mesures d'atténuation et les autres aux mesures d'émission. Quand un jeu de mesures est pris, les capteurs associés enregistrent le signal de mouvement, etc. qu'ils reçoivent. Quand tous les jeux de mesures sont pris, des comparaisons entre les signaux enregistrés des différents capteurs permettent de placer les deux jeux de mesures à des emplacements déterminés sur une échelle de temps commune. Les instants des prises des mesures peuvent être déterminés si certains des capteurs mesurent aussi le temps, ou si un signal de mesure de temps autonome est pris et mesuré. Dans le procédé illustré, deux signaux de mesure de temps sont pris aux étapes préliminaires Et13 et Et14, et servent respectivement à déterminer les instants de prises de

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mesures avec les deux techniques et les instants de prises de mesures par les capteurs.

Enfin, la synchronisation temporelle peut être assurée par des procédés de corrélation entre les projections de l'image. L'article "Kymogram detection and Kymogram-correlated image recontruction from subsecond spiral computed tomography scans of the heart", par Kachelriess et autres, Med. Phys. 29 (7), juillet 2002, p.1489 à 1503, donne un exemple.

Après ces étapes Et1, Et2 et Et3 de prise de jeux de mesures et de synchronisation temporelle, on procède à une reconstruction d'images au moins partielles du patient par états multiples selon les étapes Et4 et Et5 pour chacune des techniques de mesures. Cela signifie que chacun des jeux de mesures, tel M1, est utilisé pour donner une image particulière en supposant le patient immobile pendant toute la durée de prise du jeu de mesures. Des moyens numériques classiques comme le filtrage et la rétroprojection sont appliqués. Les images partielles ainsi obtenues sont généralement fondées sur des données trop incomplètes pour être exactes, mais elles sont tout de même assez détaillées pour être comparées entres elles et permettre de déterminer les mouvements du patient d'une phase à la suivante. On pourra plus précisément appliquer les travaux de l'art antérieur donnés ci-dessous : P. Grangeat, A. Koenig, T. Rodet and S. Bonnet, « Theoretical framework for a dynamic cone-beam reconstruction algorithm based on a dynamic particle model », Phys. Med. Biol., vol. 47, n°15, pp. 2611-2625, August 2002, pour une technique d'atténuation et

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D. R Gilland, B. A. Mair, J. E. Bowsher and R.J Jaszczak, « Simultaneous reconstruction and motion estimation for gated cardiac ECT », IEEE Trans. Nucl. Sci., vol. 49, n°5, pp. 2344-2349, October 2002, pour une technique d'émission.

Les étapes Et15 et Et16 montrent que des états du patient peuvent aussi être définis à ces mêmes états d'après les renseignements fournis par les capteurs.

La synchronisation temporelle aurait pu être appliquée maintenant à ces images d'état plutôt qu'aux jeux de mesures.

Une synchronisation spatiale est entreprise à l'étape Et6. Il s'agit d'un recalage des catégories d'images au moins partielles et des renseignements des capteurs d'après lequel des points homologues, (c'est-à-dire correspondant à un même point du patient) doivent apparaître à la même position sur les deux catégories d'images. Cette étape qui permet de comparer les deux catégories d'images entre elles n'est pas originale et l'invention ne porte par sur elle.

Elle consiste à déterminer un opérateur de déformation D paramétré pour passer d'un référentiel associé aux images d'atténuation vers le référentiel associé aux images d'émission.

Cet opérateur est supposé invariant pour la durée de l'examen. On suppose également que la synchronisation temporelle est suffisamment précise et que les mouvements du patient (physiologiques) sont reproductibles.

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Ainsi, on dispose à l'instant t d'une image d'atténuation f_t et d'une image d'émission g_t. On cherche ensuite à identifier l'opérateur de déformation D en assurant la cohérence entre les deux images f_t et g_t sur les points de mesure.

$$D = \arg\min \left[E_{ima}(f_t, g_t, D)\right]$$

avec

$$E_{ima}(f_t, g_t, D) = \sum \phi\left(f_t(r) - g_t[D(r)]\right)$$

ou ϕ est une fonction convexe et i désigne la position du pixel dans l'image.

Pour être général, on peut aussi introduire des mesures obtenues par des micro-systèmes qui renseignent sur la position du patient au niveau des capteurs (ou points de contrôle). On se place dans le cas où on dispose pour chaque type d'acquisition (à la fois d'atténuation et d'émission) d'images de la position de ces points de contrôle. On note h^{att} et $h^{émi}$ de tels jeux de mesure délivrés par les capteurs de position. De tels capteurs utilisent des systèmes optiques par opposition aux capteurs de mouvement qui eux se basent sur des systèmes à base d'accéléromètres.

On peut aussi envisager d'utiliser des systèmes d'imagerie pour localiser ces capteurs en jouant sur leur atténuation ou en leur incorporant des sources radioactives pour la partie émission.

Si on dispose à l'instant t de ces informations supplémentaires h_t^{att} et $h_t^{émi}$, alors on peut minimiser l'ensemble d'une seule fonctionnelle.

$$D = \arg\min \left[E_{ima}(f_t, g_t, D) + \alpha\, E_{capt}(h_t^{att}, h_t^{émi}, D)\right]$$

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où α est un coefficient de pondération.

Puisque D est supposé constant pour la durée de l'examen, sa détermination n'est pas limitée à un jeu d'images à l'instant t mais bien sur l'ensemble des instants à disposition.

D peut être un mouvement solide (de translation si le patient n'est pas replacé exactement à la même hauteur, rotation si le patient s'est légèrement tourné), ou un mouvement affine par exemple. La déformation D peut être aussi interprétée par analogie aux grilles de déformation des points de contrôle des techniques de déformation de forme libre.

Le cas simple est ensuite le cas où le patient ne bouge pas entre les techniques d'atténuation et d'émission et donc où D = identité.

Les étapes suivantes Et7 et Et8 concernent l'estimation du mouvement du patient d'une phase à l'autre pour chacune des deux catégories de mesures. Ici aussi on applique des procédés connus, notamment ceux du brevet français 2 736 454 ou l'article de Gilland indiqué plus haut. On obtient des champs de déplacements de points de l'objet d'une phase à une autre. Les champs de déplacements peuvent être obtenus de façon dense pour les mesures d'atténuation qui restituent bien les détails des images. Ils ne le peuvent en général pas être avec les mesures d'émission ; on peut les compléter en utilisant d'autres informations (provenant par exemple de capteurs de mouvement situés sur le patient) ou des hypothèses sur les mouvements de l'objet, comme l'absence de déformation (les mouvements sont réduits à

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des translations et des rotations), ou une déformation sans variation de volume, ou encore une déformation obéissant à des paramètres déterminés. Les mouvements du muscle cardiaque et de la cage thoracique peuvent ainsi être utilisés simplement.

Une autre façon de compléter les champs de déplacements est plus particulière à l'invention et revêt une importance spéciale. Elle concerne les mouvements cycliques comme la respiration ou le rythme cardiaque. Les mesures d'atténuation sont en général faites rapidement, en quelques cycles respiratoire ou même un seul, alors que les mesures d'émission sont faites beaucoup plus lentement, dix minutes étant souvent nécessaires. L'invention comprend alors un regroupement des jeux de mesures, surtout des mesures d'émission, d'après les phases φ considérées dans un seul cycle du mouvement, même si ces mesures concernent en réalité des cycles différents. C'est ce qu'on a encore illustré à la figure 2, où les jeux de mesures postérieurs à ceux du premier cycle respiratoire : M7, M8, etc. seront associés aux phases $\varphi 1$ et $\varphi 2$, etc. déjà mentionnées plutôt qu'aux phases $\varphi 7$ et $\varphi 8$, etc. qui s'en déduisent par un angle de 2π ou un de ses multiples. Les images partielles réduites à un petit nombre sont plus riches en contenu.

Si ce procédé de synchronisation sur un petit nombre de phases a une grande importance pratique, elle n'est cependant pas indispensable à la mise en œuvre de cette invention, qu'on pourra appliquer à un patient subissant un mouvement quelconque, ou un mouvement cyclique.

Les étapes E17 et E18 illustrent que des champs de déplacements peuvent aussi être calculés d'après les mesures des capteurs.

L'étape suivante Et9 est une des plus importantes de l'invention. Elle consiste à obtenir un champ de déplacements dit augmenté par une synthèse des deux estimations de mouvements Et7 et Et8 obtenues précédemment et en utilisant éventuellement d'autres contributions provenant de mesures différentes ou d'hypothèses.

On expose ici le calcul du champ de déplacements augmenté en essayant cette fois d'être le plus général possible.

Pour être plus général, on peut aussi introduire des mesures de microsystèmes qui seraient en les deux obtenues soit en atténuation soit en émission soit en les deux ainsi qu'un opérateur de déformation D paramétré pour passer du référentiel en atténuation vers le référentiel en émission et pour des mouvements m_{att} dans le référentiel en atténuation et $m_{émi}$ dans le référentiel en émission PET, de telle façon que

$$m_{att}(i) = m_{emi}(D(i)) = m_{émi} \circ D^{-}(i)$$

On ajoute explicitement la formule de minimisation des informations obtenues non plus seulement par des systèmes d'imagerie mais aussi par des micro systèmes enseignant sur la position et/ou le mouvement du patient au niveau des capteurs (ou aussi à des points de contrôle).

Comme expliqué précédemment, on se place dans le cas où on dispose pour chaque acquisition en atténuation ou émission d'un jeu de mesures délivré par

ces capteurs. On distingue toutefois le cas où on dispose d'images de position délivrées par le capteur (celles utilisées pour le recalage).

$\begin{cases} h_1^{att} \\ h_1^{émi} \end{cases}$, $\begin{matrix} h_2^{att} \\ h_2^{émi} \end{matrix}$ aux instants t_1 et t_2

de celui où on dispose directement du champs de déplacement en certains points de l'espace (comme les points de contrôle)

$\begin{cases} m_{att} \\ m_{émi} \end{cases}$ entre les instants t_1 et t_2,

les deux champs étant reliés par la relation précédemment établie

$m_{att} = m_{émi}$ o D

Finalement, on cherche à assurer la cohérence entre :

Sur les images médicales $\begin{cases} (f_1, f_2, moD) \\ (mf, m_oD) \end{cases}$ $\begin{matrix} (g_1, g_2, m) \\ (mg, m) \end{matrix}$;

E1 est une fonction exprimant la cohérence entre deux images au moins partielles d'émission g1 et g2 obtenues à l'étape Et5, et le champ de déplacements m qui doit les relier, et qui peut s'exprimer par E1 (g1, g2, m)=$\Sigma\phi 1[g1(r)-g2(r+m(r))]$ où $\phi 1$ est une fonction convexe et r désigne la position du pixel considéré sur l'image ; E9 est la connaissance a priori sur la régularité du champ de déplacements, avec par exemple E9(m)=Σ $\phi g(m(r))$; et E3 et E4 reflètent la cohérence du champ de déplacements m par rapport aux champs de déplacements estimés pour les deux techniques, selon les formules E3(mg,m)=$\Sigma\phi 3(m(r)-mg(r))$ et E4(mF,moD)=$\Sigma\Phi 4(moD(r)-mf(r))$. Les fonctions $\phi 1$, $\phi 2$, $\phi 3$ et $\phi 4$ sont choisies assez librement et peuvent consister en des polynômes positifs convexes,

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l'essentiel étant de pouvoir trouver facilement par des procédés d'analyse numérique un champ de déplacements m qui concilie bien les résultats existants et qu'on puisse ainsi appliquer aux images au moins partielles d'émission.

En particulier, on ajoute explicitement une cohérence entre deux images d'atténuation f_1 et f_2 obtenues à l'étape Et4 et le champ de déplacements m qui doit les relier.

Sur les données des microsystèmes $\begin{vmatrix} (h_1^{att}, h_2^{att}, moD) & (h_1^{émi}, h_2^{émi}, m) \\ (m_{att}, moD) & (m_{émi}, m) \end{vmatrix}$

avec une certaine régularité sur m.

On peut minimiser l'ensemble dans une seule fonctionnelle qui serait $(m, D) = \arg\min$

$$\left\{\begin{array}{l} a\ E_1(g_1, g_2, m_{émi} + b\ E_2\ (f_1, f_2, moD) + c\ E_3(mg, m) + d\ E_4(mf, moD) \\ + e\ E_5(h_1^{émi}, h_2^{émi}, m) + f\ E_6(h_1^{att}, h_2^{att}, moD) + g\ E_7(m_{émi}, m) + h\ E_8(m_{att}, moD) \\ + i\ E_9(m) \end{array}\right\}$$

avec m, qui est le champ de déplacements augmenté.

Les inconnues sont m et les paramètres de la déformation D.

Cette déformation est justement celle qu'on recherche lors de l'étape de synchronisation spatiale.

On peut donc imaginer séparer le problème en identifiant d'abord D en assurant la cohérence entre $(h_1^{att}, h_1^{émi}, D)$, $(h_2^{att}, h_2^{émi}, D)$, etc.

Cette minimisation partielle a été décrite plus haut.

Du coup, la fonctionnelle ne porte plus que sur l'inconnue m.

Les microsystèmes peuvent jouer deux rôles :

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- mettre en correspondance les deux techniques d'acquisition ;

- lever certaines ambiguïtés sur le calcul du champ de déplacement et de trajectoire pour au moins l'une des deux techniques d'acquisition.

En tout état de cause, l'utilisation d'une autre modalité d'imagerie de référence reste nécessaire pour pallier la mauvaise résolution spatiale et la qualité d'image médiocre (bruitée et définie seulement au niveau des régions de fixation du produit radioactif) qui caractérisent les images d'émission et qui conduiraient à des champs de déplacements de mauvaise qualité pour les zones d'intérêt.

L'inutilisation de capteurs impose e=f=g=h=o et conduit à une fonctionnelle se basant uniquement sur les informations obtenues par les systèmes d'imagerie.

Dans le cas particulier où il n'y a pas de capteurs de position et/ou de mouvements, ce champ de déplacements augmenté est noté m, et les champs de déplacements obtenus aux étapes Et7 et Et8 par mf et mg, la formule peut être simplifiée et devient :

$m=\arg\min \{aE1(g1, g2,m)+bE2(f1, f2, moD)+cE3(mg,m)+dE4(mF, moD)+iEg(m)\}$;

a, b, c et d sont des coefficients de pondération.

Un cas important correspondrait à a=b=d=0 : les champs de déplacements estimés par la technique d'atténuation seraient alors appliqués tels quels aux images partielles estimées par la technique d'émission ; puisque ainsi qu'on l'a mentionné, le champ de déplacements obtenu par la technique d'atténuation est généralement beaucoup plus précis et exact.

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Les champs de déplacements calculés aux étapes Et17 et Et18 peuvent aussi contribuer au calcul du champ de déplacements augmenté par le moyen d'autres coefficients de pondération. Toutefois, on doit souligner que l'utilisation de capteurs autonomes n'est pas indispensable si les jeux de mesures peuvent être placés autrement (par les étapes Et13 et Et14) dans une même échelle de temps ; les étapes Et11 et Et12, Et 15, Et16, Et 17 et Et 18 peuvent alors être supprimées du procédé.

Le procédé est complété par une exploitation de ce champ de déplacements augmenté pour reconstruire au moins une image définitive du patient d'après l'étape Et10. Pour cela, les images partielles sont combinées par addition en tenant compte des déplacements que leurs points ont subi d'une phase à l'autre afin de ne procéder à des additions que sur des états successifs des mêmes points. Des coefficients de pondération exprimant la confiance accordée à chaque point ou chaque image partielle peuvent être appliqués. L'image définitive plus nette que les images partielles (et composée d'acquisitions complètes entières du patient) est finalement obtenue. L'amélioration offerte par l'invention s'exprime avant tout sur l'image obtenue par les techniques d'émission. Si toutefois l'acquisition a été longue (c'est-à-dire effectuée sur plusieurs cycles), on ne reconstruit pas nécessairement une image unique mais une série d'images correspondant chacune à un état du cycle respiratoire (par exemple), et on applique l'estimation des champs de déplacements augmenté et la compensation du mouvement à ces images

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d'état. Une telle façon de procéder réduit l'influence d'un mouvement cyclique d'ensemble du patient et peut donner des résultats de meilleure qualité qu'une image unique obtenue avec tous les jeux de mesures cumulés sur le cycle et qui permettrait de mieux réduire le bruit des mesures par rapport au signal utile, mais produirait du flou dû à ce mouvement d'ensemble.

Les images de la technique d'émission peuvent encore être corrigées, de façon connue, par une correction des données d'émission corrigées ou non en mouvement, d'après l'atténuation qu'elles ont subie et qu'on peut déduire des images d'atténuation.

Des techniques d'atténuation et d'émission qui pourraient recevoir l'invention sont le CT (Tomographie à rayon x) ou l'IRM (Imagerie par résonance magnétique nucléaire) pour l'atténuation, et le SPECT (Single Photon Emission Computed Tomography) ou le TEP (tomographie à émission de positions). Pour l'émission.

L'utilisation de micro-capteurs de position et de mouvement peut venir compléter une des technique ou se substituer à elle afin de fournir une référence sur le champ de déplacements à appliquer à la fin sur les images obtenues par les techniques d'émission.

L'intérêt de l'invention est évident pour les couples de mesures comprenant une technique d'atténuation et une technique d'émission de rayonnement, mais celle-là peut aussi être appliquée à d'autres situations de double mesure.

LAG-VW00000478

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REVENDICATIONS

1. Procédé de reconstruction d'images d'un objet mobile par une première technique d'acquisition de mesures, comprenant une reconstruction d'images au moins partielles de l'objet à des états respectifs de mouvement de l'objet, une estimation du mouvement de l'objet entre les états et une combinaison des images d'états en faisant des compensations du mouvement de l'objet d'après l'estimation, caractérisé en ce que l'estimation du mouvement de l'objet utilise au moins partiellement d'autres images de l'objet, obtenues pour lesdits états, par une deuxième technique d'acquisition de mesures.

2. Procédé de reconstruction d'images selon la revendication 1, caractérisé en ce que la reconstruction d'images au moins partielles de l'objet à des états respectifs de mouvement de l'objet comporte une étape de synchronisation temporelle appliquée aux mesures issus de la première technique d'acquisition et aux mesures issues de la deuxième technique d'acquisition.

3. Procédé de reconstruction d'images selon la revendication 2, caractérisé en ce que l'estimation du mouvement de l'objet entre les états comporte une étape de synchronisation spatiale appliquée aux images au moins partielles de l'objet à des états respectifs de mouvement de l'objet.

4. Procédé de reconstruction d'images selon la revendication 1, 2 ou 3, caractérisé en ce que la première technique d'acquisition de mesures est une technique d'imagerie fonctionnelle d'émission de

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rayonnement et la deuxième technique d'acquisition des mesures est une technique d'imagerie anatomique d'atténuation de rayonnement.

5. Procédé de reconstruction d'images selon la revendication 1 à 4, caractérisé en ce qu'il comprend une mesure d'un élément cyclique du mouvement de l'objet pour synchroniser les états sur des états périodiques de l'élément cyclique.

6. Procédé de reconstruction d'images selon la revendication 5, caractérisé en ce que les états périodiques regroupent des mesures faites sur plusieurs phases associées à différentes périodes de l'élément cyclique du mouvement, au moins pour les mesures acquises par la première technique.

7. Procédé de reconstruction d'images selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comporte l'emploi de capteurs autonomes de mouvement ou de position pour évaluer le mouvement de l'objet et/ou placer les mesures par les deux techniques d'acquisition et les états de l'objet sur une échelle de temps commune.

8. Procédé de reconstruction d'images selon la revendication 7, caractérisé en ce que le mouvement de l'objet est compensé aussi avec le mouvement évalué par les capteurs autonomes.

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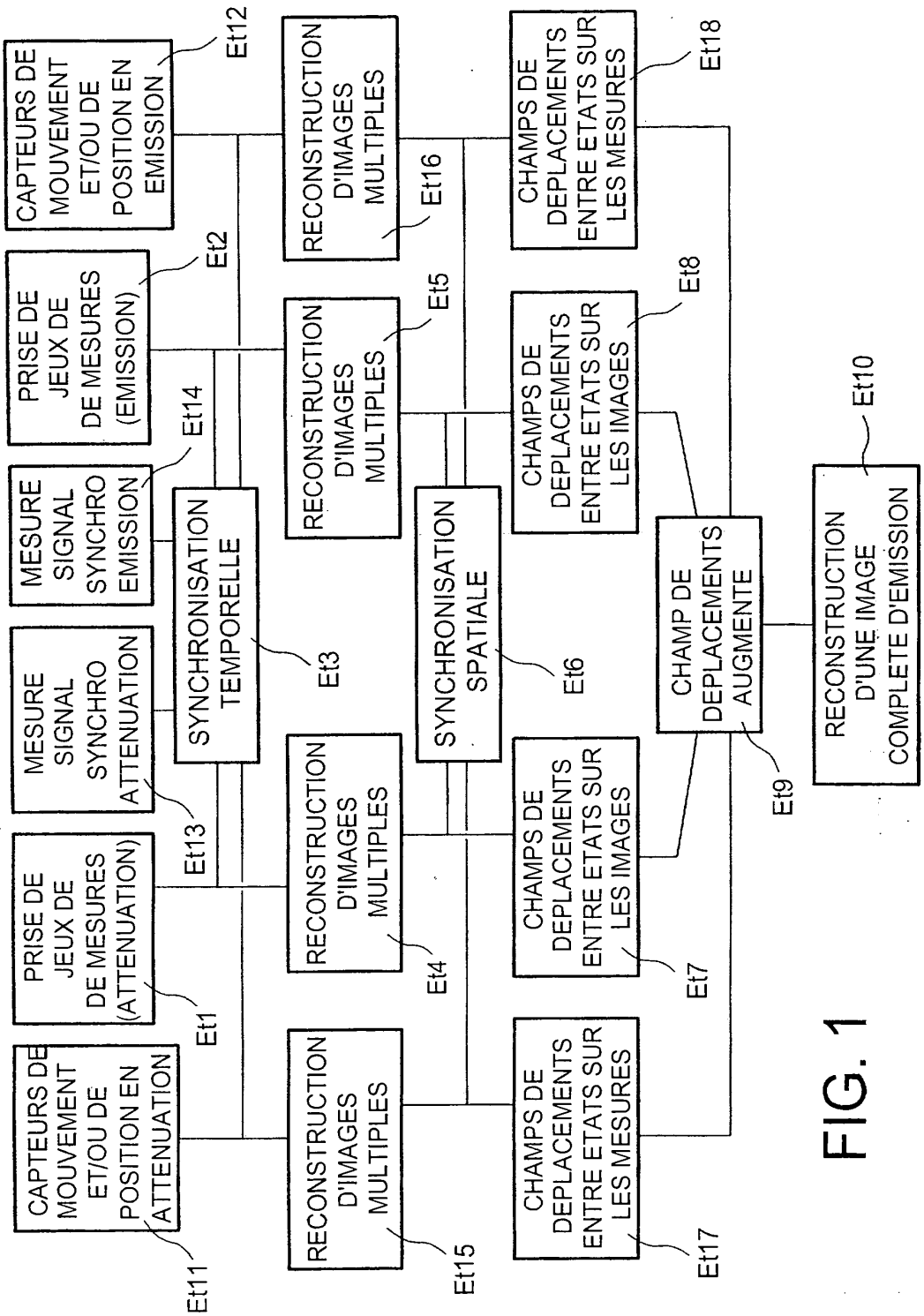


FIG. 1

B.14387

Volkswagen Exhibit 1037, Page 481 of 2532
Volkswagen v. Longhorn - IPR2025-00925

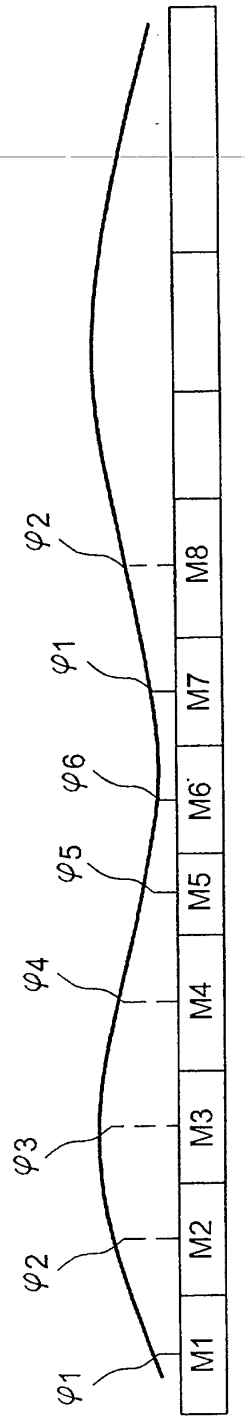


FIG. 2

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Volkswagen v. Longhorn - IPR2025-00925

reçue le 17/10/03

INPI
INSTITUT NATIONAL DE LA PROPRIETE INDUSTRIELLE

DÉPARTEMENT DES BREVETS
26 bis, rue de Saint Pétersbourg
75800 Paris Cedex 08
Téléphone : 33 (1) 53 04 53 04 Télécopie : 33 (1) 42 94 86 54

BREVET D'INVENTION
CERTIFICAT D'UTILITÉ

Code de la propriété intellectuelle - Livre VI

cerfa N° 11235*03

DÉSIGNATION D'INVENTEUR(S) Page N° 1../1..

INV

(À fournir dans le cas où les demandeurs et les inventeurs ne sont pas les mêmes personnes)

Cet imprimé est à remplir lisiblement à l'encre noire

DB 113 @ W / 2706D1

Vos références pour ce dossier *(facultatif)*	B 14387.3/JCI DD2548VR
N° D'ENREGISTREMENT NATIONAL	03.50631 DU 01.10.2003

TITRE DE L'INVENTION (200 caractères ou espaces maximum)

PROCEDE DE RECONSTRUCTION D'IMAGE AVEC ACQUISITION DE DONNEES SELON PLUSIEURS MODES D'IMAGERIE ET SYNCHRONISATION DES SERIES D'IMAGES

LE(S) DEMANDEUR(S) :

COMMISSARIAT A L'ENERGIE ATOMIQUE
31-33 rue de la Fédération
75752 PARIS 15 ème.

DESIGNE(NT) EN TANT QU'INVENTEUR(S) :

1 Nom		BONNET
Prénoms		Stéphane
Adresse	Rue	42 rue Claude Genin
	Code postal et ville	38100 GRENOBLE
Société d'appartenance *(facultatif)*		
2 Nom		GRANGEAT
Prénoms		Pierre
Adresse	Rue	136, Allée Vignes du Persan
	Code postal et ville	38330 SAINT ISMIER
Société d'appartenance *(facultatif)*		
3 Nom		
Prénoms		
Adresse	Rue	
	Code postal et ville	
Société d'appartenance *(facultatif)*		

S'il y a plus de trois inventeurs, utilisez plusieurs formulaires. Indiquez en haut à droite le N° de la page suivi du nombre de pages.

DATE ET SIGNATURE(S)
DU (DES) DEMANDEUR(S)
OU DU MANDATAIRE
(Nom et qualité du signataire)

PARIS LE 13 OCTOBRE 2003

J. LEHU
422-5/S002

La loi n°78-17 du 6 janvier 1978 relative à l'informatique, aux fichiers et aux libertés s'applique aux réponses faites à ce formulaire. Elle garantit un droit d'accès et de rectification pour les données vous concernant auprès de l'INPI.

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Volkswagen v. Longhorn - IPR2025-00925

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Volkswagen Exhibit 1037, Page 484 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2003

Application or Docket Number: 10955032

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	8	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	8 minus 20=	* —
INDEPENDENT CLAIMS	1 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT	☐	

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	385.00	OR	BASIC FEE	770.00
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL		OR	TOTAL	720

9/30/2004

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 8	Minus	** 20	=
Independent	* 1	Minus	*** 3	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	0

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐				

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

LAG-VW00000485
Volkswagen Exhibit 1037, Page 485 of 2532
Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/955,037	09/30/2004	Stephane Bonnet	BRV.10002

CONFIRMATION NO. 4535
FORMALITIES LETTER

45473
HUTCHISON & MASON PLLC
PO BOX 31686
RALEIGH, NC 27612

Date Mailed: 08/19/2005

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is unsigned.

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.16(f) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$130** for a Large Entity

- **$130** Surcharge.

Replies should be mailed to: Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

A copy of this notice MUST be returned with the reply.

Office of Initial Patent Examination (703) 308-1202

PART 3 - OFFICE COPY

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APPLICATION NUMBER	FILING OR 371 (c) DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
10/955,037	09/30/2004	Stephane Bonnet	BRV.10002

CONFIRMATION NO. 4535

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SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is **$130** for a Large Entity

- **$130** Surcharge.

Replies should be mailed to: Mail Stop Missing Parts
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09/13/2005 NNGUYEN1 00000021 503218 10955037
01 FC:1051 130.00 DA

Volkswagen Exhibit 1037, Page 488 of 2532
Volkswagen v. Longhorn - IPR2025-00925

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PART 2 - COPY TO BE RETURNED WITH RESPONSE

Volkswagen Exhibit 1037, Page 489 of 2532
Volkswagen v. Longhorn - IPR2025-00925

OIPE IAP88 SEP 12 2005 PATENT & TRADEMARK OFFICE

Patent
Attorney Docket No. BRV.10002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Stephane BONNET et al.

Application No.: 10/955,037

Filing Date: September 30, 2004

Title: Method of Reconstructing an Image With Data Acquisition According to Several Imagery Modes and Synchronisation of Image Series

Mail Stop: Missing Parts

Group Art Unit: 2882

Examiner: Unassigned

Confirmation No.: 4535

TRANSMITTAL LETTER FOR MISSING PARTS OF APPLICATION

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In complete response to the Notice to File Missing Parts of Application filed under 37 C.F.R. § 1.53(b) dated August 19, 2005 (a copy of which is enclosed), the following items are enclosed:

☒ Combined Declaration/Power of Attorney signed by the inventor(s);

☒ The surcharge of $130.00 as set forth in 37 C.F.R. § 1.16(e);

☒ Information Disclosure Statement and PTO- 1449;

☒ Please charge $130.00 to Deposit Account No. 50-3218 for the fee due for missing parts.

The Director is hereby authorized to charge any appropriate fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-3218. This paper is submitted in duplicate.

Respectfully submitted,

HUTCHISON & MASON PLLC

Date: 9/6/05

By: Mary B. Grant
Mary B. Grant
Registration No. 32,176

P.O. Box 31686
Raleigh, NC 27612
+1.919.829.9600

I hereby certify that this correspondence is being facsimile transmitted to the United States Patent and Trademark Office or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on 09/07/2005

Jennie Snead
(Typed Name of Person Signing Certificate)

Jsnead
(Signature of Person Signing Certificate)

Date of Signing: 09/07/2005

B 14387.3 JCI

OIPE IAP88 SEP 12 2005 PATENT & TRADEMARK OFFICE

Attorney Docket No. _____

COMBINED DECLARATION AND POWER OF ATTORNEY FOR UTILITY OR DESIGN PATENT APPLICATION

I hereby declare that:

Each inventor's residence, mailing address, and citizenship are as stated below next to their name.

I believe the inventor(s) named below to be the original and first inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES

the specification of which

☐ is attached hereto

OR

☒ was filed on September 30, 2004 as United States Application Number or PCT International Application Number 10/955,037 and was amended on (mm/dd/yyyy) _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent, inventor's or plant breeder's rights certificate(s), or any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (mm/dd/yyyy)	Priority Claimed?
03 50631	FRANCE	01 OCTOBER 2004	☒ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
			☐ Yes ☐ No
☐ Additional foreign application numbers are listed on a supplemental priority data sheet attached hereto.			

I hereby appoint the attorneys and agents associated with the following PTO Customer Number of Hutchison & Mason PLLC to prosecute the application identified above and to transact all business in the United States Patent and Trademark Office connected therewith:

Address all correspondence to:

Customer Number: 45473
Hutchison & Mason PLLC
P.O. Box 31686
Raleigh, North Carolina 27612
(919) 829-9600

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.	
FULL NAME OF SOLE OR FIRST INVENTOR	BONNET Stéphane
Signature	March 16, 2005
Date	
Residence (City, State, Country)	SEYSSINET-PARISET - FRANCE
Citizenship	française
Mailing Address	20, rue de Pacalaire
City, State, ZIP, Country	38170 SEYSSINET-PARISET - FRANCE
FULL NAME OF SECOND INVENTOR	GRANGEAT Pierre
Signature	March 16, 2005
Date	
Residence (City, State, Country)	SAINT ISMIER - FRANCE
Citizenship	française
Mailing Address	136, allée des Vignes du Persan
City, State, ZIP, Country	38330 SAINT ISMIER - FRANCE
FULL NAME OF THIRD INVENTOR	
Signature	
Date	
Residence (City, State, Country)	
Citizenship	
Mailing Address	same as residence
City, State, ZIP, Country	same as residence

OIPE IAP88
SEP 12 2005
PATENT & TRADEMARK OFFICE

Patent
Attorney Docket No. BRV.10002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Stephane BONNET et al.

Application No.: 10/955,037 Group Art Unit: 2882

Filing Date: September 30, 2004 Examiner: Unknown

Title: Method of Reconstructing an Image With Data Acquisition According to Several Imagery Modes and Synchronisation of Image Series Confirmation No.: 4535

INFORMATION DISCLOSURE STATEMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In accordance with the duty of disclosure as set forth in 37 C.F.R. § 1.56, Applicants hereby submit the following information in conformance with 37 C.F.R. §§ 1.97 and 1.98. A copy of each of the documents cited and required by 37 C.F.R. § 1.98 is enclosed.

Some of the listed documents were cited in a Search Report from the French Patent Office in a corresponding prior application, a copy of which is enclosed

This Information Disclosure Statement contains information which is not in the English language. In accordance with MPEP § 609 IIIA(3), English language equivalent applications have been provided, where applicable.

To assist the Examiner, the documents are listed on the attached form PTO/SB/08. It is respectfully requested that an Examiner initialed copy of this form be returned to the undersigned.

The cited documents are being submitted within three (3) months of the filing or entry of the national stage of this application or before the first Office Action on the merits, whichever is later. Since these documents are being filed within the time period set forth in 37 C.F.R. § 1.97(b), no fee or statement is required.

Volkswagen Exhibit 1037, Page 493 of 2532
Volkswagen v. Longhorn - IPR2025-00925

The Director is hereby authorized to charge any appropriate fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-3218.

Respectfully submitted,

HUTCHISON & MASON PLLC

Date: 9/6/05

By: Mary B. Grant
Mary B. Grant
Registration No. 32,176

P.O. Box 31686
Raleigh, NC 27612
+1.919.829.9600

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Snead
(Printed Name of Person Signing Certificate)

Snead
(Signature of Person Signing Certificate)

Date of Signing: 09/07/2005

PTO/SB/08A(08-03)
Approved for use through 07/31/2006. OMB 0651-0031
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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

SEP 12 2005 PATENT & TRADEMARK OFFICE

Sheet 1 of 1

Complete if Known	
Application Number	10/955,037
Filing Date	September 30, 2004
First Named Inventor	BONNET, Stephane
Group Art Unit	2882
Examiner Name	Unknown
Attorney Docket No: BRV.10002	

US PATENT DOCUMENTS

Examiner Initial *	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
	US-2003-0004405-A1	01/02/2003	TOWNSEND, David W., et al.
	US-2004-170246-A1	09/02/2004	KOENIG, Anne , et al.
	US-5,889,525	03/30/1999	DE MURCIA, Jérôme , et al.

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Foreign Document No	Publication Date	Pages,Columns,Lines,Where Relevant Passages or Relevant Figures Appear	Abstract, Translation, English Language Equivalent or Search Report
	EP-1 087 337	03/28/2001		
	FR-2736454	01/10/1997		X
	FR-2826157	12/20/2002		X
	WO-01/80184	10/25/2001		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	Abstract, Translation, English Language Equivalent or Search Report
	GILLAND, DAVID R.,et al.,"Simultaneous Reconstruction and Motion Estimation for Gated Cardiac ECT", IEEE Trans. on Nuclear Science 49(5):2344-2349 (Oct. 2002)	
	GRANGEAT, PIERRE ,et al.,"Theoretical framework for a dynamic cone-beam reconstruction algorithm based on a dynamic particle model", Phys. Med. Biol. 47:2611-2625 (2002)	
	KACHELRIESS, MARC ,et al.,"Kymogram detection and kymogram-correlated image reconstruction from subsecond spiral computed tomography scans of the heart", Med. Phys. 29(7):1489-1503 (July 2002)	
	KINAHAN, P. E.,et al.,"Attenuation correction for a combined 3D PET/CT scanner", Med. Phys. 25(10):2046-2053 (Oct. 1998)	

EXAMINER **DATE CONSIDERED**

Substitute Disclosure Statement Form (PTO-1449)

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 087 337 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.03.2001 Bulletin 2001/13

(51) Int. Cl.[7]: **G06T 11/00**

(21) Application number: **00307918.3**

(22) Date of filing: **13.09.2000**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
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(54) Process for reconstructing a tri-dimensional image of a moving object

(57) A process for reconstructing a tri-dimensional image of an object moving with a substantially cyclic motion, for example the vessels of the human heart, in which, for an acquisition duration extending over several cycles of the movement of the object, an acquisition of a plurality of initial digital radiographic images is performed using a snapshot apparatus rotating around the object. Initial images having the same temporal occurrence in the course of each cycle are selected respectively in successive cycles so as to form a group of images which is associated with this same temporal occurrence. Several different groups of initial images corresponding respectively to several different temporal occurrences are formed. An intermediate tri-dimensional representation of the object is reconstructed on the basis of each group of initial images and of an iterative image reconstruction algorithm. A law of spatial deformation between two intermediate tri-dimensional representations is formulated on the basis of the two intermediate tri-dimensional representations corresponding to two successive temporal occurrences, and a final tri-dimensional representation of the object is reconstructed on the basis of the initial images successively acquired, of the spatial deformation laws successively formulated and of an iterative image reconstruction algorithm.

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Description

[0001] The invention relates to the reconstruction of a tri-dimensional image of a moving object, in particular moving with a substantially cyclic motion.

[0002] The invention finds a particularly interesting application in the medical field, in which the reconstruction of the internal structures of patients under examination, in particular the reconstruction of images of vessels of the heart, is undertaken.

[0003] The invention can however find applications in other fields, especially in industrial non-destructive testing in which examinations of the same type as medical examinations are carried out.

[0004] The tri-dimensional reconstruction of images is generally performed on the basis of bi-dimensional projected images of the object. However, difficulties arise in this image reconstruction when the object is moving, as is the case for the heart.

[0005] Another difficulty encountered in the reconstruction of tri-dimensional images on the basis of bi-dimensional images resides in the difficulty of matching between the images, that is to say of being able to tag with minimum error the same elements of the object, for example certain vessels, from one image to another. The difficulty is further increased here owing to the movement of the object, for example the heart.

[0006] Certain reconstruction techniques require the intervention of the user, in this instance the doctor, to solve the matching problems more easily.

[0007] he invention proposes a fully automatic reconstruction of images of a moving object, and which requires minimum, or even zero interaction with the doctor.

[0008] In an embodiment of the invention, there is proposed a process for reconstructing a tri-dimensional image of an object moving with a substantially cyclic motion, for example the vessels of the human heart, in which, for an acquisition duration extending over several cycles of the movement of the object, an acquisition of a plurality of initial digital radiographic images is performed using a snapshot apparatus rotating around the object. Initial images having the same temporal occurrence in the course of each cycle are selected respectively in successive cycles in such a way as to form a group of images which is associated with this same temporal occurrence. Several different groups of initial images corresponding respectively to several different temporal occurrences are formed. An intermediate tri-dimensional representation of the object is reconstructed on the basis of each group of initial images and of an iterative image reconstruction algorithm. A law of spatial deformation between two intermediate tri-dimensional representations is formulated on the basis of the two intermediate tri-dimensional representations corresponding to two successive temporal occurrences, and a final tri-dimensional representation of the object is reconstructed on the basis of the initial images successively acquired, of the spatial deformation laws successively formulated and of an iterative image reconstruction algorithm.

[0009] An embodiment of the invention makes it possible ultimately to obtain a tri-dimensional representation of the object which takes its movement into account. The user, in this instance the doctor, can then easily be provided, on his screen, with a projected bi-dimensional image of this object on the basis of the final tri-dimensional representation obtained. Moreover, given that successive laws or models of spatial deformation corresponding to different temporal occurrences have moreover been formulated, it is also possible to provide the user, for example the doctor, with projected bi-dimensional images of the object, and especially of certain vessels, at successive time instants.

[0010] Stated otherwise, the process according to the invention allows the reconstruction of an image in "four" dimensions, namely a tri-dimensional image furthermore assigned a time parameter.

[0011] The selection, in the successive cycles, of the images having the same temporal occurrence can be performed by using an auxiliary control signal representative of the cyclic motion of the object. Thus, it will be possible to use a physiological signal such as for example an electrocardiogram representative of the movement of the heart and making it possible to determine accurately the cycles of the cardiac movement.

[0012] The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:-

Figure 1 illustrates an acquisition of digital radiographic images in a cardiac application, and

Figures 2 to 4 very schematically illustrate the various steps making it possible to obtain the final tri-dimensional representation of the object.

[0013] Although the invention is not limited thereto, the application of the process according to the invention to the reconstruction of an image of vessels VS of the heart OBJ of a patient will now be described.

[0014] In Figure 1, the references PVi designate various snapshots acquired by rotating Rot an X-ray source (not represented here for the sake of simplification) around the chest of the patient.

[0015] Each initial image acquired IMi is obtained on the basis of a bi-dimensional radiation detector, for example of the luminance amplifier type used in radiology, disposed opposite the X-ray tube in a projection plane.

[0016] In the case of an X-ray imaging system composed of an X-ray source and a bi-dimensional detector, the geometrical operation involved in producing the image acquired is a conical projection of an analysed object deployed in a three-dimensional space, onto a two-dimensional space which is that of the projection

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plane corresponding to the detection plane. The calibration of an imaging system, that is to say the operation which culminates in accurate indirect knowledge of the geometrical parameters which are involved in producing an image is conventional and well known to the person skilled in the art.

[0017] As illustrated in Figure 1, a continuous acquisition is performed for a predetermined duration, for example 5 seconds, corresponding to 5 cycles CYC1-CYC5 of the movement of the heart. With an acquisition rate of 10 images per second, substantially 10 acquired initial images are therefore obtained per cycle of the cardiac movement.

[0018] The cycles of the cardiac movement are tagged by using an auxiliary control signal ECG, which can be in this instance an electrocardiogram. The systolic and diastolic phases of the movement of the heart are thus determined in particular.

[0019] Once the acquisition of the initial images has been performed, an initial image, whose temporal occurrence is the same for all the cycles, is selected in each cycle. For example, the first initial image IM1 after the start of the cycle of the cardiac movement is selected. 5 initial images IM1 (Figure 2) are then obtained on the basis of which a reconstruction of an intermediate tri-dimensional representation of the vessels VS of the heart is performed using an iterative image reconstruction algorithm. The principle of such an iterative image reconstruction algorithm is fully known to the person skilled in the art and has already formed the subject of numerous publications. Mention will be made in particular of the article by Gordon, Bender, and Herman entitled "Algebraic reconstruction technique for tri-dimensional electron microscopy and X-ray photography", Journal of Theol. Biol. 29, pages 9471 to 781 (1970) or else French patent applications no. 89 03606 or 89 16906.

[0020] The process for reconstructing a tri-dimensional image of an object as described in French patent application no. 2 752 975 can also be implemented.

[0021] The person skilled in the art will be able to refer to these prior art documents for further details regarding a mode of implementation of the image reconstruction algorithm and/or the phase for calibrating the snapshot apparatus.

[0022] At the conclusion of this intermediate reconstruction step, a first intermediate tri-dimensional representation of the blood vessels of the heart RT1 is obtained. The same operations are performed with the images IM2, each initial image IM2 of the cycle being the second initial image acquired after the start of the cycle. A second intermediate tri-dimensional representation RT2 is then obtained.

[0023] The same operations are preferably performed for each image of the cycle so as finally to obtain in the present case 10 tri-dimensional intermediate representations.

[0024] The next step consists, as illustrated in Figure 3, in formulating for two successive intermediate tri-dimensional representations RT1 and RT2 for example, a law of spatial deformation making it possible to formulate a model of deformation between the two tri-dimensional representations RT1 and RT2. The same operations are performed in a general manner so as to obtain between two successive intermediate representations RTi and RTj a model of geometrical deformation LDij.

[0025] By way of example, one manner of obtaining such a law of spatial deformation, representative of the movement of the heart between two successive temporal occurrences, can be performed by a conventional technique for tracking elements of interest (for example a specific vessel) between the various successive tridimensional representations.

[0026] Such matching techniques are for example described in the article by Singh A. and Allen P.K. entitled "Image flow computation: an estimation theoretic Framework and a unified perspective", Computer Vision Graphics and Image Processing, Vol. 56, number 2, September 1992, pages 152-177. The person skilled in the art may optionally refer thereto.

[0027] Once all the spatial deformation laws have been obtained, a final tri-dimensional representation RTF of the vessels of the heart is reconstructed by applying the iterative image reconstruction algorithm and this time using all the initial images acquired IMi in the course of the total duration of acquisition. Moreover, the iterative image reconstruction algorithm will successively take into account, from one initial image to another, the corresponding spatial deformation law previously formulated in such a way as ultimately to obtain a correct representation of the vessels of the heart, given the latter's movement.

[0028] From a hardware point of view, in addition to the conventional snapshot apparatus, the device allowing the implementation of the process includes a computer implementing the various software means such as the iterative image reconstruction algorithm and equipped with a screen for displaying the final projected images obtained on the basis of the final tri-dimensional representation.

[0029] Moreover, although all the initial images of the cycle have been taken into account so as to formulate as many intermediate tri-dimensional representations, it would have been possible to take just one out of two, or one out of three into account so as to formulate fewer intermediate representations. This would however have led to less accurate spatial deformation laws.

Claims

1. A process for reconstructing a tri-dimensional image of an object moving with a substantially cyclic motion, in which, for an acquisition duration extending over several cycles of the movement of the object, an acquisition of a plurality of initial dig-

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ital radiographic images (IMi) is performed using a snapshot apparatus rotating around the object, initial images having the same temporal occurrence in the course of each cycle are selected respectively in successive cycles in such a way as to form a group of images which is associated with this same temporal occurrence, several different groups of initial images corresponding respectively to several different temporal occurrences are formed, an intermediate tri-dimensional representation of the object (RTi) is reconstructed on the basis of each group of initial images and of an iterative image reconstruction algorithm, a law of spatial deformation (LDIj) between two intermediate tri-dimensional representations is formulated on the basis of the two intermediate tri-dimensional representations corresponding to two successive temporal occurrences, and a final tri-dimensional representation of the object is reconstructed on the basis of the initial images successively acquired, of the spatial deformation laws successively formulated and of an iterative image reconstruction algorithm.

2. The process according to claim 1 wherein the images having the same temporal occurrence are selected in successive cycles by using an auxiliary control signal (ECG) representative of the cyclic motion of the object.

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FIG.1

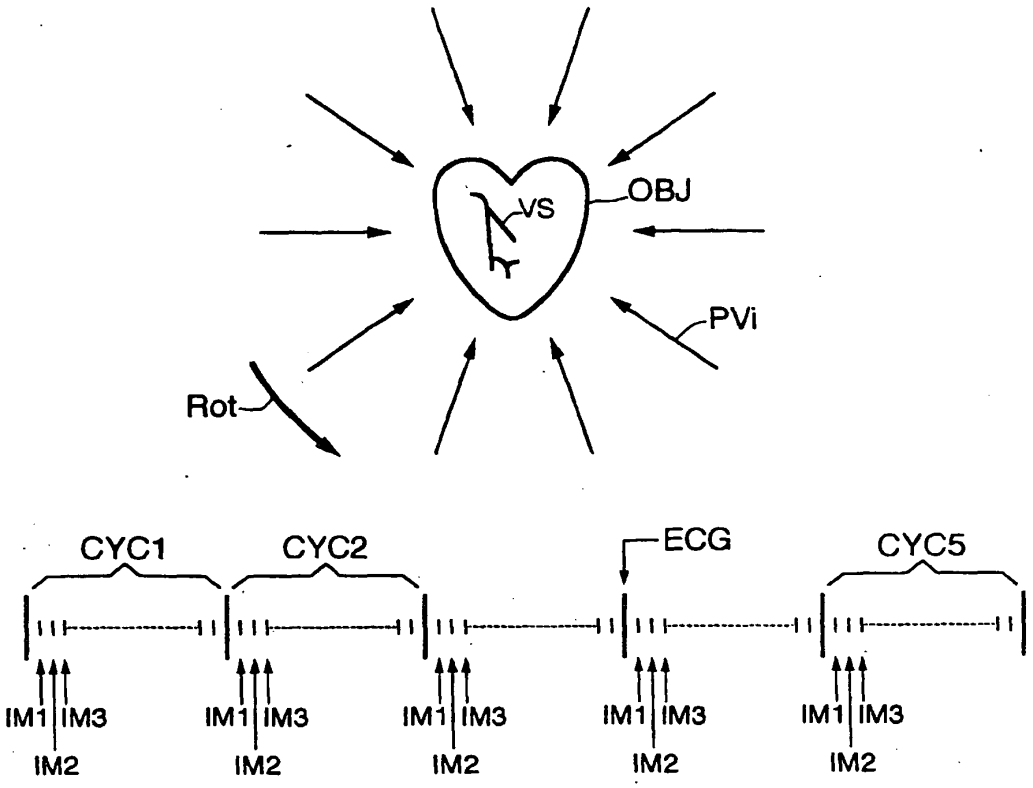
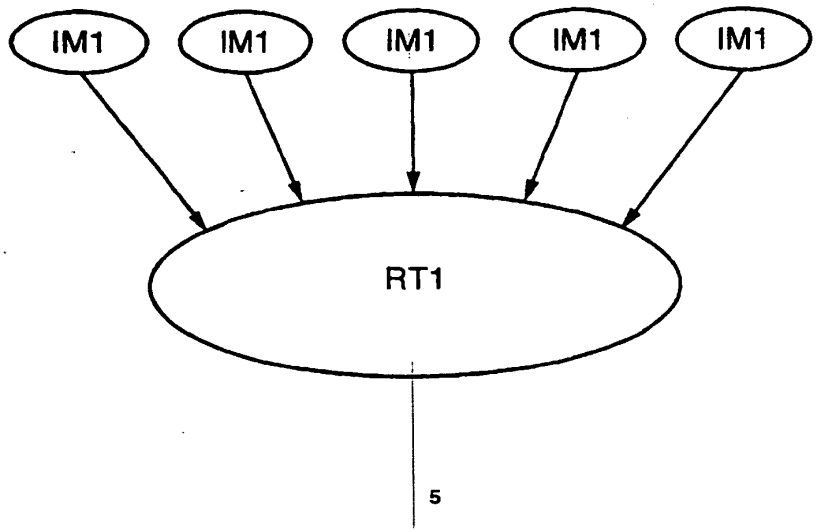


FIG.2



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FIG.3

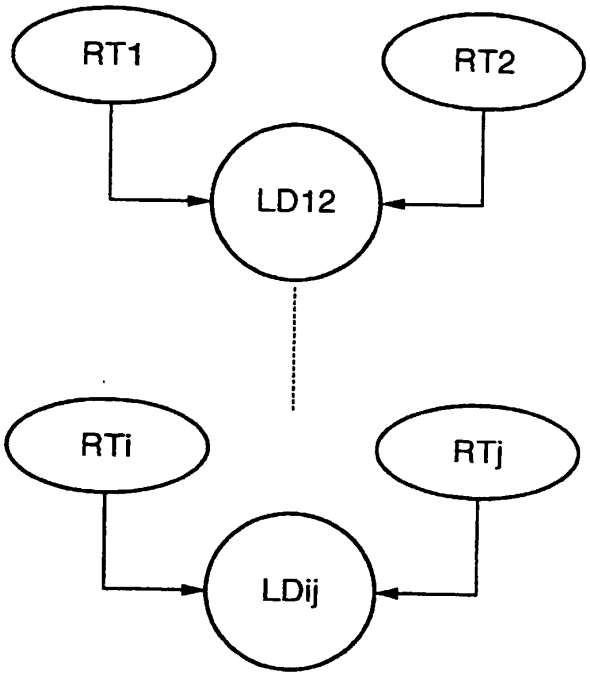
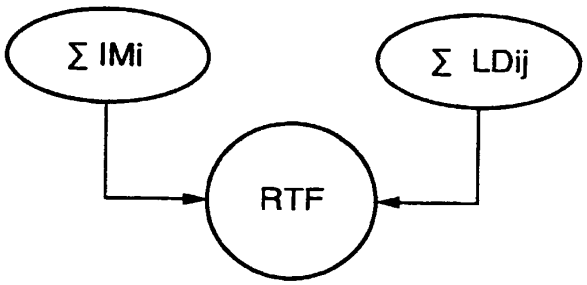


FIG.4



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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 30 7918

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 406 478 A (DELAGENIERE SOLANGE ET AL) 11 April 1995 (1995-04-11) * claims 1,2; figure 2 *	1	G06T11/00
Y	WO 99 07283 A (ELSCINT LTD ;NAHALIEL EHUD (IL); RUIMI DAVID (IL)) 18 February 1999 (1999-02-18) * claims 1,27,28 *	2	
X Y	US 5 889 525 A (GRANGEAT PIERRE ET AL) 30 March 1999 (1999-03-30) * claim 4; figure 2 *	1 2	
Y	US 5 383 231 A (YAMAGISHI ICHIRO) 17 January 1995 (1995-01-17) * claims 1,2 *	2	
A	DE MURCIA J ET AL: "Spatio-temporally regularized reconstruction of gated SPECT myocardial image sequences" PROCEEDINGS. INTERNATIONAL CONFERENCE ON IMAGE PROCESSING (CAT. NO.96CH35919), PROCEEDINGS OF 3RD IEEE INTERNATIONAL CONFERENCE ON IMAGE PROCESSING, LAUSANNE, SWITZERLAND, 16-19 SEPT. 1996, pages 721-724 vol.2, XP002139670 1996, New York, NY, USA, IEEE, USA ISBN: 0-7803-3259-8 * page 721, left-hand column, paragraph 1 - right-hand column, paragraph 2 *	1,2	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
G06T

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 November 2000	Perez Molina, E

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 30 7918

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5406478 A	11-04-1995	FR 2701135 A	05-08-1994
		DE 69421303 D	02-12-1999
		DE 69421303 T	18-05-2000
		EP 0611181 A	17-08-1994
		IL 108425 A	31-10-1996
		JP 6274627 A	30-09-1994
WO 9907283 A	18-02-1999	NONE	
US 5889525 A	30-03-1999	FR 2736454 A	10-01-1997
		EP 0752684 A	08-01-1997
		IL 118786 A	17-08-1999
		JP 9043354 A	14-02-1997
US 5383231 A	17-01-1995	JP 5003867 A	14-01-1993

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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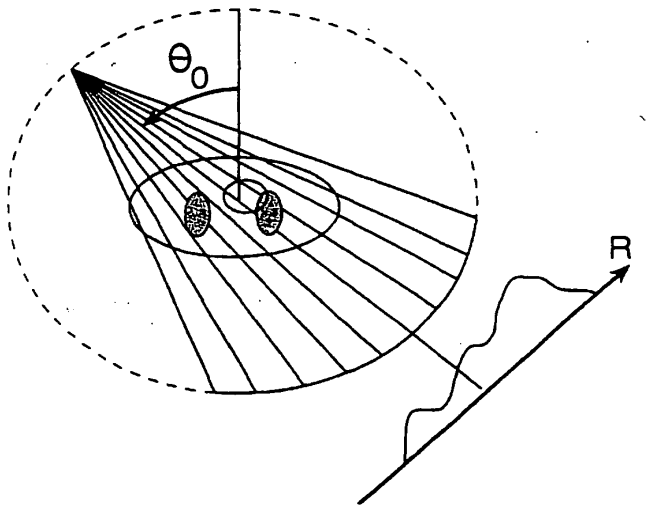
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RECONSTRUCTION OF COMPUTED TOMOGRAPHIC IMAGES USING INTERPOLATION BETWEEN PROJECTION VIEWS



(57) Abstract: An approach to image reconstruction provides enhanced image quality from limited projection data, particularly when the imaging object (or a portion of interest) is in motion during the tomographic projection data collection process. An interpolated projection view is generated from existing projection views between which an additional relationship exists by virtue of being respectively based on data collected in different data acquisition cycles. The existing projection views may represent an imaging object in consecutive data acquisition cycles or in separated data acquisition cycles or in both. The present invention provides a technique for combining the existing projection views into an interpolated projection view by interpolation in time. A further aspect of the invention provides an approach for selecting a reconstruction range for projection data representing the imaged object and covering a plurality of projection ranges. The disclosed approach allows a separation measure to be determined for the projection data for each reconstruction range. The selected reconstruction range is chosen based on the separation measures. Particular advantages are thereby obtained for cardiac imaging.

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RECONSTRUCTION OF COMPUTED TOMOGRAPHIC IMAGES USING INTERPOLATION BETWEEN PROJECTION VIEWS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is related to Provisional Application U.S. Serial No. 60/166,499, filed November 19, 1999 and Provisional Application U.S. Serial No. 60/197,208, filed April 19, 2000 in the U.S. Patent and Trademark Office, the contents of which are incorporated herein by reference, and the benefit of priority to which is claimed under 35 U.S.C. §119(e).

BACKGROUND OF THE INVENTION

This invention relates to generation of computed tomographic images. More particularly, the invention relates to reconstruction of such images through use of interpolated projection views generated by interpolating between existing projection views.

Computed tomography (CT) is an imaging technology in which an array of detectors generates data from energetic rays transmitted through or emitted from an imaged subject. For example, a transmission-type medical CT imaging system uses an array of x-ray detectors to detect an x-ray beam that has passed through the body of a human or animal subject. The attenuation of the beam by the subject causes the collected data, including the effects of the attenuation, to contain information about the interior structure of the subject. The detector data are processed by a computer system to generate image data representing a recognizable view of that interior structure.

CT techniques are valuable in a wide range of application areas where noninvasive and nondestructive examination of internal structures is needed. Medical applications include imaging of emissions from radioactive substances introduced into the subject (single photon emission CT, positron emission CT, etc.), as well as x-

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ray transmission CT. Non-medical applications include, for example, non-destructive testing and inspection, mineral deposit mapping (microseismic CT imaging), and three-dimensional image generation in electron microscopy.

A CT system generates a display image from data representing measurements of energetic signals transmitted through or emitted from a subject in a range of directions. This process is "tomographic" in that structural details of a subject are represented as a cross-sectional view along a given plane through the subject. The process is "computerized" because the raw detector data indirectly represent a view of the subject. Intensive data processing is required to convert the raw data into a recognizable view of the internal features of the subject.

Computer processing of the collected data is performed because the data correspond to mere projections of the subject structure along various different paths. The term "projection data" will be used herein for such CT data, irrespective of the application area in which the CT imaging procedure is used. The differences between the projection data for different paths through the imaged subject, in relation to the spatial separation of the paths, indirectly contain information about the interior structure of the object.

A CT reconstruction algorithm is applied to the projection data to generate image data that specify the image to be displayed. The image data are generated from the structure information indirectly represented by the projections. This is possible in view of the Fourier Slice Theorem, which states generally that a projection view of an imaged subject is related by Fourier transformation to the spatial structure of the subject. More specifically, and with reference to the canonical form of the Fourier Slice Theorem for parallel beam projection data, the Fourier transform of a parallel projection at a given view angle θ is equivalent to a one-dimensional "slice" of the two-dimensional Fourier transform of the imaged subject, taken at the same angle θ in the frequency domain.

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The Fourier Slice Theorem allows the image to be reconstructed by Fourier transforming the projection views, assembling the transforms into a two-dimensional Fourier transform, and applying inverse Fourier transformation to the result. Of course, in practical applications this process may be implemented by some form of filtered back-projection or (for diffracting sources) filtered back-propagation. The salient point is that the reconstruction process relies upon the projection views that are available. It is a commonplace fact that the resolution of the generated image will depend on the spacing of the projection views in θ: the more projection views that are taken, the greater the resolution of the resulting image.

This dependence in CT imaging on data resolution in θ (angular direction) is the source of a persistent problem that will be termed here the "missing projection views" problem. An insufficient number of projection views for a desired level of image resolution can arise in many situations. For example, the data for some projection views may be corrupted, or the level of desired resolution may exceed the maximum resolution possible with the given discretization in θ.

A typical solution for data corruption is to repeat the entire data acquisition process, i.e., to throw out the entire set of projection data. Further, where θ discretization has been too coarse, the simplest solution has been to collect more projection views. More data, to provide a finer level of resolution in θ, requires more intensive computation and also entails longer data acquisition cycles. In some situations, constraints imposed by the subject to be imaged, the imaging environment, or the computational resources of the reconstruction engine make denser data collection in θ (i.e., finer resolution in θ) an unattractive solution at best and frequently one that is unfeasible in practice.

The problem of missing projection views is particularly acute when the subject being imaged, or a relevant part thereof, is in motion. For example, CT x-ray imaging is currently being used for cardiac imaging to detect arterial calcification, which can be an indicator for coronary artery disease. X-ray CT is one alternative among various non-invasive techniques for generating images of a patient's beating

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heart. Other modalities include Doppler ultrasound, fluoroscopy, magnetic resonance imaging (MRI), and electron beam tomography (EBT). Each modality has its own advantages and disadvantages for a given application context.

For cardiac imaging, x-ray CT has the potential to provide finer spatial resolution in three dimensions, as compared with MRI (especially with multi-row spiral CT). However, current third and fourth generation CT scanners suffer from coarse temporal resolution because of limited gantry speed. This limitation on temporal resolution directly affects the available spatial resolution of the resulting images of the heart. More specifically, in a data acquisition session of practicable length, each phase or distinct configuration of the beating heart will correspond to a few projection views. For any given phase, therefore, the θ discretization will be unduly coarse and will limit the resolution of the resulting image to an unacceptably coarse level.

Recent developments in image reconstruction algorithms have improved this situation somewhat by enabling CT techniques to achieve much better time resolution than with the standard operation mode. The basic approach of these improved techniques has been to use consistent projection data, collected from multiple heart cycles, and to perform retrospective data rebinning. Such data rebinning methods have been shown to improve significantly the time resolution of the collected data. In practice, however, existing rebinning methods have been found to introduce some image artifacts due to inconsistencies in the data.

It is therefore apparent that the problem of missing projection views, in cardiac imaging and in other applications of CT imaging techniques, has remained as a persistent obstacle to wider use of CT imaging. In the particular context of cardiac imaging, physicians desire a "freeze frame" capability for medical imaging systems. Such a capability would permit an image to be accurately reconstructed to represent the patient's heart at a selected part of the cardiac pumping cycle.

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More generally, what has been needed is a method and system for processing CT projection data to overcome or minimize the effects of missing projection views. Such a method desirably would provide acceptable spatial resolution in the resulting images, without requiring extensive additional data acquisition. In imaging contexts where the imaged object is in motion, such as in cardiac imaging, the method would desirably overcome the artifact problems that have existed with current data rebinning methods. Preferably, the technique would be flexibly applicable in a broad range of CT imaging contexts.

BRIEF SUMMARY OF THE INVENTION

The present invention provides methods, apparatus, software, and systems for generating additional projection views based on existing projection data and indirect relationships between the existing data. For example, such indirect relationships may exist in timing relationships between an imaged subject in a desired state and projection data representing the imaged subject in nearby states.

In a first particular aspect, the present invention provides a tomographic image generation method, and a corresponding apparatus, system and software. An exemplary implementation of this aspect of the invention is a method comprising determining a plurality of working projection views of an object at a selected view angle based on initial projection data collected in respective different data acquisition cycles. The exemplary method further comprises interpolating between the working projection views to generate an interpolated projection view of the object at the selected view angle.

In a second aspect, the present invention may be directed toward methods, apparatus, systems, and software for generating a tomographic image of an object in cyclical motion. An exemplary method of this second aspect comprises determining a plurality of working projection views of an object in cyclical motion based on initial projection data collected from the object. The working projection views are based on selected initial projection data collected in respective different

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data acquisition cycles. The exemplary method further comprises interpolating between the working projection views to generate an interpolated projection view representing the object at the selected view angle and at a specified phase of the cyclical motion.

In a third aspect, the present invention provides a method, apparatus, and software for tomographic image generation. An exemplary method of this third aspect of the invention may comprise determining separation measures for projection data covering corresponding reconstruction ranges and representing an imaged object over plural data acquisition cycles. Such an exemplary method further comprises reconstructing a tomographic image of the object based on a portion of the projection data covering a reconstruction range selected responsive to a determination that the corresponding separation measure satisfies a predetermined selection criterion.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other aspects and advantages of the invention will become apparent and more readily appreciated from the following detailed description of the preferred embodiments, taken in conjunction with the accompanying drawings of which:

FIG. 1 is a block diagram of a general x-ray CT scanning system in which the present invention may be implemented;

FIG. 2 is a diagram of a third generation source detector assembly for a CT scanning system as shown in FIG. 1;

FIG. 3 is a diagram of a fourth generation source detector assembly for such a CT scanning system;

FIG. 4 is a diagram illustrating the correspondence between a particular view angle and generation of a row of projection data;

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FIG. 5 is an illustration of a sinogram of projection data including the row of projection data of FIG. 4;

FIG. 6 is a diagram illustrating a time dependent feature of sinogram data;

FIG. 7 is a schematic diagram illustrating a sector approach for rebinning data in cardiac imaging applications;

FIG. 8 is a diagram depicting a different perspective of the time dependent characteristics of sinogram data as provided by the invention;

FIG. 9 illustrates contrasting features of the sector approach of FIG. 7 and the perspective provided by FIG. 8;

FIG. 10 is a flow diagram illustrating a procedure of the invention;

FIG. 11 is a timing diagram illustrating a tagging function for correlation of projection data with corresponding phases of an imaged subject's cardiac cycle;

FIGS. 12-13 are diagrams illustrating an application of the present invention in cardiac imaging;

FIGS. 14-16 are flow diagrams illustrating procedures for carrying out operations as illustrated in FIGS. 12-13;

FIGS. 17-19 are diagrams illustrating an application of the present invention in a case of irregular heartbeat;

FIG. 20 is a trajectory diagram illustrating another embodiment of the invention for phase interpolation between several projection views;

FIG. 21 is a diagram of a source-detector assembly for a helical x-ray CT scanning system using a multi-row detector array;

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FIG. 22 is a schematic diagram of a multi-row detector array;

FIG. 23 is a time evolution diagram of detector row positions of a multi-row detector in helical scanning;

FIG. 24 is a graph illustrating tagging for rows of a multiple-row detector array;

FIG. 25 is a flow diagram illustrating a procedure of an embodiment of the present invention as applied in multi-row helical scanning for cardiac imaging;

FIG. 26 is a flow diagram illustrating details of an operation for selecting neighboring scanning rotations as shown in FIG. 25;

FIGS. 27-28 are diagrams illustrating operations of the procedure shown in FIG. 26;

FIG. 29 is a flow diagram illustration details of an operation for determining working projection views as shown in FIG. 25;

FIG. 30 is a diagram illustrating application of the procedure of FIG. 29;

FIG. 31 is a flow diagram illustrating a procedure of another aspect of the present invention as applied to the particular context of multiple-row helical scanning for cardiac imaging;

FIG. 32 is a flow diagram illustrating a procedure for determining a set of projection views for a selected axial position;

FIG. 33 is a trajectory diagram illustrating multiple reconstruction ranges in a set of projection views for a selected axial position;

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FIG. 34 is a flow diagram illustrating a procedure for selection of a particular reconstruction range in which to perform phase interpolation between projection views;

FIG. 35 is a flow diagram illustrating phase interpolation between projection views for view angles in a selected reconstruction range; and

FIG. 36 is a flow diagram illustrating a procedure for generating a set of tomographic slice images using phase interpolation between projection views.

DETAILED DESCRIPTION OF THE INVENTION

The present invention implements a different perspective on CT projection data, whereby a broader range of information contained in the data is recognized and used. Previous approaches to processing projection data, such as the aforementioned data rebinning techniques, have used data substitution to overcome partially the problems caused by missing projection views. In other contexts, interpolation methods have been applied to projection data to accommodate changes in the sampling grid.

However, previous methods for processing projection data have failed to recognize that distinct projection views from the same data acquisition session may contain additional information that can enhance image resolution. Such additional information may be contained in the differences between the corresponding projection data values of the respective projection views. The present invention embodies the realization that selective combination of different projection views can extract this additional information for use in improving the resolution of the generated images.

In a preferred embodiment, the present invention provides an improved processing method that achieves the objectives of previous data rebinning approaches for CT projection data collected from multiple cardiac cycles, while avoiding many of the image artifacts that have accompanied such previous approaches. The result of

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the invention is improved image quality and reduced artifacts for reconstructed images at arbitrary heart phases.

FIG. 1 is a schematic illustration showing the major components of an x-ray CT imaging system 100 in which the present invention may be embodied or incorporated. A subject 102 for imaging is typically a human patient who may be undergoing diagnostic assessment for coronary artery disease or other disease processes. Alternatively, the subject 102 may be a veterinary patient (i.e., a non-human animal) or even a non-animal subject such as an inanimate object (machine part, material sample, etc.) undergoing nondestructive testing or evaluation.

As is well known, x-ray tomographic imaging with such an imaging system 100 is typically carried out by illuminating the subject 102 with an x-ray beam 104 substantially transverse to an axis (shown by cross-hairs) through the subject 102. Typically the axis is centered on an object 106 of interest, such as an organ or other tissue structure. The subject 102 may be disposed on a table 108 that translates along the direction of the axis, thereby enabling illumination of a volumetric portion of the subject 102 by the x-ray beam 104. In the typical case the illuminated volumetric portion comprises all or a relevant portion of the object 106 of interest within the subject 102.

The CT system 100 desirably comprises a source-detector assembly 110, which in an exemplary embodiment may comprise a gantry 112 rotatable about the axis. An X-ray source 114, such as a typical X-ray tube, may be mounted on the gantry 112 and may rotate with rotation of the gantry 112. Source 114, which may comprise a collimating element (not shown), projects the beam 104 of x-rays toward a detector array 116 disposed opposite the source 114 relative to the gantry 112.

The detector array 116 is typically comprised of numerous individual detector elements 118. An alternative term in the art for an array such as detector array 118 is "a multi-channel detector." It will be understood that either term is

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intended to mean a multiple-channel detection device usable in a computed tomography system.

Detector elements 118 together provide information regarding the internal structures of the subject 102, such as the object 106. As noted above, the subject 102 may be a human patient or an animal patient. In either of these cases, the object 106 may be an organ or body part of the subject 102 and thus is the "object" for purposes of the tomographic image. In a still further alternative application, the subject 102 may itself be the object 106 being subjected to, for example, nondestructive testing or examination.

In the typical case, each detector element 118 generates an electrical signal indicating the intensity of a portion of the x-ray beam 104 impinging thereupon. Various alternatives for the specific arrangement of the source-detector assembly 110 will be described with reference to FIGS. 2-3 and 21.

The signals from detector elements 118 may indicate a degree of attenuation of the beam 104 as the x-rays traverse the material or substance of the subject 102. Typically the source 114 is rotated around the subject 102 to execute a so-called "scan" operation whereby the system 100 acquires x-ray data. The gantry 112, with source 114 attached to a side portion thereof, typically rotates about the axis of the subject 102 to acquire x-ray data from numerous different illumination angles or "view angles."

The rotation operation for the source 114 is controlled by a control/interface system 120. A controls section 122 of the control/interface system 120 provides control for positioning of the gantry 112 relative to the subject 102, such as controlling speed of rotation about the axis and control of relative positions of the table 108 and the gantry 112. The controls section 122 also typically provides control over x-ray generation (power and timing) of the source 114. The control/interface system 120 also includes a data acquisition system (DAS) 124 that samples the

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detector signals generated from the detector elements 120 and converts the sampled signals into digital data for further processing.

A reconstruction engine 130 receives the sampled and digitized data (now termed "projection data") from the DAS 1124 and performs high-speed image reconstruction. The reconstruction engine 130 may comprise a separate processor 132 and memory 134. Various algorithms are known in the art for reconstructing a slice image from projection data comprising a plurality of projection views.

The reconstruction engine 130 sends the reconstructed image to, for example, a system management computer 140 for storage, display, or further processing. The computer 140 typically comprises a CPU (a processor) 142 and a memory 144. The memory 144 may store a program 146 comprising instructions for executing a process of the present invention. Alternatively, such a program 146 may be executed (in whole or in part) by the reconstruction engine 130 or by another computer system (not shown) comprised in or coupled to the imaging system 100.

The computer 140 may display the reconstructed image on a display 152 in response to instructions from an operator console 154. Computer 140 may also convey commands and scanning parameters from the operator console 154 to the control/interface section 120. Alternatively, the image may be output to a recording device 156, such as a film recorder, or stored in a mass storage device 158. Alternatively, the image may be transmitted as image data over a network (not shown) for disposition at another location. If the computer 140 stores the image in the storage 158, the image data may be stored as a data array, a linked list, or any other known data storage configurations as are well known in the art.

An aspect of the present invention provides a tomographic imaging system with the capability to generate accurate tomographic images of an object in motion. Such an imaging system may therefore comprise a system or apparatus for acquiring timing data by which the projection data collected by the system may be correlated in time with the motion of the imaged object. For example, the system 100

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may be used to generate tomographic images of a patient's heart while the heart is beating. A timing data acquisition system for the imaging system 100 may therefore comprise an electrocardiogram such as an EKG unit 160 shown in FIG. 1. The EKG unit 160 detects electrical activity of the patient's heart and provides to the computer 140 timing information based on the detected electrical activity. For example, the timing information may be digital electrocardiographic data. The construction and use of electrocardiograms is well known to those of skill in the art and will not be presented in detail here.

The different functions of control/interface system 120, reconstruction engine 130, and computer 140 are desirably implemented on dedicated modular platforms, as described. However, the division of functions described herein is for purposes of example and is not intended to be limiting. Such functions may alternatively be implemented in software, on a single computational platform, or in a different arrangement on multiple hardware platforms.

FIG. 2 illustrates a source-detector assembly 200 as a specific embodiment of the source-detector assembly 110 shown schematically in FIG. 1. An imaging subject 202 corresponds to the subject 102 in FIG. 1. Assembly 200 illustrates the particular case of a so-called third generation "fan beam" CT system in which the subject 202 is illuminated by a beam 204 while positioned on a motorized table 208. The beam 204 may be a "fan beam," as described below.

A gantry assembly 212 corresponds to the gantry 112 of FIG. 1. An x-ray source 214 generates the fan beam 204 of x-rays directed toward a detector array 216, which is also affixed to the gantry assembly 212. Array 216 comprises individual detector elements 218 that detect x-rays emitted by source 214. The array 216, source 214, gantry 212, and table 208 of the fan beam assembly 200 are respective instances of the array 116, source 114, gantry 114, and table 108 as shown in FIG. 1.

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In operation, assembly 212 rotates around the axis Z, which typically passes through subject 202 and is perpendicular to the plane XY. Source 214 can thereby be transported completely around subject 202 along a circular path. Detector array 216, being fixed with respect to source 214, is also transported around subject 202 and thus remains opposite source 214.

Rotation of the gantry assembly 212 around the subject 202 results in x-ray data being generated by detector elements 218 for a range of view angles θ. A typical detector array 212 may comprise several hundred, such as 888, individual detector elements 218. The array 216 may be positioned on the gantry 212 at a distance of, for example, 0.949 meter (m) from the source 214. The circular path of source 214 has a radius of, for example, 0.541 m. Particular values of these parameters are not critical to the present invention and may be varied according to well-known principles of CT system design.

One complete gantry rotation for the gantry 212 may comprise, for example, 984 increments. Source 214 is thereby positioned to illuminate the subject 202 successively from 984 different directions θ. Detector array 216 generates x-ray data at each incremental position θ, from which projection data for 984 projection views may be generated.

FIG. 3 illustrates a source-detector assembly 300 for a so-called fourth generation CT system. A subject 308 is again illuminated by a fan beam 304 while positioned on a motorized table 308. An x-ray source 314, like source 214 and as a further example of source 114, generates the fan beam 304 of x-rays directed toward a detector array 316. The array 316 comprises detector elements 318 that generate x-ray data indicating internal structural information about the subject 302.

The fourth generation case of FIG. 3 differs from the third generation case, in that the detector array 316 is fixed with respect to rotation. The source 314 is supported by a suitable guide mechanism (not shown) and typically traverses a circular path around the subject 302. The detector array 316 may translate axially (in

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the Z direction) to provide x-ray data for a particular axial position. Alternatively, the array 316 may be fixed axially as well as rotationally, and positioning of the subject 302 with respect to the detector array 316 and source 314 may be achieved entirely by axial translation of the table 308.

As FIG. 2 shows, a typical third generation CT scanning system performs an axial CT scan by rotation of the gantry around the subject to be imaged. The detector data are collected as the gantry rotates the source and the detector array together. The projection data are thereby generated for different angular positions (i.e., view angles) of the gantry. A fourth generation system comprising an arrangement such as the assembly 300, shown in FIG. 3, differs in that the detector array is usually stationary (at least rotationally) with respect to the subject. The source then traverses a path around the subject and thereby projects imaging rays at different angles for detection by different portions of the fixed array.

On the other hand, both the assembly 300 and the assembly 200 may use a fan beam (204 or 304). A "fan beam" is a fan shaped beam of radiation, i.e., a beam subtending a finite angular sector in a given plane. Usually the fan is thin, where "thin" refers to the direction transverse to the fan plane, e.g., a direction generally parallel to the axis Z. X-rays in the angular sector actually subtended by the fan beam may not all be used for generation of detector data. Thus, an effective portion of the fan beam may subtend a smaller angular sector whose angular extent is called the "fan angle" of the fan beam. In the arrangements of FIGS. 2 and 3, the plane of the fan beam is transverse (typically perpendicular) to the axis Z at a fixed axial position.

A rotational scanning operation performed at a fixed axial position is sometimes called an "axial scan." The axial scan is carried out with rotation of the source (or the source and detector together) about the subject at a fixed axial position z0. Therefore, the projection data from an axial scan all represent the imaged subject at the same axial position z_0.

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The present invention provides an approach for enhancing resolution and image quality of a CT image without requiring additional detectors or additional data acquisition and generally may be applied to axial CT systems (e.g., third generation and fourth generation systems). The invention may also be used with less advanced (e.g., first or second generation) source-detector arrangements. Moreover, as will be explained below, the invention may be embodied in or implemented with spiral (i.e., helical) CT imaging systems. The basic features of the invention will be explained first in the axial CT context and then extended, with appropriate enhancements, to the helical case.

It is noted that similar operations of rotation apply in both third generation and fourth generation systems for the acquisition of detector data during a complete cycle of the source-detector assembly. In the axial scanning case, the data acquisition cycle is called an axial scan. More generally, the principle of a rotational cycle of data acquisition is generally applicable in all such x-ray CT scanning systems. The term "scanning rotation" will therefore be used here to mean the rotational operation for positioning the x-ray source (e.g., source 214 or source 314) at each angular position θ around an axis of rotation and collecting corresponding data. "Scanning rotation set" will mean the set of projection data generated from a scanning rotation. Where no confusion will arise, the term "scanning rotation" will be used variously to mean either the data acquisition operation or the projection data set generated as a result of the data acquisition operation.

Typical x-ray CT systems (e.g., third generation systems and fourth generation systems) are an exemplary class of tomographic imaging systems. For example, magnetic resonance imaging (MRI) systems also are used to generate tomographic images by a data collection and image reconstruction process that may be termed (in a generalized sense) computed tomography.

Cardiac imaging can be performed with some MRI systems by processing a series of magnetic echo data sequences with various types of gating techniques. In prospective spin echo gating, for example, the system acquires

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imaging data over a series of cardiac cycles. An additional sequence of spin echo data is acquired at each cycle. Each spin echo data sequence represents the heart at different spatial locations but is acquired during the same cardiac cycle and with the same k-space encoding value. Thus, the data collection operation for acquiring such a spin echo data sequence is analogous to the scanning rotation operation in x-ray tomographic imaging. In each case, the operation is a data sampling cycle for acquiring a consecutive sequence of data samples over a cycle interval.

Also, retrospective gating of gradient echo pulse sequences is used in MR systems to acquire "cine" images at multiple time frames of the cardiac cycle. Data acquisition again occurs over several cardiac cycles, and in each acquisition cycle the data samples have the same phase (i.e., k-space) encoding value. The phase encoding value is thus stepped to a next value at each successive R-wave trigger. The excitation pulses run asynchronously with the cardiac cycle, so that the echo pulse data acquired in each sampling cycle is resorted and interpolated into evenly distributed time frames within the cardiac cycle. Nevertheless, like rotational scanning in x-ray systems, the sample data are again acquired in a series of sequences of data samples acquired consecutively over a sampling cycle interval.

These examples illustrate a general principle of data acquisition in tomographic imaging systems: the imaging data are acquired in one or more sequences of data samples. Here, the term "data acquisition cycle" will mean a data acquisition operation for obtaining such a sequence of data samples at a sequence of consecutive sampling times. Thus, in existing approaches to x-ray tomography the data acquisition cycle is the scanning rotation (which may be carried out by gantry rotation or source rotation, for example). For MRI systems, the data acquisition cycle may be the sequence of measurement operations in which the magnetic field gradients are varied according to the particular localization method being used. As will be explained in detail, the present invention adopts a different perspective on combining data from different data acquisition cycles.

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Data from an axial scan may be stored in a two dimensional array called a "sinogram." One dimension of the sinogram corresponds to angular position of the fan beam (e.g., scanning rotation angle or "view angle"), relative to the initial rotational orientation of the beam at the start of the data acquisition cycle. The other dimension corresponds to positions of the detector elements (218 or 318) of the detector array. The detector array in a fan beam CT system (such as array 216 or array 316) typically comprises a single row of detector elements. In such a case, therefore, each row of the sinogram will correspond to a discrete view angle θ and a single axial position z0.

In the fan beam case, the sinogram may be considered as a collection of projection views of the subject at the position z_0. Here the term "projection view" means such a row of projection data corresponding to a given view angle θ and representing the imaged subject at a single axial position z_0. Well known reconstruction procedures utilize as their principal inputs a complete set of such projection views (discretized in θ, but all consisting of data values for the same axial position z_0). The projection views are processed to generate a slice image depicting the internal features of the subject at the position z_0. Usually the complete set of projection views comprises projection views at view angles covering at least radians (i.e., 180 degrees) plus the fan angle.

FIG. 4 illustrates the correspondence between a particular view angle θ_0 for the source and the generation of a well-defined row R of projection data. In the fan beam case, as noted above, the detector data from the detector array may convert directly into a single row of projection data for a projection view at view angle θ_0. This correspondence results because the detector array provides a single row of detector data representing intensities of the x-rays impinging upon the detector elements. These intensity values indicate attenuation information for the subject at the axial position z_0.

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FIG. 5 shows how the projection data for the particular view angle θ_0 is stored in a corresponding row of the sinogram. Each row of the sinogram thus constitutes a projection view that indicates attenuation information for a distinct view angle θ, but the same axial position z_0. Once the sinogram is filled with projection views (rows) for all the discrete view angles θ around the subject, then a suitable CT image reconstruction algorithm is applied to reconstruct a cross-sectional image of the subject.

FIG. 6 illustrates a time dependent feature of the projection data stored in the sinogram. The view angle θ of the source relative to a fixed direction can be written as

$$\theta(t) = \omega t,$$

where ω represents the angular speed of the gantry in radians per second and t denotes time. Each row R of the sinogram therefore represents information about the subject (at the axial position z_0) at a different time t.

Usually the fact that the rows of the sinogram are time dependent is inconsequential, because the subject is immobile during the scanning process. The assumption of stasis may be reasonable even for a living patient, because the patient can be well constrained during the time it takes to collect all the projection views (0.5 – 0.8 seconds). For example, when the area of interest is the patient's head, abdomen, etc., the body part of interest can be assumed to be stationary during the scan.

However, in cardiac imaging the assumption of stasis clearly does not apply, at least for a living subject. The beating of the patient's heart persists and cannot be suspended. Moreover, a heart rate of 72 beats per minute (bpm), for example, corresponds to 0.83 seconds (s) per beat. The heart thus completes a full cardiac cycle in a time span comparable to the time required for collecting projection views at all the view angles θ. The beating heart thus undergoes a substantial portion

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of a complete cardiac cycle while the projection data for a slice image are being obtained.

The particular motion that affects cardiac CT imaging is largely the cyclical change in the shape of the heart throughout the cardiac cycle. However, the same imaging problem appears in various situations where the object of interest is in motion during the CT scan process (the data acquisition cycle). The scanner is unable to generate a clear image of the object being imaged at a particular position (e.g., a particular phase of the cardiac cycle) because the object moves too rapidly for a complete set of projection data to be collected while the subject is in the desired position or configuration.

The problem may be analogized to the problem in conventional photography of freezing a subject in motion. If the camera shutter speed is too slow, the subject will undergo a significant amount of motion while the shutter is open (i.e., collecting image data). The resulting image of the subject is blurred. In a like manner, the CT scanning system may be unable to generate a clear slice image, if the subject is in motion while the scan data are being collected. In effect, the CT scanner has a slow shutter speed relative to most rates of motion of the subject.

FIG. 6 thus emphasizes that the collection of projection data proceeds as a function of time while the gantry or source is rotating. A projection data set should be complete (covering as much as 360°, but at least 180° plus the fan angle) to provide a useable tomographic image upon reconstruction. However, if the projection data set consists of projection views from a single scanning rotation, the projection views will respectively represent the heart at many different phases of the cardiac cycle. Each projection view corresponds to a particular row in the sinogram, but is collected at a different moment in time. Strictly speaking, reconstruction of an image at any particular phase of the heart requires collecting all the projection views (all rows of the sinogram) at that particular instant in time. This would require a very fast data acquisition cycle (i.e., a very fast shutter speed for the CT scanning system).

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A feasible solution to this problem can be achieved by making use of the cyclical nature of the cardiac cycle (more generally, any repeating feature of the motion of the object of interest). As the cycle repeats, the beating heart moves through the same cycle of shapes and assumes successive shapes in an ordered sequence in time. Multiple scanning rotations, together with data gating, can be used to collect several projection views corresponding to the same phase from multiple heart cycles. The CT scanning system can thereby generate the projection views to be used in reconstructing an image of the beating heart at a particular heart phase.

Unfortunately, obtaining all the desired projection data directly through respective data acquisition cycles would entail an inordinately large number of scanning rotations for the corresponding projection views. The "shutter speed" problem arises here in a different form: although the heart regularly repeats the cardiac cycle, the subject being imaged otherwise desirably remains stationary throughout the data collection process. A reasonable number of scanning rotations, during which the subject can be expected to remain generally stationary, will provide just a few projection views of the heart at a given phase.

FIG. 7 illustrates this problem through a simplified example in which three projection views are collected at the desired heart phase, $t=\phi_0$. It is noted that phase ϕ is measured in units equivalent to time t. Here a distinct symbol (ϕ) is used for phase to emphasize the periodicity of the heart motion, because periodicity is a dynamical feature not present in dynamic phenomena generally. The three views correspond sequentially to heart cycles 3, 1, and 2 as shown and may be collected in, for example, three scanning rotations. At 0.5 s per scanning rotation, even this level of data collection requires the patient (the imaged subject) to remain stationary for at least 1.5 s.

The following scheme has been partially successful in overcoming the persistent problem of missing projection views in the context of cardiac imaging. An assumption is made that, at least for some phases to of the cardiac cycle, the heart motion may be relatively slight in the neighborhood of $t= \phi_0$. As FIG. 7 shows, the

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heart cycle is divided into a few phase sectors, in each (or at least some) of which the heart is assumed to be close to stationary.

For each scanning rotation of the CT system, the phase sectors of the cardiac cycle can be associated with angular sectors of the rotation. Data for projection views at many different view angles are collected in each scanning rotation. If the foregoing assumptions are valid, then from all the scanning rotations the data corresponding to the phase sector of the desired phase can be used for reconstruction of an image of the heart at the desired to phase.

The approach described above has been termed data "sectoring" or "data segmentation" and has been implemented successfully in various contexts. For example, U.S. Patent No. 5,997,883, issued December 7, 1999, to Epstein et al. and assigned to the assignee of the present application, discloses a cardiac imaging technique using segmented MRI cardiac data. Data segmentation has been shown to yield x-ray CT images with image quality satisfactory for many purposes. On the other hand, such CT images suffer from certain noticeable artifacts, such as streaks. The artifacts in these images are believed to be due to inconsistency of the projection data, particularly in the regions of transition between the different sectors, because the different projection views actually represent the heart at somewhat different cardiac phases..

FIGS. 8-9 illustrate analysis of sinogram data through a different perspective that constitutes an aspect of the present invention. The diagonal trajectories 1, 2, and 3 in FIG. 8 illustrate the time dependence of the sinogram data, as shown previously in FIG. 6. Thus, each trajectory (1, 2, or 3) represents a sequence of sinogram rows as θ evolves in time. FIGS. 8-9 depict the trajectories as continuous diagonal lines, for purposes of illustration. However, like the sinograms they represent, these trajectories actually represent the sinogram data as comprising projection views corresponding to a discrete sequence of view angles θ.

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If the period of the cardiac cycle and the period of the data acquisition cycle are different, projection views can be collected corresponding to different phases of the heart during each rotation. Here T_{gantry} and T_{heart} correspond to scanning rotation period and cardiac cycle period, respectively. For description purposes, the particular example of FIG. 8 illustrates the case where T_{gantry} is less than T_{heart}. However, and the present invention readily applies also to the case T_{gantry} greater than T_{heart}.

The data trajectories are indicated in FIG. 8 by diagonal lines with arrows and represent the projection data in the θ-t domain. It is noted that θ=0° and θ=360° actually represent the same angular position. Hence each trajectory in FIG. 8 wraps around to 0° whenever θ reaches 360°. Further, because $T_{gantry} < T_{heart}$ in the case illustrated, the ordinal extent of the domain is [0, T_{heart}), and each trajectory wraps back to t=0 whenever the trajectory reaches t=T_{heart}. Each recurrence of t=0 corresponds to a next cardiac cycle, which is represented in FIG. 8 by another trajectory.

The scheme described above assigns projection data for a given view angle θ from the trajectory nearest to the vertical line at $t=\phi_0$. As noted above, this approach is commonly known as data sectoring or data segmentation. However, in view of the perspective provided by FIG. 8, a more descriptive term may be "nearest neighborhood substitution." The idea is to substitute data from the desired view, but from a nearby phase, in place of the missing projection view for the desired phase.

FIG. 9 illustrates the relationship between the data sectoring approach and the perspective illustrated in FIG. 8. The range of cardiac phases is "segmented," or divided into segments (or "sectors") denoted I, II, and III. The sectors correspond to predetermined portions of the cardiac cycle. In each of the trajectories 1, 2, and 3, the phase sectors correspond to respective angular regions in θ. Hence each of the trajectories 1, 2, and 3 is divided into angular segments corresponding to the phase sectors I, II, and III. FIG. 9 also shows that the phase sector (sector I) of the phase to coincides with different angular segments for the different trajectories. As noted

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above, the sectoring approach assigns substitute projection data for missing projection views according to the phase sector of the phase to at the desired view angle θ_m.

For example, the view angle θ_m in FIG. 9 corresponds to a missing projection view 900 for the phase ϕ_0, because none of the trajectories 1, 2, and 3 pass through the point (in θ and t) at which the view 900 is desired. The sector approach determines the trajectories within the phase sector of the target phase at the desired view angle and identifies an available projection view at that view angle and on the trajectory nearest in time to the phase to.

In FIG. 9, the projection view 910 is the projection view nearest to the desired phase. The projection data for this nearest neighbor projection view are then substituted for the missing projection view. It is noted that the information associated with other projection views, such as the next nearest projection view 920 in FIG. 9, is completely ignored in the sector approach.

The present invention uses a different perspective of the projection data and of the problem of missing projection views. For a scan where the gantry is continuously rotated, the trajectories in FIG. 8 represent the data collected in the two dimensional domain of view angle versus time (θ vs. t). This perspective enables the invention to take a different approach for processing the projection data. Instead of block assignment of the data to different phase sectors, the present invention makes use of additional information revealed by representing the projection data as trajectories. In fact, the trajectories allow quantitative relationships between the available data and the desired data to be discovered and utilized.

The perspective adopted by the invention enables the additional information contained in an additional projection view, such as the second projection view 920 in FIG. 9, to be incorporated into projection data for the missing projection view. This incorporation of multiple working projection views into projection data for a missing projection view is achieved through interpolation in the sinogram phase domain, i.e., along the t axis. For a set of (two or more) existing projection views at a

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given view angle, corresponding data values of the projection views are interpolated to generate a corresponding data value for an interpolated projection view at the given view angle and the desired phase. Here, therefore, interpolation between projection views means to carry out the same relative combination of data values for all the row positions of the set of projection views being interpolated.

FIG. 10 shows a flow diagram illustrating an interpolation procedure 1000 of the invention. An operation 1010 determines the initial projection data available. This initial data may comprise, for example, sinograms of projection data providing plural trajectories of projection views accumulated over time, as illustrated in FIG. 8. Such initial projection data may be generated directly by a DAS such as DAS 124 in FIG. 1. Alternatively, as explained below, the initial projection data may be determined from the digitized detector data by rebinning or other preprocessing operations, as are well known in the art.

An operation 1020 selects a view angle for which a projection view is to be synthesized through interpolation. From existing projection views of the initial projection data at the selected view angle, working projection views are determined in an operation 1030. The working projection views will represent the imaged object at the selected view angle, but in different data acquisition cycles. For example, in a particular embodiment of the invention, the interpolation may be performed between two projection views such as views 910 and 920 shown in FIG. 9. In such a particular instance, then, the working projection views are determined as the two projection views that are nearest in time to the desired phase ϕ_0, among projection views at the desired view angle in the initial projection data.

Interpolation is performed between the corresponding data values of the working projection views in an operation 1040. Any of various different interpolation techniques may be employed for this purpose, as are well known to those of skill in the art. For example, weighted linear interpolation between neighboring data trajectories is a particular interpolation method that has been used effectively. The weights may be computed based on respective timing differences

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between timings of the selected working projection views and a corresponding timing of the desired projection view. For example, in an implementation of the invention for cardiac imaging, the timings of the working projection views and the desired projection views may be embodied in corresponding phases of the cardiac cycle.

Where the initial projection data comprise data sinograms for cardiac imaging, the sinograms are preferably correlated with simultaneously collected timing data such as electrocardiogram (EKG) data generated by the EKG unit 160 of FIG. 1. The correlation provides a time stamp for each row of detector data. The time stamp of a row of projection data provides an explicit cross reference between the row of data and the shape configuration of the heart (as determined by the EKG data) at the time the row of data was collected.

FIG. 11 illustrates an approach for using such time stamps to correlate the projection data with contemporaneous electrocardiographic data. The EKG data represent an electrocardiograph 1110 of the patient's heart during the tomographic scanning procedure. The projection data represent the heart at various phases of the cardiac cycle and are collected at a known sampling frequency (e.g., 984 projection views in each period of the gantry rotation) that allows the projection views to be time stamped with respective temporal locations.

On the other hand, the projection data do not contain explicit phase information. The contemporaneously collected EKG waveform 1110 can be used to determine such phase information, provided the collection of the EKG data is synchronized with collection of the projection data. The projection data also do not explicitly comprise axial position (Z-location) information, but such position data may be recorded sequentially as each axial scan is performed.

In a particular implementation, for example, the EKG data for the waveform 1110 may be collected during the scanning procedure by the EKG unit 160 and may be digitized at a specified sampling frequency (e.g., 240 samples per second). The particular sampling frequency is not critical to the present invention.

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The criteria for selecting a suitable sampling frequency are well known to those of skill in the art, and such criteria will not be described here.

The temporal locations of the R-wave peaks of the waveform 1110 may be identified using any of various well-known waveform analysis techniques. Using the identified peak locations, a linear phase function 1120 may be defined to increase from 0.0 to 1.0 between each consecutive pair of R-wave peaks.

The function 1120 may be used to map (i.e., to correlate) the phases of the cardiac cycle to the time-stamped temporal locations of the projection views. Each projection view is thereby assigned a cardiac phase $_{ij}0$, where the indexes i and j respectively identify the cardiac cycle and gantry rotation of the scanning procedure. It is noted that the cardiac phase assignment $_{ij}$ may further be associated with specific axial positions, as will be explained below with reference to FIG. 24. The phase function 1120 (defined between all consecutive R-wave peaks of the waveform 1110) thereby allows all the projection views of the projection data to be correlated (tagged) with an associated cardiac phase $_{ij}$.

In the simplest case, it may be assumed that the heart rate is constant while the scan data are collected. The desired phase (in the case of cardiac imaging, corresponding to a shape configuration of the patient's heart) then occurs in each cardiac cycle at a fixed fraction of the heart period T_h following the preceding R-wave. This assumption of regular heartbeat simplifies the process of cross-referencing the projection data and the EKG data. In particular, for each R-R heart cycle the desired phase of the heart occurs on the vertical line ϕ_0 in FIG. 8.

An advantage of the foregoing implementation is that a phase function, such as the linear phase function 1120, allows correlation between heart phases and row data to be carried out even when the subject's heart rate is irregular. In either case, the time correlation between the EKG data and the collected scan data may be performed off-line, i.e., after the projection data is initially collected, binned, and time stamped.

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The linear phase function 1120 shown in FIG. 11 is only one example of a feasible phase mapping function for EKG data. Other, possibly non-linear phase mapping functions are also feasible for use with the present invention. Such alternative mappings may permit the electrocardiographic behavior of the R-R cycle to be modeled more accurately and in more detail. In turn, more accurate and detailed modeling of the electrical cycle of the heart may permit more accurate time correlation of the heart phases.

Adaptive Projection Data Processing

In a particular embodiment of the procedure illustrated in FIG. 10, the initial projection data may represent a patient's beating heart, and the two nearest projection views may be identified based on the time correlation between the collected projection data and the EKG data. The time stamps of the projection data allow the working projection views to be determined in operation 1030 based on the correlation between the gantry rotation and cardiac cycle. For example, the projection view 910 on trajectory 1 in FIG. 9 may be identified from the timing at which the gantry rotation coincides with the missing view angle θ_m and the assigned phases $_{ij}$. The phases $_{ij}$ of the projection views may be used with the EKG data to determine the phase differences, as will now be explained.

FIGS. 12-13 illustrate the data relationships that may be utilized in a particular embodiment of the invention. In FIG. 12, the initial trajectories 1 and 2 respectively include projection views 1210 and 1220 at the desired phase ϕ_0 and corresponding view angles. The point 900 again represents a missing projection view for the heart phase ϕ_0, because neither of the available trajectories includes a projection view at the view angle θ_m. Two nearest neighbor projection views 910 and 920 may be identified from the trajectories 1 and 2, respectively, using the time stamp correlations.

FIG. 13 shows phase differences d_1 and d_2 (represented as timing differences) respectively associated with the projection views 910 and 920. Using

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such timing differences, the data values of 910 and 920 may be combined through a predetermined interpolation process (operation 1040 of FIG. 10) such as a weighted linear interpolation process. A data value for view 900 may be determined in such a process from corresponding data values for the views 910 and 920 using an interpolation formula such as

$$P = \frac{1}{\Delta T}[d_2 P' + d_1 P''] \qquad (1)$$

$$= \left(\frac{\phi_0 - T_2}{T_1 - T_2}\right)P' + \left(\frac{T_1 - \phi_0}{T_1 - T_2}\right)P''$$

where $\Delta T = T_1 - T_2$, $d_1 = T_1 - \phi_0$, and $d_2 = \phi_0 - T_2$. Here P′ and P″ are the data values of the views 910 and 920 at respective detector positions in the projection views.

In the foregoing example the differences d_1 and d_2 may be determined directly from the time stamp data of the projection views 910 and 920, if the heart rate is assumed to be constant. Such an assumption ensures that the difference in the heart configuration at ϕ_0 and T_1, for example, directly corresponds to the time difference d_1. On the other hand, as noted above, the present invention also accommodates an irregular heart rate for which the heartbeat period T_h may vary with each trajectory.

FIG. 14 shows a flow diagram illustrating the main operations of a procedure to implement the invention for generating a projection data set comprising a complete set of projection views for reconstructing a slice image. As in the operation 1010 of FIG. 8, an operation 1410 determines the initial projection data (i.e., the sinogram data for a plurality of scanning rotations). A particular phase of the cardiac cycle, such as $t = \phi_0$, is selected in an operation 1420.

An initial view angle is selected in an operation 1430. Both the initial view angle and the angular interval between projection views typically will depend on the θ discretization (the sampling frequency, such as 240 Hz) of the sinogram data.

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An initial testing operation 1440 may determine whether the initial projection data includes a projection view for the selected view angle and the selected phase.

If the selected view angle corresponds to a missing projection view at operation 1440, then the procedure determines working projection views at operation 1450. An interpolated projection view is generated at an operation 1460. These operations will be described in detail with reference to FIGS. 15-16. If the sinogram data includes a projection view for the selected phase and view angle, then the desired view angle is not a missing view angle. The procedure of FIG. 14 then skips operations 1450-1460 and advances to an operation 1470, where a determination is made as to whether the selected view angle is the last view angle needed for the desired reconstruction. If not, then a next view angle is selected at operation 1480, and the procedure returns to the testing operation 1440.

FIG. 15 shows a flow diagram illustrating a version of the determination operation 1450. In an operation 1510, a projection view for the selected view angle is selected from the initial projection data. The particular projection view may be selected based on both the selected view angle and the initial projection data corresponding to phases prior to the selected phase ϕ_0 in the cardiac R-R cycle.

As has been noted with respect to FIGS. 12-13, the selected view angle occurs in each of the data trajectories of the initial projection data at a specific timing. A preferred embodiment of the invention in this aspect selects the projection view 920 at the selected view angle and occurring in the trajectory 2 closest in time before the timing of the desired cardiac phase ϕ_0. The term "configuration phase" will be used to mean the phase of the physical configuration of the heart at an associated moment in each beat of the heart.

An operation 1520 produces a similar selection result, but the projection view 910 is selected from projection data subsequent to the selected phase (time). These two operations (1510 and 1520) determine two projection views that

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may be used as the working projection views in the remainder of the procedure illustrated in FIG. 14.

FIG. 15 illustrates a particular embodiment for selecting working projection views in pairs. It will be apparent to those of skill in the art that the present invention also encompasses other arrangements for selecting the working projection views. Indeed, a significant aspect of the present invention is the discovery that substantive relationships can exist between disparate initial projection views. Such relationships can provide additional information for improving the quality of reconstructed images. Thus, as will be seen, the present invention encompasses a variety of different approaches for identifying initial projection views between which such substantive relationships exist. Various embodiments of the invention are possible for combining the initial projection views to utilize the additional information that may be provided by relationships.

FIG. 16 is a flow diagram illustrating a particular embodiment of the interpolation operation 1460 of FIG. 14. As FIGS. 4-5 indicate, each projection view may comprise, for example, 888 data values each corresponding to an output of a detector element of the detector array (such as array 216 or 316). An operation 1610 selects respective initial data elements from the working projection views. This selection may be based on the position of the detector element from which the data elements are generated. Alternatively, any other commensurate numbering system for identifying the respective data elements in the sinogram rows may be used.

An operation 1620 performs a computational procedure to interpolate between the selected data element values of the working projection views. Any of various interpolation procedures may be used, as discussed below. The result is an interpolated data value corresponding to the selected data element position, the selected phase, and the selected view angle. An operation 1630 determines whether further sets of data elements remain to be interpolated between the working projection views. If so, then the next data element values are selected at an operation 1640 (such

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as by selecting a next detector element position). The procedure of FIG. 16 then returns to the operation 1620 for another iteration of the interpolation computation.

The approach of the present invention makes the resulting projection data (any initial projection data for the desired phase, in combination with interpolated projection data) more consistent, particularly at view angles near angles at which the sector approach would join different sectors. The results provided by the invention are further improved by the fact that the general profile of motion during the cardiac cycle is known as a function of time. This profile can be used to compute weights to be used in the interpolation operation 1460. In particular, it has been found that careful selection of the interpolation weights based on the motion profile can result in even better image quality.

In a particular implementation of the invention, the weights may be selected to minimize image distortion arising from motion of the heart at the working projection views. In this approach the interpolation method weights the data from a particular working projection view (and trajectory) based on the amount of heart motion at the phase of the cardiac cycle to which the working projection view corresponds. The weighting applied to the other trajectory (or trajectories) used in the interpolation may be changed similarly, based on the relative heart position (or configuration) at the respective phases.

The relative heart position at a given projection view may be determined through off-line analysis of the contemporaneous EKG data. The amounts of heart motion at different configuration phases are well known to those of skill in the art of cardiac physiology and may be correlated to the projection views P′ and P″ through the EKG data.

Alternatively, any of various other interpolation methods may be used. In another particular implementation, a weighted inverse quadratic interpolation is performed. Here each weight may be computed to be proportional to the square of the time difference between the interpolated time and the time of the weighted

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projection data value. For example, a data value for the projection view 900 may be computed according to the formula

$$P = \frac{1}{d_1^2+d_2^2}[d_2^2 P' + d_1^2 P''] \quad (2)$$

$$P = \frac{(\phi_0 - T_2)^2}{d_1^2+d_2^2} P' + \frac{(T_1 - \phi_0)^2}{d_1^2+d_2^2} P''$$

$$P = \frac{(\phi_0 - T_2)^2}{(T_1 - \phi_0)^2 + (\phi_0 - T_2)^2} P' + \frac{(T_1 - \phi_0)^2}{(T_1 - \phi_0)^2 + (\phi_0 - T_2)^2} P''$$

It is noted that the equations (1) and (2) illustrate this feature of the present embodiment in the simple case where $|T_1-\phi_0|$ and $|\phi_0-T_2|$ are less than $T_h/2$. In many cases this condition may be satisfied automatically by using existing projection views 910 and 920 from consecutive gantry rotations (consecutive data acquisition cycles). However, the present aspect of the invention also applies in many other contexts where one or more of these simplifying assumptions fails to hold. The principles of the present aspect of the invention may also be applied where a direct phase difference (such as $T_1-\phi_0$) actually is greater than $T_h/2$. Such a case may be addressed as described with reference to equation (5) below.

Among its numerous advantages, the present invention enables the times at which to collect the projection data (for reconstructing an image of the heart at a particular configuration phase) to be determined prospectively. A method of the present invention therefore does not require the X-ray tube to be on all the time. Instead, a method of the invention operates with data collected at or near a particular phase of the heart. The time correlation by which such a method is employed can be achieved by prospective gating.

Usually in medical imaging procedures the heart rate is not uniform during the data acquisition process. As in the discussion above with respect to FIG. 10, the preferred procedure here is to collect an electrocardiographic data set along

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with the projection data. The EKG data set can then be correlated off-line with CT scan data, using the time stamps as noted previously. Thereafter, using the time stamps and the correlations to the EKG data, the particular projection data corresponding to a selected cardiac configuration phase can be identified.

Such an adaptation to heart rate variations is well known in the art and has been used, for example, in the sector approach described above with respect to FIG. 7. Persons skilled in the art will readily appreciate the appropriate measures to be used with the present invention to compensate for the presence of heart rate variability. For example, a compensation model is employed in the technique of U.S. Patent No. 5,997,883 to Epstein et al. noted previously.

On the other hand, a further embodiment of the present invention is particularly useful in cases where heart rate variability exists. The basic approach described above is employed again, but variations in the heart rate are accommodated in the interpolation process.

FIG. 17 illustrates a typical effect on a trajectory when the heart rate varies. Trajectories 1 and 2 again represent successive portions of CT projection data. The scanning rotation also continues to have a fixed period T_g. However, unlike in FIGS. 12-13, the heart rate is now variable with a period varying around some nominal period T_h. The rightmost extent of the graph in FIG. 17 does not represent successive completions of the R-R cycle of the heart. However, like FIGS. 12-13, the trajectories in FIG. 17 wrap around to $t=0$ when they reach $t=T_h$.

Unlike FIG. 12, for example, in FIG. 17 the R-waves of different heart cycles occur at different time positions on the graph. An R-wave R_1 that begins the R-R cycle of trajectory 1 is illustrated as occurring at temporal position $t=0$ on the graph. However, an R-wave R_2 occurs at a later temporal position $t=\Delta t$. The R-wave peak at R_2 occurs at a time $T_h+\Delta t$ following R_1, while the temporal positions on the graph reflect the fact that the graph wraps around to $t=0$ at intervals of T_h. The time

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difference Δt can thus be viewed as a phase delay between the cycle beginning with R_1 and the cycle beginning with R_2.

FIG. 18 illustrates the effect of heart rate variability on the time correlations between the CT projection data and the configuration phases of the heart as indicated by contemporaneously collected EKG data. Trajectories 1 and 2 with respective R-waves R_2 and R_1 are shown as in FIG. 17. Again, a set of projection views is desired for reconstructing a useful image of the heart at a specified configuration phase. In the cardiac cycle of trajectory 1, the specified configuration phase is assumed to occur at temporal position t_1. The trajectory 1 again includes the projection view 910 having a time stamp correlated to the temporal position t_1. A fixed time delay TD is defined to be numerically equal to the temporal position t_1.

The fixed time delay TD will serve a function similar to the fixed heart cycle ratio mentioned above (represented by ϕ_0 in FIG. 12), but for the case of varying heart rate. In each successive heart cycle, the timing of the specified configuration phase will occur at the time delay TD after the R-wave of the cycle. FIG. 18 shows that the specified phase therefore occurs in trajectory 2 at a temporal position t_2 on the graph.

The trajectory 2 includes a projection view 1820 that is time stamped to correspond to the temporal position t_2. The temporal position t_2 of view 1820 is commensurately offset (by the phase delay Δt) from the time position t_2 corresponding to the projection view 910 from trajectory 1. The view 1820 nevertheless represents the heart at the specified phase, because the cycle of trajectory 2 begins at the R-wave R_2. An image reconstruction of the heart in that specified configuration will therefore utilize both the projection view 910 and the projection view 1820.

The embodiment of the invention described with reference to FIGS. 12-13 can provide data for such a missing projection view through gated reconstruction that bins the data into phases. If the heart rate is uniform, as illustrated

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in FIG. 12, then these phases occur at regular intervals T_{heart} in time. The horizontal axis in FIG. 12 consistently represents both time t and cardiac phase $_{ij}$. This correspondence allows differences in the phases of the heart at the projection views 900, 910, and 920 to be determined directly from the temporal positions of those views on the graph.

However, heart rate irregularity is particularly common among patients undergoing cardiac care, and this creates a problem for using EKG data for gated reconstruction. As in FIGS. 12-13, this embodiment of the invention provides an additional, synthesized projection view 900 to be combined with the views 910 and 1820 in reconstructing the image. But when the cardiac cycle is irregular, the direct correspondence between temporal position and cardiac phase is destroyed.

FIG. 18 illustrates that the temporal position t_2 of the projection view 1820 is delayed relative to the temporal position of 910. This delay is induced by, and is numerically equal to, the phase delay Δt: $t_2 - t_1 = \Delta t$. It follows that when the heart rate is irregular, a given configuration phase will not occur at a regularly repeating temporal position, such as at ϕ_0. Instead, the desired phase will occur in each cardiac cycle at a time position determined by the R-wave of the cycle and the fixed time delay TD.

FIG. 19 illustrates an approach to account for the phase delay Δt in the determination of the differences between the cardiac phases. This approach enables the present invention to provide consistent projection view interpolation, in the presence of heart rate irregularity. The basic approach is the same as illustrated in FIG. 13: combine the working projection views 910 and 920 by interpolation to generate an interpolated projection view 900. Moreover, as in the case of constant heart rate, the interpolation formula will generally blend corresponding data values from initial projection views 910 and 920 based on differences between the different phases.

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The timing differences δ_1 and δ_2 in FIG. 19 correspond to d_1 and d_2 as in FIG. 13 and are again associated with the projection views 910 and 920. However, because the desired phase occurs in trajectory 2 at temporal position t_2, d_2 includes the difference between t_1 and t_2, i.e., t_2-t_1=Δt. Thus, for an irregular heart rate, the interpolation formula desirably blends the initial projection views 910 and 920 based on

$$\delta_1 = T_1 - t_1, \tag{3}$$

$$\delta_2 = t_2 - T_2 = t_1 - T_2 + (t_2 - t_1) = t_1 - T_2 + \Delta t.$$

Any of the various interpolation methods known in the art may be used for interpolation between 910 and 920 in FIG. 19, using appropriate measures of phase differences such as δ_1 and δ_2. For example, either of the formulas (1) and (2) above may be used directly by substituting δ_1 and δ_2 for d_1 and d_2, respectively. The use of a fixed delay TD ensures that the working projection views will correspond to a same phase of the cardiac cycle following the trigger phase. The procedure illustrated in FIGS. 14-16 may then be employed to generate the interpolated projection view 900.

The same delay time TD can be used to generate projection views for image reconstruction at a succession of slice positions z_0. A number of slice images can be generated to provide a reconstructed three dimensional image of the heart at the configuration phase specified by the selected delay TD. It is desirable to use a delay time TD corresponding to a cardiac phase at which the heart is nearly still. Alternatively, the approach of the invention may be further extended by performing the aforementioned three dimensional image reconstruction for each of a series of delay times TD. This alternative allows the creation of a time succession of such three dimensional images to provide a dynamic (four-dimensional) model of the heart.

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The aspect of the present invention described with reference to FIG. 10 may be implemented in various different embodiments, several of which may have particular application in dynamic imaging contexts such as cardiac imaging. An embodiment suitable for a given imaging context may be selected according to the particular imaging system hardware to be used, characteristics of the object to be imaged, image parameters to be emphasized, and so forth. Two particular embodiments of the invention will now be described in more detail. Those of skill in the art will appreciate details and desirable features of other alternative embodiments, upon considering the foregoing general description together with the particular descriptions to be presented below.

Interpolation Between Several Projection Views

FIG. 20 is a trajectory graph, similar to the graphs of FIGS. 12-13, but illustrating an alternative aspect of the invention. The embodiment illustrated in FIGS. 12-13 provided phase interpolation between two projection views selected from consecutive different data acquisition cycles, and thus falling on neighboring trajectories in the graphs. Here, for added clarity of illustration, the trajectories are labeled to indicate both their respective gantry rotations and heart cycles. Thus the label "M_N" indicates the trajectory represents a sequence of projection views from the M-th heart cycle and the N-th gantry rotation.

The alternative embodiment of FIG. 20 provides for generating an interpolated projection view 2000 by phase interpolation between several working projection views 2010, 2020, 2030, and 2040. While four working projection views 2010-2040 are shown, it will be apparent that this aspect of the invention encompasses other numbers of projection views, both more than four and less than four. Moreover, it may be seen that assignment of zero interpolation weights may effectively exclude some working projection views from the phase interpolation of a particular embodiment. For example, assignment of zero weights to the projection views 2030 and 2040 effectively reduces this alternate aspect of the invention to the

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previous aspect, in which phase interpolation is applied to two neighboring projection views.

More generally, this alternative aspect may be embodied through phase interpolation between several (e.g., three or more) working projection views. The result is again to obtain an interpolated projection view, now based on the interpolation formula

$$P_{\phi}(\theta) = \sum_{i,j} w_{ij}(\theta, \phi) \cdot P_{ij}(\theta) \tag{4}$$

Here i indexes cardiac cycle and j indexes gantry rotation (i.e., data acquisition cycle). The equation (4) applies fully to the case of axial scanning but is not limited to such contexts, as will be seen below.

The weights $w_{ij}(, \phi)$ in equation (4), some of which may be zero, may be selected based on any of various suitable weighting schemes. For example, the weighting formulas

$$w_{ij}(\theta, \phi) = \frac{w'_{ij}(\theta, \phi)}{\sum w'_{ij}(\theta, \phi)}, \text{ where} \tag{5}$$

$$w'_{ij}(\theta, \phi) = \left[\Delta(\Phi_{ij}(\theta) - \phi)\right]^{-p} \text{ and}$$

$$\Delta(\Phi_{ij}(\theta) - \phi) \equiv \begin{cases} \left|\Phi_{ij}(\theta) - \phi\right|, & \left|\Phi_{ij}(\theta) - \phi\right| \le \frac{T_h}{2} \\ T_h - \left|\Phi_{ij}(\theta) - \phi\right|, & \frac{T_h}{2} < \left|\Phi_{ij}(\theta) - \phi\right| \le T_h \end{cases}$$

define weights $w_{ij}(\theta, \phi)$ similar to the coefficients of P′ and P″ in (1) and (2) above.

The case where the exponent is p=2, for example, achieves rapid decay with increasing phase distance of the working projection view from the desired phase. A rapid decay condition reduces the influence of more distant working projection

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views, relative to the contribution to the interpolation result from views close to the desired phase.

It is noted that the above definition of $\Delta(\Phi_{ij}(\theta)-\phi)$ accounts for the case when the distance $|\Phi_{ij}(\theta)-\phi|$ is greater than $T_h/2$, one-half the heart cycle period. Such a difference function may be applied (with changes that will be apparent to those of skill in the art) in equations (1) and (2) above, in any case where the difference ϕ_0-T_2 or the difference $T_1-\phi_0$ exceeds one-half of the heart cycle period T_h.

Those of skill in the art will appreciate that the inverse-polynomial weighting $[\cdot]^{-p}$ set forth above is only one example of a weighting function that may be applied for phase interpolation as provided by the present invention. For example, the weights $w_{ij}(\theta, \phi)$ may be defined in terms of any nonnegative monotonically decreasing function of the distance $\Delta(\Phi_{ij}(\theta)-\phi)$ such that the sum of the weights for a given θ and ϕ is unity: $\Sigma\, w_{ij}(\theta, \phi)=1$. For example, the weighting function $w_{ij}(\theta, \phi)$ may be reduced to a unit step function having value 1 at the nearest-neighbor phase $\Phi_{ij}(\theta, \phi)$ and value 0 at more distant phases. The result of this weighting choice in equation (4) would be to reduce the interpolation approach of the present invention to the nearest-neighbor substitution approach described above.

Another implementation provided by the present invention assigns non-zero weights to working projection views in pairs, with each pair comprising one view before and one view after the desired phase (i.e., the phases of each pair "sandwich" the desired phase). In such an alternative implementation it may be particularly desirable to use sandwiching with working projection views from consecutive trajectories. That is, for each of the sandwich pairs, the projection views of the pair may be chosen from consecutive data acquisition cycles to sandwich the desired phase therebetween.

Helical Scanning

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In an implementation for cardiac imaging, as described above, the invention enables reconstruction of a single slice through the heart with high resolution in time. If reconstruction is desired for more than one slice, such as for a volumetric section (for example, a volumetric image of the entire heart), then further processing is performed.

One way to achieve this further goal is to perform the previously described method for each of several slices through the heart. However, collection of the scan data to be used for each slice involves multiple rotations of the gantry. For the example illustrated in FIG. 8, three complete scanning rotations would be needed for each slice.

Such an operation of multiple rotations for multiple slices would require an undesirably long data collection time. In particular, collection of data for all the slices through the heart would be difficult to achieve in one breath hold (20-60 seconds), at least with the current CT technology. Such an approach would also deliver to the patient an undesirably large X-ray dose. Thus, at least for dynamic contexts such as cardiac imaging, the axial scanning arrangements illustrated in FIGS. 2-3 may have disadvantages.

FIG. 21 illustrates a source-detector assembly 2100 for a desirable alternative to axial scanning, called helical scanning. The principal features of assembly 2100 are analogous to the components of assemblies 200 and 300 in FIGS. 2 and 3, respectively. A subject 2102 (here illustrated as a human patient) is illuminated by an x-ray beam 2104 while disposed on a (possibly movable) table 2108. A gantry 2112 supports an x-ray source 2114 that generates the imaging x-ray beam 2104. However, unlike the fan beams 204 and 304 described previously, beam 2104 is a so-called cone beam that spreads (or "fans") in two generally orthogonal directions as the beam is projected away from the source 2114.

The particular assembly 2100 of FIG. 21 corresponds to the third generation axial assembly 200 of FIG. 2. Specifically, the gantry 2112 also supports

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a detector array 2116 comprising multiple detector elements 2118, and both the source 2114 and the detector array 2116 are transported around the subject 2102 along respective circular paths as the gantry 2112 rotates. The detector array 2116 and the source 2114 are both fixed to the gantry 2112. The detector 2116 thereby remains opposite the source 2114, relative to the subject 2102, during the rotation.

Unlike detector array 216, however, the array 2116 is a so-called multi-row detector comprising several rows of detector elements. The array 2116 thereby provides a two dimensional detection area, which corresponds to the spread of the cone beam 2104 in two directions. Accordingly, at each (lateral) detector position of a single row detector array (such as array 216 in FIG. 2), the array 2116 comprises an entire set of detector elements arranged in a column generally parallel to the axial direction z.

FIG. 22 shows a schematic diagram of the detector elements of a multi-row detector such as detector array 2116. In the illustrated example, each column of the array 2116 comprises four detector rows. Each detector has a thickness of Δ_d.

Helical scanning relaxes the requirement of axial scanning systems that the axial position of the gantry is fixed at a single point throughout the data collection cycle. Instead, the entire gantry (source and detector array) translates axially (in the z direction) relative to the patient. This mode of operation allows a single scan to cover the entire organ or structure under study. Thus, the motion of the gantry, as well as the individual detector elements, traces a helix. The extent of translation in the z direction (as a fraction of detector thickness Δ_d) per gantry rotation is called "pitch" and is denoted by "p" in FIG. 21. Thus, the axial position of the *k*-th detector row can be written as

$$z_k(t) = p\Delta_d \frac{\omega t}{2\pi} + k\Delta_d .$$

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A helical/cone beam CT scanning system provides advantages for performing a volumetric reconstruction of the heart. For example, a multi-row detector such as detector array 2116 can collect several times more x-ray data from each scanning rotation. The axial position of the cone beam 2104 also advances continuously during the scanning operation, so that each detector element 2118 traces a helical path around the subject 2102. In this manner, the data collection proceeds continuously as the cone beam 2104 advances axially, rather than being repeatedly interrupted for a next translation maneuver.

FIG. 23 illustrates a complication that arises with helical scanning. The rotations 1, 2, and 3 represent successive loops of the helical advance of a four-row detector array such as array 2116 shown in FIGS. 21-22. As time t evolves, each scanning rotation progresses from a 0° view angle to a 360° view angle. Further, the angle 360° for a given rotation coincides with the view angle 0° of the succeeding rotation.

However, the helical advance of the gantry during the scanning process causes the detector elements of the multi-row detector to be displaced axially during each rotation. The locations of the detector rows of a three-row detector in the z direction are shown in FIG. 23 in the z-t domain. The axial position of each detector row therefore changes, both between rotations and within each rotation. Still, each of the detector rows in the multi-row detector defines data corresponding to a proper projection view, i.e., a projection view representing attenuation data for a single axial position.

The axial displacement of the detector positions in helical scanning entails additional processing (rebinning) of the collected projection data to assemble projection views conformable to the standard image reconstruction methods. One approach is initially to reformat the helically skewed data from the multi-row detector into a sequence of sinograms each corresponding to a single axial position z. This rebinning procedure typically entails an interpolation procedure between detector element values of neighboring detector rows. An additional, phase interpolation

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procedure of the present invention is also performed to obtain projection data for the missing projection views at each axial position.

FIG. 24 illustrates an alternative approach in which each data row of the three-dimensional helical projection data is tagged with corresponding phase information. Thus, following FIG. 11, the phase of the projection at view angle , cardiac cycle i, gantry rotation j, and detector row k is represented as Φ_{ijk}. The projection data may also be tagged with Z-axis position information Z_{ijk}() based on the geometry of the detector rows, the relative speed of gantry and patient, and the gantry rotation rate. In FIG. 24 the diagonal line represents the common trajectory followed by each detector row in z as time evolves. The values $np^*\Delta_d$ on the vertical axis represent the accumulated number of data rows obtained after the corresponding number of gantry rotation periods (T_g, $2T_g$, $3T_g$, etc.). The slope of the diagonal line is determined by the table speed.

FIG. 25 shows a flow diagram illustrating a procedure to implement the present invention in the context of helical scanning. An operation 2510 cross-references the view angles of the helical projection data and the timing of the cardiac cycle. This may entail tagging the set of projection data for each view angle with timing information. The operation 2510 thereby correlates the projection data sets to the cardiac cycle phases to which the respective data sets correspond. In the case of a multi-row detector, each projection data set will comprise several rows of projection data for each view angle.

A particular cardiac phase is selected for reconstruction at an operation 2520. Because the helical scanning process collects scan data over a range of axial positions, an axial position z_0 of the slice to be reconstructed is also selected at an operation 2530. An initial view angle is selected at an operation 2540 for processing of the helical data.

An operation 2550 selects a set of neighboring scanning rotations for the selected cardiac phase and the selected view angle. This operation is described in

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more detail below with reference to FIGS. 26-28. Briefly, operation 2550 relates to the fact that the helical scan data are collected as the axial position of the gantry advances through multiple rotations. A first stage toward determining working projection views is to identify from the helical projection data the scanning rotations for which the projection data are most relevant to the missing projection view.

An operation 2560 determines working projection views for the scanning rotations selected in the operation 2550. This determining operation is described in greater detail below with reference to FIGS. 29-30. Operation 2560 relates to the fact that the helical scan data from a multi-row detector is desirably conformed into projection views for the selected slice position.

When the working projection views have been determined at operation 2560, the procedure of FIG. 25 advances to an operation 2570. In this operation, an interpolated projection view is generated from the working projection views determined in the operation 2560. The operation 2570 may be the same phase interpolation (i.e., interpolation in time) described above with respect to operation 1460 of FIGS. 14 and 16. An operation 2580 determines whether the current view angle is the last view angle for which a projection view is needed for reconstruction of the selected slice. If more view angles remain, the procedure advances to an operation 2590 where the next view angle is selected. The procedure then returns to operation 2550.

FIG. 26 shows a flow diagram illustrating an exemplary sequence of operations for performing the operation 2550 of FIG. 25. The context for this procedure is that the helical projection data comprise data for a succession of scanning rotations each including the selected view angle. However, because the cardiac cycle will not be synchronized with the scanning rotations, the data for the selected view angle from different scanning rotations generally will represent the heart at different cardiac phases.

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Operations 2610 and 2620 determine particular helical projection data (such as by selecting particular scanning rotations) for which the selected view angle corresponds to respective cardiac phases near the selected phase. The operation 2610 determines such data for a nearby phase timing prior to the timing of the selected phase, and the operation 2620 determines data for a nearby phase subsequent to the selected phase.

For example, with reference to the trajectories of FIG. 8, the trajectories 3 and 2 would be selected as neighbors for (i.e., before and after) the selected phase t_0, for all view angles θ between 0° and 60°. For θ between 60° and 180°, trajectories 1 and 3 would be selected; for θ between 180° and 300°, trajectories 2 and 1 would be selected; and for θ between 300° and 360°, trajectories 3 and 2 would be selected. It is desirable for the procedure to select those scanning rotations for which the selected view angle occurs at a cardiac phase closest to the selected cardiac phase.

FIGS. 27-28 illustrate the determinations of operations 2610 and 2620. In FIG. 27, each of scanning rotations 1, 2, and 4, the timing of the selected phase is denoted as ϕ_0. The scanning rotation 3 lacks an occurrence of the selected phase, reflecting the fact that in the illustrated example the cardiac cycle period T_h is longer that the scanning rotation period T_g. The selected view angle is denoted θ_v and occurs in every rotation, including rotation 3.

FIG. 28 illustrates determination of scanning rotation sets for operations 2610 and 2620. In a preferred embodiment, the rotations are ones in which the selected view angle occurs at a cardiac phase close to an occurrence of the selected phase. FIG. 28 shows that the phase differences between the phase at the selected view angle θ_v and the selected phase ϕ_0 are represented as phase differences $\Delta\phi$.

The designation of phase differences $\Delta\phi$ emphasizes that the present invention may determine a working projection view based on the difference between

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the phase of the heart at the working view and the desired phase. An interpolation rule used in the present invention may account for the relative phase differences of two working projection views and may give greater weight to a working view that is closer in phase than a working view that is farther away. As indicated above with reference to FIGS. 17-19, the actual phase difference may be better determined by a delay following a most recent trigger wave in the EKG (such as an R-wave), rather than a uniform phase timing such as timing ϕ_0 in FIG. 12.

Returning to FIG. 28, the view angle θ_v in rotation 1 occurs at a phase delay $\Delta\phi_1$ away from the occurrence of the phase ϕ_0. In rotation 2, view angle θ_v occurs $\Delta\phi_2$ away from ϕ_0 in rotation 1 and $\Delta\phi_3$ away from ϕ_0 in rotation 2. Similarly, in rotation 3 θ_v occurs $\Delta\phi_4$ away from ϕ_0 in rotation 2 and $\Delta\phi_5$ away from ϕ_0 in rotation 4. θ_v in rotation 4 occurs $\Delta\phi_6$ away from ϕ_0 in the same scanning rotation. Of course, additional scanning rotations will generally provide additional occurrences of θ_v at corresponding phase differences $\Delta\phi$ away from ϕ_0.

The selection of neighboring scanning rotations in operation 2550 (see FIG. 25), performed in operations 2610 and 2620 of FIG. 26, may select a pair of rotations for which the selected view angle θ_v occurs at a timing close in phase to the desired phase ϕ_0. In a particular case, θ_v may occur in the selected rotations at the closest phases before and after phase ϕ_0, respectively, among the collected projection data. Thus, rotation 4 will be selected because θ_v occurs closest in phase to ϕ_0, of the available rotations. The occurrence of θ_v in rotation 3 is the closest occurrence after an occurrence of ϕ_0, among the available rotations. It should be observed at this point that the selected rotations 3 and 4 are temporally consecutive data acquisition cycles, a natural consequence of selecting the closest trajectories before and after the desired phase.

It follows that the exemplary embodiment illustrated in FIG. 28 determines the helical projection data in operation 2610 as the data at θ_v in rotation 4. The data determined in operation 2620 are, in like manner, the data at θ_v in rotation 3.

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In summary, the illustrated embodiment of the procedure selects the nearest neighbor scanning rotations before and after the selected phase. The possibility exists to interpolate between view angles corresponding to other scanning rotations, as well, as noted above with reference to FIG. 20. Such alternatives will be described in more detail below with reference to FIGS. 31-36.

FIG. 29 shows a flow diagram illustrating an exemplary sequence of operations for performing the operation 2560 of FIG. 25. The result of these operations is to determine for each selected scanning rotation a projection view representing the subject at the selected axial position. As noted above, the helical scan data is usually collected with a multi-row detector and cone beam.

An operation 2910 selects an initial scanning rotation from the selected scanning rotations for which working projection views are to be determined. The selected axial position will generally fall between the axial positions for two detector rows of the selected scanning rotation at the selected view angle. FIG. 27 shows that the axial position of each detector row advances as the view angle of the rotation increments from 0° to 360°. For the selected view angle, operation 2920 determines from the selected scanning rotation the two rows closest to the selected position z_0.

FIG. 30 is a time evolution diagram, similar to FIGS. 27-28, showing the helical projection data determined in the procedure of FIG. 26. As seen in FIG. 30, the helical projection data will usually comprise several rows of data corresponding to the rows of detector elements arranged successively in the axial direction. In the typical case, as illustrated in FIG. 30, none of the selected data rows will provide a projection view at the selected axial position z_0. This is a common occurrence with helical scanning data and arises because of the axial translation of the detector array during the scanning rotation. A projection view for the selected position z_0 will therefore be constructed from the existing helical projection data.

FIG. 30 also illustrates the scanning rotations and data rows that may be selected in operations 2910 and 2920. For the purposes of this illustration, it is

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assumed that the scanning rotation 3 is the selected initial scanning rotation. The two data rows 3010 and 3020, respectively below and above z_0 in the axial direction Z, comprise the neighboring detector row data selected in the operation 2920.

Returning to FIG. 29, projection data for an interpolated projection view at the selected position z_0 are then computed at an operation 2930. Here the interpolated projection data are generated by interpolating in z (the axial direction) between the neighboring row data at each detector position along the selected rows. In some respects this computation resembles a grid transformation operation, whereby the available data are converted to projection data for a different grid. Such transformations are well known in the art, and the various available alternatives for carrying out the corresponding computations will not be detailed here. In a typical such alternative, the data values of the z-interpolated projection view are obtained according to a formula such as

$$P_{ij}(\theta, z_0) = \sum_{ijk_3 \left| Z_{ijk}(\theta) - z_0 \right| \le \Delta_d} \omega_k(z_0) \cdot P_{ijk}(\theta), \quad \text{where} \tag{6}$$

$$\omega_k(z_0) = G\left(\left| Z_{ijk}(\theta) - z_0 \right|\right), \quad \sum_k \omega_k(z_0) = 1 .$$

Here k indexes the rows of the multi-row detector array, $Z_{ijk}(\theta)$ is the z-location of the projection view $P_{ijk}(\theta)$, and Δ_d is the collimation (which, as noted previously, is the inter-row distance). It is also noted that the projection views $P_{ijk}(\theta)$ for given θ, i and j have the same phase $\Phi_{ij}(\theta)$ for all rows k. This commonality arises because in such a case the projections of all the rows are collected at the same moment in time.

The weights $\omega_k(z_0)$ may be defined in terms of a function $G(\cdot)$ of the distance $\left| Z_{ijk}(\theta) - z_0 \right|$, where G is a non-negative monotonically decreasing function of its argument. For example, G may be a linear function of the distance $\left| Z_{ijk}(\theta) - z_0 \right|$. The idea behind this z-interpolation, like the phase interpolation described previously, is that the closer a projection view is to z_0 (or ϕ_0), the more that

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projection view contributes to the interpolated projection view. As with the previous discussion of weights for phase interpolation, those of skill in the art will appreciate that many weighting schemes may be employed to carry out z-interpolation with the present invention.

An operation 2940 determines whether working projection views are to be determined for more scanning rotations. If so, then the procedure advances to an operation 2950 where the next of the selected scanning rotations is selected for interpolation. For example, in FIG. 30 the next scanning rotation would be scanning rotation 4. The procedure of FIG. 29 then returns to operation 2920. The two data rows 3030 and 3040, respectively below and above z_0, comprise the neighboring detector row data selected in the operation 2920. The operation 2930 then interpolates between rows 3030 and 3040 to generate the second working projection view at the selected axial position z_0.

In the procedure of FIG. 26 the operations 2610 and 2620 will be performed twice. At the completion of the procedure illustrated in FIG. 29, there will have been determined two (or more) separate working projection views each computed by interpolation in z between neighboring detector rows of the respective scanning rotation data. At this point the procedure of FIG. 25 continues as described above.

Flexible Projection Data Processing

A further alternative embodiment of the invention will now be described with reference to FIGS. 31-35. A procedure of this alternative bears some similarities to the procedure of FIG. 14 above. The result to be obtained may be a 3-D image of the patient's heart at a desired cardiac phase ϕ_0. A three-dimensional image (a volumetric representation based on several slice images) of the subject's heart may be obtained through this alternative embodiment by reconstructing 2-D slices for a range of z-locations (z_0). For each two-dimensional slice, the system may

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obtain a slice image corresponding to the given phase ϕ_0, as well as the axial position of the slice.

FIG. 31 is a flow diagram illustrating a procedure 3100 of this alternative embodiment of the invention for the case of helical scan data. In an operation 3110 the three-dimensional projection data are tagged with phase and z-location information. Based on the temporal location of the identified R-wave peaks, as described above with reference to FIG. 11, each projection view is assigned a cardiac phase Φ_{ijk}. In this operation the gantry period T_g is also used to determine the gantry rotation of the projection view. Similarly, the z-locations of the projection views are determined based on the relationship between the gantry period T_g and the table speed, as indicated above with reference to FIG. 24. The phase and z-location tags are used in the subsequent operations of the procedure 3100.

An operation 3120 selects a cardiac phase at which a slice image of the patient's heart is to be reconstructed. A corresponding axial position z_0 for the slice image is selected in an operation 3130. These operations specify the slice image and enable the appropriate projection data to be identified by reference to the phase and location tags.

An operation 3140 determines, from among the helical projection data, the set of projection views from which an interpolated projection view for the slice image may be generated. Given the selected z-location z_0, the projection views that possibly could contribute to the interpolation result of equation (4). As noted above, for a given axial position either one or two data rows of the helical projection data correspond to row positions that are closest to the selected axial position z_0. The projection data were tagged with location information in the operation 3110, and therefore the data rows can be searched for the one or two nearest neighbors to z_0.

Operation 3150 determines a reconstruction range in which to obtain a complete set of projection views for the selected slice image. The operation 3170 determines working projection views for the selected view angle by interpolating in

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the z-direction between the neighboring projection views as determined by the location tags $Z_{ijk}(\theta)$. This operation determines a reconstruction range, i.e., a range of view angles (the range having extent 180°+fan angle) from among the full range [0°, 360°). Here a "reconstruction range" comprises a plurality of discrete view angles, because the projection data are sampled in discrete sampling intervals. A set of projection data is said to "cover" a given reconstruction range if the set of projection data comprises a projection view at each of the discrete view angles of the reconstruction range.

The reconstruction range is selected as a subset of the projection views covering the selected axial position (see operation 3140) for which the total phase distance from the selected phase ϕ_0 is a minimum. The operation 3150 will be described in more detail with reference to FIG. 33. An operation 3160 selects an initial view angle at which an interpolated projection view will be generated.

Operations 3170 and 3180 are repeated for each view angle in the selected reconstruction range. This interpolation may be carried out substantially as described above with reference to FIG. 29.

The operation 3180 performs phase interpolation between the z-interpolated projection views obtained from the operation 3170, using the selected interpolation rule of the form (4) above. Alternatively, the interpolations of operations 3170 and 3180 may be performed in an integrated computation, using an interpolation rule such as

$$P_\phi(\theta) = \sum_{i,j,k} w_{ij}\omega_k P_{ijk}(\theta). \qquad (7)$$

It is further noted that the separated weight $w_{ij}\omega_k$ may be replaced with an integrated weight Ω_{ijk}

The procedure 3100 advances from the operation 3170 to an operation 3180 that determines whether more view angles in the selected reconstruction range

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remain for interpolated projection views to be generated. If so, then an operation 3190 selects the next view angle and the procedure loops back to the operation 3150. If not, the procedure 3100 returns.

FIG. 32 is a flow diagram illustrating details of an exemplary procedure for carrying out the operation 3140 of FIG. 31. An operation 3210 selects an initial time stamp corresponding to an initial sampling interval of the (three-dimensional) helical projection data. This identifies the projection data rows generated first in time among the helical data.

From the operation 3210 the procedure of FIG. 32 enters an iterative loop in which rows of data are examined for possible inclusion in the set of selected projection views. An operation 3220 determines whether any data row corresponding to the current time stamp is tagged with a z-location within the collimation distance Δ_d from the selected axial position z_0. If such a row is identified, the row is selected for the set of projection views in an operation 3230.

The procedure of FIG. 32 advances from the selection operation 3230 to an operation 3240 in which it is determined whether the projection data comprise a second row within the collimation distance Δ_d from the z-position z_0. If so, the second row is selected for the set of projection views. As noted above, for any given data sampling interval (i.e., any given time stamp) will correspond to at most two data rows tagged with z-locations within the collimation distance from a selected axial position.

If the determination at either the operation 3220 or the operation 3240 is negative, then the procedure advances directly to an operation 3260. The operation 3260 determines whether all the time stamps for the collected projection data have been considered. If not, then the procedure advances to an operation 3270 where a next time stamp is selected. From the operation 3270 the procedure loops back to the determination at the operation 3220. If the determination at the operation 3260 is affirmative, then the procedure returns. Alternatively, instead of looping back based

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on the determination of operation 3260, the procedure of FIG. 32 may instead continue until a row of data has been selected at a time stamp and no row of data is selected at a subsequent time stamp, or until all of the time stamps have been considered, whichever occurs first. This alternative may be more efficient because a final block of rows that comprises no selectable rows will not be searched.

FIG. 33 is a trajectory graph, similar to the graph of FIG. 20, for illustrating the operation 3150 of FIG. 31. The filled circles 3310 each represent projection data corresponding to a respective data sampling interval. The data acquisition cycles of the imaging system 100 provide several trajectories 1, 2, 3 of projection data. Each trajectory, although discretized in time and hence also in view angle, nevertheless covers the full range [0°, 360°) of view angles. Moreover, for each discrete view angle in the range [0°, 360°), the projection data comprise several sets 3310 of projection data having time stamps corresponding to the given view angle. Thus, as in FIG. 20, an interpolated projection view could be generated for each discrete view angle from the existing sets of projection data at that view angle.

On the other hand, as noted above, current reconstruction algorithms generally can produce high quality image reconstructions with projection data covering less than the full range [0°, 360°). The projection views should cover an angular sector of at least 180° plus the fan angle. FIG. 33 illustrates that this condition may be satisfied by several different sets of projection views covering different sectors of view angles. The several trajectories 1, 2, 3, etc., therefore comprise more projection data than is necessary for the desired image reconstruction.

This surplus of projection data presents a potential opportunity for optimizing the image quality by carefully selecting the reconstruction range for the desired image. Here a reconstruction range Θ_r is simply the range of view angles of the projection views from which the slice image will be reconstructed. The perspective of the projection data afforded by the trajectory graph of FIG. 33 raises the possibility that different reconstruction ranges may provide reconstructed images with different features.

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Yet another aspect of the present invention provides an approach for determining a reconstruction range that will optimize some data parameter having an influence on image quality. In one implementation of this aspect of the invention, a reconstruction range is selected that has a minimum total phase distance from the desired phase. Here, "minimum total phase distance" means the smallest distance value defined by the following formula:

$$D(\theta_1,\theta_2)=\sum_{\theta\in R_r=[\theta_1,\theta_2]} d(\theta,\phi) \tag{8}$$

where the reconstruction range R_r extends between beginning and ending view angles θ_1 and θ_2, respectively. The total phase distance is a "separation measure" for the reconstruction range, because the total phase distance measures a separation (in phase) between the existing projection views of the reconstruction range and an ideal set of projection views (e.g., all at the desired phase). The value $d(\theta,\phi)$ is selected as the minimum phase distance between the phase of the current projection view and the desired phase, as follows:

$$d(\theta,\phi)=\arg\min_{i,j}\left|\Phi_{ij}(\theta)-\phi\right|. \tag{9}$$

Those of skill in the art will appreciate that the reconstruction range R_r may begin at an angle θ_1 that is actually larger than the ending angle θ_2, due to the periodicity of θ_1. In such a case the representation $[\theta_1, \theta_2]$ for the reconstruction range R_r in equation (2) above may be replaced by the corresponding representation $R_r=[\theta_1, 2\pi)\cup[0, \theta_2]$.

In the foregoing particular example the detector array has four rows of detectors. In this exemplary case it follows from simple geometry that the number of gantry rotations contributing projection views for a given z-location is determined by 4/p, where p is again the pitch of the helical scan. The pitch p may be selected to be small enough that multiple projection views are generated for the same view angle,

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although from different gantry rotations and cardiac cycles. Depending on the heart rate, these projection views will represent the heart in a distribution of cardiac phases.

Therefore, in a first procedure, the temporal (phase) distance d_{ij} of each projection to the reconstruction (target) phase ϕ_0 will be determined. Each of these phase distances indicates a separation (in phase) between the projection view and an ideal projection view (at the desired phase), and thus each is a "separation value" for the respective projection view. Then, for each view angle, the minimum temporal distance is found and used with equations (8) and (9) to determine the start angle θ_s and the end angle θ_e of the least-distance reconstruction range. The result is a reconstruction range with a subset of projection views that are closest in phase to the reconstruction phase ϕ_0.

FIG. 34 is a flow diagram illustrating a procedure of this further aspect of the invention for determining such a reconstruction range. An operation 3410 computes the phase difference d_{ij} for each projection view in the selected set of projection data. An operation 3420 then selects a projection view closest in phase to the desired phase ϕ_0, for each view angle. A total D_R of these minimum distances is computed at an operation 3430 for each potential reconstruction range in the full sector [0°, 360°). A particular reconstruction range whose total distance D_R is a minimum relative to the other reconstruction ranges is selected in an operation 3440, and the procedure of FIG. 34 returns.

FIG. 35 is a flow diagram illustrating an exemplary procedure of the invention for determining the interpolated projection views for a selected reconstruction range. An operation 3510 selects an initial view angle in the selected range. It is noted that the reconstruction range may be represented by an angular interval $[\theta_s, \theta_e]$, so that the initial view angle may be θ_s. An operation 3520 interpolates between the row data of the projection views selected for the view angle. An operation 3530 determines whether more view angles remain at which to generate

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interpolated projection views. If more view angles remain, an operation 3540 selects the next view angle, and the procedure loops back to the operation 3520.

FIG. 36 is a flow diagram outlining an overall procedure of the invention for generating a set of slice images for a corresponding range of axial positions z. Where the set of slice images comprises a plurality of images, this procedure effectively provides for generating a volumetric image of the object of interest. The direct result of the particular procedure as illustrated is a three-dimensional representation of the patient's heart at a selected phase of the cardiac cycle. Persons of skill in the art will appreciate that this basic procedure may be employed for a range of selected phases to generate a dynamic model of the patient's heart, for purposes such as dynamic functional assessment.

An operation 3610 selects the desired cardiac phase ϕ_0. An operation 3620 similarly selects a range of axial (z-axis) locations for the slice images to be generated. An operation 3630 tags the projection data with phase identification information and z-location information, as described previously with reference to FIGS. 11 and 24. An operation 3640 selects an initial slice location (z_0).

Operation 3650 generates interpolated projection views for the selected slice by phase interpolation, as provided by the various aspects of the present invention. A complete set of projection views is thereby generated for the selected slice, perhaps with supplementation from the existing views of the projection data. Operation 3660 performs reconstruction on the complete set of projection views, using any of various well-known methods for tomographic image reconstruction. An operation 3670 determines whether more slice images remain to be generated. If so, the procedure advances to operation 3680 where the next slice position is selected, and the procedure then returns to the operations 3650 and 3660.

A Technique for Re-ordering Data in the Phase Domain

The foregoing exemplary embodiments illustrate an aspect of the invention that provides advantages for tomographic imaging of objects in motion.

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This aspect of the invention provides for reconstruction of a tomographic image from projection views that have been processed to account for dynamic behavior of the imaged object during collection of the projection data [$\theta(n)$, $Z(m)$].

The examples described above further illustrate that such processing to account for dynamic behavior may be carried out in various alternative ways. For example, the adaptive processing approach of the first embodiment described above is oriented toward independent sets of projection data where each set corresponds to a single axial position z. In this sense, the first embodiment may be described as "position driven." When the raw data [$\theta(n)$, $Z(m)$] are obtained by helical/cone beam scanning, further processing (rebinning) may be carried out to assemble the helically skewed data into a sequence of such independent sets for successive axial positions. This rebinning procedure typically entails an interpolation procedure between detector element values of neighboring detector rows, such as z-interpolation as described above.

An additional technique for preprocessing the raw projection data will now be described. Such preprocessing may be used with the present invention and particularly with "position driven" embodiments as noted above.

This additional technique proceeds from the further observation that useful information potentially exists in relationships between helical scan data in both space and time. The rebinning procedure noted above illustrates that the spatial proximity of adjacent detector rows has been used to synthesize projection data corresponding to a particular axial position. The technique to be described uses the further discovery that the selection of appropriate subsets of the three-dimensional projection data can allow additional information to be extracted from relationships between the raw data collected in different gantry rotations.

One source of this additional information may be the potential for overlap between the helical scan paths of various detector elements in a multi-row detector array. However, it has been recognized also that other relationships may

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exist between the raw data of different gantry rotations. A particular instance of such relationships will now be described in conjunction with an exemplary embodiment of the present additional technique in the particular context of volumetric cardiac imaging.

FIG. 37 is a flow diagram illustrating a general procedure provided by the present additional technique. An operation 3710 is the basic data collection operation for obtaining three-dimensional projection data. If the projection data are generated with a helical scanning system comprising or having a source-detector assembly such as the assembly 2100, then the operation may comprise several rotations of the gantry 2112 to execute multiple data acquisition cycles. In any case, the operation 3710 obtains volumetric projection data representing the imaged object over a plurality of data acquisition cycles.

In an operation 3720, the three-dimensional projection data are analyzed to determine (for example, to select) a particular set of projection views at a selected view angle for each data acquisition cycle. It is desirable to select the view angles for this operation 3720 according to a time dependent feature (i.e., a "dynamic behavior") of the object being imaged. The particular sets of projection views may then be selected to satisfy a predetermined relationship for the time dependent feature between the different sets. A particular case of this determining operation will be described below with reference to FIGS. 40-42.

An operation 3730 provides a reconciliation between the axial positions at which the projection views of a given set represent the object and the axial positions at which the stacked slice images are to represent the object. This reconciliation is typically helpful because the helical projection data are axially skewed within each rotation data set. Thus, with reference to FIG. 23, it will be likely that none of the detector rows will coincide in axial position with a specified position, at least when the view angle θ is chosen according to some other criterion. Thus, to generate projection views representing the object at the specified axial position, a

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spatial interpolation (such as the z-interpolation described above) is typically carried out in the operation 3730.

An operation 3740 generally completes the procedure by reconstructing a number of slice images (usually several, but possibly only one or two) at the respective specified axial positions. For each slice image, this operation entails selecting projection views from respective ones of the sets of projection views (or from the reconciled sets of projection views). In this way, each slice image may be reconstructed from several projection views representing the object at different view angles but at the same specified axial position.

A particular embodiment of the present additional technique will now be described in the context of cardiac imaging. Persons of skill in the art will appreciate, however, that this technique can also be applied in other medical and non-medical imaging contexts where a time dependent feature of the three dimensional projection data implicitly carries additional information about the imaged object.

As noted above, in the simplest case of cardiac imaging, it may be assumed that the heart rate is constant while the scan data are collected. The desired phase of the heart's cycle of configurations then occurs in each cardiac cycle at a fixed fraction of the heart period T_h following the preceding R-wave. For a given cardiac cycle, a projection view corresponding to the desired heart phase may be identified by reference to the fixed fraction and the time stamps correlating to the cardiac R-wave that begins the cardiac cycle.

The assumption of regular heartbeat simplifies the process of cross-referencing the projection data and the EKG data. In particular, for each R-R heart cycle the desired phase of the heart occurs at the same time t_0 after the R-wave of the cycle. The simplifying assumption of regular heart rate thus creates an assumed correlation between the time stamps of the row data and the respective phases of the cardiac cycle.

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However, usually the heart rate is not uniform during the data acquisition process. The preferred procedure is then to collect an electrocardiogram (EKG) data set along with the helical scan data. The EKG data set can then be correlated off-line with CT scan data, using the time stamps associated with the raw volumetric projection data. Thereafter, using the time stamps and the correlations to the EKG data, the particular projection data corresponding to a selected cardiac configuration phase can be identified, as in the embodiments described above.

Such an adaptation to heart rate variations is well known in the art and has been used, for example, in the sector approach described above with respect to FIG. 6. Persons skilled in the art will readily appreciate the appropriate measures to be used with the present additional technique to compensate for the presence of heart rate variability. For example, a compensation model is employed in the technique of U.S. Patent No. 5,997,883 to Epstein et al. noted previously.

On the other hand, an embodiment of the present additional technique is particularly useful in cases where heart rate variability exists. It is known that in most cases where the heart cycle duration varies, the systole period of the cardiac cycle is relatively stable. In other words, the portion of the cardiac cycle that changes in duration most commonly is the diastole period, when the heart is in a relaxed state. This fact can be used to develop a selection criterion for selecting sets of projection views, as in the operation 3720 of FIG. 37.

FIG. 38 depicts timing diagrams that illustrate the determination of a trigger delay TD with which to select the projection data sets. In trace A of FIG. 38, the R waves of successive cardiac cycles occur at irregular times, due to the heart rate variability. Trace B of FIG. 38 shows the corresponding displacement of a coronary artery to be imaged.

During the systole period, the displacement is substantial and will tend to create motion inconsistencies in the projection data. However, if a fixed time TD is measured after each R wave, it can be seen that the heart has entered the quiescent

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diastole period. As trace B of FIG. 38 illustrates, the duration of the diastole period may vary substantially from cardiac cycle to cardiac cycle. However, the entering portion of the diastole occurs reliably at the delay time TD after the R wave.

Trace C of FIG. 38 illustrates the timing of trigger signals by which to select the sets of projection views from the three-dimensional projection data. By generating a trigger signal at a fixed trigger delay TD after each R wave, sets of projection views can be selected from the volumetric data to represent the heart in a same phase of the cardiac cycle. The trigger delay can be chosen so that the particular phase is a phase at which the heart is nearly still, thereby enhancing the consistency of the selected projection data sets.

Different trigger delays can be used to generate a four-dimensional model of the heart. The foregoing aspects of the present invention, such as the first embodiment described above, may be employed to generate interpolated projection views for this purpose. For a given phase of the desired four-dimensional model, a projection view at a selected view angle and a selected axial position may be synthesized by interpolating between projection views at nearby phases.

FIG. 39 is a flow diagram illustrating a procedure of the present technique as applied in the foregoing context of cardiac imaging. A trigger delay TD is set to a specific value in an operation 3910, thereby determining the particular phase of the heart for the three-dimensional image reconstruction.

As can be seen from FIG. 23, the trigger delay TD will typically correspond to a different view angle θ for each of the scanning rotations (data acquisition cycles ROTATION 1, ROTATION 2, etc.). An operation 3920 therefore identifies the trigger angles θ_i for the corresponding rotational data sets. An operation 3930 collects the raw data $[\theta(n), Z(m)]$ at the corresponding trigger angles θ_i, using the time stamp correlations between the EKG data and the projection data.

An operation 3940 selects the axial positions z_i at which the one or more slice images are to be reconstructed. The positions z_i may be chosen to coincide

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with the successive axial positions of one of the selected projection data sets, although the helical skew of the volumetric projection data will generally prevent such coincidence for the other sets. An operation 3950 then completes the reconciliation of the axial positions of the selected projection data sets with the specified axial positions for the slice images, by interpolating the collected projection data sets in z. The reconciled projection data sets can then be input to the reconstruction process to generate the desired slice images.

FIG. 40 shows a time evolution diagram similar to the diagram of FIG. 23, but with the trigger delay TD indicated after the R waves R_1, R_2, and R_3. In the illustrated example, the gantry rotation period T_{gantry} is less than the nominal period of the cardiac cycle. Therefore, triggers t_1 and t_2 occur in rotations 1 and 2, respectively, but trigger t_3 does not occur until rotation 4. A different choice for TD would result in different locations of the triggers t_i.

FIG. 41 shows that the triggers t_i determine trigger angles θ_i in the rotations 1, 2, and 4. Each selected trigger angle θ_i determines a corresponding set of projection views in the time stamped projection data. For example, θ_1 determines the projection views 4112, 4114, 4116, and 4118, which happen to correspond to the first through fourth detector rows of the multi-row detector array. The trigger angle θ_2 determines the projection views 4122, 4124, 4126, and 4128 from rotation 2. The trigger angle θ_3 determines the projection views 4132, 4134, 4136, and 4138 from rotation 4.

A notable point is that all of the projection views 4112 through 4138 represent the imaged heart in the same phase of the cardiac cycle. This is achieved by determining the sets of projection views from the raw data, rather than selecting a specified axial position for the desired image and then searching for suitable projection views in the raw data.

FIG. 42 shows the selected sets of projection views at their respective view angles relative to a single cycle of view angles θ. Due to the axial skewing of

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the raw projection data, the several projection views 4112 through 4138 correspond to different axial positions z. Reconstruction of a slice image at a specified axial position therefore will typically entail reconciliation of the selected projection view sets. A reconciled set of projection views is thereby selected to representing the heart at the same view angles θ_1 through θ_3, but at a single specified axial position z.

Various implementations of the invention described herein above have been tested with clinical cardiac data. These results demonstrate that the invention can noticeably reduce the streaks and other artifacts that occur when the sector approach is applied.

As this invention may be embodied in several forms without departing from the spirit or principal characteristics thereof, the present embodiments are therefore illustrative and not restrictive. Those skilled in the art will appreciate that changes may be made to these embodiments without departing from the principles and spirit of the invention. Accordingly, the scope of the invention is defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claims, or equivalents of such metes and bounds thereof, are therefore intended to be embraced by the claims.

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WHAT IS CLAIMED IS:

1. A tomographic image generation method, comprising:

determining a plurality of working projection views (910, 920) of an object (106) at a selected view angle based on initial projection data collected in respective different data acquisition cycles; and

interpolating between the working projection views (910, 920) to generate an interpolated projection view (900) of the object (106) at the selected view angle.

2. A method according to claim 1, wherein the plurality of working projection views comprises three projection views.

3. A method according to claim 2, wherein the three projection views are respectively based on initial projection data collected in consecutive data acquisition cycles.

4. A method according to claim 1, wherein the plurality of working projection views comprises four projection views.

5. A method according to claim 1, wherein the plurality of working projection views (910, 920) consists of two projection views.

6. A method according to claim 1, wherein the object (106) is in motion during collection of the initial projection data.

7. A method according to claim 6, wherein the motion of the object (106) is cyclical motion.

8. A method according to claim 7, wherein successive cycles of the cyclical motion have a same cycle period.

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9. A method according to claim 7, wherein successive cycles of the cyclical motion each has a cycle duration within a range of variation about a nominal cycle period.

10. A method according to claim 1, wherein:

the object (106) is in cyclical motion during collection of the initial projection data; and

the determining operation comprises selecting the working projection views (910, 920) from projection views of the initial projection data based on the selected view angle and a specified phase of the cyclical motion, whereby the interpolated projection view (900) represents the object at the selected view angle and in the specified phase of the cyclical motion.

11. A method according to claim 10, wherein:

the cyclical motion comprises successive cycles of at least one of translation, rotation, and elastic deformation of the object (106); and

the specified phase corresponds to a selected translation, rotation, or elastic deformation state assumed by the object (106) in each of the successive cycles.

12. A method according to claim 1, wherein the plurality of working projection views (910, 920) consists of two projection views (910, 920) respectively based on initial projection data collected in two consecutive data acquisition cycles.

13. A method according to claim 12, wherein the specified phase is determined by a selected shape configuration repeatedly assumed by the object (106) during the cyclical change in shape configuration.

14. A method according to claim 1, wherein the initial projection data represent intensities of energetic rays transmitted through the object (106) and detected by a detector array (116).

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15. A method according to claim 1134, wherein the energetic rays comprise x-rays (104).

16. A method according to claim 14, wherein:

the detector array (116) is a multi-row detector array (2116); and

a cone beam (1104) impinges on a side of the object opposite the detector array and the energetic rays comprise rays of the cone beam (1104) transmitted through the object (106) to the detector array (2116).

17. A method according to claim 14, wherein the energetic rays are attenuated by the object (106) and the initial projection data represent intensities of the energetic rays subsequent to the attenuation.

18. A method according to claim 1, wherein the working projection views (910, 920) comprise projection views selected from the initial projection data based on contemporaneously collected timing data.

19. A method according to claim 1, wherein:

the initial projection data are collected by the detector array (116) in a cyclical scan comprising a plurality of rotational data acquisition cycles; and

the initial projection data comprise initial projection views of the object (106) collected in plural successive rotational data acquisition cycles.

20. A method according to claim 19, wherein:

the object (106) is in cyclical motion during collection of the initial projection data; and

a rotation period of the plurality of rotational data acquisition cycles is different from a cycle duration of successive cycles of the cyclical motion.

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21. A method according to claim 1, wherein the object (106) is an organ of a subject (102).

22. A method according to claim 21, wherein the organ (106) is a heart.

23. A method according to claim 12, wherein the object (106) is a human heart.

24. A method according to claim 1, wherein the interpolating operation comprises performing weighted linear interpolation between respective projection data of first and second ones of the working projection views (910, 920).

25. A method according to claim 1, wherein the interpolating operation comprises performing weighted nonlinear interpolation between respective projection data of first and second ones of the working projection views (910, 920).

26. A method according to claim 25, wherein the weighted nonlinear interpolation is weighted quadratic interpolation.

27. A method according to claim 12, wherein:

the determining operation comprises selecting first and second projection views from the initial projection data as the working projection views (910, 920), the first projection view (710) comprising projection data collected in a first data acquisition cycle and the second projection view (720) comprising projection data collected in a second data acquisition cycle subsequent to the first data acquisition cycle; and

the interpolating operation comprises performing weighted quadratic interpolation between respective projection data of the first and second projection views (910, 920).

28. A computer readable medium encoded with a program for tomographic image generation, said program comprising instructions for:

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determining a plurality of working projection views (910, 920) of an object (106) at a selected view angle based on initial projection data collected in respective different data acquisition cycles; and

interpolating between the working projection views (910, 920) to generate an interpolated projection view (900) of the object at a selected view angle.

29. A computer readable medium according to claim 28, wherein:

the object (106) is in cyclical motion during collection of the initial projection data; and

the instructions for the determining procedure comprise instructions for selecting each working projection view (910, 920) from projection views of the initial projection data based on the selected view angle and a specified phase of the cyclical motion, whereby the interpolated projection view (900) represents the object (106) at the selected view angle and in the specified phase of the cyclical motion.

30. A computer readable medium according to claim 28, wherein the plurality of working projection views (910, 920) consists of two projection views respectively based on initial projection data collected in two consecutive data acquisition cycles.

31. A computer readable medium according to claim 28, wherein the initial projection data represent intensities of energetic rays transmitted through the object (106).

32. A computer readable medium according to claim 28, wherein the working projection views (910, 920) comprise projection views selected from the initial projection data based on contemporaneously collected timing data.

33. A tomographic image generation device (130, 140), comprising:

a storage (134, 144) storing initial projection data collected from an object by a detector array; and

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a processor (132, 142) determining a plurality of working projection views (910, 920) of an object (106) at a selected view angle based on initial projection data collected in respective different data acquisition cycles, and interpolating between the working projection views (910, 920) to generate an interpolated projection view (900) of the object (106) at the selected view angle.

34. A device (130, 140) according to claim 33, wherein:

the object (106) is in cyclical motion during collection of the initial projection data; and

said processor (132) determines the working projection views (910, 920) by selecting each working projection view from projection views of the initial projection data based on the selected view angle and a specified phase of the cyclical motion, whereby the interpolated projection view (900) represents the object (106) at the selected view angle and in the specified phase of the cyclical motion.

35. A device (130, 140) according to claim 33, wherein:

the object (106) is in cyclical motion during collection of the initial projection data; and

the plurality of working projection views (910, 920) consists of two projection views respectively based on initial projection data collected in two consecutive data acquisition cycles.

36. A device (130, 140) according to claim 33, wherein the projection data are collected from energetic rays transmitted through the object (106).

37. A device (130, 140) according to claim 33, wherein the working projection views (910, 920) comprise projection views selected from the initial projection data based on contemporaneously collected timing data.

38. A tomographic image generation system (100), comprising:

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a detector array (116) generating initial projection data for an object (106); and

a computer (130, 140) comprising a processor (132, 142) determining a plurality of working projection views (910, 920) of an object (106) at a selected view angle based on initial projection data collected in respective different data acquisition cycles, and interpolating between the working projection views (910, 920) to generate an interpolated projection view (900) of the object (106) at the selected view angle.

39. A system (100) according to claim 38, wherein:

the object (106) is in cyclical motion during collection of the initial projection data; and

the processor (132, 142) determines the working projection views (910, 920) by selecting each working projection view from projection views of the initial projection data based on the selected view angle and a specified phase of the cyclical motion, whereby the interpolated projection view (900) represents the object (106) at the selected view angle and in the specified phase of the cyclical motion.

40. A system (100) according to claim 38, wherein the plurality of working projection views (910, 920) consists of two projection views respectively based on initial projection data collected in two consecutive data acquisition cycles.

41. A system (100) according to claim 38, wherein the initial projection data represent intensities of energetic rays transmitted through the object (106).

42. A system (100) according to claim 38, wherein the working projection views comprise projection views selected from the initial projection data based on contemporaneously collected timing data.

43. A projection data processing method, comprising:

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tagging projection views (910, 920) representing an object (106) in motion with tags indicating respective phases of the motion and respective axial locations for the projection views (910, 920);

determining the tagged projection views (910, 920) representing the object at respective axial locations within a collimation distance from a selected axial location;

determining separation values representing phase separations between the phases of the determined projection views (910, 920) and a selected phase of the motion;

determining projection view subsets from the determined projection views, each projection view subset comprising plural projection views tagged with respective different phases of the motion at each of plural view angles covering a corresponding reconstruction range;

determining for each view angle of each projection view subset a minimum of the separation values of the projection views of the subset at the view angle;

computing a separation measure for each projection view subset by summing the minimum separation values of the projection view subset;

selecting from the determined projection view subsets a subset having a minimum separation measure of the computed separation measures;

successively selecting the view angles of the selected projection view subset; and

interpolating between the plural projection views of the selected projection view subset at each selected view angle to generate an interpolated projection view (900) of the object (106) at the selected axial position and the selected view angle.

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44. A method according to claim 43, wherein the motion of the object (106) is cyclical motion.

45. A method according to claim 43, wherein the selected projection view subset comprises for each view angle thereof at least three projection views at respective different phases of the motion.

46. A method according to claim 44, wherein:

the selected projection view subset comprises for each view angle thereof and each of a predetermined number of different phases of the motion a plurality of projection views representing the object at respective axial positions within the collimation distance from the selected axial position; and

the interpolating operation comprises, for each of the view angles and each of the predetermined number of different phases, interpolating between the plurality of projection views representing the object at respective axial locations.

47. A tomographic image generation method, comprising:

determining a plurality of working projection views (910, 920) of an object (106) in cyclical motion based on initial projection data collected from the object (106), the working projection views (910, 920) being based on selected initial projection data collected in respective different data acquisition cycles; and

interpolating between the working projection views (910, 920) to generate an interpolated projection view (900) representing the object (106) at the selected view angle and at a specified phase of the cyclical motion.

48. A method according to claim 47, wherein the plurality of working projection views (910, 920) consists of two projection views.

49. A method according to claim 47, wherein the cyclical motion comprises successive cycles of motion each having a cycle duration within a range of variation about a nominal cycle duration.

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50. A method according to claim 47, wherein the cyclical motion comprises successive cycles of periodic motion.

51. A method according to claim 47, wherein the object (106) is a heart within a living subject (102).

52. A method according to claim 51, wherein the cyclical motion consists of successive repetitions of a cardiac cycle of the heart (106) and the specified phase is a specified phase of the cardiac cycle.

53. A method according to claim 47, wherein the working projection views (910, 920) comprise projection views selected from the initial projection data based on contemporaneously collected timing data.

54. A method according to claim 47, wherein:

the cyclical motion comprises cyclical elastic deformation of the object (106); and

the specified phase corresponds to a selected shape repeatedly assumed by the object (106) during the cyclical elastic deformation.

55. A method according to claim 47, further comprising collecting quantitative data over plural successive cycles of the cyclical motion, the quantitative data representing a physical property of the object (106) varying synchronously in time with the cyclical motion of the object (106).

56. A method according to claim 55, wherein:

the object (106) is a heart within a living subject (102) and the cyclical motion comprises successive repetitions of a cardiac cycle of the heart (106); and

the quantitative data comprises electrocardiogram data representing an electrical cycle of the heart (106) and the specified phase of the cyclical motion coincides with a selected wave of the electrical cycle.

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57. A method according to claim 56, wherein the selected wave is an R-wave of the electrocardiogram data and the specified phase occurs at a selected time delay after the R-wave.

58. A method according to claim 47, wherein the initial projection data are determined from energetic rays (104) transmitted through the object (106).

59. A method according to claim 58, wherein the initial projection data represent attenuation of the energetic rays (104) by the object (106).

60. A method according to claim 47, wherein the determining operation comprises selecting the working projection views (910, 920) from a plurality of first projection views of the initial projection data.

61. A method according to claim 47, wherein:

the initial projection data are collected in a helical tomographic scan of the object (106) by a multi-row detector array (2116) and comprise plural rows of projection data for each of plural rotational data acquisition cycles of the helical tomographic scan; and

the determining operation comprises computing working projection data for each working projection view (910, 920) based on the initial projection data.

62. A method according to claim 61, further comprising selecting an axial position of the helical scan for the interpolated projection view 900, and wherein for each working projection view (910, 920), the determining operation comprises:

selecting a rotational data acquisition cycle of the helical tomographic scan corresponding to the specified phase of the cyclical motion,

selecting from the plural rows of projection data for the selected rotational data acquisition cycle first and second rows of data corresponding to first and second rows of the multi-row detector array (2116) nearest to the selected axial position during the selected rotational data acquisition cycle, and

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interpolating between the respective projection data of the first and second rows of data to generate the working projection data for the working projection view (900).

63. A method according to claim 47, wherein:

the initial projection data are collected for the object (106) over a plurality of rotational data acquisition cycles using a rotation period different from a cycle duration for a cycle of the cyclical motion; and

first and second ones of the working projection views (910, 920) represent the object (106) in two consecutive rotational data acquisition cycles.

64. A method according to claim 63, wherein the object (106) is an organ of a living subject (102).

65. A method according to claim 47, further comprising:

performing the determining operation successively to determine a succession of pluralities of working projection views (910, 920); and

performing the interpolating operation successively for the succession of pluralities of working projection views (910, 920) to generate a succession of interpolated projection views (900); and

generating a tomographic image of the object (106) by image reconstruction using the projection views of the succession of pluralities of working projection views (910, 920) and the projection views of the succession of interpolated projection views (900).

66. A tomographic image generation apparatus, comprising:

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a storage (134, 144) storing initial projection data for an object in cyclical motion, the initial projection data relating to a specified phase of the cyclical motion and a selected view angle; and

a processor (132, 142) determining a plurality of working projection views (910, 920) of an object (106) in cyclical motion based on initial projection data collected from the object (106), the working projection views (910, 920) being based on selected initial projection data collected in respective different data acquisition cycles, and interpolating between the working projection views (910, 920) to generate an interpolated projection view (900) representing the object (106) at the selected view angle and at a specified phase of the cyclical motion.

67. A tomographic image generation system (100), comprising:

an x-ray source (1114) generating a cone beam (1104) of x-rays to impinge upon a subject (1122);

a multi-row detector array (2116) receiving x-rays transmitted through the subject (1122) from said x-ray source (1114) and generating initial projection data from the received x-rays, at least a portion of the subject (1122) being in cyclical motion and the initial projection data corresponding to a specified phase of the cyclical motion and a selected view angle; and

a computer (130, 140) determining a plurality of working projection views of the at least a portion in cyclical motion based on initial projection data collected from the subject (1122), the working projection views (910, 920) being based on selected initial projection data collected in respective different data acquisition cycles, said computer (130, 140) interpolating between the working projection views (910, 920) to generate an interpolated projection view (900) representing the at least a portion of the subject (1122) at the selected view angle and at a specified phase of the cyclical motion.

68. A tomographic image generation method, comprising:

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determining separation measures for projection data covering corresponding reconstruction ranges and representing an imaged object over plural data acquisition cycles; and

reconstructing a tomographic image of the object based on a portion of the projection data covering a reconstruction range selected responsive to a determination that the corresponding separation measure satisfies a predetermined selection criterion.

69. A method according to claim 68, wherein determining the separation measures comprises:

calculating a separation value for each projection view comprised in the projection data; and

calculating each separation measure based on the separation values of the projection views having view angles in the corresponding reconstruction range.

70. A method according to claim 68, further comprising:

determining a minimum separation measure from the separation measures of the reconstruction ranges; and

selecting the reconstruction range corresponding to the minimum separation measure as the selected reconstruction range.

71. A method according to claim 68, further comprising:

collecting the projection data over the plural data acquisition cycles; and

collecting timing information contemporaneously with collecting the projection data, the timing information representing a time sequence of a dynamic behavior of the object during collection of the projection data;

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and wherein the separation measures are determined based on the contemporaneous timing information.

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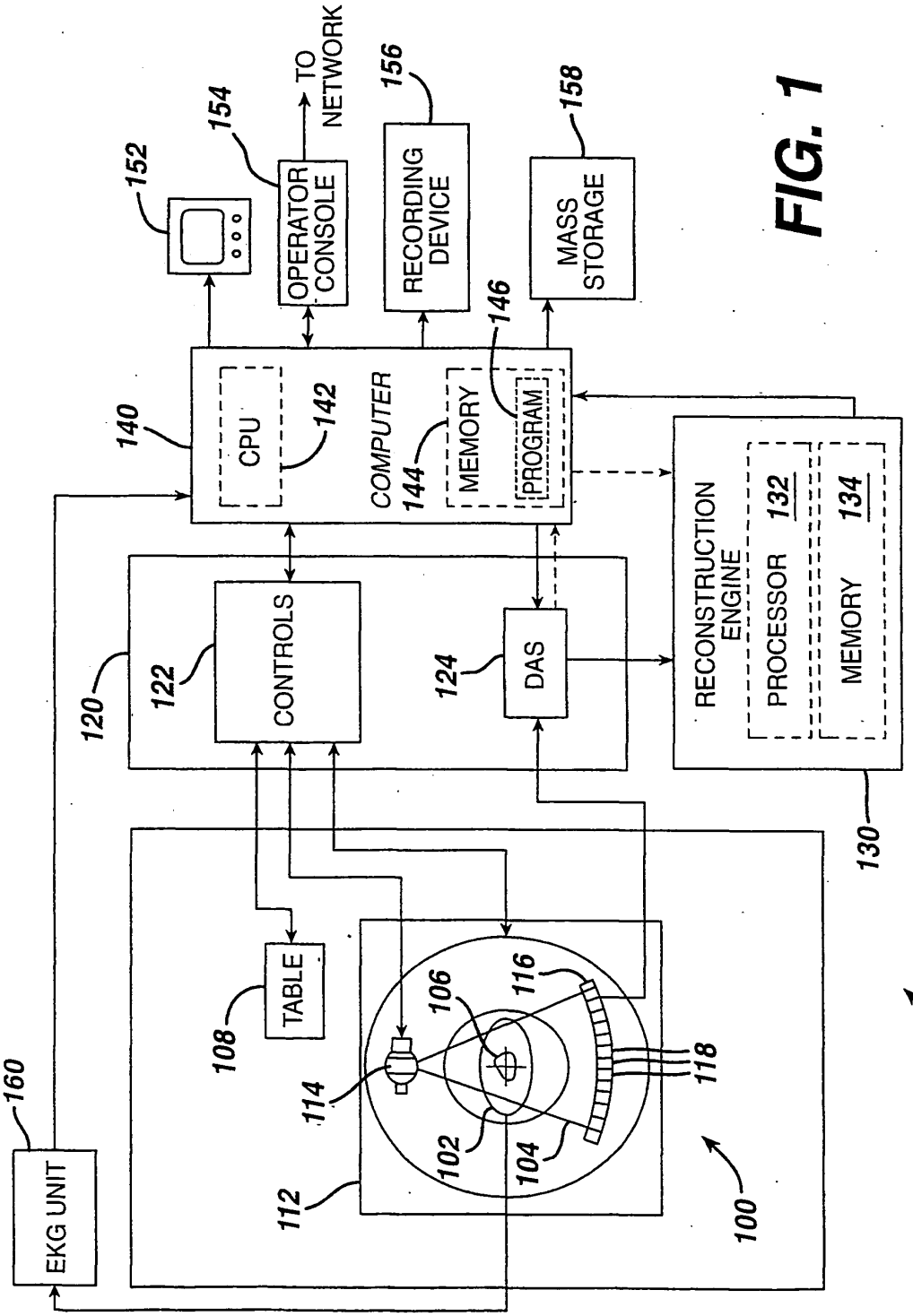


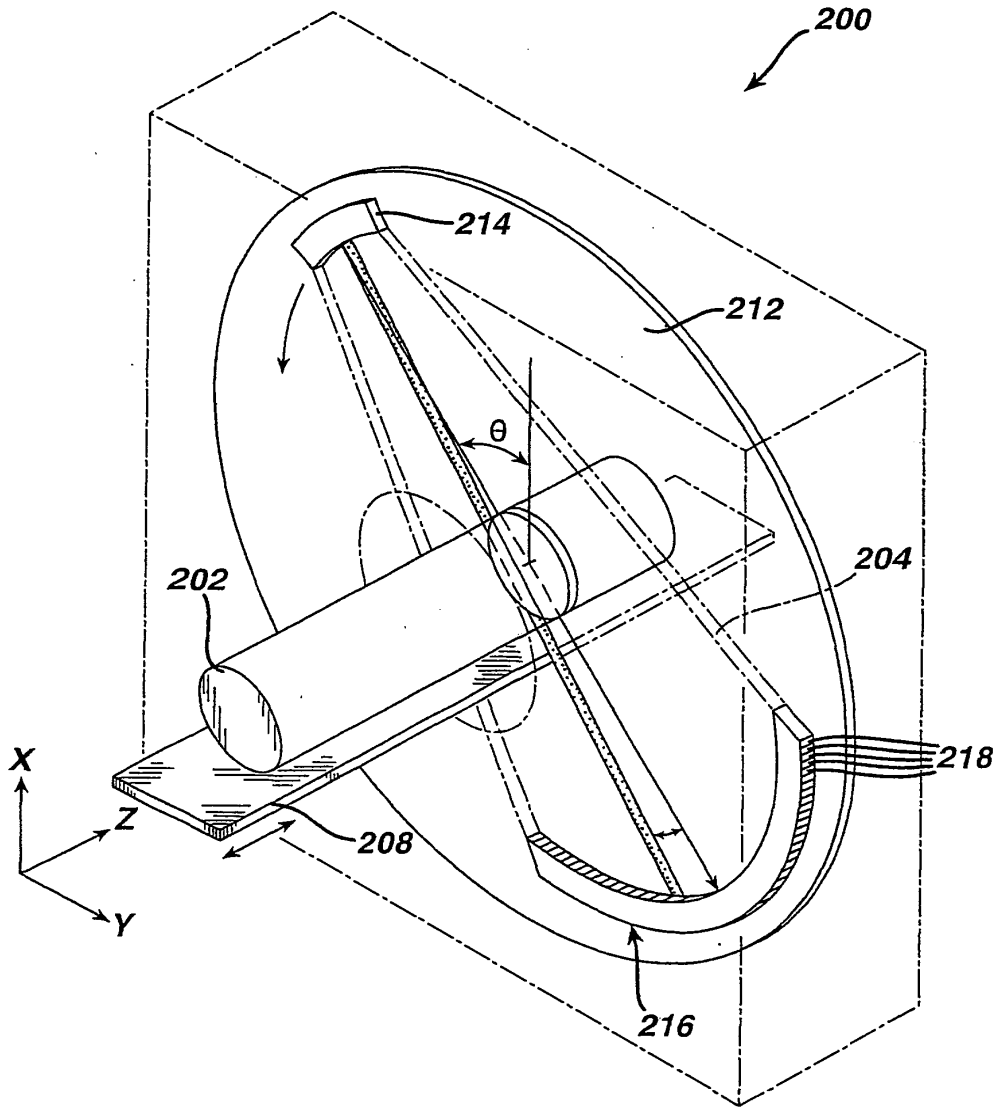
FIG. 1

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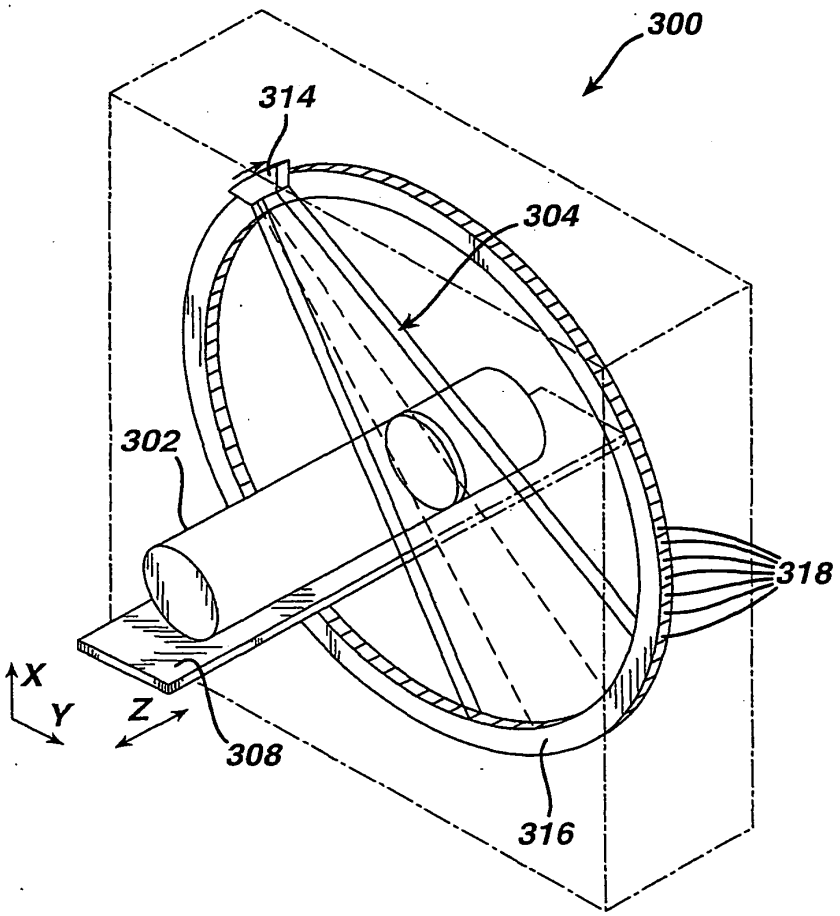
FIG. 2



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FIG. 3



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FIG. 4

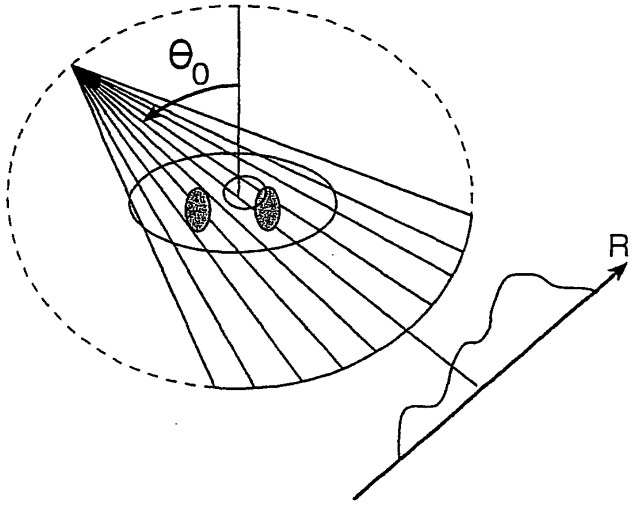
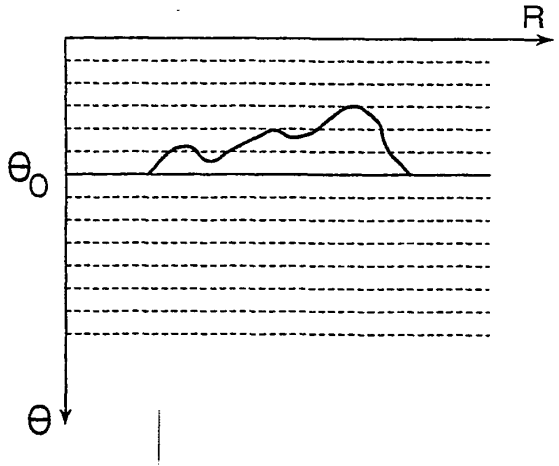


FIG. 5



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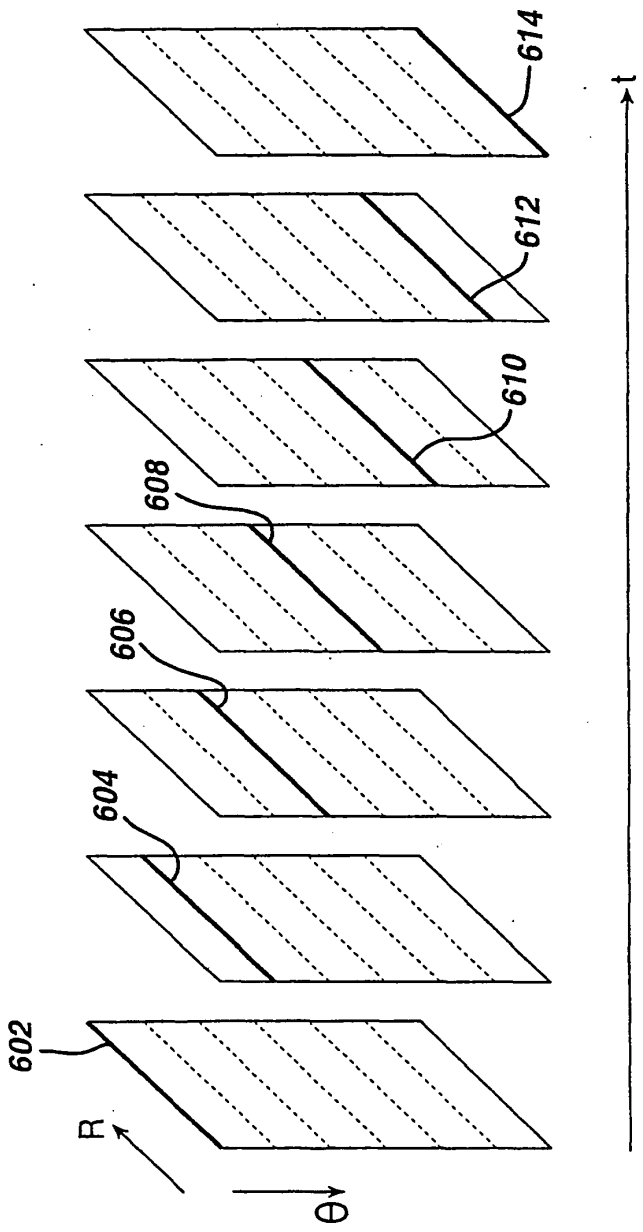


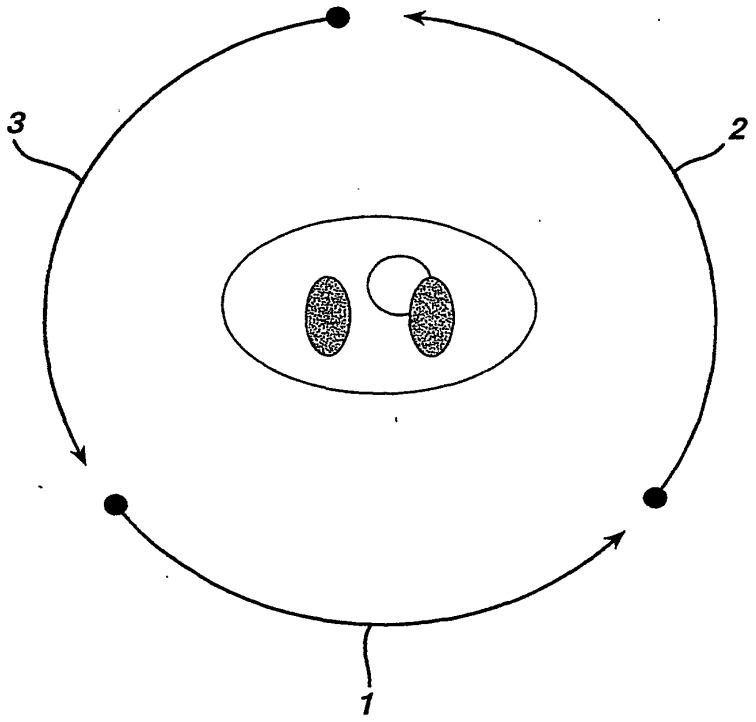
FIG. 6

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FIG. 7



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FIG. 8

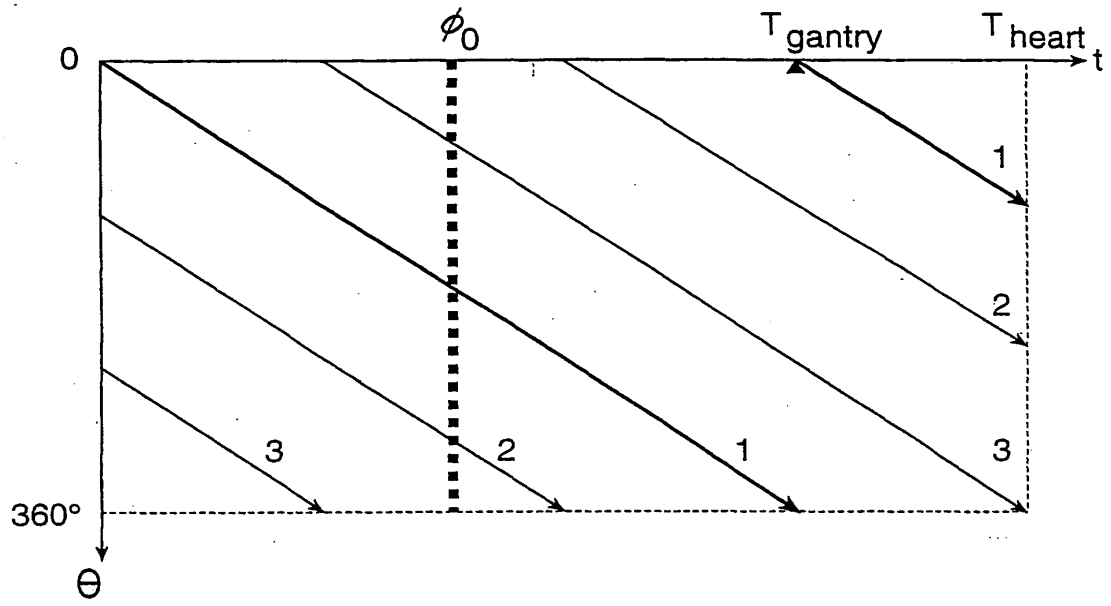
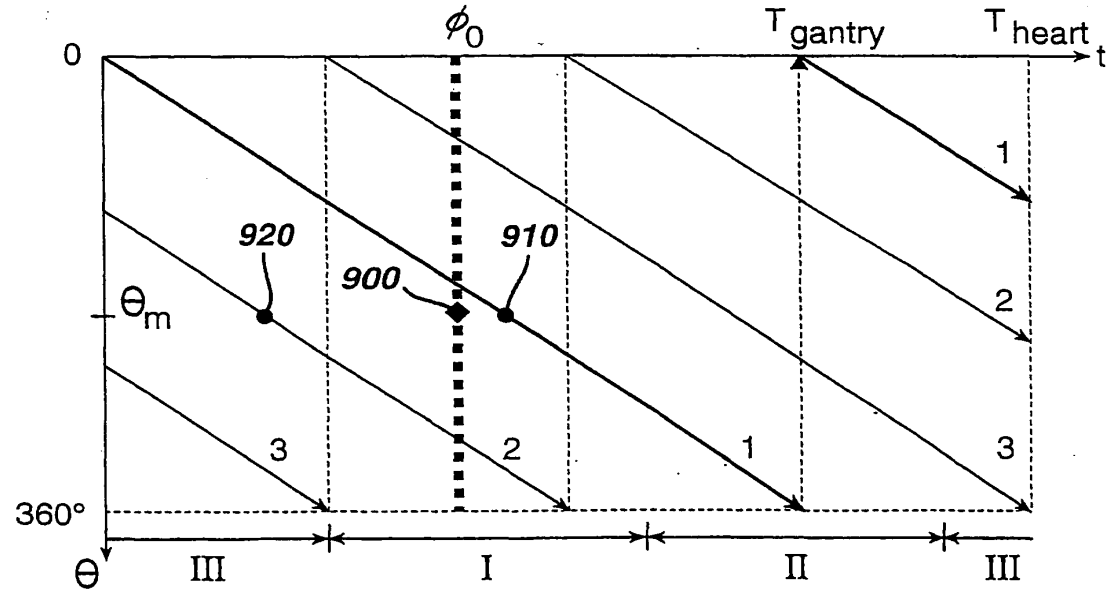


FIG. 9

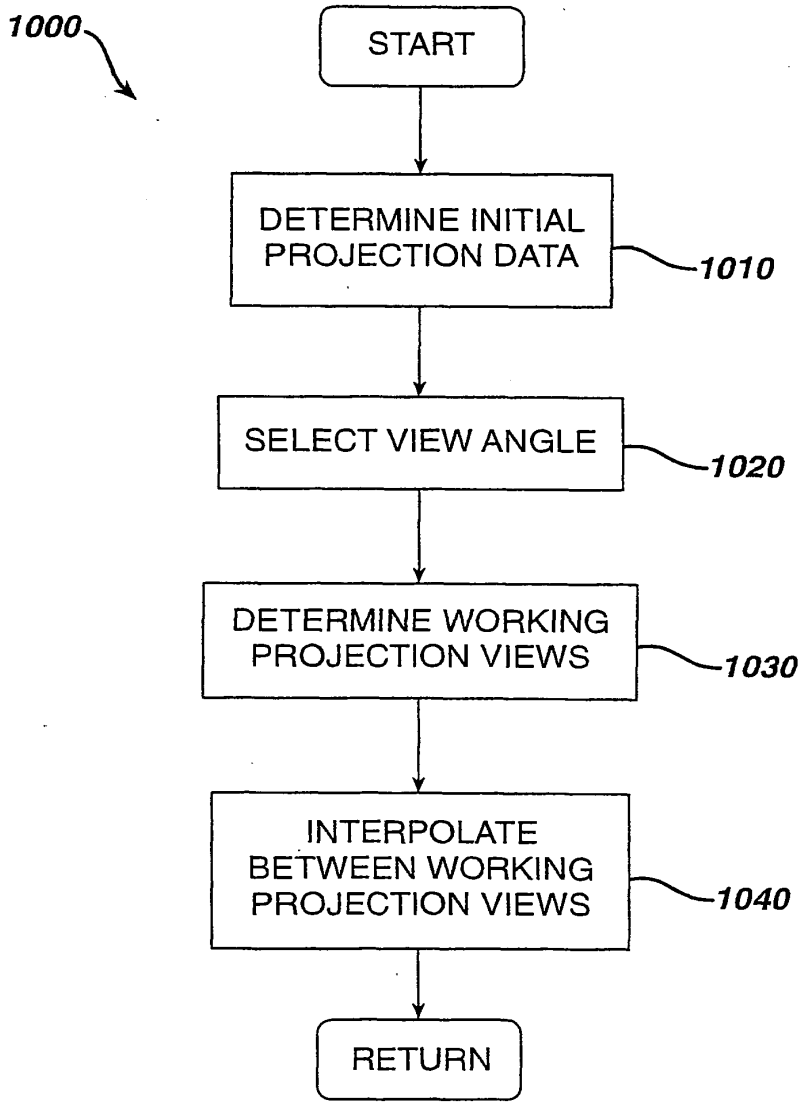


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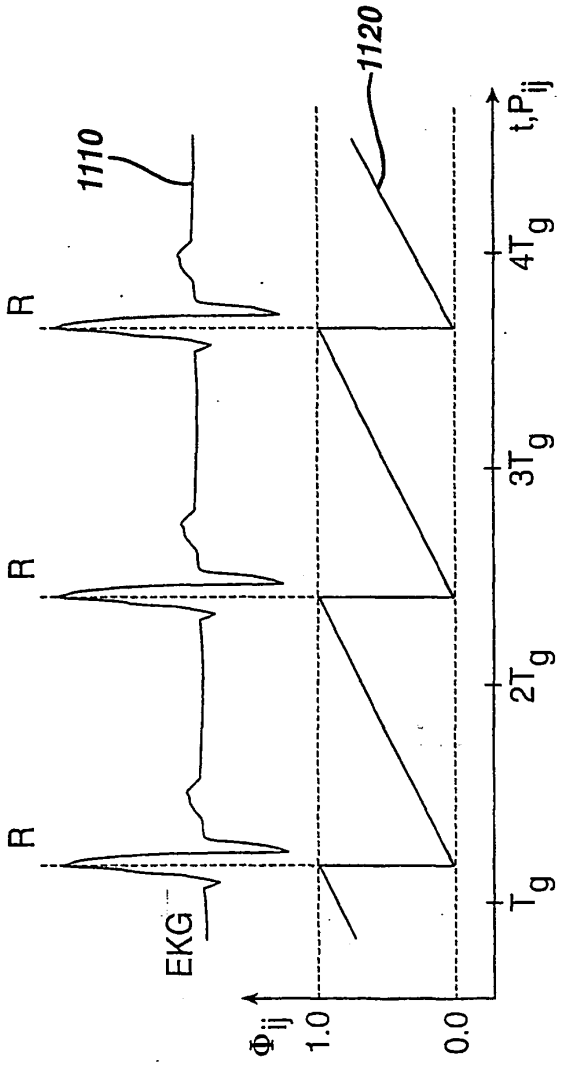
FIG. 10



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FIG. 11



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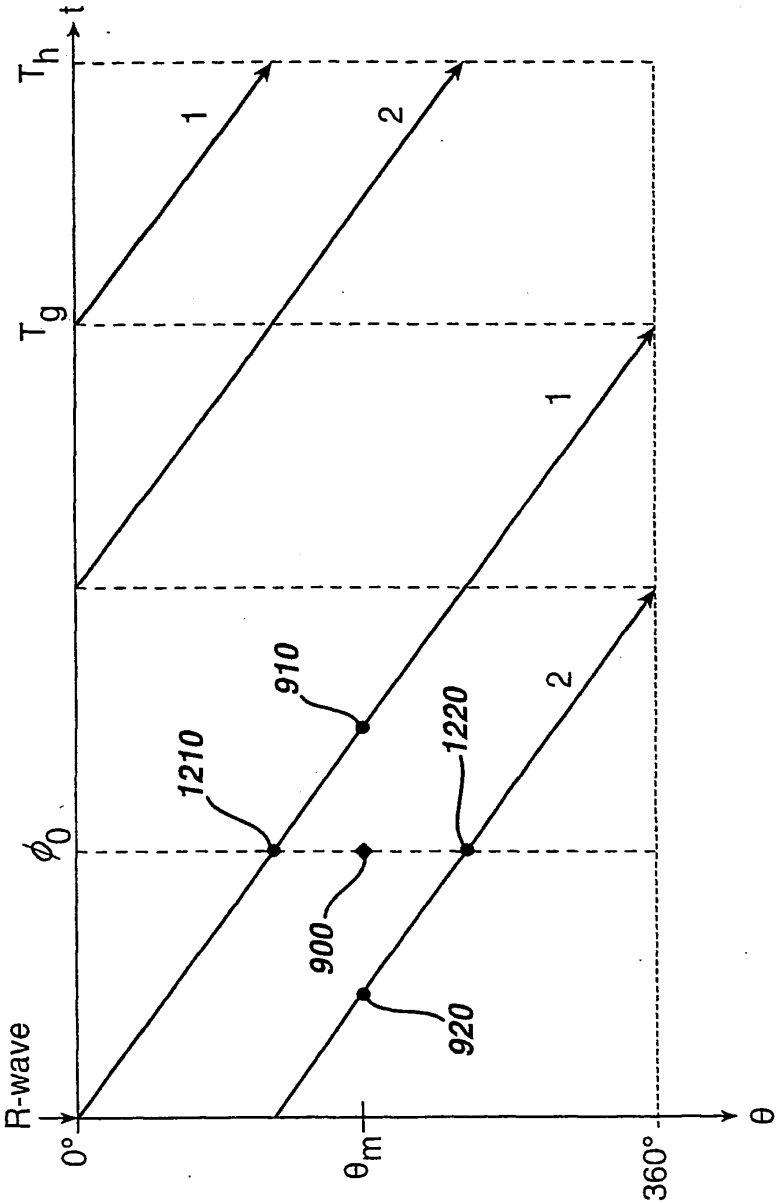
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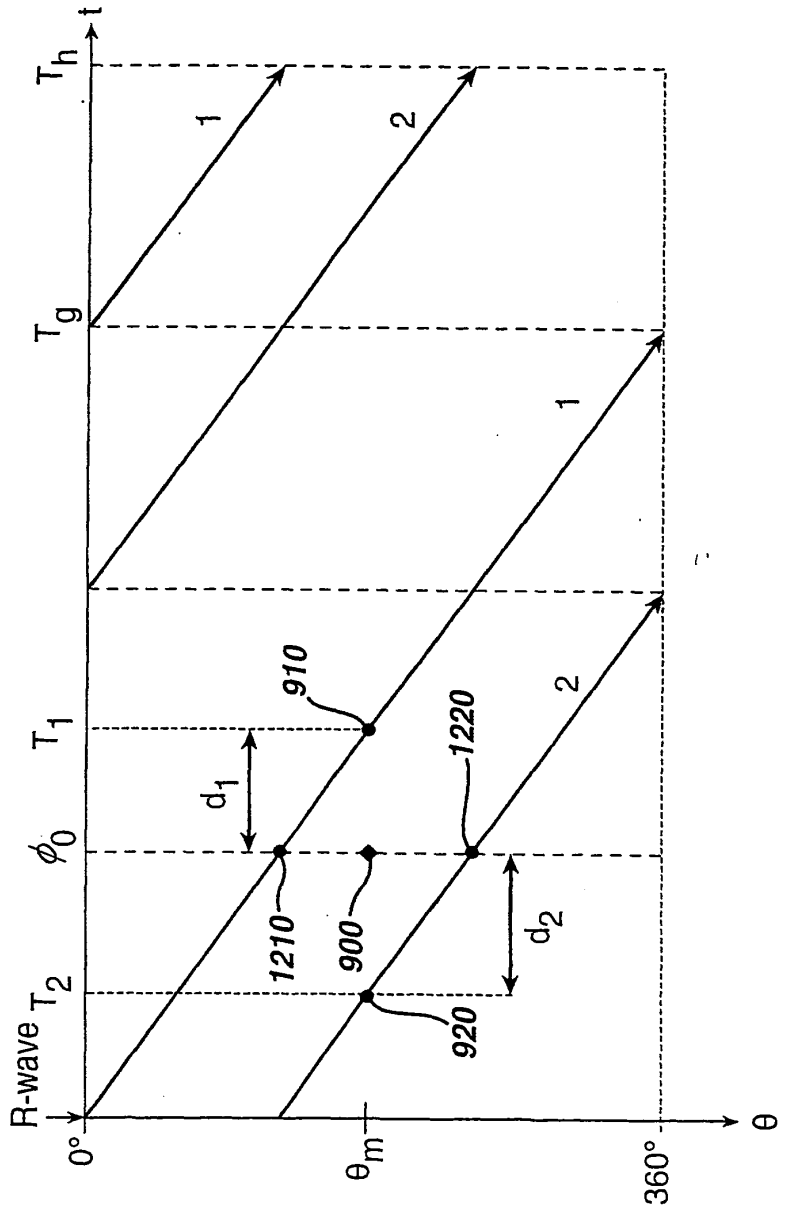
FIG. 12



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FIG. 13

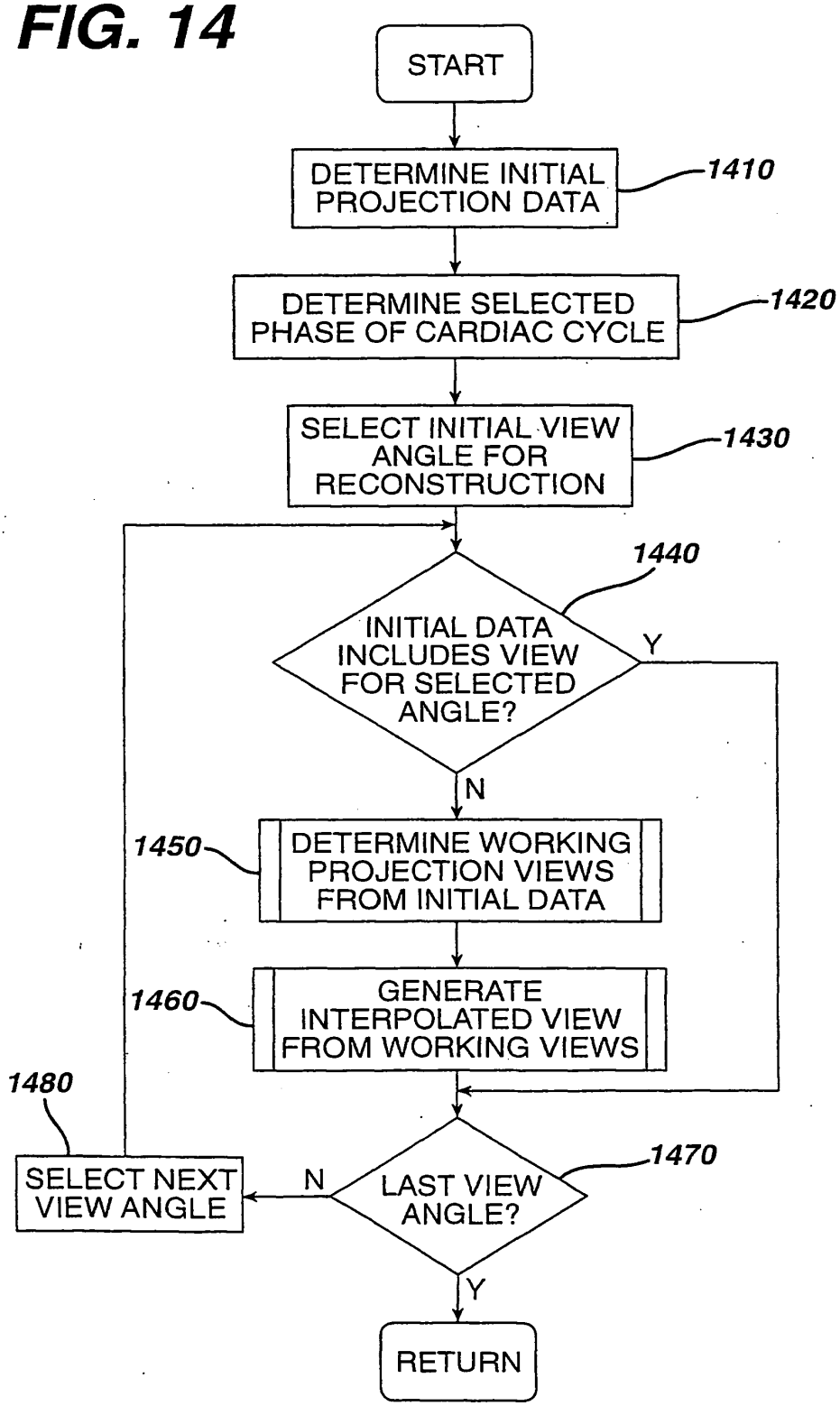


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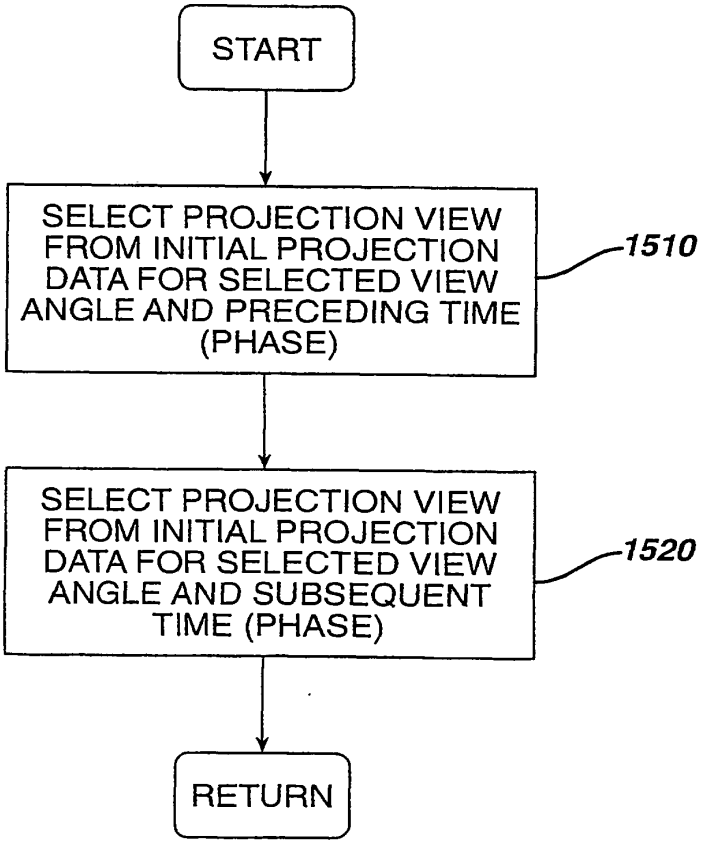
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FIG. 14



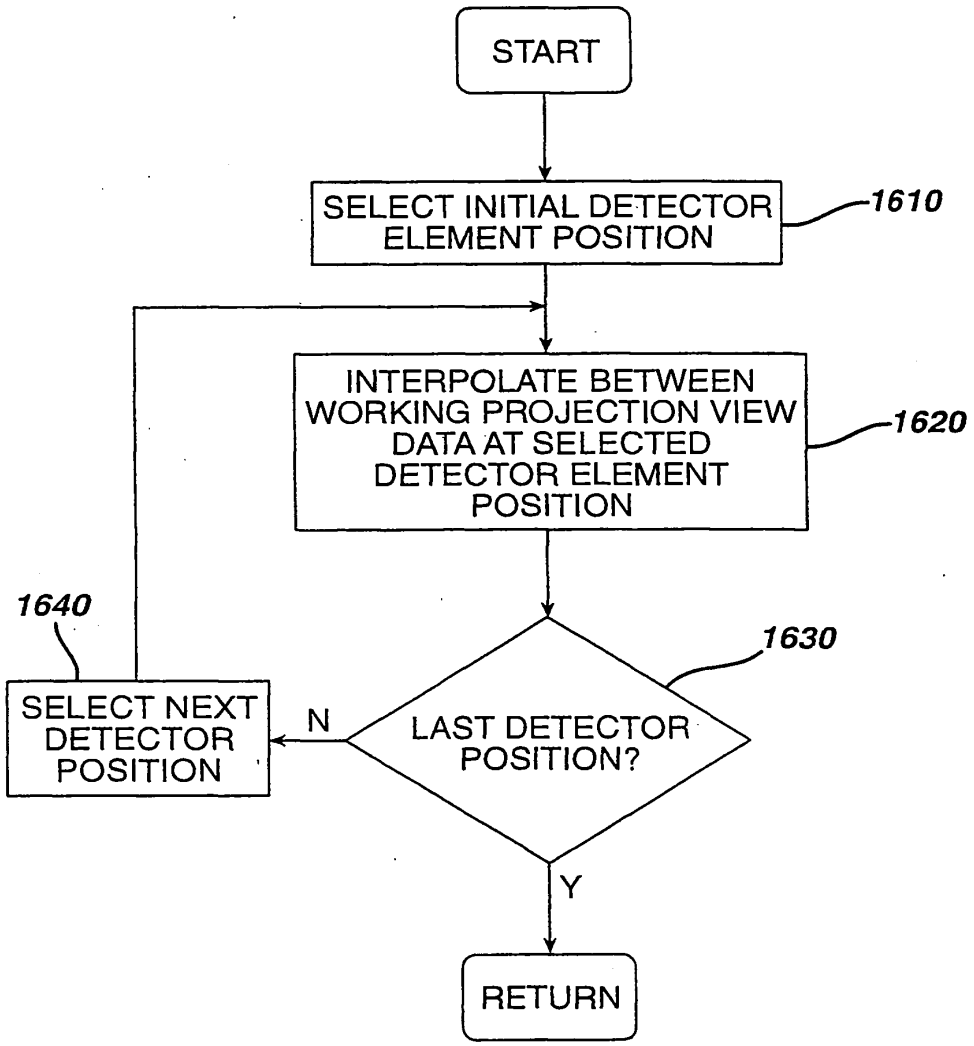
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FIG. 15



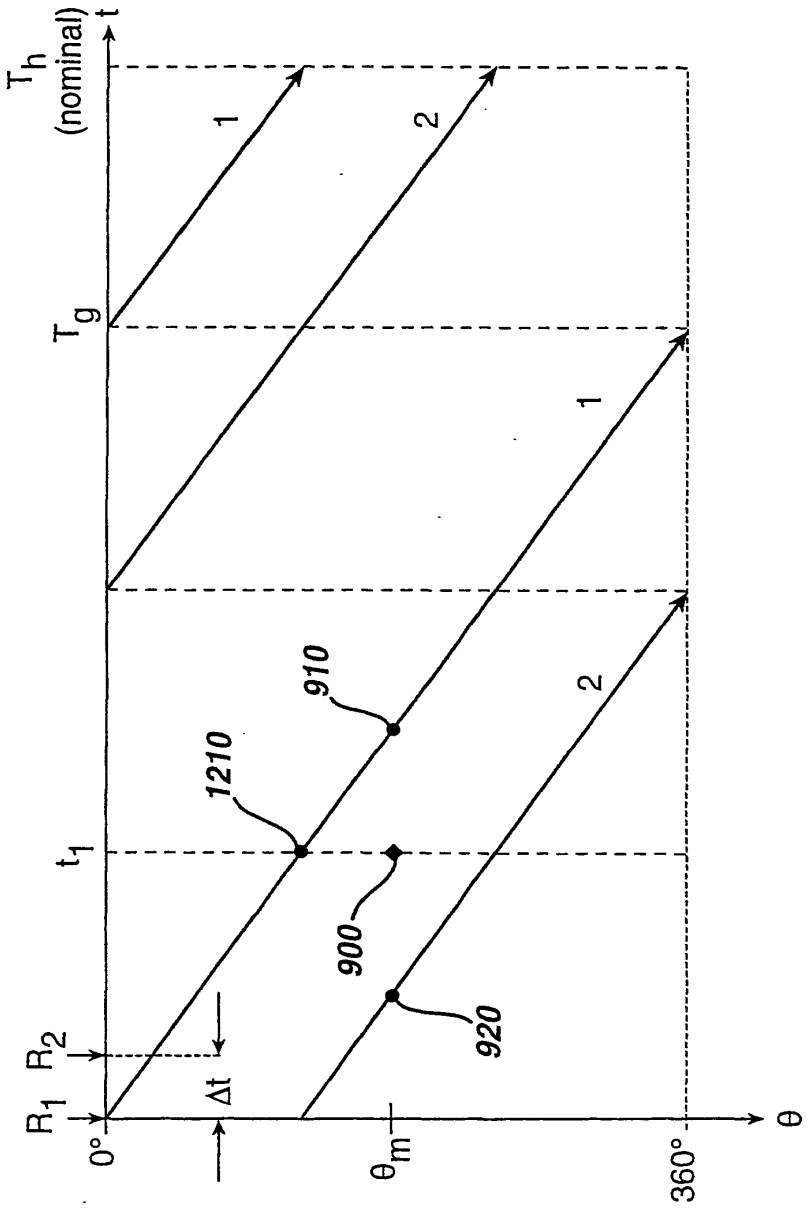
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FIG. 16



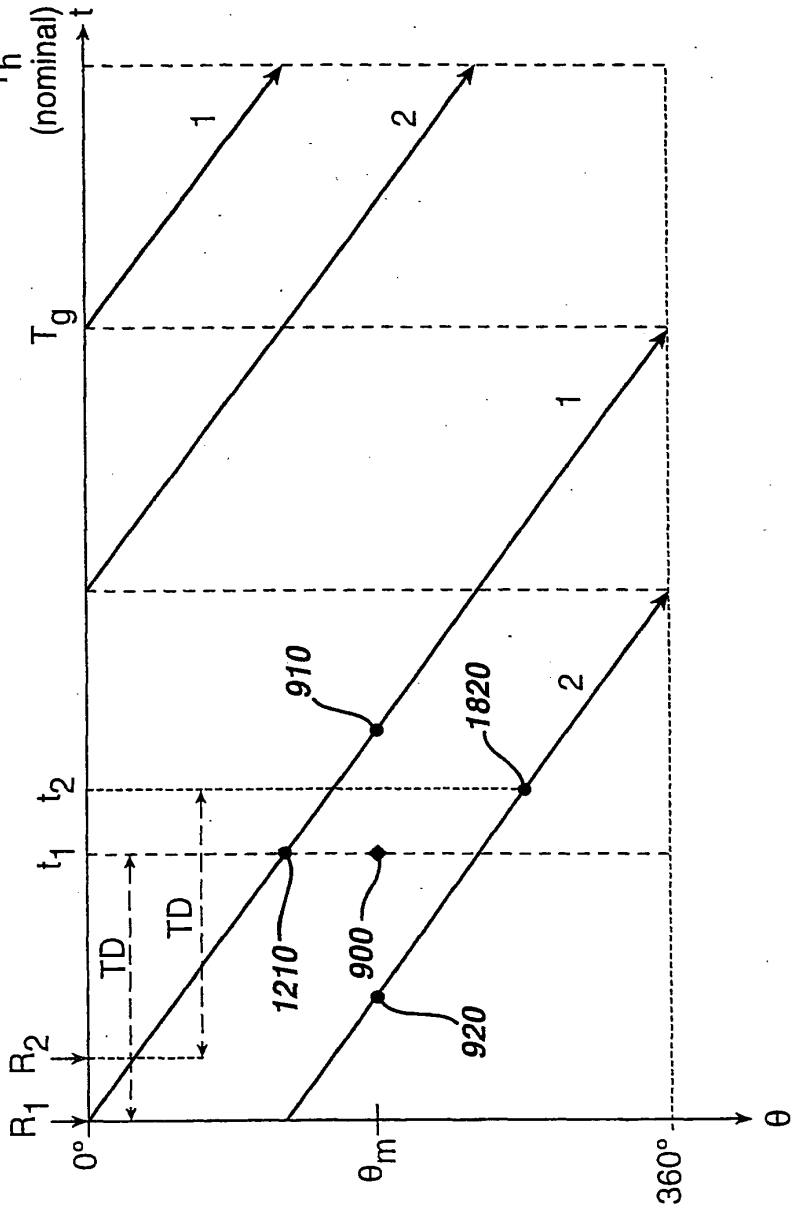
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FIG. 17



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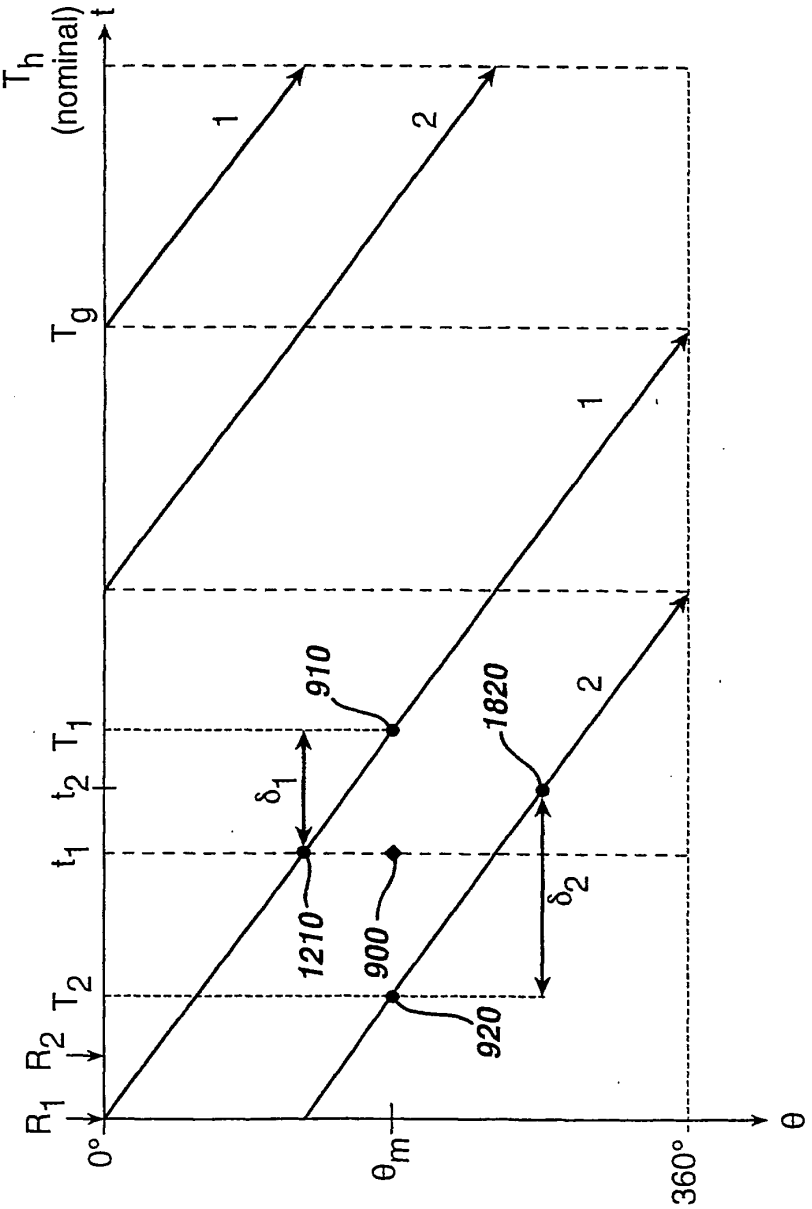
FIG. 18



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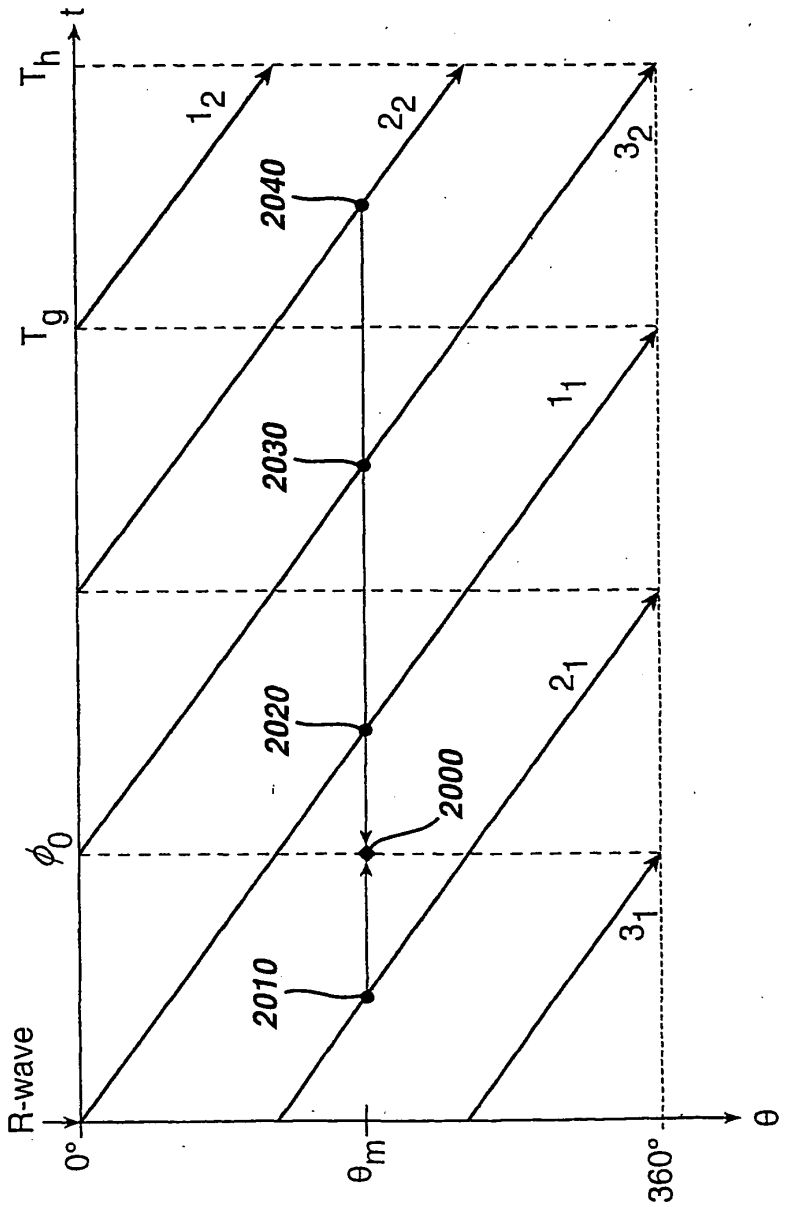
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FIG. 19



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FIG. 20

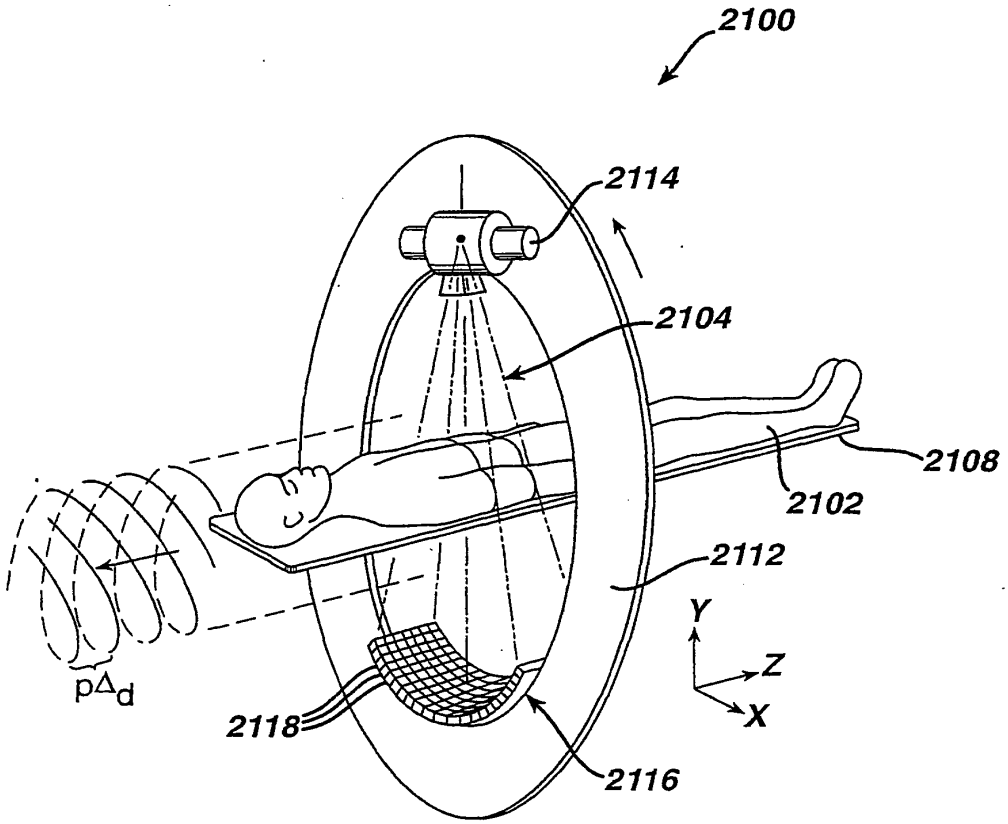


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FIG. 21



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FIG. 22

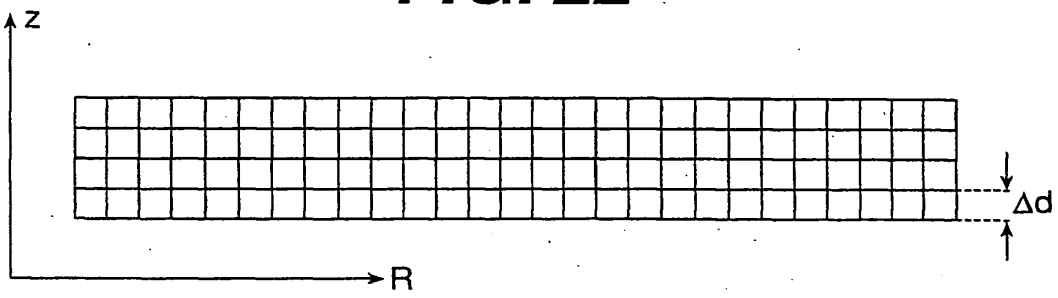
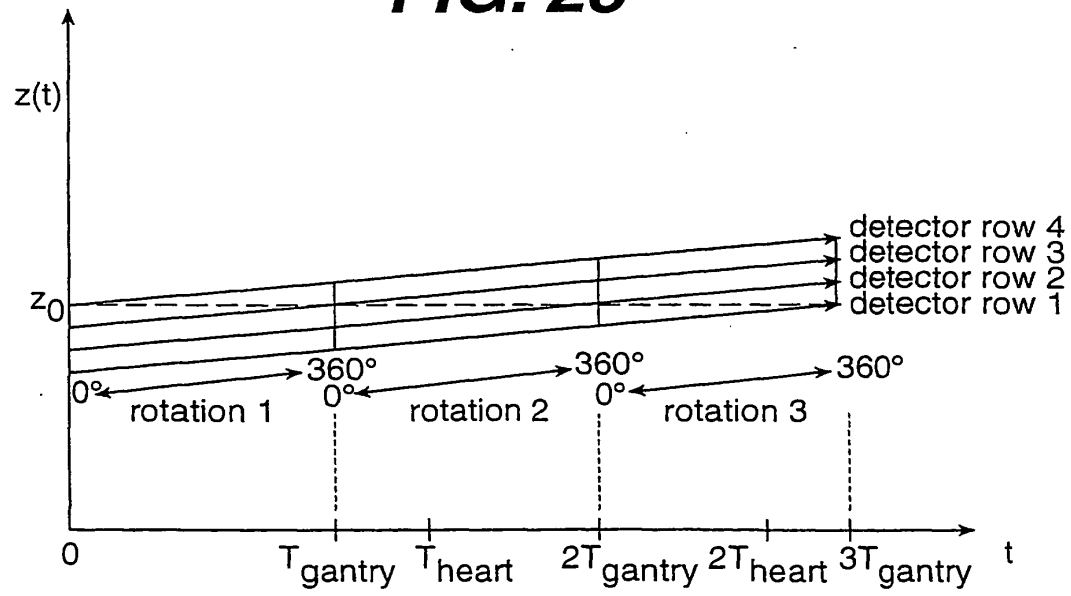


FIG. 23

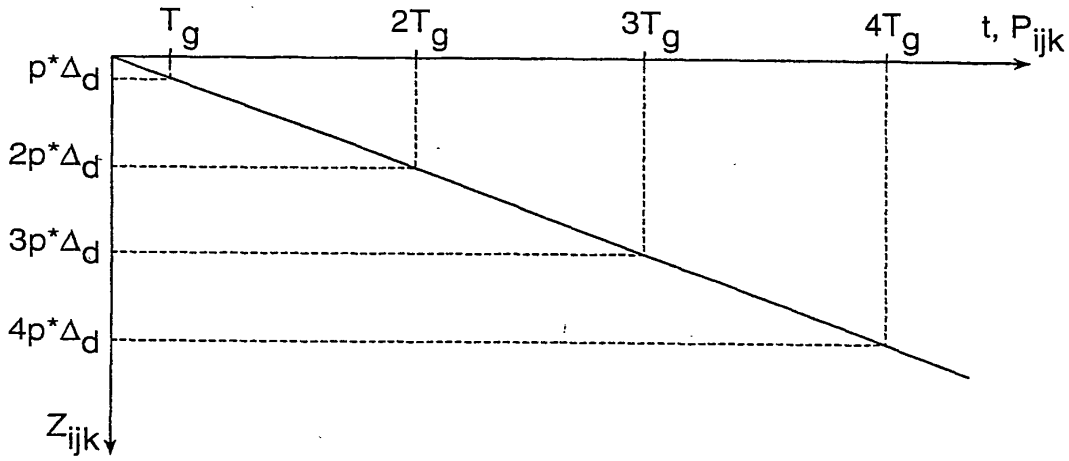


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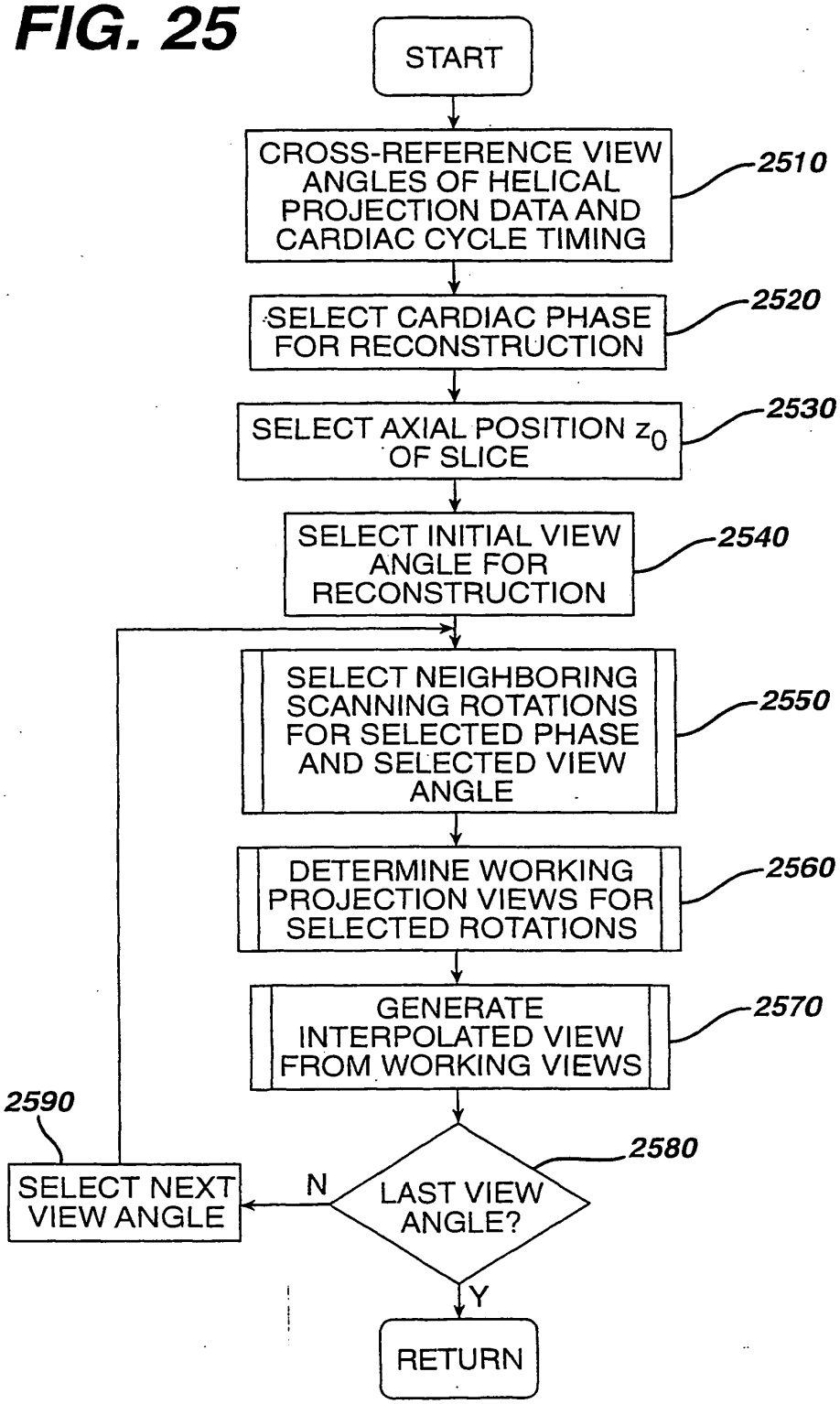
FIG. 24



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FIG. 25

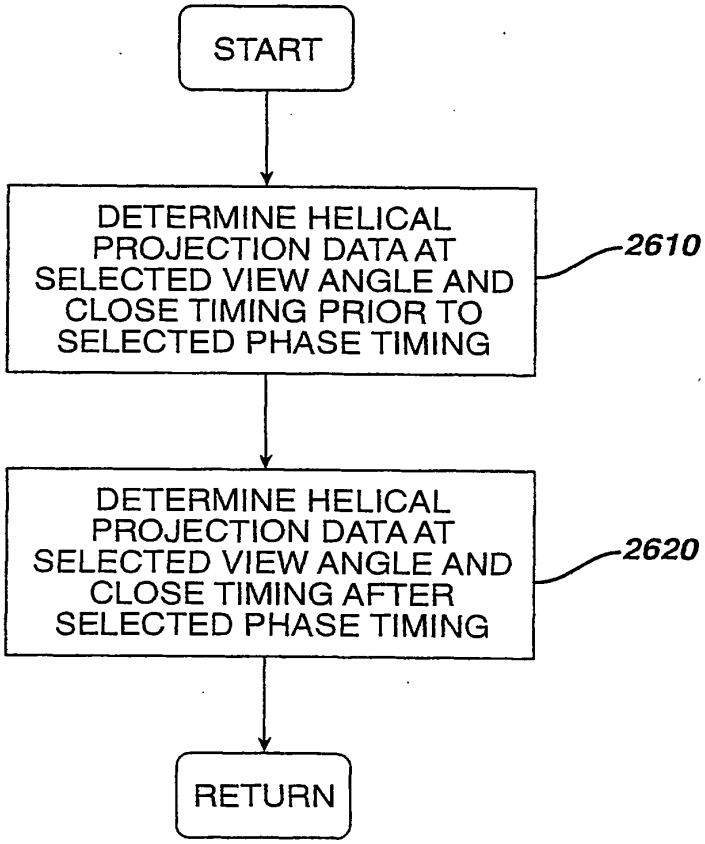


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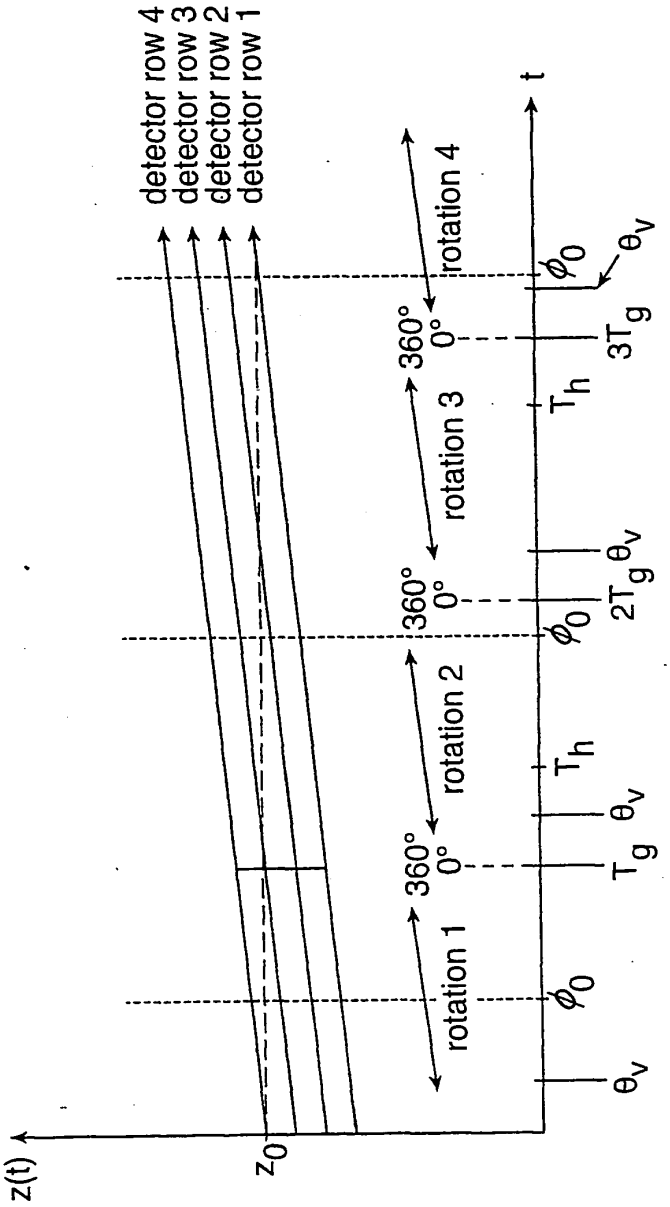
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FIG. 26



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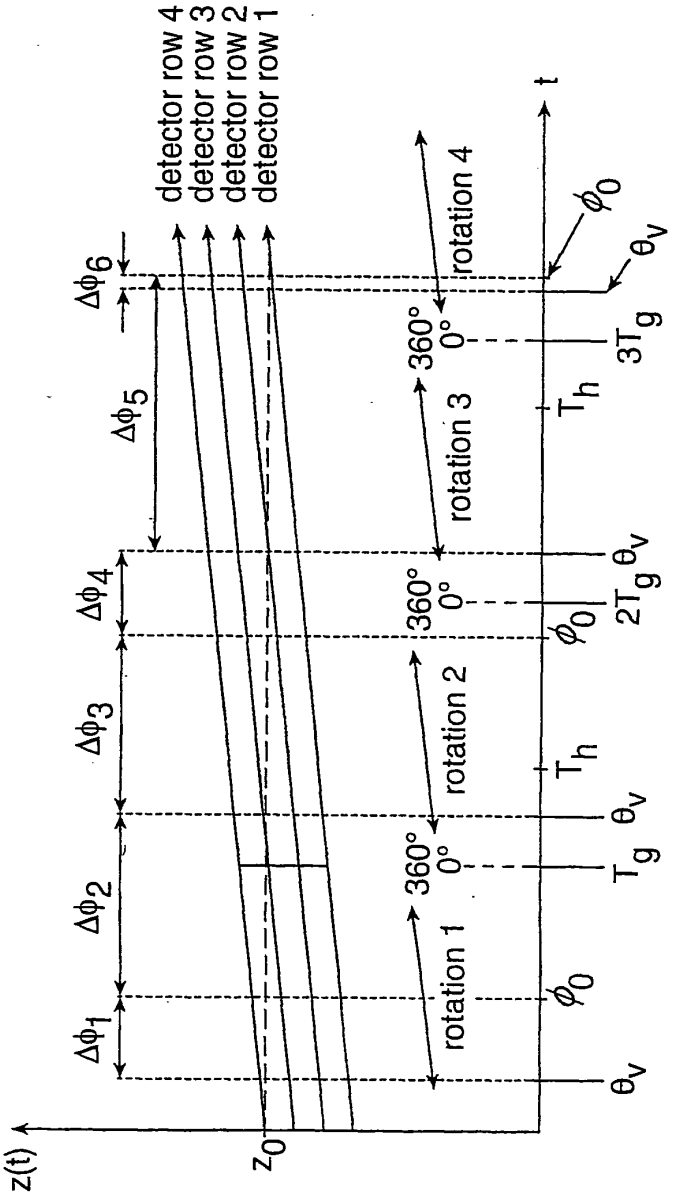
FIG. 27



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FIG. 28

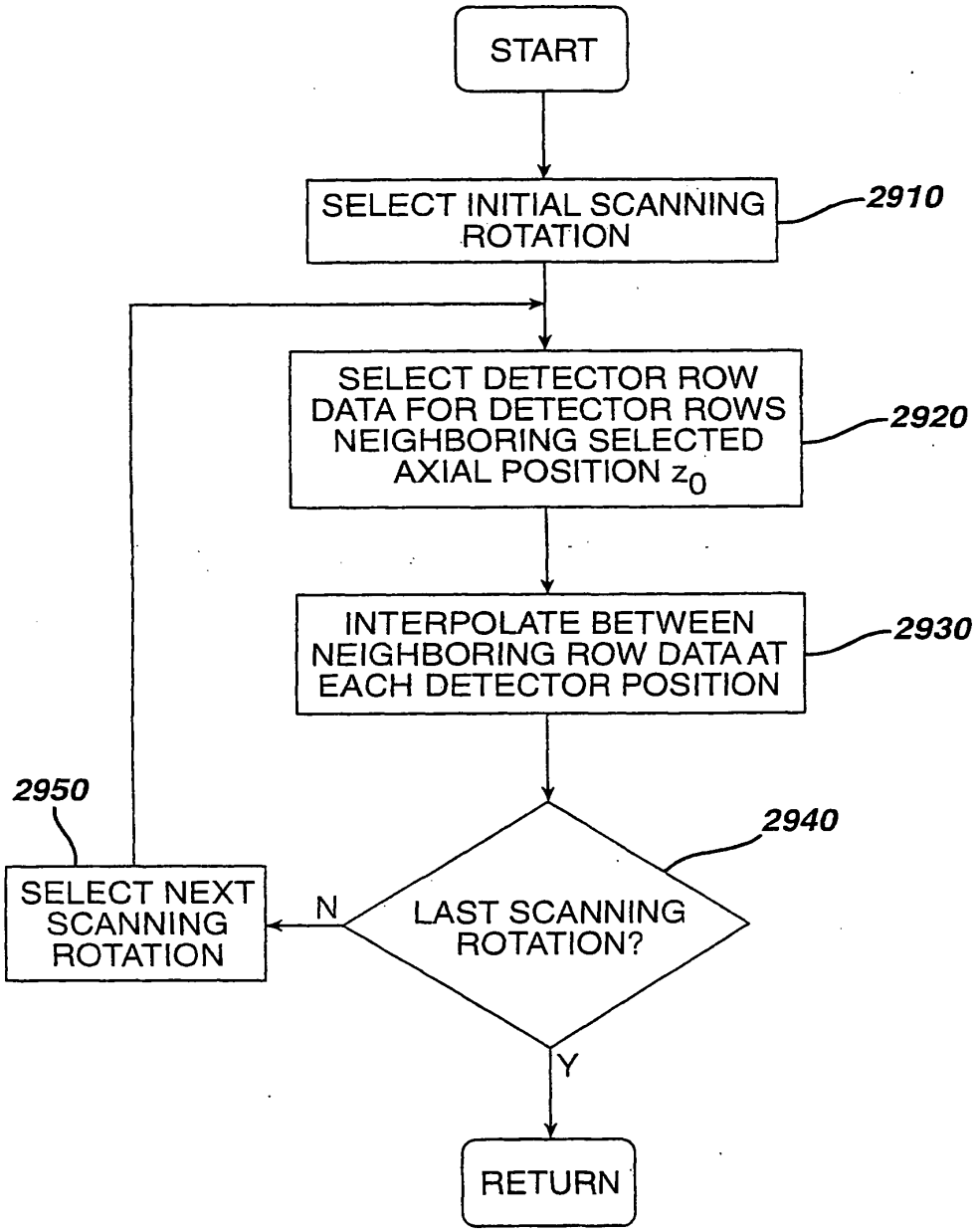


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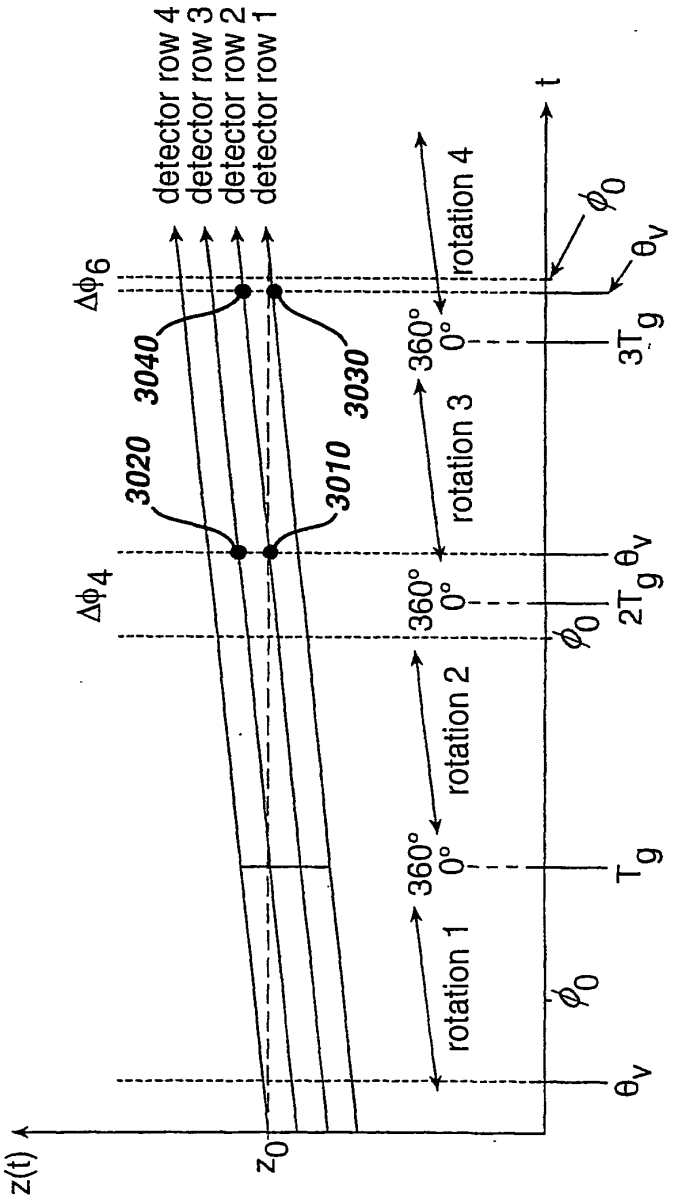
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FIG. 29



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FIG. 30

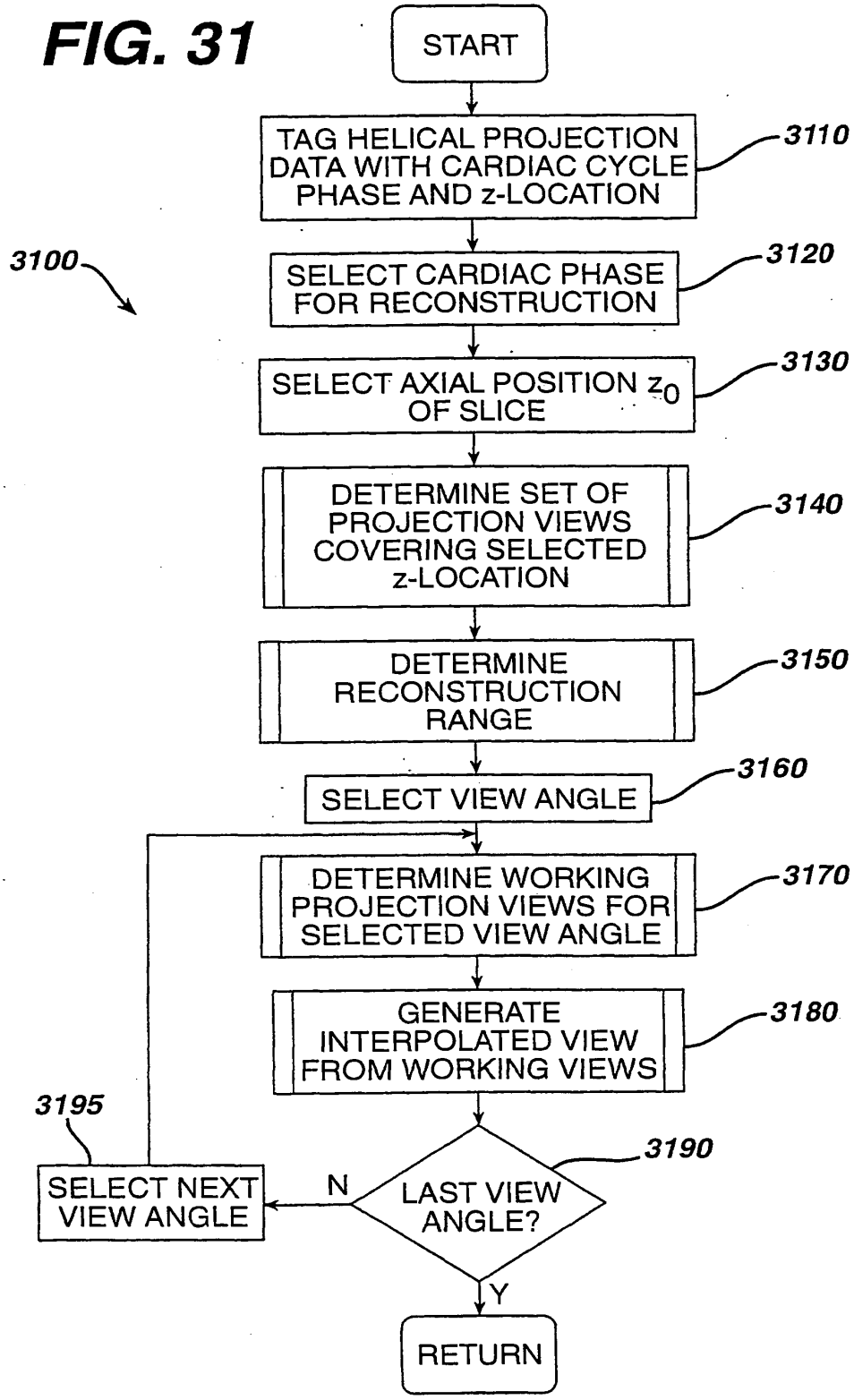


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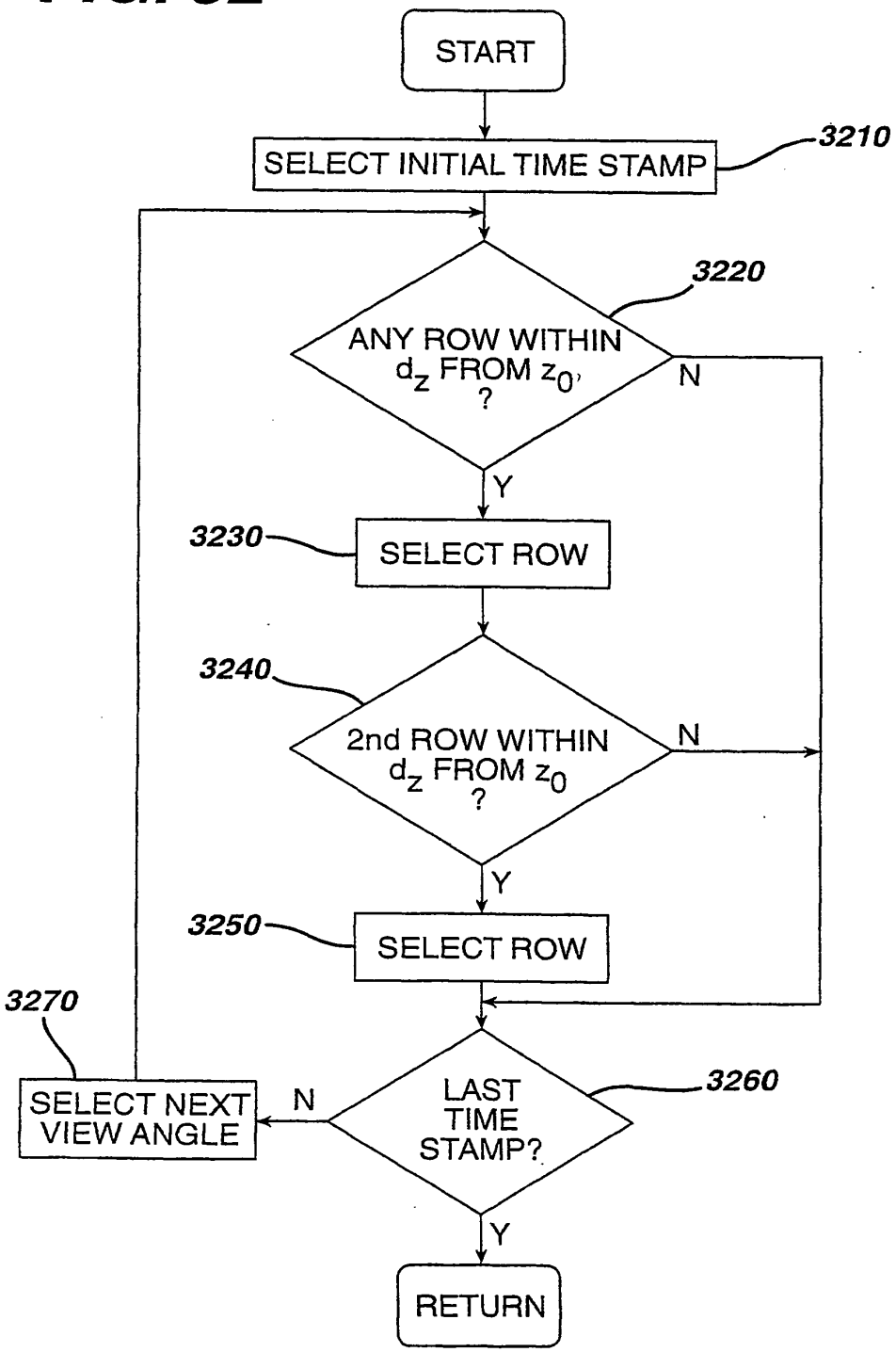
FIG. 31



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FIG. 32

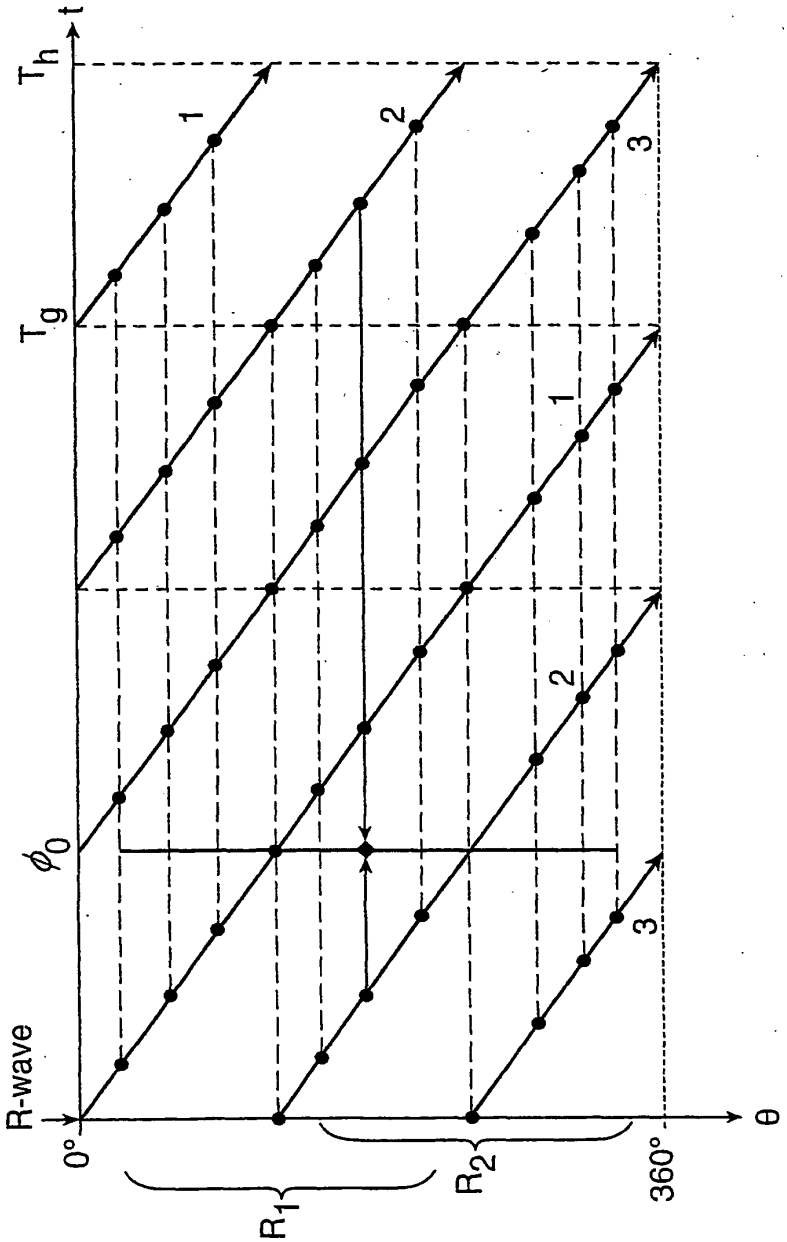


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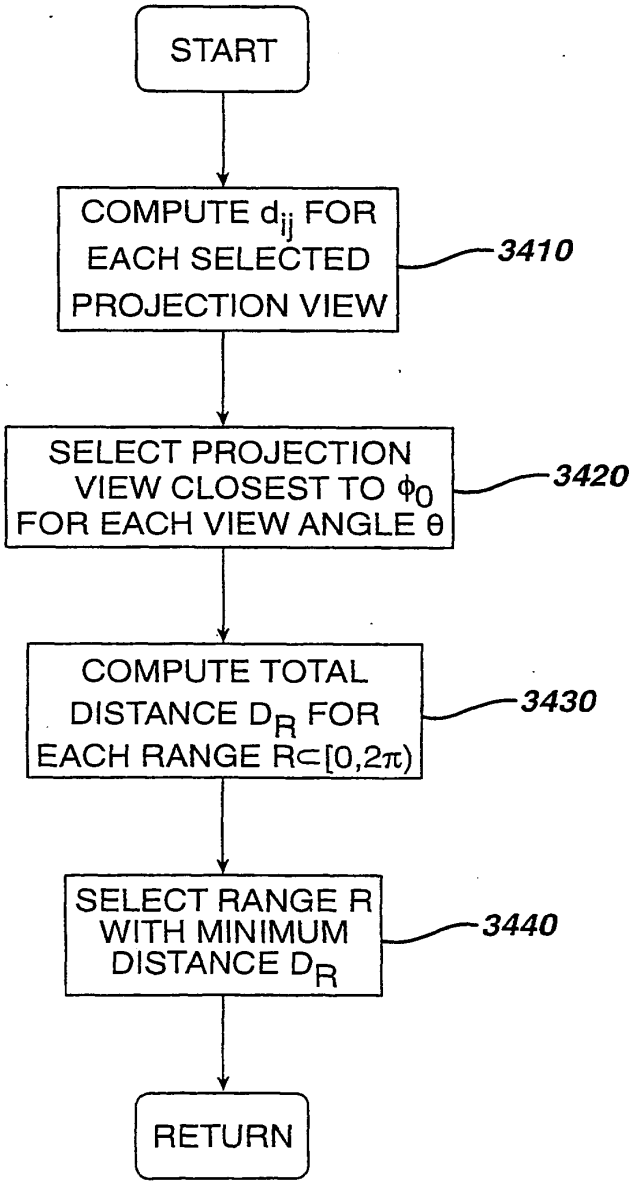
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FIG. 33



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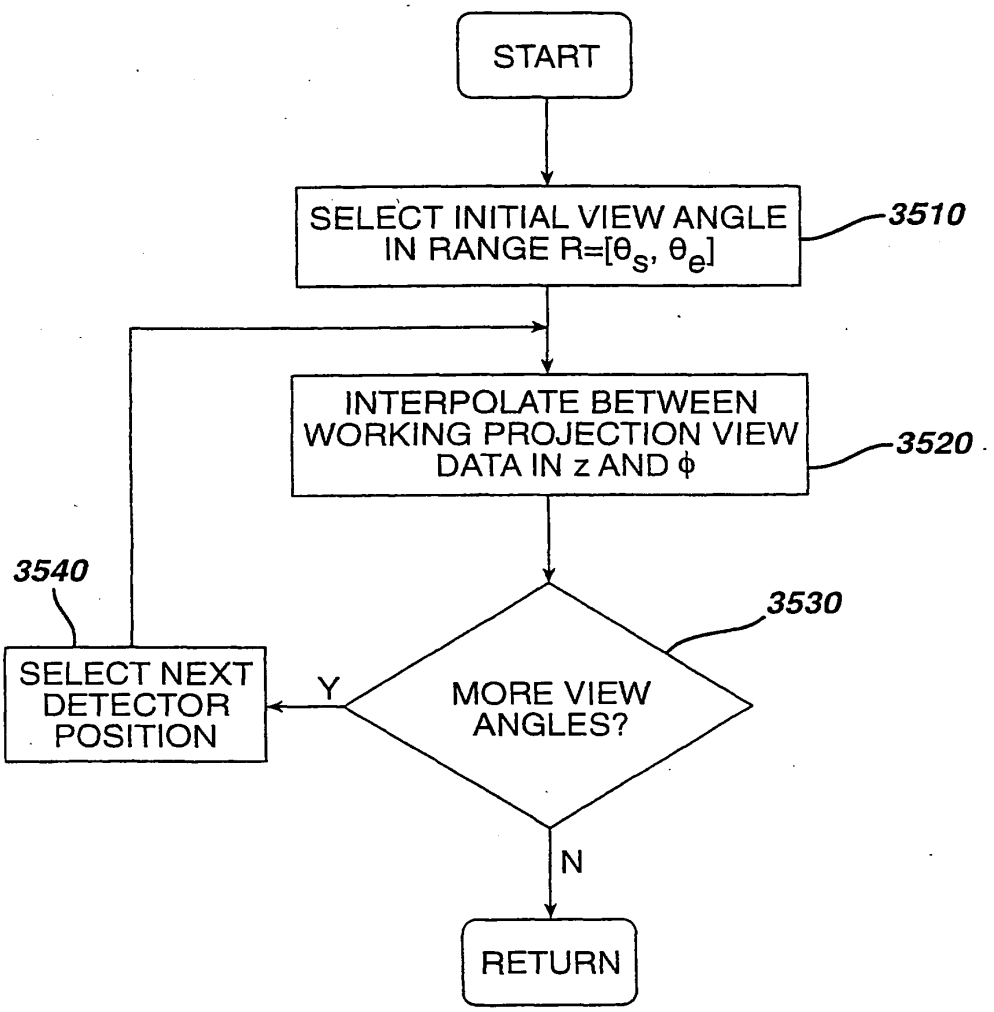
FIG. 34



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FIG. 35



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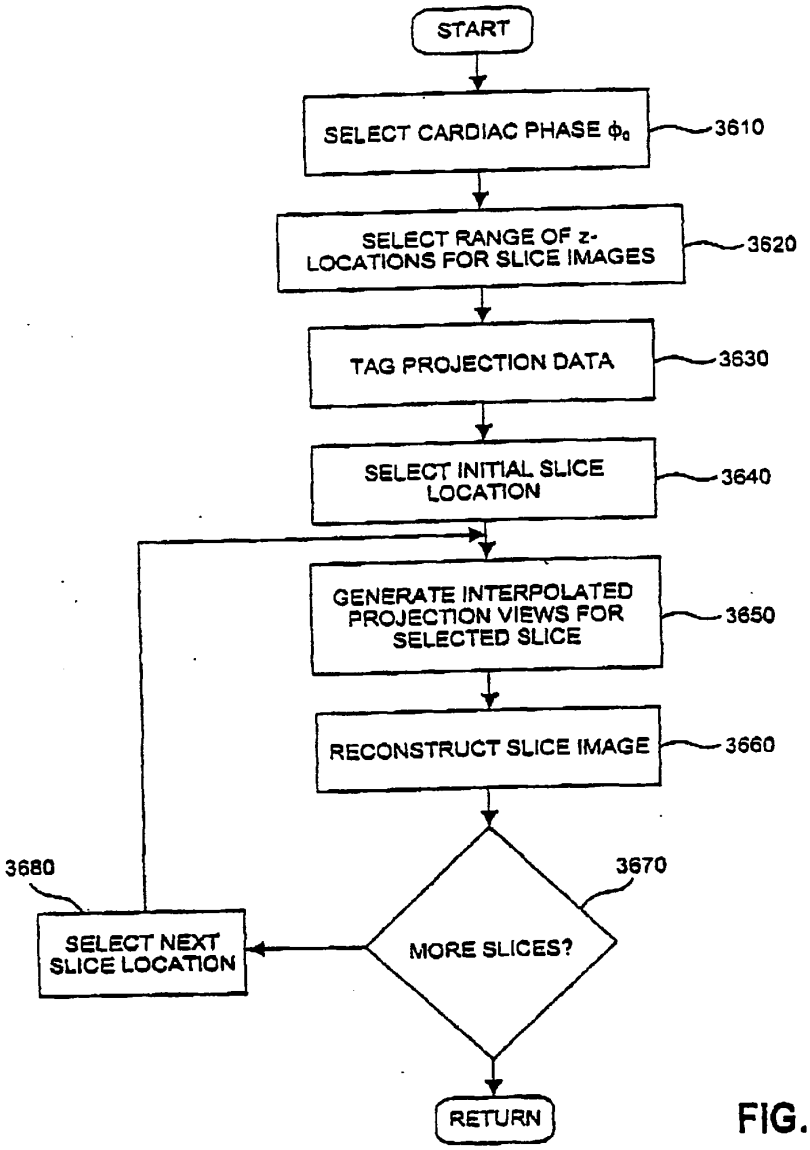


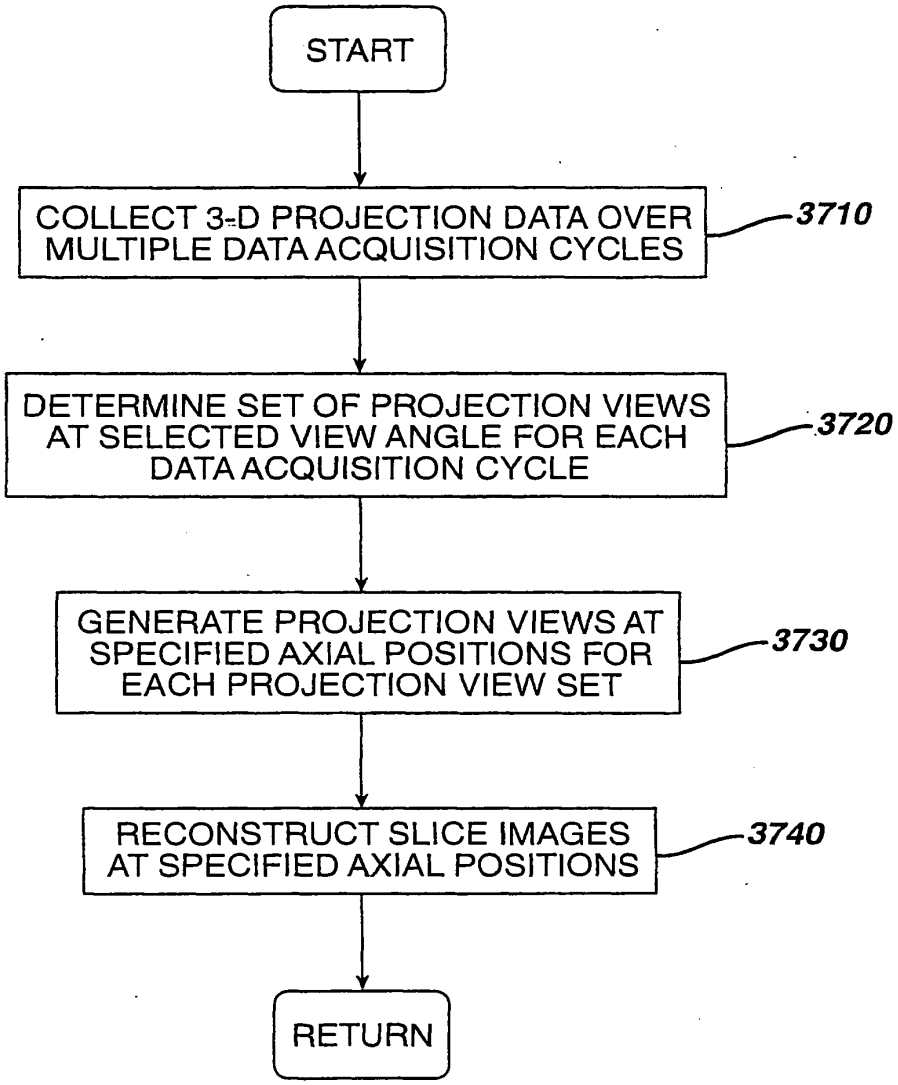
FIG. 36

BNSDOCID: <WO___0180184A1_I_>

LAG-VW00000619

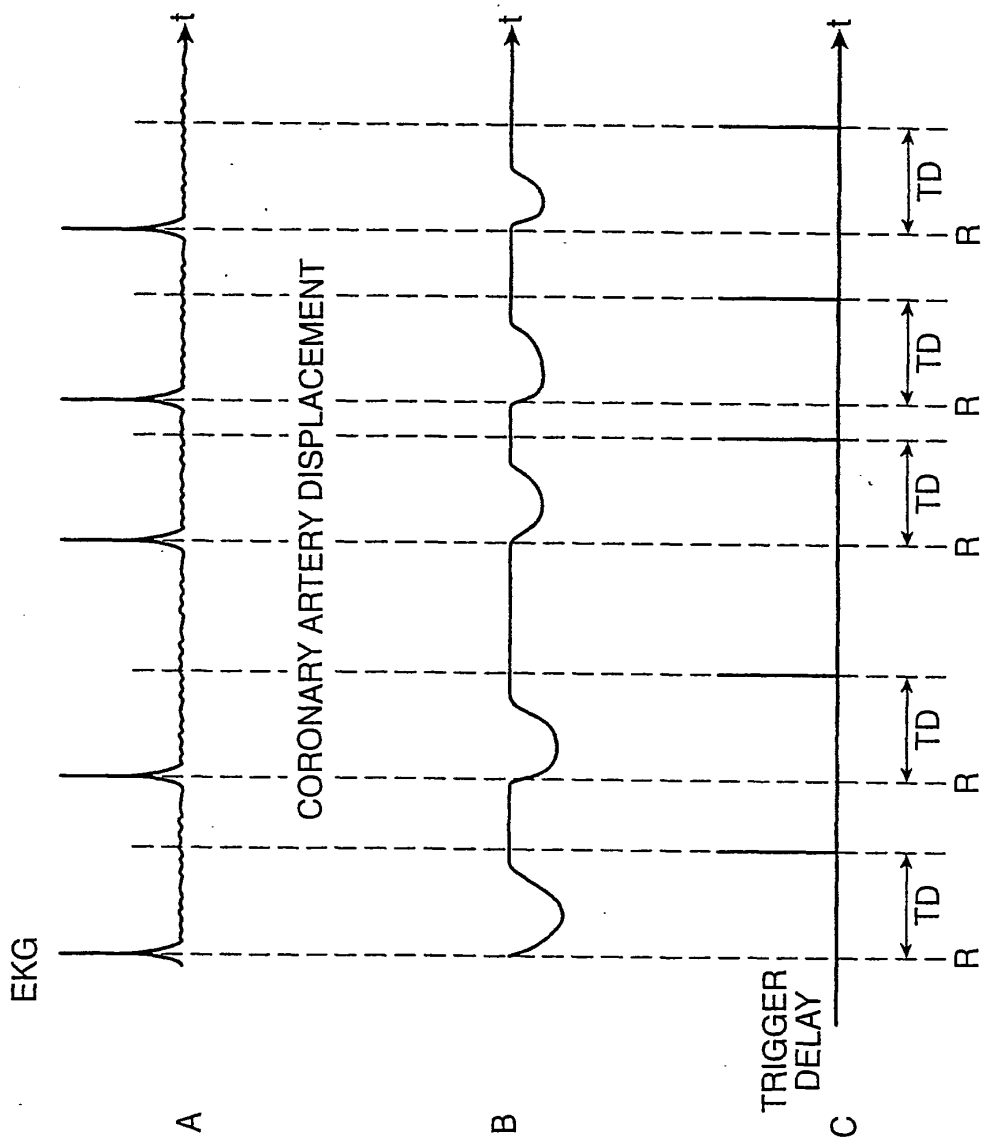
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Volkswagen v. Longhorn - IPR2025-00925

FIG. 37



BNSDOCID: <WO___0180184A1_I_>

FIG. 38

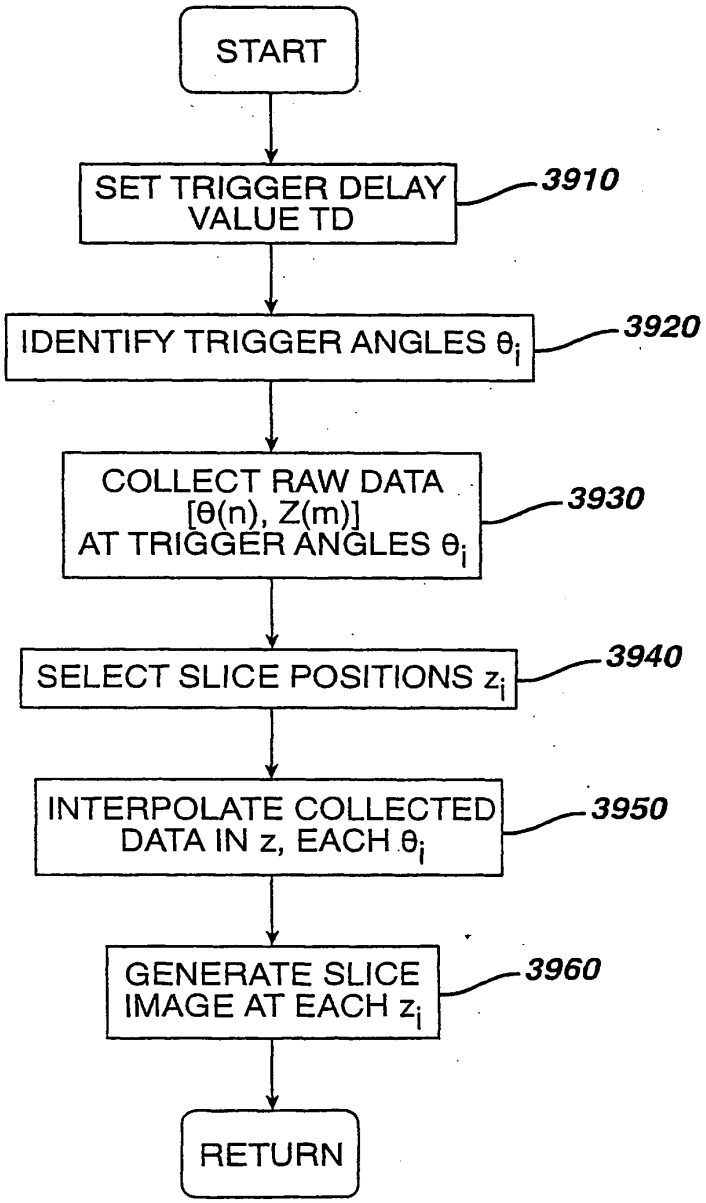


BNSDOCID: <WO___0180184A1_I_>

LAG-VW00000621

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Volkswagen v. Longhorn - IPR2025-00925

FIG. 39



BNSDOCID: <WO___0180184A1_I_>

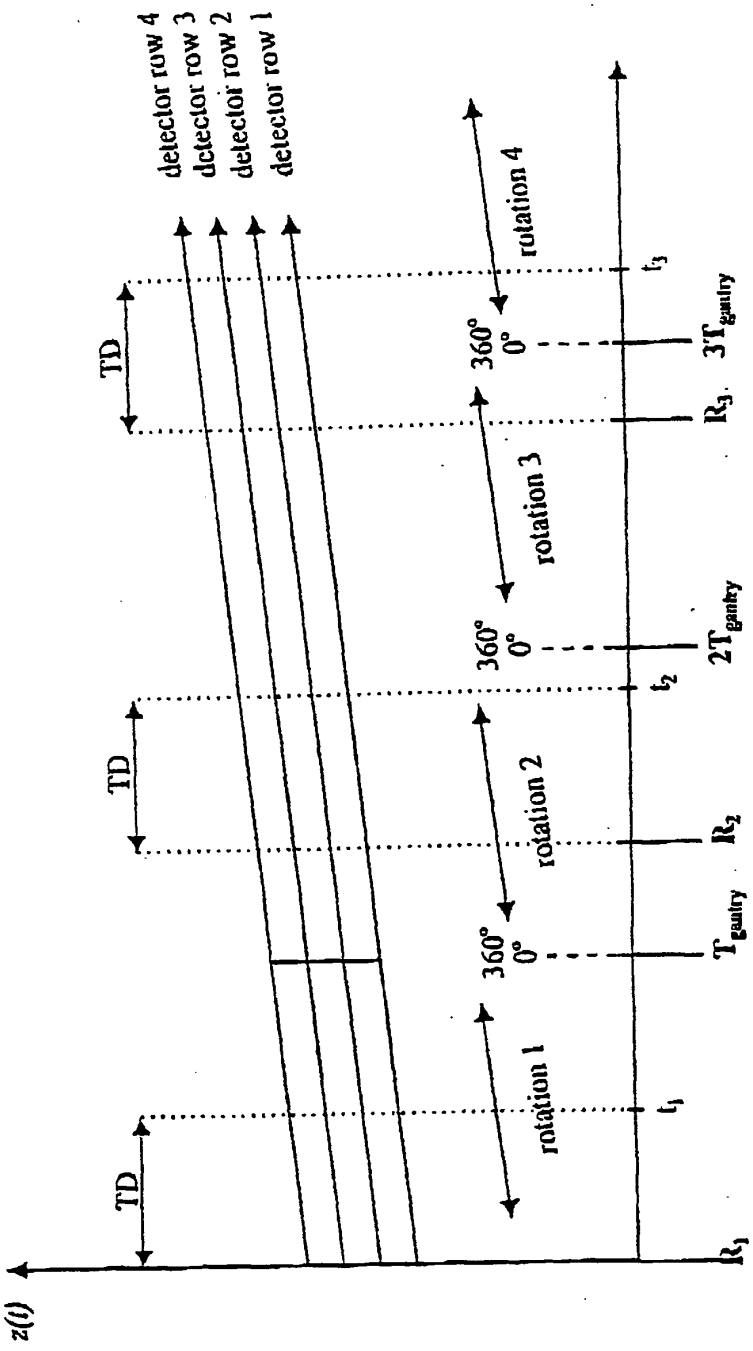


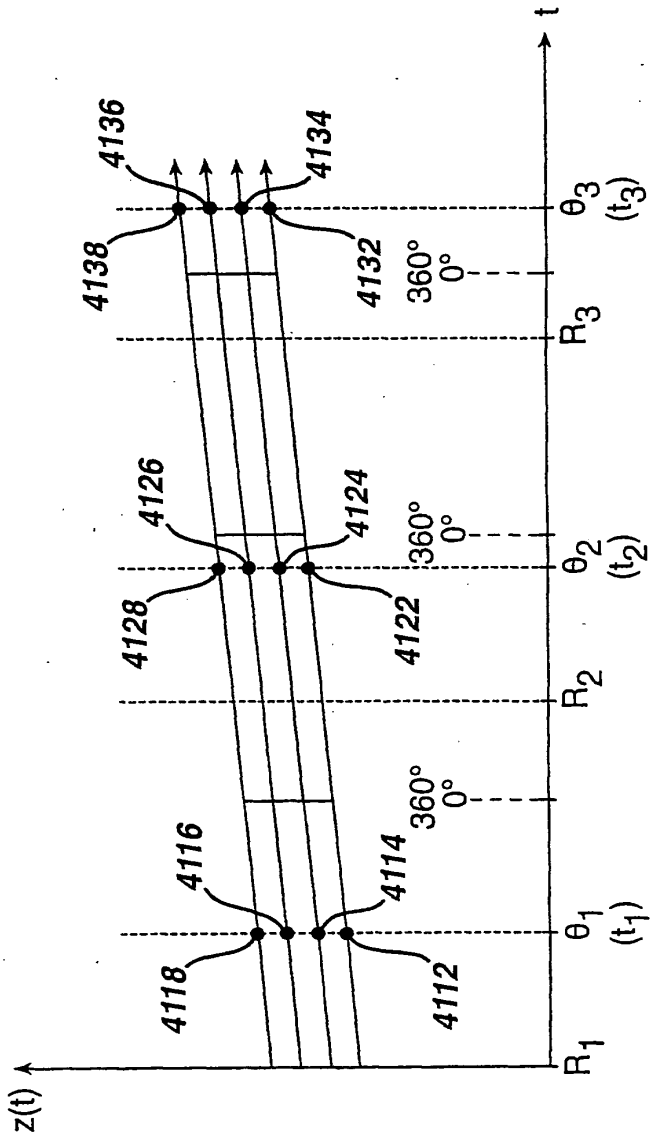
FIG. 40

BNSDOCID: <WO___0180184A1_I_>

LAG-VW00000623

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Volkswagen v. Longhorn - IPR2025-00925

FIG. 41



BNSDOCID: <WO___0180184A1_I_>

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Volkswagen v. Longhorn - IPR2025-00925

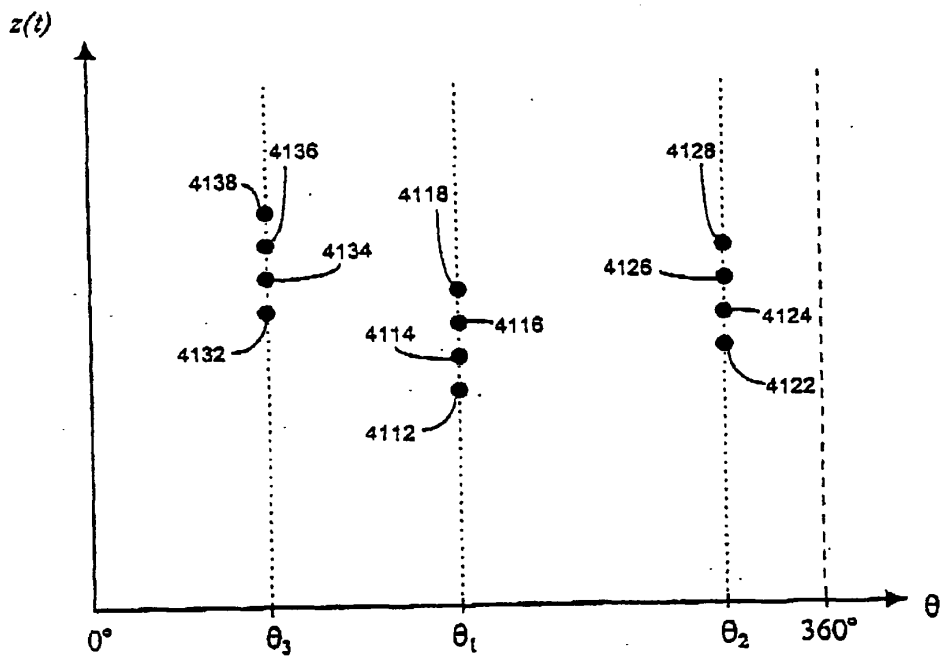


FIG. 42

BNSDOCID: <WO___0180184A1_I_>

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Volkswagen v. Longhorn - IPR2025-00925

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/00904

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G06T11/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G06T

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 627 868 A (TOKI YUSUKE ET AL) 6 May 1997 (1997-05-06) abstract; figures 3,4,6-12 column 2, line 19 - last line column 6, line 47 -column 7, line 22 column 8, line 8 - line 31 column 14, line 26 - line 34	1-9
A		10-71
A	US 5 889 833 A (SILVER MICHAEL D) 30 March 1999 (1999-03-30) abstract column 5, line 7 -column 6, line 20	1-71
A	EP 0 430 549 A (GEN ELECTRIC) 5 June 1991 (1991-06-05) abstract	1-71
	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 July 2001	18/07/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Diallo, B

Form PCT/ISA/210 (second sheet) (July 1992)

BNSDOCID: <WO___0180184A1_I_>

LAG-VW00000626

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Volkswagen v. Longhorn - IPR2025-00925

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 01/00904

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 838 756 A (TAGUCHI KATSUYUKI ET AL) 17 November 1998 (1998-11-17)	
A	US 5 243 284 A (NOLL DOUGLAS C) 7 September 1993 (1993-09-07)	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

BNSDOCID: <WO___0180184A1_I_>

LAG-VW00000627

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 01/00904

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5627868 A	06-05-1997	JP 3090400 B	18-09-2000
		JP 7323027 A	12-12-1995
		DE 69425631 D	28-09-2000
		DE 69425631 T	19-04-2001
		EP 0655713 A	31-05-1995
		EP 0953942 A	03-11-1999
		JP 7194592 A	01-08-1995
		JP 2000189414 A	11-07-2000
		US 5513237 A	30-04-1996
		US 5566218 A	15-10-1996
		US 5608772 A	04-03-1997
		JP 2000342573 A	12-12-2000
		JP 2000350724 A	19-12-2000
		US 5594772 A	14-01-1997
		US 5612985 A	18-03-1997
US 5889833 A	30-03-1999	JP 11004823 A	12-01-1999
EP 0430549 A	05-06-1991	US 5216601 A	01-06-1993
		CA 2021623 A	23-05-1991
		IL 96320 A	08-12-1995
		JP 1945090 C	23-06-1995
		JP 3186250 A	14-08-1991
		JP 6069452 B	07-09-1994
US 5838756 A	17-11-1998	JP 9187449 A	22-07-1997
		JP 9187450 A	22-07-1997
US 5243284 A	07-09-1993	NONE	

BNSDOCID: <WO___0180184A1_I_>

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EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	spatial ADJ synchorniz$5	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/01/04 11:04
L2	0	spatial ADJ synchornization	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/01/04 11:04

LAG-VW00000630
Volkswagen Exhibit 1037, Page 630 of 2532
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EAST Search History

L3	0	spatial ADJ synchornize	US-PG PUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/01/04 11:04
L4	102	spatial ADJ synchronization	US-PG PUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/01/04 11:06
L5	2	L4 AND (moving ADJ object)	US-PG PUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/01/04 11:05

EAST Search History

L6	1	L4 NEAR moving	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/01/04 11:05
S1	1	10/955037	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 09:38
S2	2163	bonnet.IN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 09:38

LAG-VW00000632

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EAST Search History

S3	9	bonnet-stephane.IN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 09:55
S4	40	grangeat-pierre.IN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 09:41
S5	2127	382/128.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 10:49

LAG-VW00000633

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EAST Search History

S6	0	"382.CCLA"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 10:49
S7	0	"382.CLAS"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 10:49
S8	57452	"382".CLAS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 10:49

LAG-VW00000634
Volkswagen Exhibit 1037, Page 634 of 2532
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EAST Search History

S9	80967	"345".CLAS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 10:49
S10	28016	"715".CLAS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 10:49
S11	990	345/420.CCLS.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:40

LAG-VW00000635
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EAST Search History

S12	0	functional ADJ radiation ADJ imagery	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:40
S13	5	functional ADJ radiation ADJ image	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:41
S14	0	functional ADJ radiation ADJ emission ADJ image	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:42

LAG-VW00000636

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EAST Search History

S15	11	radiation ADJ emission ADJ image	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:43
S16	8	radiation ADJ attenuation ADJ image	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:45
S17	0	S15 AND S16	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:45

LAG-VW00000637

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EAST Search History

S18	885	reconstruct$4 ADJ image ADJ object	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:46
S19	0	S17 AND S8	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:46
S20	71	S18 AND S8	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:48

LAG-VW00000638

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EAST Search History

S21	1	S18 NEAR movement	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:49
S22	1	S18 NEAR moving	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:50
S23	0	S22 AND estimate	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:49

LAG-VW00000639

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EAST Search History

S24	0	S22 AND calculation	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:50
S25	0	S22 AND calculte	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:50
S26	7	imagery ADJ mode	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:51

EAST Search History

S27	20	S18 AND S9	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 11:51
S28	8	S27 AND moving	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:07
S29	4416	townsend.IN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:07

LAG-VW00000641
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EAST Search History

S30	140	"0004405"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:08
S31	0	S29 AND S30	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:08
S32	32	"170246"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:09

LAG-VW00000642

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EAST Search History

S33	2	"20030004405"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:11
S34	841	PET NEAR CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:12
S35	2	"2004170246"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:13

EAST Search History

S36	9	Koeing.IN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:14
S37	5	"5889525"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:14
S38	17	S8 AND (spatial ADJ synchronization)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2006/12/26 12:47

LAG-VW00000644

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United States Patent and Trademark Office
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	BRV.10002	4535

45473 7590 01/10/2007
HUTCHISON LAW GROUP PLLC
PO BOX 31686
RALEIGH, NC 27612

EXAMINER	
LEE, JOHN W	
ART UNIT	**PAPER NUMBER**
2112	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/10/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	John Wahnkyo Lee	2112	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 September 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 September 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *20050912*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. An initialed and dated copy of Applicant's IDS form 1449, Paper No. 20050912, is attached to the instant Office action.

Specification

2. The disclosure is objected to because of the following informalities:

(1) There are miss-spellings and grammar errors in the pages as follows:

From pages 1, 3-9, 11, and 15, the examiner recommends substituting "synchronisation", "ionising", "... the periphery of the object collect radiation ...", "isbn", "recognisable", "regularise", "generalised", "synchronise", "minimised", "minimisation", "characterise" with "synchronization", "ionizing", "... the periphery of the object collects radiation ...", "ISBN", "recognizable", "regularize", "generalize", "synchronize", "minimized", "minimization", "characterize", respectively.

(2) In page 11, it is written about the step of "E17" and "E18." However, referring the drawings of the application, it is believed that "E17" and "E18" have to be replaced with "Et17" and "Et18", respectively.

Appropriate correction is required.

3. The abstract of the disclosure is objected as follows:

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(1) There are miss-spellings. The examiner recommends substituting "synchronisation" with "synchronization".

(2) The length of the title is too long.

Correction is required. See MPEP § 608.01(b).

Drawings

4. The drawings are objected to because some parts of the words in Fig. I is written in French rather than in English, which is hard for the examiner to comprehend. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

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Claim Objections

5. Claims 1-8 are objected to because of the following informalities: All of the claims have miss-spellings. It is recommended to replace "characterised", "synchronisation", and "synchronise" with "characterized", "synchronization", and "synchronize", respectively.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-3, and 5-8 are rejected under 35 U.S.C. 102(b) as being anticipated by De Murcia et al. (5,889,525).

8. Regarding claim 1, the claim encompasses a method of reconstruction of an image of a mobile object by a first measurement acquisition technique containing at least partial reconstruction of images of the object at corresponding movement states of the object, an estimate of the object movement between the states, and a combination of state images by making compensations of the object movement according to the

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estimate at least using partially other images of the object using a second measurement acquisition technique.

De Murcia discloses a process for the reconstruction of three-dimensional images of a mobile or deformable object (col. 1, lines 7-8). An approximate image of the object in each state "f" is reconstituted; a reference state to each of the states are evaluated; the estimation of the image of the object at the reference state is obtained by a convergence towards the information relative to the measurements and to the previously calculated movements of the objects, which implies the reconstruction of the image is from at least a combination of states retrieved by at least two independent techniques (abstract; Fig. 2).

9. Regarding claims 2 and 3, the method recited in claim 1 has a synchronization step applied to measurements originating from the second acquisition technique and comprises a spatial synchronization for estimating the object movement.

De Murcia discloses that the sensors, which have different incidences and take different series of sets of measurements, synchronizes on a given group of states of the heart or phases of its cycle (col. 3, lines 36-39), which can be interpreted as a spatial synchronization process.

10. Regarding claims 5 and 6, the method recited in claim 1 contains a feature of a measurement of a cyclic element of the object movement to synchronize the states on

periodic states of the cyclic element on several phases associated with different periods of the movement cyclic element.

De Murcia discloses that the sensor does a synchronization of states of the heart or the phases of its cycles for series (col. 3, lines 36-39) of sets of successive measurements corresponding to different states of objects (col. 3, lines 49-51).

11. Regarding claims 7 and 8, the method recited in claim 1 uses the independent movement or position sensors to evaluate the movement of the object and/or to place the measurements by the two acquisition techniques and the states of the object on a common time scale, and to estimate the movement for compensation.

De Murcia discloses sensors having different incidences taking a series of sets of measurements synchronized on a given group of states of the heart or the phases of its cycle (col. 3, lines 36-39). De Murcia also discloses an estimation of deformations, which a reference state to each of the states is evaluated (abstract; Fig. 2).

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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13. Claims 1 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murcia et al. (5,889,525) in view of Beyer et al.

14. Regarding claim 4, the method recited in claim 1 has a functional radiation emission imagery technique and an anatomic radiation attenuation imagery technique.

As discussed before, De Murcia discloses all the features of claim 1. However, De Murcia does not disclose the feature of claim 4, but Beyer does by disclosing the method of using X-ray CT data for attenuation correction of PET data (abstract). PET is an example of a system using functional radiation emission imagery technique and CT is an example of a system using an anatomic radiation attenuation imagery technique.

De Murcia and Beyer are analogous because they are from the same field of endeavor of method of image manipulation.

It would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made to use Beyer's method in De Murcia's process for the reconstruction of three-dimensional images. The motivation would have been to make it possible to acquire rapidly and low-noise transmission scans for PET attenuation correction and to use of a *priori* information to help guide the PET image reconstruction process as suggested by Beyer (page 1573). Therefore, it would have been obvious to combine De Murcia and Beyer to obtain the invention of claim 4.

Conclusion

15. No claims are allowed.

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16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Wahnkyo Lee whose telephone number is (571) 272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Stucker can be reached on (571) 272-0911. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JEFFREY STUCKER
SUPERVISORY PATENT EXAMINER

John W. Lee

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Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/08A(08-03)
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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

IAP98 SEP 12 2005 PATENT & TRADEMARK OFFICE

Sheet 1 of 1

Complete if Known	
Application Number	10/955,037
Filing Date	September 30, 2004
First Named Inventor	BONNET, Stephane
Group Art Unit	~~2882~~ JWL 2112
Examiner Name	~~Unknown~~ JWL John W. Lee
Attorney Docket No:	BRV.10002

US PATENT DOCUMENTS

Examiner Initial*	USP Document Number	Publication Date	Name of Patentee or Applicant of cited Document
JWL	US-2003-0004405-A1	01/02/2003	TOWNSEND, David W., et al.
	US-2004-170246-A1	09/02/2004	KOENIG, Anne , et al.
	US-5,889,525	03/30/1999	DE MURCIA, Jérôme , et al.

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Foreign Document No	Publication Date	Pages,Columns,Lines,Where Relevant Passages or Relevant Figures Appear	Abstract, Translation, English Language Equivalent or Search Report
JWL	EP-1 087 337	03/28/2001		
	FR-2736454	01/10/1997		X
	FR-2826157	12/20/2002		X
	WO-01/80184	10/25/2001		

OTHER DOCUMENTS -- NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.), date, page(s), volume-issue number(s), publisher, city and/or country where published.	Abstract, Translation, English Language Equivalent or Search Report
JWL	GILLAND, DAVID R.,et al.,"Simultaneous Reconstruction and Motion Estimation for Gated Cardiac ECT", IEEE Trans. on Nuclear Science 49(5):2344-2349 (Oct. 2002)	
JWL	GRANGEAT, PIERRE ,et al.,"Theoretical framework for a dynamic cone-beam reconstruction algorithm based on a dynamic particle model", Phys. Med. Biol. 47:2611-2625 (2002)	
JWL	KACHELRIESS, MARC ,et al.,"Kymogram detection and kymogram-correlated image reconstruction from subsecond spiral computed tomography scans of the heart", Med. Phys. 29(7):1489-1503 (July 2002)	
JWL	KINAHAN, P. E.,et al.,"Attenuation correction for a combined 3D PET/CT scanner", Med. Phys. 25(10):2046-2053 (Oct. 1998)	

EXAMINER	/John Lee/	DATE CONSIDERED	12/27/2006

Substitute Disclosure Statement Form (PTO-1449)

* EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional) 2 Applicant is to place a check mark here if English language Translation is attached

Notice of References Cited	Application/Control No. 10/955,037	Applicant(s)/Patent Under Reexamination BONNET ET AL.	
	Examiner John Wahnkyo Lee	Art Unit 2112	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,889,525 A	03-1999	De Murcia et al.	345/420
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Beyer, T. et al., "The use of X-ray CT for Attenuation Correction of PET Data", 1995, IEEE, Vol. 4, page 1573
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

A

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www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 4535

SERIAL NUMBER	FILING OR 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/955,037	09/30/2004 RULE	382	2112	BRV.10002

APPLICANTS

Stephane Bonnet, Seyssinet-Pariset, FRANCE; JwL
Pierre Grangeat, Saint Ismier, FRANCE; JwL

** CONTINUING DATA **********
JwL

** FOREIGN APPLICATIONS **********
FRANCE 03 50631 10/01/2003 JwL

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
** 08/19/2005

Foreign Priority claimed ☑ yes ☐ no 35 USC 119 (a-d) conditions met ☑ yes ☐ no ☐ Met after Allowance Verified and Acknowledged Examiner's Signature Initials JwL	STATE OR COUNTRY FRANCE	SHEETS DRAWING 2	TOTAL CLAIMS 8	INDEPENDENT CLAIMS 1

ADDRESS
45473

TITLE
Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
900	No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

LAG-VW00000656

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Volkswagen v. Longhorn - IPR2025-00925

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/27/2006								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

SEARCHED			
Class	Subclass	Date	Examiner
382	128	12/26/2006	John W. Lee
345	420	12/26/2006	John W. Lee

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	12/26/2006	John W. Lee
East Search	12/26/2006	John W. Lee
IEEE (Non- Patent Literature Search)	12/26/2006	John W. Lee

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

Patent
Attorney Docket No. BRV.10002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Stephane BONNET

Mail Stop: Amendment

Application No.: 10/955,037

Group Art Unit: 2112

Filing or 371(c) Date: September 30, 2004

Examiner: John W. Lee

Title: Method of Reconstructing an Image With Data Acquisition According to Several Imagery Modes and Synchronisation of Image Series

Confirmation No.: 4535

AMENDMENT

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action mailed January 10, 2007, please amend this application as follows.

Amendments to the Specification begin on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims, which begins on page 6 of this paper.

Amendments to the Drawings begin on page 8 of this paper and include attached Replacement sheet.

Remarks begin on page 9 of this paper.

1 sheet of **Replacement Drawing Figure** is attached following page of this paper.

Amendments to the Specification:

Please replace the Title, with the following:

Method of reconstructing an image acquired using ~~with data acquisition according to~~ several imagery modes ~~and synchronisation of image series~~

Please replace the second full paragraph of page 1, with the following:

Images may be taken inside objects, and particularly living beings, using several types of methods. Some are attenuative, in other words the attenuation of radiation passing through the object is measured, and others are emissive, in other words ~~ionising~~ ionizing particles originating from a radioactive liquid previously swallowed by the organism to be studied, are collected. In both cases, detector networks rotating around the object or covering the periphery of the object ~~collect~~ collects radiation, and images of the object are obtained by combining measurements of detectors taken at different angles using well-known computed tomography methods (see "Tomography", directed by P. Grangeat Paris: Hermes Science Publications 2002 ~~ibsn~~ ISBN 2.7462-0356-1).

Please replace the first full paragraph of page 3, with the following:

Image correction methods by estimating the displacement field have been applied primarily to attenuation images that can be taken quickly and for which the more distinct contents provide more details about object movements. Emission images have less abundant contents due to the fact that the measurements are more dispersed in time and they are not as easily ~~recognisable~~ recognizable since different categories of tissues are not as clearly distinguished. Therefore, it is difficult to establish a displacement field so that it can be used to compensate for object movements and ~~regularise~~ regularize its image.

Please replace the first full paragraph of page 4, with the following:

These displacement fields are then applied to measurements taken using the emission technique in general after having been modified or adapted by processes that will be

described in detail in the remainder of this document. Thus, these emission measurements may be corrected to compensate for the movement and obtain an improved final functional image. All that is necessary is to ~~synchronise~~ synchronize measurements made using the two techniques on a common time base.

Please replace the last full paragraph of page 4, with the following:

Although the invention is useful at the moment in the special context of acquisition pairs by attenuation and emission, it could be easily be ~~generalised~~ generalized to include any pair of measurement acquisitions and is not limited to the embodiments described below.

Please replace the last paragraph beginning on page 5 and ending on page 6, with the following:

Attenuation and emission measurements are made in steps Et1 and Et2 in FIG. 1. For each measurement category, measurement sets are taken at successive instants, which are usually not simultaneous for the two measurement categories. However, a time ~~synchronisation~~ synchronization of measurement sets is usually necessary, within the two series and between the two series after step Et3. One useful method for achieving this may be to measure a patient movement using an independent sensor such as a breathing sensor, a pressure sensor or an electrocardiogram. Each measurement set is then associated with a determined state of the patient during which a measurement of his movement was made. If this measurement relates to a cyclic phenomenon such as breathing, the measurement sets may be associated with time phases of this movement as suggested in the diagram in FIG. 2, in which six measurement sets M1 to M6 taken over a breathing cycle are associated with average phases $\varphi 1$ to $\varphi 6$.

Please replace the last paragraph beginning on page 6 and ending on page 7, with the following:

Finally, the time may be ~~synchronised~~ synchronized by correlation processes between image projections. The article entitled "Kymogram detection and Kymogram-correlated image

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reconstruction from subsecond spiral computed tomography scans of the heart", by Kachelriess et al., Med. Phys. 29 (7), July 2002, p. 1489 to 1503, gives an example.

Please replace the second full paragraph of page 8, with the following:

Time ~~synchronisation~~ synchronization could then have been applied to these state images rather than to measurement sets.

Please replace the fifth full paragraph of page 8, with the following:

This operator is assumed to be invariable throughout the examination period. It is also assumed that the time ~~synchronisation~~ synchronization is sufficiently precise and that the patient's movements (physiological) are reproducible.

Please replace the third full paragraph of page 9, with the following:

If this additional information h_t^{att} and h_t^{mi} is available at time t, then the complete set can be ~~minimised~~ minimized into a single function.

Please replace the second full paragraph of page 11, with the following:

Although this ~~synchronisation~~ synchronization method using a small number of phases is very practical, it is not essential for use of this invention that can be applied to a patient subjected to an arbitrary movement or a cyclic movement.

Please replace the third full paragraph of page 11, with the following:

Steps ~~E17 and E18~~ Et17 and Et18 illustrate that displacement fields can also be calculated using sensor measurements.

Please replace the second full paragraph of page 15, with the following:

This deformation is precisely the deformation required during the spatial ~~synchronisation~~ synchronization step.

Please replace the fourth full paragraph of page 15, with the following:

This partial ~~minimisation~~ minimization has been described above.

Please replace the last full paragraph of page 15, with the following:

In any case, the use of another reference imagery method remains necessary to compensate for the poor spatial resolution and the mediocre image quality (noisy and defined only in regions in which the radioactive product is fixed) which ~~characterise~~ characterize emission images and would result in poor quality displacement fields for areas of interest.

Please replace the Abstract, with the following:

Measurements of a mobile object and particularly a living being are made using two techniques, normally radiation attenuation and radiation emission, in ~~synchronisation~~ synchronization to provide images of the object state. Movement displacement fields from one phase to the next are estimated for both techniques, but the final images obtained by the emission technique are improved by the knowledge of the displacement field obtained by the other technique that is more precise.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-8 (Cancelled).

Claim 9 (New): A method of at least partial reconstruction of an image of a mobile object, comprising the following steps:

taking first measurements of the object with a first acquisition technique and obtaining a plurality of first images of the object at corresponding movement states of the object;

taking second measurements of the object with a second acquisition technique and obtaining a plurality of second images of the object at corresponding movement states of the object;

estimating a movement of the object according to a time from at least one of the plurality of second images;

estimating the movement of the object at said movement states from when the first measurements are taken;

combining the first images of the object so as to obtain a final image of the object at a reference time, and

compensating for movements of the object from the reference time to at least one of the movement states and in at least one of the first images, respectively.

Claim 10 (New): The method according to claim 9, wherein the first acquisition technique is a radiation emission imagery technique and the second acquisition technique is a radiation attenuation imagery technique.

Claim 11 (New): The method according to claim 9, wherein the movement states when the first measurements are taken are different from the movement states when the second measurements are taken, the method further comprising a step of time synchronization between the different movement states and the movements of the object.

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Claim 12 (New): The method according to claim 11, wherein the movement of the object is composed of cycles, wherein said movement states and said movements of the object are related to respective phases in one of said cycles in the time synchronization step.

Claim 13 (New): The method according to claim 11, wherein the time synchronization step is made by taking third measurements of the object using position measurement sensors, wherein the third measurements are related to both the first measurements and the second measurements.

Claim 14 (New): The method according to claim 9, further comprising estimating the movement of the object from movements of control points of the object, said movements of the control points being measured by further sensors, said control points being located at least in the second images.

Amendments to the Drawings:

Please replace FIG. 1 with the following replacement figure that is attached hereto.

No new matter has been added to the Figure.

REMARKS

Claims 1-8 were pending in the present application. Claims 1-8 have been cancelled. New claims 9-14 are added. Support for the new claims is found at least in the specification, Figures, and originally filed claims. No new matter has been added. Thus, claims 9-14 are now pending in the application.

Reexamination of the application and reconsideration of the objections and rejections are respectfully requested in view of the above amendments and the following remarks, which follow the order set forth in the Office Action.

Objections

A. Specification

(1) The disclosure was objected to because of informalities found on pages 1, 3-9, 11, and 15, regarding spellings of the following: "synchronisation", "ionising", "... the periphery of the object collect radiation ...", "isbn", "recognisable", "regularise", "generalised", "synchronise", "minimised", "minimisation", and "characterise."

Applicants are appreciative of the Examiner's careful review of the application. The above terms have been corrected as suggested by the Examiner. Thus, Applicants request withdrawal of this objection.

(2) The reference to the callout numbers Et17" and "Et18" of FIG. 1 have been corrected as suggested by the Examiner. Thus, Applicants respectfully request withdrawal of this objection.

B. Drawings

FIG. 1 was objected to because some parts of the words were written in French rather than in English. A Replacement Drawing Sheet has been provided with an English translation of the French text. Thus, Applicants request withdrawal of this objection.

C. Claims

New claims 9-14 do not include any of the objectionable terms.

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D. Abstract

The Abstract was objected to for containing the above spellings. The Abstract has been corrected as suggested by the Examiner. Thus, Applicants respectfully request withdrawal of this objection.

E. Title

The Title was objected to with regard to its length. The Title has been amended. Thus, Applicants respectfully request withdrawal of this objection.

Rejections under 35 U.S.C. § 102(b) are traversed

Claims 1-3, and 5-8 were rejected under 35 U.S.C. § 102(b) as being anticipated by De Murcia et al. (U.S. Patent No. 5,889,525; hereinafter "De Murcia"). Applicants respectfully traverse these rejections in the order they appear.

Amended claim 1 recites a method of at least partial reconstruction of an image of a mobile object. The method comprises the following steps:

taking first measurements of the object with a first acquisition technique and obtaining a plurality of first images of the object at corresponding movement states of the object;

taking second measurements of the object with a second acquisition technique and obtaining a plurality of second images of the object at corresponding movement states of the object;

estimating a movement of the object according to a time from at least one of the plurality of second images;

estimating the movement of the object at said movement states from when the first measurements are taken;

combining the first images of the object so as to obtain a final image of the object at a reference time, and

compensating for movements of the object from the reference time to at least one of the movement states and in at least one of the first images, respectively.

De Murcia discloses a process for the reconstruction of three-dimensional images of a mobile or deformable object. *Col. 1, lines 7-8.* An approximate image of the object in each state "f" is reconstituted; a reference state to each of the states are evaluated; the estimation of the image of the object at the reference state is obtained by a convergence towards the

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information relative to the measurements and to the previously calculated movements of the objects. *Abstract; FIG. 1.* The process of De Murcia comprises taking a series of sets of measurements of a characteristic property of the object by a two-dimensional array of mobile sensors around the object, the sets of measurements consisting of a two-dimensional array of projections of the property on the sensors, the sets of measurements being taken at a group of different states of the object with respect to the variations in the position or shape of the object. *Col. 2, lines 56-63; FIG. 2.* De Murcia details the process of mathematically manipulating a series of sets of successive measurements in col. 3, through col. 4, using a series of calculations governed by defined equations (2)-(7). De Murcia discloses that:

> The performance of all these calculations makes it necessary to find the deformation operator D_{k+1}. For this purpose use is made of the previously obtained image estimate f_0^k and an approximate image f^{k+1} of the object at state k+1 with the aid of projections m_{k+1} taken into consideration, using a conventional three-dimensional image reconstruction algorithm, known as reprojection, with respect to the filtered projections.

Col. 4, line 63, through col. 5, line 3 (emphasis added).

De Murcia further discloses that:

> In the case of the heart muscle, this reference frame has for its origin and for directional axes the centre C and the major axes of an ellipsoid used for modelling the barycentric surface of the heart muscle between its inner and outer surfaces (endocardium and pericardium). This surface can be defined in spherical coordinates for the tip or apex of the heart and cylindrical coordinates for the base of the heart. This system of coordinates is designated (ρ,φ) by the equation:

$$\rho G(\varphi G, .) = \frac{\int_0^{\rho_{max}} a(\rho, \varphi G, .)\rho d\rho}{\int_0^{\rho_{max}} a(\rho, \varphi G, .)d\rho} \quad (9)$$

> in which $a(\rho, \varphi G,.)$ designates the emission activity at the coordinate point ($\rho 100$ G,.) and ρmax designates the maximum scanning distance. For any angular coordinate (ρ, φG,.), the point of the barycentric surface consequently has the radial coordinate φG.

Col. 4, line 63, through col. 5, line 3 (emphasis added).

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De Murcia does not teach or fairly suggest a second measurement acquisition technique or estimating a movement of the object according to a time from at least one of the plurality of second images obtained using a second acquisition technique. De Murcia also does not teach or fairly suggest estimating a movement of the object according to a time from at least one of the plurality of second images.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).*

A. In the Action, it is asserted that claim 1 is anticipated because the disclosure of De Murcia "implies the reconstruction of the image is from at least a combination of states retrieved by at least two independent techniques (abstract, Fig. 2.)" *Office Action mailed January 10, 2007, page 4 through page 5.* Applicants respectfully disagree.

With respect to the new claims 9-14, De Murcia does not teach or fairly suggest another independent acquisition technique. In contrast, De Murcia teaches only a mono-photon emission tomography process (MPET) using an array of mobile sensors or transducers. *Col. 3, lines 25-42; FIG. 1.* With regard to FIG. 2, De Murcia discloses a two-dimensional array of sensors or transducers 3, which are collimated in the same direction. *Col. 3, lines 27-30; FIG.2.* FIG. 2 of De Murcia does not depict or fairly suggest at least two independent acquisition techniques as asserted in the Action. De Murcia discloses "sensors having different incidences taking a series of sets of measurements synchronized on a given group of states of the heart or the phases of its cycle." *Col. 3, lines 36-39.* One of ordinary skill in the art would not interpret "sensors having different incidences and taking different sets of measurements" as different, but only as having different spatial positions about an object based on a fair understanding of FIG. 2 and its description. Moreover, as disclosed in equation 9 of De Murcia, only one acquisition function is recited, the function representing an "emission activity," which is consistent with FIG. 1 of De Murcia. *Col. 6, lines 5-17; FIG. 1.* Therefore, De Murcia does not teach or fairly suggest all the elements of claim 1. Thus, Applicants respectfully request withdrawal of this rejection.

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B. Claims 2 and 3 were rejected as anticipated by De Murcia. The Action states:

> De Murcia discloses that the sensors, which have different incidences and take different series of sets of measurements, synchronizes on a given group of states of the heart or phases of its cycle (col. 3, lines 36-39), which can be interpreted as a spatial synchronization process.
> *Office Action mailed January 10, 2007, page 5.*

Applicants respectfully disagree. With respect to new claim 11, De Murcia does not teach or fairly suggest the use of first and second acquisition technique measurements and time synchronization between the movement states and the movements of the object. As required by claim 11, the movement states when the first measurements are taken are different from the movement states when the second measurements are taken. As required by claim 12, the movement states and the movements of the object are related to respective phases in one of the cycles in the time synchronization step. In contrast, De Murcia fairly discloses using only one acquisition technique, a mono-photon emission tomography process (MPET). *Col. 3, lines 25-42; col. 6, lines 5-17; FIG. 1.* Therefore, De Murcia does not teach or fairly suggest all the elements of claims 11-12. Thus, Applicants respectfully request withdrawal of this rejection.

C. Claims 5 and 6 were rejected as anticipated by De Murcia. In the Action, it is asserted that:

> De Murcia discloses that the sensor does a synchronization of states of the heart or the phases of its cycles for series (col. 3, lines 36-39) of sets of successive measurements corresponding to different states of objects (col. 3, lines 49-51).
> *Office Action mailed January 10, 2007, page 6.*

Applicants respectfully disagree. With respect to new claim 12, De Murcia does not teach or fairly suggest the use of first and second acquisition technique measurements and where the movement of the object is composed of cycles. In contrast, De Murcia discloses using only one acquisition technique. *Col. 3, lines 25-42; col. 6, lines 5-17; FIG. 1.* Therefore, De Murcia does not teach or fairly suggest all the elements of claim 12. Thus, Applicants respectfully request withdrawal of this rejection.

D. Claims 7 and 8 were rejected as anticipated by De Murcia. The Action states:

> De Murcia discloses sensors having different incidences taking a series of sets of measurements synchronized on a given group of states of the heart or the phases of its cycle (col. 3, lines 36-39). De

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Volkswagen v. Longhorn - IPR2025-00925

> Murcia also discloses an estimation of deformations, which a reference state to each of the states is evaluated (abstract; Fig. 2).
> *Office Action mailed January 10, 2007, page 6.*

Applicants respectfully disagree. With regard to new claim 13, De Murcia does not teach or fairly suggest the use of a first and second acquisition technique measurements and taking third measurements of the object using position measurement sensors. The third measurements are related to both the first measurements and the second measurements, as required in claim 13. With regard to new claim 14, De Murcia does not teach or fairly suggest the use of a first and second acquisition technique measurements and estimating the movement of the object from movements of control points of the object, the movements of the control points being measured by further sensors, the control points being located at least in the second images, as required in claim 14. In contrast, De Murcia discloses using only one acquisition technique. *Col. 3, lines 25-42; col. 6, lines 5-17; FIG. 1.* Therefore, De Murcia does not teach or fairly suggest all the elements of claims 13-14. Thus, Applicants respectfully request withdrawal of this rejection.

Because De Murcia does not teach each and every element of claim 9 and dependent claims 10-14, for at least the reasons stated above, Applicants respectfully request reconsideration and withdrawal of the rejection.

Rejections under 35 USC § 103 are traversed

Claims 1 and 4 were rejected under 35 U.S.C. § 103(a) as being unpatentable over De Murcia in view of Beyer et al, *IEEE, (1995) 4: 1573-77* (herein after referred to as "Beyer"). Applicants respectfully traverse.

New claim 10 requires the first acquisition technique is a functional radiation emission imagery technique and the second acquisition technique is an anatomic radiation attenuation imagery technique.

De Murcia was discussed above. Beyer discloses evaluating the use of X-ray CT data for attenuation correction of PET data. *Abstract.* Beyer discloses the testing of two methods, scaling and segmentation methods, with data acquired from separate PET and CT scans of a phantom with regions of different densities. Beyer discloses:

> Additional advantages of accurate geometrical information from a combined scanner include the potential for (1) rapidly-acquired,

> low-noise transmission scans for PET attenuation correction, (2) transmission scans performed post-injection, (3) the use of model-based scatter correction methods, and (4) the use of *a priori* information to help guide the PET image reconstruction process.
> *INTRODUCTION, page 1573.*

Beyer also discloses:

> The basic procedure by which the attenuation correction is performed in volume-imaging PET is as follows: (1) acquisition in 2D mode (with septa extended) of a blank and transmission scan, (2) acquisition in 3D mode (with septa retracted) of an emission scan, (3) reconstruction of the 2D transmission scan into a stacked set of transmission images (4) calculation of the attenuation correction factors (ACFs) by forward-projection of the transmission images into sinograms, followed by exponentiation, (5) correction of the 3D emission sinograms by multiplication with the 3D ACF sinograms.
> *ATTENUATION CORRECTION METHODS, page 1573.*

Beyer discloses the scaling and segmentation methods of attenuation correction by acquiring separate CT and PET scans of a "NEMA-PET phantom," which is depicted in figure 3, and comprises three inserts, which are axially uniform but have large transaxial variations in attenuation. *METHODS, page 1575; Figure 3.*

Beyer does not teach or fairly suggest the use of a different acquisition technique to estimate movement of the object states. Beyer also does not teach or fairly suggest the compensation for movement of the object from the reference time to each of the first states and in each of the first images, respectively using different acquisition techniques.

"The prior art reference (or references when combined) must teach or suggest all the claim limitations." *MPEP § 2143.*

The Action acknowledges De Murcia does not disclose a system using functional radiation emission imagery technique and an anatomic radiation attenuation imagery technique as recited in claim 4. In combining Beyer with De Murcia to remedy this deficit, the Action asserts that "[t]he motivation would have been to make it possible to acquire rapidly and low-noise transmission scans for PET attenuation correction and to use [of] *a priori* information to help guide the PET image reconstruction process as suggested by Beyer (page 1573). *Office Action mailed January 10, 2007, page 7.* Applicants respectfully disagree.

De Murcia does not teach or fairly suggest all the features of new claim 9, specifically, the use of a different acquisition technique to estimate movement of the object states, or compensating for movements of the object from the reference time to at least one of the movement states and in at least one of the first images, respectively, as required by claim 9. Beyer fails to remedy the deficit in De Murcia because the process of Beyer also fails to teach or suggest the compensating for movements of the object from the reference time to at least one of the movement states and in at least one of the first images, respectively. In contrast, Beyer teaches processes performed on a stationary object, the NEMA-PET phantom. *METHODS, page 1575*. Therefore, there would be no motivation to combine Beyer with De Murcia as each reference, alone and in combination, fail to teach each and every element of the claim. Thus, Applicants respectfully request reconsideration and withdrawal of the rejection.

For the foregoing reasons, claims 9-14 are considered allowable. A Notice to this effect is respectfully requested. If any questions remain, the Examiner is invited to contact the undersigned at the number given below.

Respectfully submitted,

HUTCHISON LAW GROUP PLLC

Date: July 10, 2007

By: _____
Christopher J. Knors
Registration No. 45,569

P.O. Box 31686
Raleigh, NC 27612
+1.919.829.9600

1 / 2

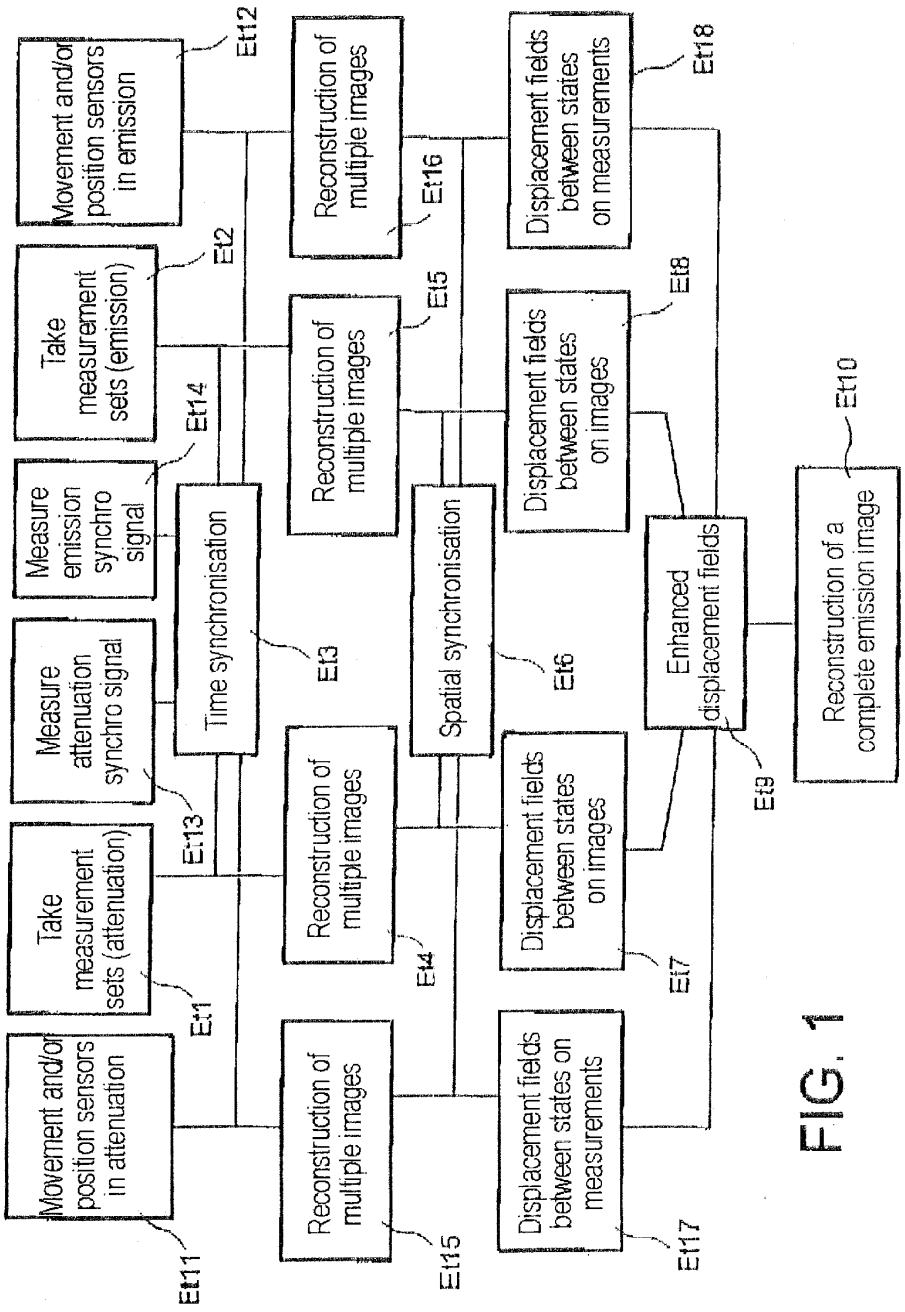

Movement and/or position sensors in emission
Et12
Take measurement sets (emission)
Et2
Measure emission synchro signal
Et14
Measure attenuation synchro signal
Et13
Take measurement sets (attenuation)
Et1
Movement and/or position sensors in attenuation
Et11
Time synchronisation
Et3
Reconstruction of multiple images
Et5
Reconstruction of multiple images
Et4
Reconstruction of multiple images
Et15
Spatial synchronisation
Et6
Displacement fields between states on images
Et8
Displacement fields between states on images
Et7
Displacement fields between states on measurements
Et17
Displacement fields between states on measurements
Et18
Enhanced displacement fields
Et9
Reconstruction of a complete emission image
Et10

FIG. 1

Electronic Patent Application Fee Transmittal

Application Number:	10955037
Filing Date:	30-Sep-2004
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Filer:	Christopher J. Knors/Jennie Snead
Attorney Docket Number:	BRV.10002

Filed as Large Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with $0 paid	1253	1	1020	1020

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**1020**

Volkswagen Exhibit 1037, Page 677 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt	
EFS ID:	1956662
Application Number:	10955037
International Application Number:	
Confirmation Number:	4535
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Customer Number:	45473
Filer:	Christopher J. Knors/Jennie Snead
Filer Authorized By:	Christopher J. Knors
Attorney Docket Number:	BRV.10002
Receipt Date:	10-JUL-2007
Filing Date:	30-SEP-2004
Time Stamp:	16:08:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment was successfully received in RAM	$1020
RAM confirmation Number	1111
Deposit Account	503218
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 and 1.17	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1		BRV10002Amendment.pdf	1575955 9a7215a326b0d320daab7611f863b96467ca15ca	yes	19

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Miscellaneous Incoming Letter	1	1
Extension of Time	2	2
Amendment - After Non-Final Rejection	3	3
Specification	4	7
Claims	8	9
Drawings	10	10
Applicant Arguments/Remarks Made in an Amendment	11	18
Drawings	19	19

Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8208 1de357fdd9e33d6d10bd709e6701ff97508b400f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1584163		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Volkswagen Exhibit 1037, Page 680 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/21 (04-07)
Approved for use through 09/30/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Total Number of Pages in This Submission: 19

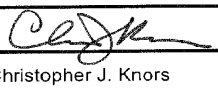
Application Number	10/955,037
Filing Date	September 30, 2004
First Named Inventor	Stephane BONNET
Art Unit	2112
Examiner Name	John W. Lee
Attorney Docket Number	BRV.10002

ENCLOSURES (Check all that apply)

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☑ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☑ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
  - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
- ☐ Terminal Disclaimer
- ☐ Request for Refund
- ☐ CD, Number of CD(s) _____
  - ☐ Landscape Table on CD
- ☐ After Allowance Communication to TC
- ☐ Appeal Communication to Board of Appeals and Interferences
- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
- ☐ Status Letter
- ☐ Other Enclosure(s) (please Identify below):

Remarks: The Director is hereby authorized to charge any appropriate fees that may be required by this paper, and to credit any overpayment, to Deposit Account No. 50-3218.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Hutchison Law Group PLLC		
Signature			
Printed name	Christopher J. Knors		
Date	July 10, 2007	Reg. No.	45,569

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below:

Signature			
Typed or printed name		Date	

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and1.14. This collection is estimated to 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/22 (09-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARMENT OF COMMERCE
Under the paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless if displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) **FY 2006** *(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)*	Docket Number (Optional) BRV.10002
Application Number 10/955,037	Filed September 30, 2004
For Method of Reconstructing an Image With Data Acquisition According to	
Art Unit 2112	Examiner John W. Lee

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$120	$60	$
☐	Two months (37 CFR 1.17(a)(2))	$450	$225	$
☑	Three months (37 CFR 1.17(a)(3))	$1020	$510	$ 1020
☐	Four months (37 CFR 1.17(a)(4))	$1590	$795	$
☐	Five months (37 CFR 1.17(a)(5))	$2160	$1080	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-3218. I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed (Form PTO/SB/96).

☑ attorney or agent of record. Registration Number 45,569

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____


Signature

July 10, 2007
Date

Christopher J. Knors
Typed or printed name

+1.919.829.9600
Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of _____ forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

10955039

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2003

Application or Docket Number
10955039

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	8	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	8 minus 20= *	-
INDEPENDENT CLAIMS	1 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT	☐	

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	385.00	OR	BASIC FEE	770.00
XS 9=		OR	XS18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL		OR	TOTAL	720

9/30/2004

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 8	Minus	** 20	= X
Independent	* 1	Minus	*** 3	= X
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM	☐			

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	X
X43=		OR	X86=	X
+145=		OR	+290=	X
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	0

1,10,07

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 6	Minus	** 20	= 0
Independent	* 1	Minus	*** 3	= 0
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM	☐			

		OR		
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM	☐			

		OR		
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X43=		OR	X86=	
+145=		OR	+290=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 10/03)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	BRV.10002	4535

45473 7590 09/13/2007
HUTCHISON LAW GROUP PLLC
PO BOX 31686
RALEIGH, NC 27612

EXAMINER	
LEE, JOHN W	
ART UNIT	PAPER NUMBER
2624	
MAIL DATE	DELIVERY MODE
09/13/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	John Wahnkyo Lee	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) *1-8* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *9-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The response received on 13 July 2007 has been placed in the file and was considered by the examiner. An action on the merits follows.

Response to Amendment

2. The applicant's amendments filed on 13 July 2007 have been fully considered.

Objections

A. Specification

Applicant's arguments to the objection to the specification have been fully considered and are persuasive. The objection to the specification is hereby withdrawn.

B. Drawings

Applicant's arguments to the objection to the drawings have been fully considered and are persuasive. The objection to the drawings is hereby withdrawn.

C. Claims

Applicant's arguments to the objection to the claims have been fully considered and are persuasive. The objection to the claims is hereby withdrawn.

D. Abstract

Applicant's arguments to the objection to the abstract have been fully considered and are persuasive. The objection to the abstract is hereby withdrawn.

E. Title

Applicant's arguments to the objection to the title have been fully considered and are persuasive. The objection to the title is hereby withdrawn.

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Volkswagen v. Longhorn - IPR2025-00925

Response to Arguments

3. Applicant's arguments filed on 13 July 2007 have been fully considered, but are not persuasive.

4. Applicant's arguments with respect to claims 9-14 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 1 recites the limitations, "first image" and "second image." There is insufficient antecedent basis for this limitation in the claim. The examiner is not sure what these terms are pointing out wants the applicant to clarify these terms.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 9, 11-14 are rejected under 35 U.S.C. 102(b) as being anticipated by De Murcia et al. (US 5,889,525).

Regarding claim 9, De Murcia discloses a method of at least partial reconstruction of an image of a mobile object (col.1, lines 6-7), comprising the following

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Volkswagen v. Longhorn - IPR2025-00925

steps: taking first measurements (abstract; col. 2, lines 56-57; claims 1 and 2, "sets of measurements") of the object with a first acquisition technique (col. 2, lines 56-64, "two dimensional array of projections") and obtaining a plurality of first images of the object at corresponding movement states of the object (abstract; claim 1); taking second measurements (abstract; col. 2, lines 56-57; claims 1 and 2, "sets of measurements") of the object with a second acquisition technique (col. 2, lines 56-64, "two dimensional array of projections") and obtaining a plurality of second images of the object at corresponding movement states of the object (abstract; claim 1); estimating a movement of the object according to a time from at least one of the plurality of second images (col. 4, lines 10-25, " $\hat{f}^{k+1}$ "; claim 2, "obtaining an approximate image ..." and "evaluating ..."); estimating the movement of the object at said movement states from when the first measurements are taken (col. 4, lines 10-25, " $\hat{f}^{k+1}$ "; claim 2, "obtaining an approximate image ..." and "evaluating ..."); combining the first images of the object so as to obtain a final image of the object at a reference time (col. 5, lines 13-18), and compensating for movements of the object from the reference time to at least one of the movement states and in at least one of the first images, respectively (col. 5, lines 13-18; claim 1, "m_k" and "D_k")

Regarding claim 11, De Murcia discloses the movement states when the first measurements are taken are different from the movement states when the second measurements are taken (abstract, "sets of measurements ... different states of the object"; col. 3, lines 49-51), the method further comprising a step of time

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Volkswagen v. Longhorn - IPR2025-00925

synchronization between the different movement states and the movements of the object (col. 3, lines 38-43, "synchronized").

Regarding claim 12, De Murcia discloses that the movement of the object is composed of cycles, wherein said movement states and said movements of the object are related to respective phases in one of said cycles in the time synchronization step (col. 3, lines 38-43, "phase of its cycle").

Regarding claim 13, De Murcia discloses that the time synchronization step is made by taking third measurements of the object using position measurement sensors (col. 3, lines 36-38, "sensors ... measurements") wherein the third measurements (col. 3, line 37, "sets of measurements") are related to both the first measurements and the second measurements (col. 3, lines 36-43).

Regarding claim 14, De Murcia discloses comprising estimating the movement of the object from movements of control points (claims 1 and 2, "a two dimensional array") of the object, said movements of the control points being measured by further sensors (claims 1 and 2, "sensors"), said control points being located at least in the second images (claims 1 and 2).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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Volkswagen v. Longhorn - IPR2025-00925

10. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over De Murcia et al. (US 5,889,525) in view of Townsend et al. (US 2003/0004405).

Regarding claim 10, De Murcia discloses all the previous claim limitations except the ones recited in claim 10. However, Townsend discloses that the first acquisition technique is a radiation emission imagery technique (abstract; claim 1, "PET is an example of a system using functional radiation emission imagery technique") and the second acquisition technique is a radiation attenuation imagery technique (abstract; claim 1, "CT is an example of a system using an anatomic radiation attenuation imagery technique").

It would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made to use Townsend's invention in De Murcia's invention to obtain satisfactory imaging results as suggested by De Murcia (col. 2, lines 44-55).

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Wahnkyo Lee whose telephone number is (571) 272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on (571) 272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

John W. Lee
(AU 2624)

JINGGE WU
SUPERVISORY PATENT EXAMINER

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Volkswagen v. Longhorn - IPR2025-00925

Notice of References Cited	Application/Control No. 10/955,037	Applicant(s)/Patent Under Reexamination BONNET ET AL.	
	Examiner John Wahnkyo Lee	Art Unit 2624	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,889,525 A	03-1999	De Murcia et al.	345/420
*	B	US-2003/0004405 A1	01-2003	Townsend et al.	600/407
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/27/2006	09/07/2007							
	1	✓	-							
	2	✓	-							
	3	✓	-							
	4	✓	-							
	5	✓	-							
	6	✓	-							
	7	✓	-							
	8	✓	-							
9			✓							
10			✓							
11			✓							
12			✓							
13			✓							
14			✓							

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application Nos.:
07/310,726; 08/185,472; 08/390,087;
10/955,037; 08/065,142; 08/338,570;
08/761,757; 08/975,459; 09/438,367;
09/583,746; 10/312,489; 10/480,742

Customer No.: 30678

Revocation and Power of Attorney

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

All previous powers of attorney and authorizations of agent are hereby revoked, and the undersigned hereby appoints the attorneys and agents of Connolly Bove Lodge & Hutz LLP associated with U.S. Patent and Trademark Office ("PTO") Customer Number 30678 to prosecute these applications and any U.S., foreign, or international applications under the Patent Cooperation Treaty based on them and to transact all business in the PTO connected therewith, and to receive all communications from the PTO, including the patent documents. Further details about each application are found in the Appendix to this paper. The authority under this Power of Attorney of each person listed under the aforementioned PTO Customer Number shall automatically terminate and be revoked upon such person ceasing to be associated with Connolly Bove Lodge & Hutz LLP.

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Designation of Correspondence Address

Please send all notices, official letters, documents, communications, and other correspondence regarding these applications to:

Connolly Bove Lodge & Hutz LLP
1875 Eye Street NW, Suite 1100
Washington, DC 20006

or to the address currently associated with PTO Customer Number 30678. Please also record the respective Attorney Docket Numbers in the attached appendix in any applicable databases.

Certificate Under 37 C.F.R. § 3.73(b)

Intellectual Ventures Fund 23 LLC is the assignee of the entire right, title, and interest in these patents and applications by virtue of an assignment from Commissariat a l'Energie Atomique to Intellectual Ventures Fund 23 LLC, recorded in the records of the PTO on January 17, 2008 at Reel 020371, Frame 0692. To the best of the undersigned's knowledge and belief, the titles are in the name of said assignee. The undersigned, whose title is supplied below, is empowered to sign this certificate on behalf of Intellectual Ventures Fund 23 LLC.

Signed: _____ Date: 1-30-08
Name: Joe Kosiara
Title: Authorized Person
Intellectual Ventures Fund 23 LLC

LAG-VW00000695

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APPENDIX: DETAILS OF LISTED APPLICATIONS

Appln. No.	Confirmation No.	Patent No.	Filing Date	First Named Inventor	Title	Attorney Docket No.
07/310,726	1706	5,124,914	01-09-1989	Pierre GRANGEAT	METHOD AND DEVICE FOR OBTAINING TRIDIMENSIONAL OPTICAL IMAGE FORMATION FROM BIDIMENSIONAL MEASUREMENTS OF ATTENUATION OF RADIATION THROUGH AN OBJECT	27592-00934-US
08/185,472	3004	5,406,478	01-24-1994	Pierre GRANGEAT	METHOD FOR RECONSTRUCTING THREE-DIMENSIONAL IMAGES OF A CHANGING OBJECT	27592-00954-US
08/390,087	6630	5,574,333	02-17-1995	Jean-Fredric CLERC	METHOD FOR MANUFACTURING A CATHODE FOR FLUORESCENT DISPLAY SCREENS OF THE MICRO-TIP TYPE	27592-00964-US
10/955,037	4535	N/A	09-30-2004	Stephane BONNET	METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATIO N OF IMAGE SERIES	27592-00987-US
08/065,142	2958	5,408,511	05-21-1993	Pierre GRANGEAT	PROCESS FOR THE RECONSTRUCTION OF THREE-DIMENSIONAL IMAGES OF AN OBJECT BY MEASUREMENTS USING A CONICAL RADIATION AND A BIDIMENSIONAL DETECTOR ARRAY	27592-00958-US

LAG-VW00000696

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Volkswagen v. Longhorn - IPR2025-00925

Appln. No.	Confirmation No.	Patent No.	Filing Date	First Named Inventor	Title	Attorney Docket No.
08/338,570	3064	5,638,091	11-17-1994	Denis SARRASIN	PROCESS FOR THE DISPLAY OF DIFFERENT GREY LEVELS AND SYSTEM FOR PERFORMING THIS PROCESS	27592-00927-US
08/761,757	1149	5,862,397	12-05-1996	Hassane ESSAFI	ARRAY SYSTEM ARCHITECTURE OF MULTIPLE PARALLEL STRUCTURE PROCESSORS	27592-00971-US
08/975,459	9586	6,115,413	11-21-1997	Didier LATTARD	PROCESS FOR THE TRANSMISSION OF INFORMATION BY PULSE RESPONSE AND THE CORRESPONDING RECEIVER	27592-00978-US
09/438,367	9219	6,296,387	11-12-1999	Regis GUILLEMAUD	METHOD FOR CORRECTING IMAGE DEFECTS FROM A MATRIX-TYPE X OR Y-RAY DETECTOR	27592-00981-US
09/583,746	4147	6,748,007	05-31-2000	Didier LATTARD	METHOD OF PROCESSING A PULSE RESPONSE WITH AN ADAPTIVE THRESHOLD AND CORRESPONDING RECEIVER	27592-00984-US
10/312,489	9090	6,877,986	07-18-2003	Raymond FOURNIER	ELEMENT WITH EXPANSIBLE RELIEF	27592-00985-US
10/480,742	7379	6,888,915	12-11-2003	Anne KOENIG	METHOD FOR RECONSTRUCTION OF AN IMAGE OF A MOVING OBJECT	27592-00986-US

587521

LAG-VW00000697

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Volkswagen v. Longhorn - IPR2025-00925

Electronic Acknowledgement Receipt

EFS ID:	2794647
Application Number:	10955037
International Application Number:	
Confirmation Number:	4535
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Customer Number:	45473
Filer:	Jeffrey W. Gluck
Filer Authorized By:	
Attorney Docket Number:	BRV.10002
Receipt Date:	31-JAN-2008
Filing Date:	30-SEP-2004
Time Stamp:	13:16:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	PoACEA2007.pdf	95793 a49489b336ecaba2bfc93bb6e75b2accddbbb361	no	4

Warnings:	
Information:	

Total Files Size (in bytes):	95793

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/955,037	09/30/2004	Stephane Bonnet	27592-00987- US

CONFIRMATION NO. 4535

30678
CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20036

POA ACCEPTANCE LETTER

OC000000028148219

Date Mailed: 02/07/2008

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/31/2008.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/sibrahim/

Office of Initial Patent Examination (571) 272-4000 or 1-800-PTO-9199

LAG-VW00000700

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Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/955,037	09/30/2004	Stephane Bonnet	BRV.10002

CONFIRMATION NO. 4535

45473
HUTCHISON LAW GROUP PLLC
PO BOX 31686
RALEIGH, NC 27612

POWER OF ATTORNEY NOTICE

OC000000028148183

Date Mailed: 02/07/2008

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/31/2008.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/sibrahim/

Office of Initial Patent Examination (571) 272-4000 or 1-800-PTO-9199

LAG-VW00000701

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Volkswagen v. Longhorn - IPR2025-00925

PTO/SB/30EFS (08/06)
Approved for use through 08/31/2006. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	10955037	Filing Date	2004-09-30	Docket Number (if applicable)	27592-00987-US	Art Unit	2624
First Named Inventor	Stephane Bonnet			Examiner Name	John W. Lee		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other _____

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 220185

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

Signature of Registered U.S. Patent Practitioner			
Signature	/Jeffrey W. Gluck/	Date (YYYY-MM-DD)	2008-03-07
Name	Jeffrey W. Gluck, Ph.D.	Registration Number	44457

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Docket No.: 27592-00987-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Stephane BONNET et al.

Application No.: 10/955,037 | Confirmation No.: 4535

Filed: September 30, 2004 | Art Unit: 2624

For: METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES | Examiner: John W. Lee

RESPONSE TO FINAL OFFICE ACTION

MS RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action dated September 13, 2007, Applicants submit the following response. While Applicants believe that no fees are due other than those that may be indicated on an accompanying paper, if further fees are due, or if an overpayment has been made, such fees are authorized to be charged to, or such overpayment credited to, Deposit Account No. 22-0185, from which the undersigned is authorized to draw, under Order No. 27592-00987-US.

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Volkswagen v. Longhorn - IPR2025-00925

Amendments

Applicants request entry of the amendments found on the following pages. In particular:

Amendments to the Claims may be found beginning at page 3 of this paper; and

Remarks may be found beginning at page 8 of this paper.

LAG-VW00000706

Volkswagen Exhibit 1037, Page 706 of 2532
Volkswagen v. Longhorn - IPR2025-00925

Amendments to the Claims

The following listing of claims shall replace any and all previous listings of the claims in this application.

Listing of Claims:

1.-14. (Cancelled)

15. (New) A method of forming an image of a mobile object, comprising:

obtaining a plurality of first images of the mobile object using a first imaging technique and an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements.

16. (New) The method of Claim 15, further comprising:

time-synchronizing said first measurements and said second measurements.

17. (New) The method of Claim 15, further comprising:

forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

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18. (New) The method of Claim 17, further comprising:

spatially-synchronizing said first reconstructed images and said second reconstructed images.

19. (New) The method of Claim 15, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

20. (New) The method of Claim 15, further comprising:

spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements.

21. (New) The method of Claim 15, further comprising:

forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

22. (New) The method of Claim 21, wherein said forming an image of the mobile object comprises combining said displacement fields.

23. (New) The method of Claim 21, wherein said forming displacement fields comprises:

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estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

24. (New) The method of Claim 23, wherein at least one of said movement estimates is formed relative to a reference time.

25. (New) The method of Claim 15, wherein said plurality of first measurements and said plurality of second measurements are taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images.

26. (New) An apparatus to form an image of a mobile object, comprising:

means for obtaining a plurality of first images of the mobile object using a first imaging technique;

means for obtaining an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

means for obtaining a plurality of second images of the mobile object using a second imaging technique;

means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

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means for forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements.

27. (New) The apparatus of Claim 26, further comprising:

means for forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

28. (New) The apparatus of Claim 26, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

29. (New) The apparatus of Claim 26, further comprising:

means for forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

30. (New) The apparatus of Claim 29, wherein said means for forming an image of the mobile object comprises means for combining said displacement fields.

31. (New) The apparatus of Claim 29, wherein said means for forming displacement fields comprises:

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means for estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

32. (New) The apparatus of Claim 31, wherein at least one of said movement estimates is to be formed relative to a reference time.

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REMARKS

Applicants thank the Examiner for his careful consideration of this application. Applicants respectfully request reconsideration of this application in view of the above amendments and the following remarks.

Claims 15-32 are now pending in this application, of which Claims 15 and 26 are the independent claims. Claims 1-8 were previously cancelled (without prejudice), and Claims 9-14 are now cancelled without prejudice. It is respectfully submitted that new Claims 15-32 are supported at least by the claims as originally filed, by Fig. 1, and by the specification, in general.

At page 3, the Office Action rejects Claim 1 under 35 U.S.C. § 112, second paragraph, as being indefinite. It is respectfully submitted that this rejection is moot, given the previous cancellation of Claim 1.

At pages 3-5, the Office Action rejects Claims 9 and 11-14 under 35 U.S.C. § 102(b) as being anticipated by DeMurcia et al. (U.S. Patent No. 5,889,525). At page 6, the Office Action rejects Claim 10 under 35 U.S.C. § 103(a) as being unpatentable over DeMurcia et al. in view of Townsend et al. (U.S. Patent Application Publication No. 2003/004405). Applicants respectfully submit that these rejections are moot in view of the cancellation of Claims 9-14.

Applicants note that new independent Claims 15 and 26 now recite the obtaining of pluralities of first images and associated first measurements and second images and associated second measurements and the combination of these images and measurements to obtain an image of a mobile object. The Office Action relies primarily on DeMurcia et al. to reject the previously-presented (and now-cancelled) claims. However, DeMurcia et al., noting, e.g., the abstract and Fig. 2, is directed to a process in which estimation of deformations of an object for which a three-dimensional image is to be formed are used to form a series of deformation

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images, relative to a reference image, and the multiple images formed in this fashion are combined to form a three-dimensional image of the object. It is noted that this lacks numerous elements of the claimed invention, for example, obtaining two sets of images using two imaging techniques and obtaining sets of measurements respectively associated with each set of images. It is also noted that the secondary reference, Townsend et al., fails to disclose or suggest such features. For at least these reasons, it is respectfully submitted that new Claims 15-32 are allowable over the cited references.

Applicants may not have presented all possible arguments or have refuted the characterizations of either the claims or the prior art as may be found in the Office Action. However, the lack of such arguments or refutations is not intended to act as a waiver of such arguments or as concurrence with such characterizations.

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Conclusion

Applicants believe that the above amendments and remarks address all of the grounds for rejection and place the application in condition for allowance. Applicants, therefore, respectfully request prompt and favorable consideration of this Response and reconsideration of this application.

If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, he is invited to telephone the undersigned at the number provided.

Dated: March 7, 2008

Respectfully submitted,

/Jeffrey W. Gluck/
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CB-591180

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Volkswagen Exhibit 1037, Page 714 of 2532
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Electronic Patent Application Fee Transmittal

Application Number:	10955037
Filing Date:	30-Sep-2004
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Filer:	Jeffrey W. Gluck
Attorney Docket Number:	27592-00987- US

Filed as Large Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 3 months with $0 paid	1253	1	1050	1050

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	1801	1	810	810
		Total in USD ($)		**1860**

Electronic Acknowledgement Receipt

EFS ID:	2965007
Application Number:	10955037
International Application Number:	
Confirmation Number:	4535
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Customer Number:	30678
Filer:	Jeffrey W. Gluck
Filer Authorized By:	
Attorney Docket Number:	27592-00987- US
Receipt Date:	07-MAR-2008
Filing Date:	30-SEP-2004
Time Stamp:	13:39:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1860
RAM confirmation Number	9502
Deposit Account	220185
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)

1	Extension of Time	EoT_3_7_08.pdf	43061 ad5bd1e30d08ace8a468075610cafa0b6a2cdb7b	no	1
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	RCE_3_7_08.pdf	641409 c670eb88671e3ebb68b9b0953810c01dd5027bf0	no	3
Warnings:					
Information:					
3		RCEAmdt_3_7_08.pdf	255952 26d2cb55821abb6dca5727fbddafee8f87e8e943	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment Submitted/Entered with Filing of CPA/RCE	1	2
	Claims	3	7
	Applicant Arguments/Remarks Made in an Amendment	8	10

Warnings:					
Information:					
4	Fee Worksheet (PTO-06)	fee-info.pdf	8358 b31af9a0ab21c591257a8f7dc428280ffa82032d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	948780		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/22 (10-07)
Approved for use through 10/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) FY 2006 (Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)	Docket Number (Optional) 27592-00987-US
Application Number 10/955,037	Filed September 30, 2004
For METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES	
Art Unit 2624	Examiner John W. Lee

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	
☐	One month (37 CFR 1.17(a)(1))	$120	$60	$
☐	Two months (37 CFR 1.17(a)(2))	$460	$230	$
☒	Three months (37 CFR 1.17(a)(3))	$1050	$525	$ 1050.00
☐	Four months (37 CFR 1.17(a)(4))	$1640	$820	$
☐	Five months (37 CFR 1.17(a)(5))	$2230	$1115	$

☐ Applicant claims small entity status. See 37 CFR 1.27.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 22-0185 . I have enclosed a duplicate copy of this sheet.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

I am the

☐ applicant/inventor.

☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96).

☒ attorney or agent of record. Registration Number 44,457

☐ attorney or agent under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 _____

/Jeffrey W. Gluck/	March 7, 2008
Signature	Date
Jeffrey W. Gluck	(202) 331-7111
Typed or printed name	Telephone Number

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below.

☐ Total of 1 forms are submitted.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/955,037	Filing Date 09/30/2004	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT	03/07/2008	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $ =		OR	X $50=	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $ =		OR	X $210=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/THERESA LINDSAY/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	27592-00987- US	4535

30678 7590 05/29/2008
CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20036

EXAMINER	
LEE, JOHN W	
ART UNIT	PAPER NUMBER
2624	
MAIL DATE	DELIVERY MODE
05/29/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	JOHN Wahnkyo LEE	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 March 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) *1-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 7 March 2008 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 15, 17, 21, 23, 25-27, 29, or 31recite the limitations, “first images”, “first imaging technique", "second images" and "second imaging technique". There is insufficient antecedent basis for these limitations in the claims.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-18, 20-24, 26-27 and 29-32 are rejected under 35 U.S.C. 102(b) as being anticipated by De Murcia et al. (US 5,889,525).

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Volkswagen v. Longhorn - IPR2025-00925

Regarding claim 15, De Murcia discloses a method of forming an image (col. 1, line 6-7, “reconstruction o three-dimensional images”) of a mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”), comprising: obtaining a plurality of first images (equation (2); col. 4; lines 1-8, “m_k”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) using a first imaging technique (col. 2, lines 56-64, “two dimensional array of projections”) and an associated plurality of first measurements (col. 2, lines 59-60; col. 4, lines 9-10) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) at movement states corresponding to movement states (col. 4, lines 7-8, “states k”) of said plurality of first images (equation (2); col. 4; lines 1-8, “m_k”); obtaining a plurality of second images (equation (2); col. 4; line 67, “m_{k+1}”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) using a second imaging technique (col. 2, lines 56-64, “two dimensional array of projections”) and an associated plurality of second measurements (col. 2, lines 59-60; col. 4, lines 9-10) of the mobile object at movement states corresponding to movement states (col. 4, line 67, “state k+1”) of said plurality of second images (equation (2); col. 4; line 67, “$m_{k=1}$”); and forming an image (fig. 2, “object reconstructed” and "$\hat{f}_o$") of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated

plurality of second measurements (equations (2)-7; col. 4, lines 1-67; col. 5, lines 1-25).

Regarding claim 16, De Murcia discloses time-synchronizing said first measurements and said second measurements (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 17, De Murcia discloses forming first reconstructed images corresponding to said plurality of first images (col. 4, lines 58-67; col. 5, lines 1-12, "$\hat{f}_o^k$") and second reconstructed images corresponding to said plurality of second images (col. 5, lines 1-25, "f_o^{k+1}").

Regarding claim 18, De Murcia discloses spatially-synchronizing said first reconstructed images and said second reconstructed images (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 20, De Murcia discloses spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 21, De Murcia discloses forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements (col. 2, lines 45-55, "… displacements …").

Regarding claim 22, De Murcia discloses wherein said forming an image of the mobile object comprising combining said displacement fields (equations (8); col. 5, lines 45-67, "v(M)").

Regarding claim 23, De Murcia discloses wherein said forming displacement fields comprises: estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields (equations (8); col. 5, lines 45-67, "v(M)"; equation (14); col. 7, lines 63-67; col. 8, lines 1-29, "… displacements …").

Regarding claim 24, De Murcia discloses wherein at least one of said movement estimates is formed relative to a reference time (col. 3, lines 38-44, "phases of its cycle …").

Regarding claim 26, claim 26 is analogous and corresponds to claim 15. See rejection of claim 15 for further explanation.

Regarding claim 27, claim 27 is analogous and corresponds to claim 17. See rejection of claim 17 for further explanation.

Regarding claim 29, claim 29 is analogous and corresponds to claim 21. See rejection of claim 21 for further explanation.

Regarding claim 30, claim 30 is analogous and corresponds to claim 22. See rejection of claim 22 for further explanation.

Regarding claim 31, claim 31 is analogous and corresponds to claim 23. See rejection of claim 23 for further explanation.

Regarding claim 32, claim 32 is analogous and corresponds to claim 24. See rejection of claim 24 for further explanation.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 19, 25, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Murcia et al. (US 5,889,525) in view of Townsend et al. (US 2003/0004405).

Regarding claim 19, De Murcia discloses all the previous claim limitations except the first imaging technique being a radiation attenuation technique and second imaging technique being a radiation emission technique specified in claim 19. However, Townsend can overcome De Murcia's deficiency by disclosing that the first imaging technique being a radiation attenuation technique (abstract; claim 1, "CT is an example of a system using an anatomic radiation attenuation imagery technique") and second imaging technique being a radiation emission technique (abstract; claim 1, "PET is an example of a system using functional radiation emission imagery technique").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize Townsend's invention in De Murcia's invention to

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obtain satisfactory imaging results as suggested by De Murcia (col. 2, lines 44-55).

Regarding claim 25, Townsend further discloses wherein said plurality of first measurements and said plurality of second measurements being taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images (abstract; claim 1, "CT is an example of a system using an anatomic radiation attenuation imagery technique" and "PET is an example of a system using functional radiation emission imagery technique").

Regarding claim 28, claim 28 is analogous and corresponds to claim 19. See rejection of claim 19 for further explanation.

Conclusion

8. No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN Wahnkyo LEE whose telephone number is (571)272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MATTHEW C. BELLA can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR)

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system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C Bella/
Supervisory Patent Examiner, Art Unit 2624

/John Wahnkyo Lee/
Examiner, Art Unit 2624

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Volkswagen v. Longhorn - IPR2025-00925

Notice of References Cited	Application/Control No. 10/955,037	Applicant(s)/Patent Under Reexamination BONNET ET AL.	
	Examiner JOHN Wahnkyo LEE	Art Unit 2624	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-5,889,525 A	03-1999	De Murcia et al.	345/420
*	B	US-2003/0004405 A1	01-2003	Townsend et al.	600/407
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/27/2006	09/07/2007	05/25/2008						
	1	✓	-	-						
	2	✓	-	-						
	3	✓	-	-						
	4	✓	-	-						
	5	✓	-	-						
	6	✓	-	-						
	7	✓	-	-						
	8	✓	-	-						
9			✓	-						
10			✓	-						
11			✓	-						
12			✓	-						
13			✓	-						
14			✓	-						
15				✓						
16				✓						
17				✓						
18				✓						
19				✓						
20				✓						
21				✓						
22				✓						
23				✓						
24				✓						
25				✓						
26				✓						
27				✓						
28				✓						
29				✓						
30				✓						
31				✓						
32				✓						

Amendments to the Claims

The following listing of claims shall replace any and all previous listings of the claims in this application.

Listing of Claims:

1.-14. (Cancelled)

15. (New) A method of forming an image of a mobile object, comprising:

obtaining a plurality of first images of the mobile object using a first imaging technique and an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements.

16. (New) The method of Claim 15, further comprising:

time-synchronizing said first measurements and said second measurements.

17. (New) The method of Claim 15, further comprising:

forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

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18. (New) The method of Claim 17, further comprising:

spatially-synchronizing said first reconstructed images and said second reconstructed images.

19. (New) The method of Claim 15, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

20. (New) The method of Claim 15, further comprising:

spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements.

21. (New) The method of Claim 15, further comprising:

forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

22. (New) The method of Claim 21, wherein said forming an image of the mobile object comprises combining said displacement fields.

23. (New) The method of Claim 21, wherein said forming displacement fields comprises:

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estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

24. (New) The method of Claim 23, wherein at least one of said movement estimates is formed relative to a reference time.

25. (New) The method of Claim 15, wherein said plurality of first measurements and said plurality of second measurements are taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images.

26. (New) An apparatus to form an image of a mobile object, comprising:

means for obtaining a plurality of first images of the mobile object using a first imaging technique;

means for obtaining an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

means for obtaining a plurality of second images of the mobile object using a second imaging technique;

means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

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means for forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements.

27. (New) The apparatus of Claim 26, further comprising:

means for forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

28. (New) The apparatus of Claim 26, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

29. (New) The apparatus of Claim 26, further comprising:

means for forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

30. (New) The apparatus of Claim 29, wherein said means for forming an image of the mobile object comprises means for combining said displacement fields.

31. (New) The apparatus of Claim 29, wherein said means for forming displacement fields comprises:

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means for estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

32. (New) The apparatus of Claim 31, wherein at least one of said movement estimates is to be formed relative to a reference time.

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Docket No.: 27592-00987-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Stephane Bonnet

Application No.: 10/955,037 | Confirmation No.: 4535

Filed: September 30, 2004 | Art Unit: 2624

For: METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES | Examiner: John W. Lee

RESPONSE UNDER 37 C.F.R. 1.112 (NON-FINAL OFFICE ACTION)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

In response to the Office Action mailed May 29, 2008, the following remarks are respectfully submitted.

Remarks begin on page 2 of this Amendment.

	Claims remaining after Amendment		**Highest number previously paid for**		**Present extra**
Total	18		20		0
Independent	2		3		0

615942

REMARKS

Claims 15-32 are pending in this application. Claims 15 and 26 are independent claims. Reconsideration and allowance of the present application are respectfully requested.

Rejections under 35 U.S.C. §112

Claims 15, 17, 21, 23, 25-27, 29 and 31 stand rejected under 35 USC § 112, first paragraph, for failing to provide sufficient antecedent basis for the limitations in the claims. This rejection is respectfully traversed.

Line 2 of claim 15 and line 2 of claim 26, in part, recite "a plurality of first images" and "a first imaging technique." Line 5 of claim 5 and line 5 of claim 26, in part, recites "a second imaging technique" and "a plurality of second images." Applicant submits that there is clear antecedent basis for "first images," "first imaging technique," "second images," and "second imaging techniques" in each of claims 15-32. Therefore, Applicants respectfully request that the rejections of claims 15, 17, 21, 23, 25-27, 29 and 31 under 35 U.S.C. §112 be withdrawn.

Rejections under 35 U.S.C. §102

Claims 1-18, 20-24, 26-27 and 29-32 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,889,525 to De Murcia et al. (hereinafter "De Murcia"). This rejection is respectfully traversed.

Claim 15, upon which claims 16-25 depend, recites "a method of forming an image of a mobile object, comprising: obtaining a plurality of first images of the mobile object using a first imaging technique and an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images; obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements."

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Claim 26, upon which claims 27-32 depend, recites "an apparatus to form an image of a mobile object, comprising: means for obtaining a plurality of first images of the mobile object using a first imaging technique; means for obtaining an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images; means for obtaining a plurality of second images of the mobile object using a second imaging technique; means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and means for forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements."

As outlined below, De Murcia does not teach or suggest each of the elements recited in claims 15-32.

De Murcia discloses a process including taking a series of sets of measurements of a characteristic property of an object by a two-dimensional array of mobile sensors around the object. The sets of measurements include a two-dimensional array of projections of the property on the sensors. The sets of measurements are taken at a group of different states of the object with respect to the variations in the position or shape of the object. The process includes reconstructing an approximate image of the object at each of the states, combining their respective sets of measurements, evaluating the variations of the object between an image of the object at a reference state and the approximate images, and modifying the image of the object at the reference state by a combination with the sets of measurements and the variations of the object associated with the sets of measurements. See at least Col. 2, line 56-Col. 3, line 4 of De Murcia.

Applicant submits that De Murcia does not teach or suggest each of the elements recited in claims 15-18, 20-24, 26-27 and 29-32. Each of independent claims 15 and 27, in part, recites "obtaining a plurality of second images of the mobile object using a second imaging technique; obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and forming an image of the mobile object based on said plurality of first images and associated plurality of first

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measurements and on said plurality of said second images and associated plurality of second measurements." De Murcia does not teach or suggest these features.

De Murcia merely discloses taking a series of sets of measurements of a characteristic property of an object by a two-dimensional array of mobile sensors around the object. As noted in the Office Action, the two-dimensional array of projections is equivalent to the "first imaging technique" recited in the pending claims. There is no teaching or suggestion in De Murcia of a "second imaging technique," that is, an imaging technique which is different from the first technique. Thus, there is no teaching or suggestion in De Murcia of "obtaining a plurality of second images of the mobile object using a second imaging technique" and "obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images," as recited in the pending claims. There is also no teaching or suggestion in De Murcia of "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements," as recited in the pending claims. Therefore, Applicants respectfully submit the De Murcia does not teach or suggest each of the elements of claims 15 and 27. Each of claims 16-26 and 28-32 are allowable at least because of their dependence on claims 15 and 27, respectively, in addition to the further limitations recited in each of claims 16-26 and 28-31. In light of the distinctions noted above, Applicants respectfully request that this rejection of claims 1-18, 20-24, 26-27 and 29-32 under 35 U.S.C. §102 be withdrawn.

Rejections Under 35 U.S.C. § 103

Claims 19, 25 and 28 stand rejected under 35 U.S.C. §103(a) as being unpatentable over De Murcia et al. in view of U.S. Patent Publication No. 2003/0004405 to Townsend et al. (hereinafter "Townsend"). This rejection is respectfully traversed.

Townsend does not cure the deficiencies of De Murcia, as noted above. Specifically, Townsend does not teach or suggest "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements," as recited in claims 15 and 27, upon which claims 19, 25 and 28 depend.

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Townsend merely discloses a combined PET and X-Ray CT tomography for acquiring CT and PET images sequentially in a single device. There is no teaching or suggestion in Townsend of "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements," as recited in claims 15 and 27, upon which claims 19, 25 and 28 depend. Therefore, Applicants respectfully request that this rejection of claims 19, 25 and 28 under 35 U.S.C. §103 be withdrawn.

Disclaimer

Applicants may not have presented all possible arguments or have refuted the characterizations of either the claims or the prior art as found in the Office Action. However, the lack of such arguments or refutations is not intended to act as a waiver of such arguments or as concurrence with such characterizations.

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CONCLUSION

In view of the above, consideration and allowance are respectfully solicited.

In the event the Examiner believes an interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees to Deposit Account No. 22-0185.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 22-0185, under Order No. 27592-00987-US from which the undersigned is authorized to draw.

Dated: July 30, 2008

Respectfully submitted,

Electronic signature: /Arlene P. Neal/
Arlene P. Neal
Registration No.: 43,828
CONNOLLY BOVE LODGE & HUTZ LLP
1875 Eye Street, NW
Suite 1100
Washington, DC 20006
(202) 331-7111
(202) 293-6229 (Fax)
Attorney for Applicant

LAG-VW00000743

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Electronic Acknowledgement Receipt

EFS ID:	3699882
Application Number:	10955037
International Application Number:	
Confirmation Number:	4535
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Customer Number:	30678
Filer:	Burton A. Amernick
Filer Authorized By:	
Attorney Docket Number:	27592-00987- US
Receipt Date:	30-JUL-2008
Filing Date:	30-SEP-2004
Time Stamp:	12:35:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response_07_30_08.pdf	96410 475cee9dcc235076c5c3a3d955d6715d7acd6e57	yes	6

Volkswagen Exhibit 1037, Page 744 of 2532
Volkswagen v. Longhorn - IPR2025-00925

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment - After Non-Final Rejection	1	1
	Applicant Arguments/Remarks Made in an Amendment	2	6
Warnings:			
Information:			
	Total Files Size (in bytes):	96410	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	FILE WRAPPER LOCATION
10/955,037		2624	26M1

OC000000032096402

Correspondence Address/Fee Address Change

The following fields have been set to Customer Number 30678 on 09/15/2008

- **Correspondence Address**
- **Power of Attorney Address**

The address of record for Customer Number 30678 is:

30678
CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20006

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	27592-00987- US	4535

30678 7590 11/14/2008
CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20006

EXAMINER	
LEE, JOHN W	
ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
11/14/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	JOHN Wahnkyo LEE	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 August 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) *1-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The response received on 30 August 2008 has been placed in the file and was considered by the examiner. An action on the merits follows.

Response to Amendment

2. The applicant's amendments filed on 30 July 2008 have been fully considered.

Rejection under 35 U.S.C. § 112

Applicant's arguments to the rejection under 35 U.S.C. § 112 with respect to claims 15-32 have been fully considered. However, examiner can admit that claims 19, 25 and 28 have overcome this issue, but not the rest of the claims. It is still unclear and vague what the "first image", "first measurements", "first imaging technique", "second image" , "second measurements" and "second imaging technique" is trying to indicate. Moreover, it is also unclear whether the "first measurement" and "first imaging technique" are different with the "second measurement" and "second imaging technique", respectively. If the applicant does not specify this, then the examiner will interpretate the "first measurement" and "first imaging technique" are same with the "second measurement" and "second imaging technique", respectively. So, the rejection under 35 U.S.C. § 112 with respect to claims 15-18, 20-24, 26-27 and 29-32 will not be withdrawn and claims 19, 25 and 28 will be withdrawn.

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Response to Arguments

3. Applicant's arguments filed on 30 July 2008 have been fully considered, but are not persuasive. After the response to the applicant's arguments, the rejection will be provided.

Rejection under 35 U.S. C. § 102

Applicant argues that De Murcia does not disclose all the claim limitations of claims 15 and 26. However, the examiner respectively traverses it. De Murcia might not implement the exact invention comparing to the application, but it is good enough to read on the claims. As discussed before, the applicant does not distinguish or specify whether the “first measurement” and “first imaging technique" are different with the “second measurement" and “second imaging technique", respectively, in the independent claims. In the specification, the applicant might have disclosed that the “first measurement” and “first imaging technique" are different with the “second measurement" and “second imaging technique", respectively, but what it matters the limitations recited in the claims. The examiner only reviews the claims with the broadest claim interpretation without reading the specifications on the claims. So, the rejection under 35 U.S.C. § 102 with respect to claims 1-18, 20-24, 26-27 and 29-32 cannot be withdrawn.

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Rejection under 35 U.S. C. § 103

The combination of the two references, De Murcia and Townsend do disclose or teach all the claim limitations of claims 19, 25 and 28. So, the rejection under 35 U.S.C. § 103 with respect to claims 19, 25 and 28 cannot be withdrawn.

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claims 15-25 are rejected under 35 U.S.C. 101 as not falling within one of the four statutory categories of invention. While the claims recite a series of steps or acts to be performed, a statutory "process" under 35 U.S.C. 101 must (1) be tied to another statutory category (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing (Reference the May 15, 2008 memorandum issued by Deputy Commissioner for Patent Examining Policy, John J. Love, titled "Clarification of 'Processes' under 35 U.S.C. 101" – publicly available at USPTO.GOV, "memorandum to examining corp"). The instant claims neither transform underlying subject matter nor positively tie to another statutory category that accomplishes the claimed method steps, and therefore do not qualify as a statutory process. In order for a process to be "tied" to another statutory category, the structure of another statutory category should be positively recited in a step or steps significant to the basic inventive concept, and NOT just in association with statements of intended use or purpose, insignificant pre or post solution activity, or implicitly.

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Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 15-18, 20-24, 26-27 and 29-32 recite the limitations, “first images”, “first imaging technique", “first measurement”, "second images", "second measurement” and "second imaging technique". There are insufficient antecedent basis for these limitations in the claims.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 1-18, 20-24, 26-27 and 29-32 are rejected under 35 U.S.C. 102(b) as being anticipated by De Murcia et al. (US 5,889,525).

Regarding claim 15, De Murcia discloses a method of forming an image (col. 1, line 6-7, “reconstruction o three-dimensional images”) of a mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”), comprising: obtaining a plurality of first images (equation (2); col. 4; lines 1-8, “m_k”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) using a first imaging technique (col. 2, lines 56-64, “two dimensional array of projections”) and an associated plurality of first measurements (col. 2, lines 59-60; col. 4, lines 9-10, “the sets of measurements”) of the mobile object (fig. 1; col. 1, line 6-7,

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"mobile object"; col. 2, lines 10-11, "mobile organs such as heart") at movement states corresponding to movement states (col. 4, lines 7-8, "states k") of said plurality of first images (equation (2); col. 4; lines 1-8, "m_k"); obtaining a plurality of second images (equation (2); col. 4; line 67, "m_{k+1}") of the mobile object (fig. 1; col. 1, line 6-7, "mobile object"; col. 2, lines 10-11, "mobile organs such as heart") using a second imaging technique (col. 2, lines 56-64, "two dimensional array of projections") and an associated plurality of second measurements (col. 2, lines 59-60; col. 4, lines 9-10) of the mobile object at movement states corresponding to movement states (col. 4, line 67, "state k+1") of said plurality of second images (equation (2); col. 4; line 67, "$m_{k=1}$"); and forming an image (fig. 2, "object reconstructed" and "$\hat{f}_o$") of the mobile object based on said plurality of first images (equation (2); col. 4; lines 1-8, "m_k") and associated plurality of first measurements (col. 2, lines 59-60; col. 4, lines 9-10, "the sets of measurements") and on said plurality of said second images (equation (2); col. 4; line 67, "$m_{k=1}$") and associated plurality of second measurements (equations (2)-7; col. 4, lines 1-67; col. 5, lines 1-25, "the sets of measurements").

Regarding claim 16, De Murcia discloses time-synchronizing said first measurements and said second measurements (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 17, De Murcia discloses forming first reconstructed images corresponding to said plurality of first images (col. 4, lines 58-67; col. 5, lines 1-12,

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"$\hat{f}_o^k$") and second reconstructed images corresponding to said plurality of second images (col. 5, lines 1-25, "f_o^{k+1}").

Regarding claim 18, De Murcia discloses spatially-synchronizing said first reconstructed images and said second reconstructed images (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 20, De Murcia discloses spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 21, De Murcia discloses forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements (col. 2, lines 45-55, "… displacements …").

Regarding claim 22, De Murcia discloses wherein said forming an image of the mobile object comprising combining said displacement fields (equations (8); col. 5, lines 45-67, "v(M)").

Regarding claim 23, De Murcia discloses wherein said forming displacement fields comprises: estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields (equations (8); col. 5, lines 45-67, "v(M)"; equation (14); col. 7, lines 63-67; col. 8, lines 1-29, "… displacements …").

Regarding claim 24, De Murcia discloses wherein at least one of said movement estimates is formed relative to a reference time (col. 3, lines 38-44, "phases of its cycle …").

Regarding claim 26, claim 26 is analogous and corresponds to claim 15. See rejection of claim 15 for further explanation.

Regarding claim 27, claim 27 is analogous and corresponds to claim 17. See rejection of claim 17 for further explanation.

Regarding claim 29, claim 29 is analogous and corresponds to claim 21. See rejection of claim 21 for further explanation.

Regarding claim 30, claim 30 is analogous and corresponds to claim 22. See rejection of claim 22 for further explanation.

Regarding claim 31, claim 31 is analogous and corresponds to claim 23. See rejection of claim 23 for further explanation.

Regarding claim 32, claim 32 is analogous and corresponds to claim 24. See rejection of claim 24 for further explanation.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

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10. Claims 19, 25, and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Murcia et al. (US 5,889,525) in view of Townsend et al. (US 2003/0004405).

Regarding claim 19, De Murcia discloses all the previous claim limitations except the first imaging technique being a radiation attenuation technique and second imaging technique being a radiation emission technique specified in claim 19. However, Townsend can overcome De Murcia's deficiency by disclosing that the first imaging technique being a radiation attenuation technique (abstract; claim 1, "CT is an example of a system using an anatomic radiation attenuation imagery technique") and second imaging technique being a radiation emission technique (abstract; claim 1, "PET is an example of a system using functional radiation emission imagery technique").

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize Townsend's invention in De Murcia's invention to obtain satisfactory imaging results as suggested by De Murcia (col. 2, lines 44-55).

Regarding claim 25, Townsend further discloses wherein said plurality of first measurements and said plurality of second measurements being taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images (abstract; claim 1, "CT is an example of a system using an anatomic radiation attenuation imagery technique" and "PET is an example of a system using functional radiation emission imagery technique").

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Regarding claim 28, claim 28 is analogous and corresponds to claim 19. See rejection of claim 19 for further explanation.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN Wahnkyo LEE whose telephone number is (571)272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jingge Wu can be reached on (571) 272-7429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jingge Wu/
Supervisory Patent Examiner, Art Unit 2624

/John Wahnkyo Lee/

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Examiner, Art Unit 2624

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Notice of References Cited	Application/Control No. 10/955,037	Applicant(s)/Patent Under Reexamination BONNET ET AL.	
	Examiner JOHN Wahnkyo LEE	Art Unit 2624	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,694,156 A	09-1987	Swanberg, Melvin E.	250/214RC
*	B	US-5,889,525 A	03-1999	De Murcia et al.	345/420
*	C	US-2003/0004405 A1	01-2003	Townsend et al.	600/407
*	D	US-6,885,702 B1	04-2005	Goudezeune et al.	375/240.12
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

SEARCHED			
Class	Subclass	Date	Examiner
382	128	12/26/2006	John W. Lee
345	420	12/26/2006	John W. Lee
382	128	11/06/2008	John W. Lee

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	12/26/2006	John W. Lee
East Search	12/26/2006	John W. Lee
IEEE (Non- Patent Literature Search)	12/26/2006	John W. Lee
EAST Search	11/06/2008	John W. Lee

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

/JOHN W LEE/ Examiner.Art Unit 2624	

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/27/2006	09/07/2007	05/25/2008	11/07/2008					
	1	✓	-	-	-					
	2	✓	-	-	-					
	3	✓	-	-	-					
	4	✓	-	-	-					
	5	✓	-	-	-					
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	7	✓	-	-	-					
	8	✓	-	-	-					
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30				✓	✓					
31				✓	✓					
32				✓	✓					

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	10/955037	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:20
L2	3258	382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
L3	3206	2 AND IMAG$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
L4	593	3 and CYCLE	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30

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L5	358	4 AND state	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
L6	8	\2003/0004405	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
L7	2	"20030004405"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:31
L8	5	"5889525"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:31

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EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	10/955037	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:20
S2	3258	382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S3	3206	S2 AND IMAG$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S4	593	S3 and CYCLE	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30

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S5	358	S4 AND state	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S6	8	\2003/0004405	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S7	2	"20030004405"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:31
S8	5	"5889525"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:31

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Amendments to the Claims

The following listing of claims shall replace any and all previous listings of the claims in this application.

Listing of Claims:

1.-14. (Cancelled)

15. (New) A method of forming an image of a mobile object, comprising:

obtaining a plurality of first images of the mobile object using a first imaging technique and an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements.

16. (New) The method of Claim 15, further comprising:

time-synchronizing said first measurements and said second measurements.

17. (New) The method of Claim 15, further comprising:

forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

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18. (New) The method of Claim 17, further comprising:

spatially-synchronizing said first reconstructed images and said second reconstructed images.

19. (New) The method of Claim 15, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

20. (New) The method of Claim 15, further comprising:

spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements.

21. (New) The method of Claim 15, further comprising:

forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

22. (New) The method of Claim 21, wherein said forming an image of the mobile object comprises combining said displacement fields.

23. (New) The method of Claim 21, wherein said forming displacement fields comprises:

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estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

24. (New) The method of Claim 23, wherein at least one of said movement estimates is formed relative to a reference time.

25. (New) The method of Claim 15, wherein said plurality of first measurements and said plurality of second measurements are taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images.

26. (New) An apparatus to form an image of a mobile object, comprising:

means for obtaining a plurality of first images of the mobile object using a first imaging technique;

means for obtaining an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

means for obtaining a plurality of second images of the mobile object using a second imaging technique;

means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

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means for forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements.

27. (New) The apparatus of Claim 26, further comprising:

means for forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

28. (New) The apparatus of Claim 26, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

29. (New) The apparatus of Claim 26, further comprising:

means for forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

30. (New) The apparatus of Claim 29, wherein said means for forming an image of the mobile object comprises means for combining said displacement fields.

31. (New) The apparatus of Claim 29, wherein said means for forming displacement fields comprises:

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means for estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

32. (New) The apparatus of Claim 31, wherein at least one of said movement estimates is to be formed relative to a reference time.

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PTO/SB/30 (01)
Approved for use through 02/28/2009. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/955,037-Conf. #4535
Filing Date	September 30, 2004
First Named Inventor	Stephane Bonnet
Art Unit	2624
Examiner Name	J. W. Lee
Attorney Docket Number	27592-00987-US

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. [ ] Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. [ ] Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. [ ] Other _____

   b. [x] Enclosed

      i. [x] Amendment/Reply

      ii. [ ] Affidavit(s)/Declaration(s)

      iii. [ ] Information Disclosure Statement (IDS)

      iv. [ ] Other _____

2. Miscellaneous

   a. [ ] Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. [ ] Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. [ ] The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any Overpayments, to Deposit Account No. 22-0185 .

      i. [x] RCE fee required under 37 CFR 1.17(e)

      ii. [ ] Extension of time fee (37 CFR 1.136 and 1.17)

      iii. [ ] Other _____

   b. [ ] Check in the amount of $ _____ enclosed

   c. [x] Payment by credit card (Form PTO-2038 enclosed)

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Arlene Neal/	Date	February 13, 2009
Name (Print/Type)	Arlene Neal	Registration No.	43,828

Docket No.: 27592-00987-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Stephane Bonnet

Application No.: 10/955,037 | Confirmation No.: 4535

Filed: September 30, 2004 | Art Unit: 2624

For: METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES | Examiner: John W. Lee

RESPONSE UNDER 37 C.F.R. 1.116 (FINAL OFFICE ACTION)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Madam:

INTRODUCTORY COMMENTS

In response to the Office Action mailed November 14, 2008, the following amendments and remarks are respectfully submitted.

Amendments to the claims begin on page 2 of this Amendment.
Remarks begin on page 7 of this Amendment.

	Claims remaining after Amendment		Highest number previously paid for		Present extra
Total	18		20		0
Independent	2		3		0

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Amendments to the Claims

The following listing of claims shall replace any and all previous listings of the claims in this application.

Listing of Claims:

1.-14. (Cancelled)

15. (Currently Amended) A method of forming an image of a mobile object, comprising:

obtaining a plurality of first images of the mobile object using a first imaging technique and an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements,

wherein the first imaging technique is different from the second imaging technique.

16. (Previously Presented) The method of Claim 15, further comprising:

time-synchronizing said first measurements and said second measurements.

17. (Previously Presented) The method of Claim 15, further comprising:

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forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

18. (Previously Presented) The method of Claim 17, further comprising:

spatially-synchronizing said first reconstructed images and said second reconstructed images.

19. (Previously Presented) The method of Claim 15, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

20. (Previously Presented) The method of Claim 15, further comprising:

spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements.

21. (Previously Presented) The method of Claim 15, further comprising:

forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

22. (Previously Presented) The method of Claim 21, wherein said forming an image of the mobile object comprises combining said displacement fields.

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23. (Previously Presented) The method of Claim 21, wherein said forming displacement fields comprises:

estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

24. (Previously Presented) The method of Claim 23, wherein at least one of said movement estimates is formed relative to a reference time.

25. (Previously Presented) The method of Claim 15, wherein said plurality of first measurements and said plurality of second measurements are taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images.

26. (Currently Amended) An apparatus to form an image of a mobile object, comprising:

means for obtaining a plurality of first images of the mobile object using a first imaging technique;

means for obtaining an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

means for obtaining a plurality of second images of the mobile object using a second imaging technique;

means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

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means for forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements,

wherein the first imaging technique is different from the second imaging technique.

27. (Previously Presented) The apparatus of Claim 26, further comprising:

means for forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

28. (Previously Presented) The apparatus of Claim 26, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

29. (Previously Presented) The apparatus of Claim 26, further comprising:

means for forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

30. (Previously Presented) The apparatus of Claim 29, wherein said means for forming an image of the mobile object comprises means for combining said displacement fields.

31. (Previously Presented) The apparatus of Claim 29, wherein said means for forming displacement fields comprises:

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means for estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

32. (Previously Presented) The apparatus of Claim 31, wherein at least one of said movement estimates is to be formed relative to a reference time.

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REMARKS

Claims 15-32 are pending in this application. Claims 15 and 26 are independent claims. Claims 15 and 26 are amended. Reconsideration and allowance of the present application are respectfully requested.

Claim Rejections under 35 U.S.C. §101

Claims 15-25 stand rejected under 35 U.S.C. §101 as allegedly being directed to non-statutory subject matter. This rejection is respectfully traversed.

According to the Office Action, "while the claims recite a series of steps to be performed, a statutory "process" under 35 U.S.C. 101 must be (1) tied to another statutory process (such as a particular apparatus), or (2) transform underlying subject matter (such as an article or material) to a different state or thing (Reference the May 15 2008 memorandum issued by Deputy Commissioner for Patent Examining Policy, John J. Love, titled "Clarification of 'Processes' under 35 U.S.C. 101")." Applicant notes that the memorandum discussed in the Office Action was issued in anticipation of a ruling by the Court of Appeals for the Federal Circuit. See *In re Bilski,* 545 F.3d *943,* 88 USPQ2d 1385 (Fed. Cir. 2008). The Federal Circuit's opinion, issued after the memorandum was written, clarifies the standards applicable in determining whether a claimed method constitutes a statutory "process" under 35 U.S.C 101.

The Federal Circuit noted that the Supreme Court held that "a claimed process is surely patent-eligible under §101 if: (1) it is tied to a particular machine or apparatus, or (2) it transforms a particular article into a different state or thing." *In re Bilski,* 545 F.3d at 953, 88 USPQ2d at 1395. Also see *Gottschalk v. Benson*, 409 U.S. 63, 72 (1972) and *Diamond v. Diehr*, 450 U.S. 175, 182 (1981). The Federal Circuit then held that the true test in determining whether a process transforms underlying subject matter to a different state is whether the "applicant is seeking to claim a fundamental principle (such as an abstract idea) or a mental process." *In re Bilski,* 545 F.3d at 949, 88 USPQ2d at 1392. The Federal Circuit, therefore, used the machine-or-transformation test, noted in the Office Action, to determine if the Applicant is seeking to claim a fundamental principle or a mental process. The Federal Circuit primarily considered the transformation part of this test.

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According to the Federal Circuit, "a claimed process is patent-eligible if it transforms an article into a different state or thing." *Id,* 567 F.3d at 949, 88 USPQ2d at 1429. In defining an article, the Federal Circuit noted that "the raw materials of many information-age processes, however, are electronic signals and electronically-manipulated data." *Id,* at F.3d at 950, 88 USPQ2d at 1430. The Federal Circuit also noted the difference between electrical signals and electronically-manipulated data and "manipulation of even more abstract constructs such as legal obligations, organizational relationships, and business risks." *Id,* at F.3d at 951, 88 USPQ2d at 1431. The Federal Circuit further noted that the transformation of electronic data is "not required to involve any transformation of the underlying physical object that the data represented." *Id,* at F.3d at 953, 88 USPQ2d at 1433. Therefore, the Federal Circuit clearly accepted that transforming of electrical signals and electronically-manipulated data would satisfy the transformation element of its machine-or-transformation test. In fact, the Federal Circuit continued to follow the current rule that the claim must be considered as a whole to determine whether it is for a particular application and not directed to a fundamental principle. See MPEP 2106 IV C.

Independent claim 15, upon which claims 16-25 depend, in part, recites "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements." The plurality of first images and associated plurality of first measurements and the plurality of said second images and associated plurality of second measurements are transformed into the image. The transformed image and hence the associated data being transformed represent a physical object. As noted above, the Federal Circuit held that "a claimed process is patent-eligible if it transforms an article into a different state or thing." *Id,* 567 F.3d at 949, 88 USPQ2d at 1429. Therefore, this element of claim 15 clearly satisfies the transformation step as required in the machine-or-transformation test, in particular, the transforming of two images and measurements into a single image. Therefore, Applicant submits that each of the pending claims recites statutory subject matter and Applicant respectfully requests that the rejections of claims 15-25 under 35 U.S.C. §101 be withdrawn.

Claim Rejections under 35 U.S.C. §112

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Claims 15-18, 20-24, 26-27 and 29-32 stand rejected under 35 USC § 112, as being indefinite on the grounds of insufficient antecedent basis. This rejection is respectfully traversed.

As noted in the Response to the previous Office Action, line 2 of claim 15 and line 2 of claim 26, in part, recite "a plurality of first images" and "a first imaging technique." Line 5 of claim 15 and line 5 of claim 26, in part, recites "a second imaging technique" and "a plurality of second images." Line 3 of claim 15 and line 3 of claim 26, in part, recite "an associated plurality of first measurements" and line 6 of claim 15 and line 6 of claim 26, in part, recite "an associated plurality of second measurements."

In the Response to Amendment Section, the Office Action indicated that with regards to claims 15-18, 20-24, 26-27 and 29-32, it is unclear what the "first image," "first measurements," "first imaging technique," "second image," second measurements," and "second imaging technique" is trying to indicate. According to the MPEP, "a claim is indefinite when it contains words or phases whose meaning is unclear. The lack of clarity could arise where a claim refers to "said lever" or "the lever", where the claim contains no earlier recitation or limitation of a lever where it would be unclear as to what element the limitation was making reference." See MPEP 2173.05(e).

As noted above, each of independent claims 15 and 26, upon which claims 16-25 and 27-32 depend, clearly recites "a plurality of first images," "a first imaging technique," "a second imaging technique," "a plurality of second images," "an associated plurality of first measurements," and "an associated plurality of second measurements." Therefore, it is clear that recitations of the "first images," "first imaging technique," "first measurements," "second images," "second imaging technique," and "second measurements" in the pending claims are referencing "a plurality of first images," "a first imaging technique," "a second imaging technique," "a plurality of second images," "an associated plurality of first measurements," and "an associated plurality of second measurements," as recited in claims 15 and 26. Therefore, Applicant submits that rejection of claims 15-18, 20-24, 26-27 and 29-32 under 35 USC § 112, as being indefinite on the grounds of insufficient antecedent basis is in error and should be withdrawn.

Furthermore, the Office Action alleged that it is also unclear whether the "first measurements" and the "first imaging technique" are different from the "second measurements"

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and "second imaging technique", respectively. The pending claims clearly recite two different measurements, that is, the first measurements and the second measurements. The claims also clearly recite two different imaging techniques, that is, the first and second imaging techniques, "wherein the first imaging technique is different from the second imaging technique."

Based on the discussion above, Applicant submits that there is clear antecedent basis for "first images," "first measurement," "first imaging technique," "second images," "second measurement" and "second imaging techniques" in each of claims 15-18, 20-24, 26-27 and 29-32. The pending claims also recite two different measurements, that is, the first measurements and the second measurements and two different imaging techniques, that is, the first and second imaging techniques. Therefore, Applicants respectfully request that the rejections of claims 15, 17, 21, 23, 25-27, 29 and 31 under 35 U.S.C. §112 be withdrawn.

Claim Rejections under 35 U.S.C. §102

Claims 1-18, 20-24, 26-27 and 29-32 stand rejected under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,889,525 to De Murcia et al. (hereinafter "De Murcia"). This rejection is respectfully traversed.

As submitted in the previous Response, De Murcia discloses a process including taking a series of sets of measurements of a characteristic property of an object by a two-dimensional array of mobile sensors around the object. The sets of measurements include a two-dimensional array of projections of the property on the sensors. The sets of measurements are taken at a group of different states of the object with respect to the variations in the position or shape of the object. The process includes reconstructing an approximate image of the object at each of the states, combining their respective sets of measurements, evaluating the variations of the object between an image of the object at a reference state and the approximate images, and modifying the image of the object at the reference state by a combination with the sets of measurements and the variations of the object associated with the sets of measurements. See at least Col. 2, line 56-Col. 3, line 4 of De Murcia.

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Applicant submits that De Murcia does not teach or suggest each of the elements recited in claims 15-18, 20-24, 26-27 and 29-32. Each of independent claims 15 and 26, in part, recites "obtaining a plurality of second images of the mobile object using a second imaging technique; obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements, wherein the first imaging technique is different from the second imaging technique." De Murcia does not teach or suggest these features.

De Murcia merely discloses taking a series of sets of measurements of a characteristic property of an object by a two-dimensional array of mobile sensors around the object. As noted in the Office Action, the two-dimensional array of projections is equivalent to the "first imaging technique" recited in the pending claims. There is no teaching or suggestion in De Murcia of a "second imaging technique," that is, an imaging technique which is different from the first technique. Thus, there is no teaching or suggestion in De Murcia of "obtaining a plurality of second images of the mobile object using a second imaging technique" and "obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images," as recited in the pending claims. There is also no teaching or suggestion in De Murcia of "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements," as recited in the pending claims.

In the Response to Arguments Section, the Office Action indicated that "applicant does not distinguish or specify whether the "first measurement" and "first imaging technique" are different with the "second measurement" and "second imaging technique", respectively, in the independent claims." As noted above, each of the pending claims clearly recites two types of measurements, that is, the first and second measurements and two types of imaging techniques, that is, the first and second imaging techniques.

By defining the measurements as the first and second measurements, the claims clearly recite two different/types of measurements. The same is true that by defining the imaging

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techniques as the first and second imaging techniques, the claims clearly recite two types of imaging techniques. If the measurements and imaging techniques were the same, then there would be no need to differentiate between them by defining one measurement/imaging technique as the first measurements/imaging technique and defining the other measurement as the second measurements/imaging technique. Instead, the claims clearly recite two types of measurements and types of imaging techniques. Therefore, the broadest interpretation of these claims would conclude that the first measurements/imaging technique is of one type and the second measurements/imaging technique is of a different type. Nevertheless, the claims have been amended to clearly recite that "the first imaging technique is different from the second imaging technique."

Therefore, Applicants respectfully submit the De Murcia does not teach or suggest each of the elements of claims 15 and 27. Each of claims 16-26 and 28-32 are allowable at least because of their dependence on claims 15 and 27, respectively, in addition to the further limitations recited in each of claims 16-26 and 28-31. In light of the distinctions noted above, Applicants respectfully request that this rejection of claims 1-18, 20-24, 26-27 and 29-32 under 35 U.S.C. §102 be withdrawn.

Claim Rejections Under 35 U.S.C. §103

Claims 19, 25 and 28 stand rejected under 35 U.S.C. §103(a) as being unpatentable over De Murcia et al. in view of U.S. Patent Publication No. 2003/0004405 to Townsend et al. (hereinafter "Townsend"). This rejection is respectfully traversed.

Townsend does not cure the deficiencies of De Murcia, as noted above. Specifically, Townsend does not teach or suggest "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements, wherein the first imaging technique is different from the second imaging technique," as recited in claims 15 and 27, upon which claims 19, 25 and 28 depend.

Townsend merely discloses a combined PET and X-Ray CT tomography for acquiring CT and PET images sequentially in a single device. There is no teaching or suggestion in Townsend of "forming an image of the mobile object based on said plurality of first images and

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associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements," as recited in claims 15 and 27, upon which claims 19, 25 and 28 depend. Therefore, Applicants respectfully request that this rejection of claims 19, 25 and 28 under 35 U.S.C. §103 be withdrawn.

Disclaimer

Applicants may not have presented all possible arguments or have refuted the characterizations of either the claims or the prior art as found in the Office Action. However, the lack of such arguments or refutations is not intended to act as a waiver of such arguments or as concurrence with such characterizations.

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CONCLUSION

In view of the above, consideration and allowance are respectfully solicited.

In the event the Examiner believes an interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees to Deposit Account No. 22-0185.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 22-0185, under Order No. 27592-00987-US from which the undersigned is authorized to draw.

Dated: February 13, 2009

Respectfully submitted,

Electronic signature: /Arlene P. Neal/
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Registration No.: 43,828
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Attorney for Applicant

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Electronic Patent Application Fee Transmittal	
Application Number:	10955037
Filing Date:	30-Sep-2004
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Filer:	Burton A. Amernick/Mary Ann Taylor
Attorney Docket Number:	27592-00987- US
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	1801	1	810	810
		Total in USD ($)		**810**

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Electronic Acknowledgement Receipt

EFS ID:	4788631
Application Number:	10955037
International Application Number:	
Confirmation Number:	4535
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Customer Number:	30678
Filer:	Burton A. Amernick/Mary Ann Taylor
Filer Authorized By:	Burton A. Amernick
Attorney Docket Number:	27592-00987- US
Receipt Date:	13-FEB-2009
Filing Date:	30-SEP-2004
Time Stamp:	10:58:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$810
RAM confirmation Number	5997
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Request for Continued Examination (RCE)	RCE_02_13_09.pdf	65492 4312648738fb82dc68000a696e4f49f89677d47b	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		Response_02_13_09.pdf	139854 1dd1318a0eedc77b7591a5f6c0a4c69dd8564197	yes	14

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment After Final	1	1
Claims	2	6
Applicant Arguments/Remarks Made in an Amendment	7	14

Warnings:					
Information:					
3	Fee Worksheet (PTO-06)	fee-info.pdf	30153 729692a10227a239fb7b4b1dfda90ef9b4443240	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	235499		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/955,037	Filing Date 09/30/2004	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT	02/13/2009	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/DEBRA a. SAVOY/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	27592-00987- US	4535

30678 7590 04/28/2009

CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20006

EXAMINER	
LEE, JOHN W	

ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
04/28/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	JOHN Wahnkyo LEE	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 February 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) *1-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 13 February 2009 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 15-18, 20-24, 26-27 and 29-32 recite the limitations, “first images”, “first imaging technique", “first measurement”, "second images", "second measurement” and "second imaging technique". There are insufficient antecedent basis for these limitations in the claims. It is still unclear and vague what the "first image", "first measurements”, "first imaging technique", "second image" , "second measurements" and "second imaging technique" is trying to indicate. Moreover, it is also unclear whether the “first measurement” and “first imaging technique" are different with the “second measurement" and “second imaging technique", respectively. If the applicant does not specify this, then the examiner will consider the “first measurement” and “first imaging

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technique" are same with the “second measurement" and “second imaging technique", respectively.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 15-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Murcia et al. (US 5,889,525) in view of Townsend et al. (US 2003/0004405).

Regarding claim 15, De Murcia discloses a method of forming an image (col. 1, line 6-7, “reconstruction o three-dimensional images”) of a mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”), comprising: obtaining a plurality of first images (equation (2); col. 4; lines 1-8, “m_k”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) using a first imaging technique (col. 2, lines 56-64, “two dimensional array of projections”) and an associated plurality of first measurements (col. 2, lines 59-60; col. 4, lines 9-10, “the sets of measurements”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) at movement states corresponding to movement states (col. 4, lines 7-8, “states k”) of said plurality of first images (equation (2); col. 4; lines 1-8, “m_k”); obtaining a plurality of second images (equation (2); col. 4; line 67, “m_{k+1}”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) using a second imaging

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technique (col. 2, lines 56-64, “two dimensional array of projections”) and an associated plurality of second measurements (col. 2, lines 59-60; col. 4, lines 9-10) of the mobile object at movement states corresponding to movement states (col. 4, line 67, “state k+1”) of said plurality of second images (equation (2); col. 4; line 67, “m_{k+1}”); and forming an image (fig. 2, “object reconstructed” and "$\hat{f}_o$") of the mobile object based on said plurality of first images (equation (2); col. 4; lines 1-8, “m_k”) and associated plurality of first measurements (col. 2, lines 59-60; col. 4, lines 9-10, “the sets of measurements”) and on said plurality of said second images (equation (2); col. 4; line 67, “m_{k+1}”) and associated plurality of second measurements (equations (2)-7; col. 4, lines 1-67; col. 5, lines 1-25, “the sets of measurements”). However, De Murcia does not disclose all the claim limitations. Instead of De Murcia, Townsend discloses the first imaging technique (abstract; claim 1, “CT is an example of a system using an anatomic radiation attenuation imagery technique”) is different from the second imaging technique (abstract; claim 1, “PET is an example of a system using functional radiation emission imagery technique”).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize Townsend’s invention in De Murcia’s invention to obtain satisfactory imaging results as suggested by De Murcia (col. 2, lines 44-55).

Regarding claim 16, De Murcia further discloses time-synchronizing said first measurements and said second measurements (col. 3, lines 38-44, “… synchronized … phases of its cycle …”).

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Regarding claim 17, De Murcia further discloses forming first reconstructed images corresponding to said plurality of first images (col. 4, lines 58-67; col. 5, lines 1-12, "$\hat{f}_o^k$") and second reconstructed images corresponding to said plurality of second images (col. 5, lines 1-25, "f_o^{k+1}").

Regarding claim 18, De Murcia further discloses spatially-synchronizing said first reconstructed images and said second reconstructed images (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 19, Townsend further discloses the first imaging technique being a radiation attenuation technique (abstract; claim 1, "CT is an example of a system using an anatomic radiation attenuation imagery technique") and second imaging technique being a radiation emission technique (abstract; claim 1, "PET is an example of a system using functional radiation emission imagery technique").

Regarding claim 20, De Murcia further discloses spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 21, De Murcia further discloses forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements (col. 2, lines 45-55, "… displacements …").

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Regarding claim 22, De Murcia further discloses wherein said forming an image of the mobile object comprising combining said displacement fields (equations (8); col. 5, lines 45-67, “v(M)”).

Regarding claim 23, De Murcia further discloses wherein said forming displacement fields comprises: estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields (equations (8); col. 5, lines 45-67, “v(M)”; equation (14); col. 7, lines 63-67; col. 8, lines 1-29, “… displacements …”).

Regarding claim 24, De Murcia further discloses wherein at least one of said movement estimates is formed relative to a reference time (col. 3, lines 38-44, “phases of its cycle …”).

Regarding claim 25, Townsend further discloses wherein said plurality of first measurements and said plurality of second measurements being taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images (abstract; claim 1, “CT is an example of a system using an anatomic radiation attenuation imagery technique” and “PET is an example of a system using functional radiation emission imagery technique”).

Regarding claim 26, claim 26 is analogous and corresponds to claim 15. See rejection of claim 15 for further explanation.

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Regarding claim 27, claim 27 is analogous and corresponds to claim 17. See rejection of claim 17 for further explanation.

Regarding claim 28, claim 28 is analogous and corresponds to claim 19. See rejection of claim 19 for further explanation.

Regarding claim 29, claim 29 is analogous and corresponds to claim 21. See rejection of claim 21 for further explanation.

Regarding claim 30, claim 30 is analogous and corresponds to claim 22. See rejection of claim 22 for further explanation.

Regarding claim 31, claim 31 is analogous and corresponds to claim 23. See rejection of claim 23 for further explanation.

Regarding claim 32, claim 32 is analogous and corresponds to claim 24. See rejection of claim 24 for further explanation.

Conclusion

6. No claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN Wahnkyo LEE whose telephone number is (571)272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed can be reached on (571) 272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Volkswagen v. Longhorn - IPR2025-00925

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John Wahnkyo Lee/
Examiner, Art Unit 2624

/Samir A. Ahmed/
Supervisory Patent Examiner, Art Unit 2624

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Notice of References Cited	Application/Control No. 10/955,037	Applicant(s)/Patent Under Reexamination BONNET ET AL.	
	Examiner JOHN Wahnkyo LEE	Art Unit 2624	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,694,156 A	09-1987	Swanberg, Melvin E.	250/214RC
*	B	US-5,889,525 A	03-1999	De Murcia et al.	345/420
*	C	US-2003/0004405 A1	01-2003	Townsend et al.	600/407
*	D	US-6,885,702 B1	04-2005	Goudezeune et al.	375/240.12
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/27/2006	09/07/2007	05/25/2008	11/07/2008	04/22/2009				
	1	✓	-	-	-	-				
	2	✓	-	-	-	-				
	3	✓	-	-	-	-				
	4	✓	-	-	-	-				
	5	✓	-	-	-	-				
	6	✓	-	-	-	-				
	7	✓	-	-	-	-				
	8	✓	-	-	-	-				
9			✓	-	-	-				
10			✓	-	-	-				
11			✓	-	-	-				
12			✓	-	-	-				
13			✓	-	-	-				
14			✓	-	-	-				
15				✓	✓	✓				
16				✓	✓	✓				
17				✓	✓	✓				
18				✓	✓	✓				
19				✓	✓	✓				
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25				✓	✓	✓				
26				✓	✓	✓				
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28				✓	✓	✓				
29				✓	✓	✓				
30				✓	✓	✓				
31				✓	✓	✓				
32				✓	✓	✓				

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

SEARCHED			
Class	Subclass	Date	Examiner
382	128	12/26/2006	John W. Lee
345	420	12/26/2006	John W. Lee
382	128	11/06/2008	John W. Lee

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	12/26/2006	John W. Lee
East Search	12/26/2006	John W. Lee
IEEE (Non- Patent Literature Search)	12/26/2006	John W. Lee
EAST Search	11/06/2008	John W. Lee
EAST Search	4/22/2009	John W. Lee

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

/JOHN W LEE/ Examiner.Art Unit 2624	

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	10/955037	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:20
S2	3258	382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S3	3206	S2 AND IMAG$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S4	593	S3 and CYCLE	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30

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S5	358	S4 AND state	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S6	8	\2003/0004405	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S7	2	"20030004405"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:31
S8	5	"5889525"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:31

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Docket No.: 27592-00987-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Stephane Bonnet et al.

Application No.: 10/955,037 | Confirmation No.: 4535

Filed: September 30, 2004 | Art Unit: 2624

For: METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES | Examiner: J. W. Lee

RESPONSE UNDER 37 C.F.R. 1.112 (NON-FINAL OFFICE ACTION)

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Madam:

INTRODUCTORY COMMENTS

This is in response to the non-final Office Action mailed April 28, 2009, in the above-captioned case.

Amendments to the Claims are reflected in the Listing of Claims which begins on page 2 of this paper.

Remarks begin on page 7 of this paper.

	Claims remaining after Amendment		**Highest number previously paid for**		**Present extra**
Total	18		20		0
Independent	2		3		0

683810

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AMENDMENTS TO THE CLAIMS

This Listing of Claims will replace all prior versions and listings of claims in this application.

Listing of Claims:

1.-14. (Cancelled)

15. (Previously Presented) A method of forming an image of a mobile object, comprising:

obtaining a plurality of first images of the mobile object using a first imaging technique and an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements,

wherein the first imaging technique is different from the second imaging technique.

16. (Previously Presented) The method of Claim 15, further comprising:

time-synchronizing said first measurements and said second measurements.

17. (Previously Presented) The method of Claim 15, further comprising:

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forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

18. (Previously Presented) The method of Claim 17, further comprising:

spatially-synchronizing said first reconstructed images and said second reconstructed images.

19. (Previously Presented) The method of Claim 15, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

20. (Previously Presented) The method of Claim 15, further comprising:

spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements.

21. (Previously Presented) The method of Claim 15, further comprising:

forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

22. (Previously Presented) The method of Claim 21, wherein said forming an image of the mobile object comprises combining said displacement fields.

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23. (Previously Presented) The method of Claim 21, wherein said forming displacement fields comprises:

estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

24. (Previously Presented) The method of Claim 23, wherein at least one of said movement estimates is formed relative to a reference time.

25. (Previously Presented) The method of Claim 15, wherein said plurality of first measurements and said plurality of second measurements are taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images.

26. (Previously Presented) An apparatus to form an image of a mobile object, comprising:

means for obtaining a plurality of first images of the mobile object using a first imaging technique;

means for obtaining an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

means for obtaining a plurality of second images of the mobile object using a second imaging technique;

means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and

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means for forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements,

wherein the first imaging technique is different from the second imaging technique.

27. (Previously Presented) The apparatus of Claim 26, further comprising:

means for forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

28. (Previously Presented) The apparatus of Claim 26, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

29. (Previously Presented) The apparatus of Claim 26, further comprising:

means for forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

30. (Previously Presented) The apparatus of Claim 29, wherein said means for forming an image of the mobile object comprises means for combining said displacement fields.

31. (Previously Presented) The apparatus of Claim 29, wherein said means for forming displacement fields comprises:

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means for estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

32. (Previously Presented) The apparatus of Claim 31, wherein at least one of said movement estimates is to be formed relative to a reference time.

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REMARKS

Applicants thank the Examiner for the careful consideration given to this application. Claims 15-32 are pending in this application. Claims 15 and 26 are independent claims. Reconsideration and allowance of the present application are respectfully requested.

As a preliminary matter, Applicants' representative thanks the Examiner for discussing the rejections under 35 U.S.C 112 and 35 U.S.C 103 and for agreeing to reconsider those rejections.

Claim Rejections under 35 U.S.C. §112

Claims 15-18, 20-24, 26-27 and 29-32 stand rejected under 35 USC §112, second paragraph, as being indefinite. This rejection is respectfully traversed.

Claims 15-18, 20-24, 26-27 and 29-32 stand rejected under 35 USC § 112, as being indefinite on the grounds of insufficient antecedent basis. This rejection is respectfully traversed.

As noted in the Response to the previous Office Action, line 2 of claim 15 and line 2 of claim 26, in part, recite "a plurality of first images" and "a first imaging technique." Line 5 of claim 15 and line 5 of claim 26, in part, recites "a second imaging technique" and "a plurality of second images." Line 3 of claim 15 and line 3 of claim 26, in part, recite "an associated plurality of first measurements" and line 6 of claim 15 and line 6 of claim 26, in part, recite "an associated plurality of second measurements."

In the Response to Amendment Section, the Office Action indicated that with regards to claims 15-18, 20-24, 26-27 and 29-32, it is unclear what the "first image," "first measurements," "first imaging technique," "second image," second measurements," and "second imaging technique" is trying to indicate. According to the MPEP, "a claim is indefinite when it contains words or phases whose meaning is unclear. The lack of clarity could arise where a claim refers to "said lever" or "the lever", where the claim contains no earlier recitation or limitation of a lever where it would be unclear as to what element the limitation was making reference." See at least MPEP 2173.05(e).

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As noted above, each of independent claims 15 and 26, upon which claims 16-25 and 27-32 depend, clearly recites "a plurality of first images," "a first imaging technique," "a second imaging technique," "a plurality of second images," "an associated plurality of first measurements," and "an associated plurality of second measurements." Therefore, it is clear that recitations of the "first images," "first imaging technique," "first measurements," "second images," "second imaging technique," and "second measurements" in the pending claims are referencing "a plurality of first images," "a first imaging technique," "an associated plurality of first measurements," "a plurality of second images," and "a second imaging technique," and "an associated plurality of second measurements," as recited in claims 15 and 26. Therefore, Applicant submits that rejection of claims 15-18, 20-24, 26-27 and 29-32 under 35 USC § 112, as being indefinite on the grounds of insufficient antecedent basis is in error and should be withdrawn.

Furthermore, the Office Action alleged that it is also unclear whether the "first measurements" and the "first imaging technique" are different from the "second measurements" and "second imaging technique", respectively. The pending claims clearly recite two different measurements, that is, the first measurements and the second measurements. The claims also clearly recite two different imaging techniques, that is, the first and second imaging techniques. In fact, the claims clearly recite that "the first imaging technique is different from the second imaging technique."

Based on the discussion above, Applicant submits that there is clear antecedent basis for "first images," "first measurement," "first imaging technique," "second images," "second measurement" and "second imaging techniques" in each of claims 15-18, 20-24, 26-27 and 29-32. The pending claims also recite two different measurements, that is, the first measurements and the second measurements and two different imaging techniques, that is, the first and second imaging techniques. Therefore, Applicants respectfully request that the rejections of claims 15, 17, 21, 23, 25-27, 29 and 31 under 35 U.S.C. §112, second paragraph, be withdrawn. Applicants also respectfully request that the rejections of claims 15-18, 20-24, 26-27 and 29-32 under 35 U.S.C. §112 be withdrawn.

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Claim Rejections Under 35 U.S.C. §103

Claims 15-32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,889,525 to De Murcia et al. (hereinafter "De Murcia") in view of U.S. Patent Publication No. 2003/0004405 to Townsend et al. (hereinafter "Townsend"). This rejection is respectfully traversed.

Applicant submits that the combination of De Murcia and Townsend does not teach or suggest each of the elements recited in claims 15-18, 20-24, 26-27 and 29-32. Each of independent claims 15 and 26, in part, recites "obtaining a plurality of second images of the mobile object using a second imaging technique; obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images; and forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements, wherein the first imaging technique is different from the second imaging technique." De Murcia does not teach or suggest these features.

De Murcia merely discloses taking a series of sets of measurements of a characteristic property of an object by a two-dimensional array of mobile sensors around the object. The Office Action equates the two-dimensional array of projections to the "first imaging technique" recited in the pending claims. There is no teaching or suggestion in De Murcia of a "second imaging technique," that is, an imaging technique which is different from the first technique. Thus, there is no teaching or suggestion in De Murcia of "obtaining a plurality of second images of the mobile object using a second imaging technique" and "obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images," as recited in the pending claims. There is also no teaching or suggestion in De Murcia of "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements," as recited in the pending claims.

The Office Action indicated that "applicant does not distinguish or specify whether the "first measurement" and "first imaging technique" are different with the "second measurement" and "second imaging technique", respectively, in the independent claims." As noted above, with

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respect to the 112 rejections and as submitted during a telephone discussion with the Examiner, each of the pending claims clearly recites two different imaging techniques, that is, the first and second imaging techniques, "wherein the first imaging technique is different from the second imaging technique." Therefore, as also provided in the discussion above directed to the 112 rejections, Applicant does specify that the "first measurement" and "first imaging technique" are different from the "second measurement" and "second imaging technique", respectively, in the independent claims.

Townsend does not cure the deficiencies of De Murcia. Specifically, Townsend does not teach or suggest "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements, wherein the first imaging technique is different from the second imaging technique," as recited in claims 15 and 27, upon which claims 19, 25 and 28 depend.

Townsend merely discloses a combined PET and X-Ray CT tomography for acquiring CT and PET images sequentially in a single device. So in Townsend the CT images are separate from the PET images. There is no teaching or suggestion in Townsend of forming an image by combining the separate CT and PET images. Thus, there is no teaching or suggestion in Townsend of "forming an image of the mobile object based on said plurality of first images and associated plurality of first measurements and on said plurality of said second images and associated plurality of second measurements," as recited in claims 15 and 27, upon which claims 19, 25 and 28 depend. Therefore, Applicants respectfully request that this rejection of claims 15-32 under 35 U.S.C. §103 be withdrawn.

Disclaimer

Applicants may not have presented all possible arguments or have refuted the characterizations of either the claims or the prior art as found in the Office Action. However, the lack of such arguments or refutations is not intended to act as a waiver of such arguments or as concurrence with such characterizations.

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CONCLUSION

In view of the above, consideration and allowance are respectfully solicited.

In the event the Examiner believes an interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees to Deposit Account No. 22-0185.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 22-0185, under Order No. 27592-00987-US from which the undersigned is authorized to draw.

Dated: July 27, 2009

Respectfully submitted,

Electronic signature: /Arlene P. Neal/
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LAG-VW00000816

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Electronic Acknowledgement Receipt

EFS ID:	5775959
Application Number:	10955037
International Application Number:	
Confirmation Number:	4535
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Customer Number:	30678
Filer:	Burton A. Amernick/Mary Ann Taylor
Filer Authorized By:	Burton A. Amernick
Attorney Docket Number:	27592-00987- US
Receipt Date:	27-JUL-2009
Filing Date:	30-SEP-2004
Time Stamp:	16:33:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Response_07_27_09.pdf	112838 91552b6a3df617b16882c187720762f9b592f450	yes	11

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	11
Warnings:			
Information:			
	Total Files Size (in bytes):	112838	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/955,037	Filing Date 09/30/2004	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1)		(Column 2)	(Column 3)					
	07/27/2009	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $ =		OR	X $52 =	0
	Independent (37 CFR 1.16(h))	* 2	Minus	*** 3	= 0	X $ =		OR	X $220 =	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	**0**

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/THERESA LINDSAY/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	27592-00987- US	4535

30678 7590 11/27/2009

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SUITE 1100
WASHINGTON, DC 20006

EXAMINER	
LEE, JOHN W	
ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
11/27/2009	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	JOHN Wahnkyo LEE	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 September 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) *1-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

- The application was forwarded to the examiner on 9 September 2009.

Response to Arguments/Amendments

1. Applicant's arguments and amendments filed on 27July 2009 have been fully considered.

2. Applicant's arguments, with respect to claims 15-32 under 35 U.S.C. 112, second paragraph have been considered, but are not persuasive. The reason why the rejection cannot be withdrawn will be provide below.

3. Applicant's arguments, with respect to claims 15-32, under 35 U.S.C. 103 have been considered, but are not persuasive. Applicant argues that De Murcia does not disclose or distinguish that the “first measurement” and the “first imaging technique” are different with the “second measurement” and the "second imaging technique", respectively. However, the applicant did not mention any in the claims that the "first measurement" and the "second measurement" are different. Arguing about whether the prior art distinguishes whether the “first measurement” and the “second measurement” are different is irrelevant. Of course, the imaging technique is different. It is recited that “the first imaging technique” and the “second imaging technique” are different. The applicant is right that De Murica does not disclose that the first imaging technique and the second imaging technique are different. For that reason, Townsend was cited as a secondary reference to cure the deficiency of De Murcia. Townsend discloses a

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combined PET and X-Ray CT tomograph for acquiring CT and PET images, which can be imaging techniques, sequentially in a single device.

The Supreme Court in KSR International Co. v. Teleflex Inc., 550 U.S. ___, ___, 82 USPQ2d 1385, 1395-97 (2007) identified a number of rationales to support a conclusion of obviousness which are consistent with the proper "functional approach" to the determination of obviousness as laid down in Graham. The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. Moreover, according to the Supreme Court, the teaching, suggestion, or motivation (TSM) is one of a number of valid rationales that could be used to determine obviousness, but not the only rationale that may be relied upon to support a conclusion of obviousness.

Adding the combined PET and X-Ray CT tomography for acquiring CT and PET images taught by Townsend to De Murcia's process for reconstructing of 3D images does no more to De Murcia's process than it would do if it were added to any other systems or method. The function remains that same. Predictably, combined PET and X-Ray CT tomography for acquiring CT and PET images adds greater reliability. Thus, it would have been obvious one of ordinary skill in the art would have been motivated to update De Murcia's process with Townsend's combined PET and X-Ray CT tomography for acquiring CT and PET images to gain, predictably, the commonly understood benefits of such adaptation, that is, a having a reliable process, because the both advantages of the PET and X-Ray CT can be used for a better quality of acquiring the images.

Because of the reason discussed above, the rejection cannot be withdrawn.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 15-32 have insufficient antecedent basis for these limitations in the claims. In claim 15, lines 9 and 10, “associated plurality of first measurements" and “associated plurality of second measurements" are mentioned in the previous claim limitations. So, it needs a “the” or a “said" before the “associated plurality of first measurements" and the “associated plurality of second measurements." Same reason applies for claim 26 as well.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 15-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Murcia et al. (US 5,889,525) in view of Townsend et al. (US 2003/0004405).

Regarding claim 15, De Murcia discloses a method of forming an image (col. 1, line 6-7, “reconstruction o three-dimensional images”) of a mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”), comprising:

obtaining a plurality of first images (equation (2); col. 4; lines 1-8, “m_k”) of the mobile

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object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) using a first imaging technique (col. 2, lines 56-64, “two dimensional array of projections”) and an associated plurality of first measurements (col. 2, lines 59-60; col. 4, lines 9-10, “the sets of measurements”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) at movement states corresponding to movement states (col. 4, lines 7-8, “states k”) of said plurality of first images (equation (2); col. 4; lines 1-8, “m_k”); obtaining a plurality of second images (equation (2); col. 4; line 67, “m_{k+1}”) of the mobile object (fig. 1; col. 1, line 6-7, “mobile object”; col. 2, lines 10-11, “mobile organs such as heart”) using a second imaging technique (col. 2, lines 56-64, “two dimensional array of projections”) and an associated plurality of second measurements (col. 2, lines 59-60; col. 4, lines 9-10) of the mobile object at movement states corresponding to movement states (col. 4, line 67, “state k+1”) of said plurality of second images (equation (2); col. 4; line 67, “$m_{k=1}$”); and forming an image (fig. 2, “object reconstructed” and "$\hat{f}_o$") of the mobile object based on said plurality of first images (equation (2); col. 4; lines 1-8, “m_k”) and associated plurality of first measurements (col. 2, lines 59-60; col. 4, lines 9-10, “the sets of measurements”) and on said plurality of said second images (equation (2); col. 4; line 67, “$m_{k=1}$”) and associated plurality of second measurements (equations (2)-7; col. 4, lines 1-67; col. 5, lines 1-25, “the sets of measurements”). However, De Murcia does not disclose all the claim limitations. Instead of De Murcia, Townsend discloses the first imaging technique (abstract; claim 1, “CT is an example of a system using an anatomic radiation attenuation imagery technique”) is different from the second imaging technique

(abstract; claim 1, “PET is an example of a system using functional radiation emission imagery technique”).

Adding the combined PET and X-Ray CT tomography for acquiring CT and PET images taught by Townsend to De Murcia's process for reconstructing of 3D images does no more to De Murcia’s process than it would do if it were added to any other systems or method. The function remains that same. Predictably, combined PET and X-Ray CT tomography for acquiring CT and PET images adds greater reliability. Therefore, it would have been obvious one of ordinary skill in the art would have been motivated to update De Murcia's process with Townsend's combined PET and X-Ray CT tomography for acquiring CT and PET images to gain, predictably, the commonly understood benefits of such adaptation, that is, a having a reliable process, because the both advantages of the PET and X-Ray CT can be used for a better quality of acquiring the images.

Regarding claim 16, De Murcia further discloses time-synchronizing said first measurements and said second measurements (col. 3, lines 38-44, “… synchronized … phases of its cycle …”).

Regarding claim 17, De Murcia further discloses forming first reconstructed images corresponding to said plurality of first images (col. 4, lines 58-67; col. 5, lines 1-12, "$\hat{f}_o^k$") and second reconstructed images corresponding to said plurality of second images (col. 5, lines 1-25, “ f_o^{k+1} ”).

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Regarding claim 18, De Murcia further discloses spatially-synchronizing said first reconstructed images and said second reconstructed images (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 19, Townsend further discloses the first imaging technique being a radiation attenuation technique (abstract; claim 1, "CT is an example of a system using an anatomic radiation attenuation imagery technique") and second imaging technique being a radiation emission technique (abstract; claim 1, "PET is an example of a system using functional radiation emission imagery technique").

Regarding claim 20, De Murcia further discloses spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements (col. 3, lines 38-44, "… synchronized … phases of its cycle …").

Regarding claim 21, De Murcia further discloses forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements (col. 2, lines 45-55, "… displacements …").

Regarding claim 22, De Murcia further discloses wherein said forming an image of the mobile object comprising combining said displacement fields (equations (8); col. 5, lines 45-67, "v(M)").

Regarding claim 23, De Murcia further discloses wherein said forming displacement fields comprises: estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said

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plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields (equations (8); col. 5, lines 45-67, “v(M)”; equation (14); col. 7, lines 63-67; col. 8, lines 1-29, “… displacements …”).

Regarding claim 24, De Murcia further discloses wherein at least one of said movement estimates is formed relative to a reference time (col. 3, lines 38-44, “phases of its cycle …”).

Regarding claim 25, Townsend further discloses wherein said plurality of first measurements and said plurality of second measurements being taken using separate measurement systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images (abstract; claim 1, “CT is an example of a system using an anatomic radiation attenuation imagery technique” and “PET is an example of a system using functional radiation emission imagery technique”).

Regarding claim 26, claim 26 is analogous and corresponds to claim 15. See rejection of claim 15 for further explanation.

Regarding claim 27, claim 27 is analogous and corresponds to claim 17. See rejection of claim 17 for further explanation.

Regarding claim 28, claim 28 is analogous and corresponds to claim 19. See rejection of claim 19 for further explanation.

Regarding claim 29, claim 29 is analogous and corresponds to claim 21. See rejection of claim 21 for further explanation.

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Volkswagen v. Longhorn - IPR2025-00925

Regarding claim 30, claim 30 is analogous and corresponds to claim 22. See rejection of claim 22 for further explanation.

Regarding claim 31, claim 31 is analogous and corresponds to claim 23. See rejection of claim 23 for further explanation.

Regarding claim 32, claim 32 is analogous and corresponds to claim 24. See rejection of claim 24 for further explanation.

Conclusion

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN Wahnkyo LEE whose telephone number is (571)272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed can be reached on (571) 272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John Wahnkyo Lee/
Examiner, Art Unit 2624

/Samir A. Ahmed/
Supervisory Patent Examiner, Art Unit 2624

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Notice of References Cited	Application/Control No. 10/955,037	Applicant(s)/Patent Under Reexamination BONNET ET AL.	
	Examiner JOHN Wahnkyo LEE	Art Unit 2624	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,694,156 A	09-1987	Swanberg, Melvin E.	250/214RC
*	B	US-5,889,525 A	03-1999	De Murcia et al.	345/420
*	C	US-2003/0004405 A1	01-2003	Townsend et al.	600/407
*	D	US-6,885,702 B1	04-2005	Goudezeune et al.	375/240.12
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/27/2006	09/07/2007	05/25/2008	11/07/2008	04/22/2009	11/20/2009			
	1	✓	-	-	-	-	-			
	2	✓	-	-	-	-	-			
	3	✓	-	-	-	-	-			
	4	✓	-	-	-	-	-			
	5	✓	-	-	-	-	-			
	6	✓	-	-	-	-	-			
	7	✓	-	-	-	-	-			
	8	✓	-	-	-	-	-			
9			✓	-	-	-	-			
10			✓	-	-	-	-			
11			✓	-	-	-	-			
12			✓	-	-	-	-			
13			✓	-	-	-	-			
14			✓	-	-	-	-			
15				✓	✓	✓	✓			
16				✓	✓	✓	✓			
17				✓	✓	✓	✓			
18				✓	✓	✓	✓			
19				✓	✓	✓	✓			
20				✓	✓	✓	✓			
21				✓	✓	✓	✓			
22				✓	✓	✓	✓			
23				✓	✓	✓	✓			
24				✓	✓	✓	✓			
25				✓	✓	✓	✓			
26				✓	✓	✓	✓			
27				✓	✓	✓	✓			
28				✓	✓	✓	✓			
29				✓	✓	✓	✓			
30				✓	✓	✓	✓			
31				✓	✓	✓	✓			
32				✓	✓	✓	✓			

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

SEARCHED			
Class	Subclass	Date	Examiner
382	128	12/26/2006	John W. Lee
345	420	12/26/2006	John W. Lee
382	128	11/06/2008	John W. Lee

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	12/26/2006	John W. Lee
East Search	12/26/2006	John W. Lee
IEEE (Non- Patent Literature Search)	12/26/2006	John W. Lee
EAST Search	11/06/2008	John W. Lee
EAST Search	4/22/2009	John W. Lee
EAST Search	11/20/2009	John W. Lee

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

/JOHN W LEE/ Examiner.Art Unit 2624	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	136269	different NEAR2 imag $4	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/11/20 20:19
L2	4064	382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/11/20 21:54
L3	1747	L1 and L2	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2009/11/20 21:54

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S1	1	10/955037	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:20
S2	3258	382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S3	3206	S2 AND IMAG$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S4	593	S3 and CYCLE	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30
S5	358	S4 AND state	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2008/11/06 15:30

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Volkswagen v. Longhorn - IPR2025-00925

S6	8	\ 2003/ 0004405	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; I BM_TDB	OR	ON	2008/ 11/ 06 15:30
S7	2	"20030004405"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; I BM_TDB	OR	ON	2008/ 11/ 06 15:31
S8	5	"5889525"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; I BM_TDB	OR	ON	2008/ 11/ 06 15:31

11/ 20/ 2009 9:54:56 PM
C:\ Documents and Settings\ jlee15\ My Documents\ EAST\ Workspaces\ 10955037RCEF.wsp

Volkswagen Exhibit 1037, Page 836 of 2532
Volkswagen v. Longhorn - IPR2025-00925

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	27592-00987- US	4535

30678 7590 01/19/2010
CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20006

EXAMINER	
LEE, JOHN W	
ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
01/19/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Interview Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	JOHN Wahnkyo LEE	2624	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Samir Ahmed*. (3)*Jeffery Gluck*.

(2) *JOHN Wahnkyo LEE*. (4)_____.

Date of Interview: *5 January 2009*.

Type: a)☒ Telephonic b)☐ Video Conference
c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *1*.

Identification of prior art discussed: *De Murcia et al. and Townsend et al.*.

Agreement with respect to the claims f)☐ was reached. g)☒ was not reached. h)☐ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *The examiners and the attoreny discussed about the rejections under 35 U.S.C. 112, second paragraph and 35 U.S.C. 103 (a).The attorney argued that the claims which the examiner pointed out as lack of antecedent basis are incorrect. Moreover, the attorney also argued that Townsend does not implement the invention the same way with the applicant's invention does.* .

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

/John Wahnkyo Lee/ Examiner, Art Unit 2624	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

———

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

PTO/SB/30 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Request for Continued Examination (RCE) Transmittal

Address to:
Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Application Number	10/955,037-Conf. #4535
Filing Date	September 30, 2004
First Named Inventor	Stephane Bonnet
Art Unit	2624
Examiner Name	J. W. Lee
Attorney Docket Number	27592-00987-US

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.

Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. See Instruction Sheet for RCEs (not to be submitted to the USPTO) on page 2.

1. Submission required under 37 CFR 1.114 Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

   a. [ ] Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

      i. [ ] Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____

      ii. [ ] Other _____

   b. [x] Enclosed

      i. [x] Amendment/Reply

      ii. [ ] Affidavit(s)/Declaration(s)

      iii. [ ] Information Disclosure Statement (IDS)

      iv. [ ] Other _____

2. Miscellaneous

   a. [ ] Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of _____ months. (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

   b. [ ] Other _____

3. Fees The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.

   a. [ ] The Director is hereby authorized to charge the following fees, any underpayment of fees, or credit any Overpayments, to Deposit Account No. 22-0185 .

      i. [x] RCE fee required under 37 CFR 1.17(e)

      ii. [ ] Extension of time fee (37 CFR 1.136 and 1.17)

      iii. [ ] Other _____

   b. [ ] Check in the amount of $ _____ enclosed

   c. [x] Payment by credit card

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

Signature	/Jeffrey W. Gluck/	Date	February 19, 2010
Name (Print/Type)	Jeffrey W. Gluck	Registration No.	44,457

Docket No.: 27592-00987-US
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:
Stephane Bonnet et al.

Application No.: 10/955,037 | Confirmation No.: 4535

Filed: September 30, 2004 | Art Unit: 2624

For: METHOD OF RECONSTRUCTING AN IMAGE WITH DATA ACQUISITION ACCORDING TO SEVERAL IMAGERY MODES AND SYNCHRONISATION OF IMAGE SERIES | Examiner: J. W. Lee

AMENDMENT FILED WITH RCE UNDER 37 C.F.R. 1.114

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is in response to the final Office Action mailed November 27, 2009, in the above-captioned case and is intended to be filed with a Request for Continued Examination (RCE). If no RCE accompanies this paper, continued examination is hereby requested.

Amendments to the Claims are reflected in the Listing of Claims which begins on page 2 of this paper.

Remarks begin on page 6 of this paper.

	Claims remaining after Amendment		**Highest number previously paid for**		**Present extra**
Total	18		20		0
Independent	2		3		0

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AMENDMENTS TO THE CLAIMS

This Listing of Claims will replace all prior versions and listings of claims in this application.

Listing of Claims:

1.-14. (Cancelled)

15. (Currently Amended) A method of forming an image of a mobile object, comprising:

obtaining a plurality of first images of the mobile object using a first imaging technique and an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images, wherein the plurality of second measurements are distinct from the plurality of first measurements; and

forming an image of the mobile object based on said plurality of first images and said associated plurality of first measurements and on said plurality of said second images and said associated plurality of second measurements,

wherein the first imaging technique is different from the second imaging technique.

16. (Previously Presented) The method of Claim 15, further comprising:

time-synchronizing said first measurements and said second measurements.

17. (Previously Presented) The method of Claim 15, further comprising:

forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

18. (Previously Presented) The method of Claim 17, further comprising:

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spatially-synchronizing said first reconstructed images and said second reconstructed images.

19. (Previously Presented) The method of Claim 15, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

20. (Previously Presented) The method of Claim 15, further comprising:

spatially-synchronizing information based on said plurality of first measurements and information based on said plurality of second measurements.

21. (Previously Presented) The method of Claim 15, further comprising:

forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

22. (Previously Presented) The method of Claim 21, wherein said forming an image of the mobile object comprises combining said displacement fields.

23. (Previously Presented) The method of Claim 21, wherein said forming displacement fields comprises:

estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

24. (Previously Presented) The method of Claim 23, wherein at least one of said movement estimates is formed relative to a reference time.

25. (Previously Presented) The method of Claim 15, wherein said plurality of first measurements and said plurality of second measurements are taken using separate measurement

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systems respectively associated with separate imaging systems used to obtain said plurality of first images and said plurality of second images.

26. (Currently Amended) An apparatus to form an image of a mobile object, comprising:

means for obtaining a plurality of first images of the mobile object using a first imaging technique;

means for obtaining an associated plurality of first measurements of the mobile object at movement states corresponding to movement states of said plurality of first images;

means for obtaining a plurality of second images of the mobile object using a second imaging technique;

means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images, wherein the plurality of second measurements are distinct from the plurality of first measurements; and

means for forming an image of the mobile object based on said plurality of first images and said associated plurality of first measurements and on said plurality of said second images and said associated plurality of second measurements,

wherein the first imaging technique is different from the second imaging technique.

27. (Previously Presented) The apparatus of Claim 26, further comprising:

means for forming first reconstructed images corresponding to said plurality of first images and second reconstructed images corresponding to said plurality of second images.

28. (Previously Presented) The apparatus of Claim 26, wherein said first imaging technique is a radiation attenuation technique and said second imaging technique is a radiation emission technique.

29. (Previously Presented) The apparatus of Claim 26, further comprising:

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means for forming displacement fields corresponding, respectively, to said plurality of first images, said plurality of first measurements, said plurality of second images, and said plurality of second measurements.

30. (Previously Presented) The apparatus of Claim 29, wherein said means for forming an image of the mobile object comprises means for combining said displacement fields.

31. (Previously Presented) The apparatus of Claim 29, wherein said means for forming displacement fields comprises:

means for estimating movement of the mobile object based, respectively, on said plurality of first images, said plurality of second images, said plurality of first measurements, and said plurality of second measurements, in order to form said displacement fields.

32. (Previously Presented) The apparatus of Claim 31, wherein at least one of said movement estimates is to be formed relative to a reference time.

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REMARKS

Applicants thank the Examiner for the careful consideration given to this application and for the very helpful telephone interview conducted on January 5, 2010 (summarized below). Reconsideration is now respectfully requested in view of the amendment above and the following remarks.

Claims 15-32 are pending in this application. Claims 15 and 26 are independent claims. Claims 15 and 26 are amended. Claims 1-14 were previously cancelled without prejudice or disclaimer. Reconsideration and allowance of the present application are respectfully requested.

Summary of Interview of January 5, 2010

Again, Applicants are grateful for the very helpful telephone interview held on January 5, 2010. The participants were Examiner John Lee, Supervisory Patent Examiner Samir Ahmed, and Applicants' undersigned representative. The first topic of discussion was the rejection of all claims under 35 U.S.C. § 112, second paragraph. Messrs. Lee and Ahmed explained their position, and the undersigned explained Applicants' position. While Applicants disagree with this rejection, the undersigned indicated that amendments to Claims 15 and 26 would be considered by Applicants. The second topic of discussion related to the art-based rejections under 35 U.S.C. § 103, based on DeMurcia et al. and Townsend et al. (see below for further details). Messrs. Lee and Ahmed explained how the two references were being combined; namely, DeMurcia et al. was used in the Office Action to teach obtaining a set of images with corresponding measurements and using the images and measurements to reconstruct an object, while Townsend et al. was being used to teach the use of obtaining two types of images and combining their results (paragraph [0080] of Townsend et al. was specifically discussed). The undersigned pointed to reasons why the two references may not be combined to obtain the claimed invention. Possible amendments to the independent claims to clarify such differences were discussed. No firm agreement was reached on any of the rejections.

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Claim Rejections under 35 U.S.C. § 112

Claims 15-32 stand rejected under 35 USC § 112, second paragraph, as being indefinite. This rejection is respectfully traversed in view of the amendments to Claims 15 and 26, which Applicants believe address the concerns stated in the rejection. Therefore, Applicants respectfully request that the rejection of Claims 15-32 under 35 U.S.C. § 112 be withdrawn.

Claim Rejections Under 35 U.S.C. §103

Claims 15-32 stand rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 5,889,525 to De Murcia et al. (hereinafter "De Murcia et al.") in view of U.S. Patent Publication No. 2003/0004405 to Townsend et al. (hereinafter "Townsend et al."). This rejection is respectfully traversed for at least the following reasons.

Claim 15, as amended, includes the recitations, "obtaining a plurality of second images of the mobile object using a second imaging technique and an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images, wherein the plurality of second measurements are distinct from the plurality of first measurements," and, "forming an image of the mobile object based on said plurality of first images and said associated plurality of first measurements and on said plurality of said second images and said associated plurality of second measurements." Claim 26, as amended, includes the recitations, "means for obtaining an associated plurality of second measurements of the mobile object at movement states corresponding to movement states of said plurality of second images, wherein the plurality of second measurements are distinct from the plurality of first measurements," and, "means for forming an image of the mobile object based on said plurality of first images and said associated plurality of first measurements and on said plurality of said second images and said associated plurality of second measurements." Applicants respectfully submit that the combination of DeMurcia et al. with Townsend et al. fails to teach or suggest at least these claim elements, for at least the following reasons.

As noted above (see Summary of Interview) and discussed, e.g., at page 5 of the Office Action, DeMurcia et al. teaches obtaining a single set of images and a single set of associated measurements and uses them to form an image. Also as discussed above and, e.g., at pages 5-6 of the Office Action, Townsend et al. teaches the use of CT and PET imaging and, at paragraph

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[0080] discusses "image 'fusion'" to combine their results. Applicants note that paragraph [0080] of Townsend et al. specifically states:

> The PET images are therefore fully quantitative and are interpolated and displayed with the same pixel size as the CT images. PET images are displayed either adjacent to, or superimposed on, CT images for simultaneous interpretation of functional and morphological information. In one embodiment, the PET and CT images are displayed side by side in a viewing tool with linked cross-hair cursors, so that positional correspondence between the two image sets is easily established. A second technique of image `fusion` is also employed, where the two different image sets are combined into a single image. See FIG. 3. For display of the fused PET and CT images, an alternating pixel method is extended to a 3D display format. Since the PET images have an isotropic resolution of approximately 10 mm for whole-body oncology imaging, the images are interpolated into the CT image space without loss of information in the PET image, thus preserving the resolution of the CT image. Because image fusion methods can obscure low-contrast objects, the CT display panel can be toggled between CT only and fused PET/CT mode. The viewing panels also have independent color scales and can be switched between transverse, sagittal, and coronal viewing modes.

Townsend et al. at paragraph [0080]. It is significant that the word "fusion" is in quotation marks, namely, because, as is subsequently explained in paragraph [0080], "For display of the fused PET and CT images, an alternating pixel method is extended to a 3D display format," and "the [PET] images are interpolated into the CT image space." That is, Townsend et al. creates a combined image based on two different imaging techniques, but it specifically uses combining techniques that ***do not use associated sets of measurements***, as presently claimed. In fact, for example, in the abstract and paragraph [0035], Townsend et al. provides a system in which such measurements are not necessary because, due to the physically-known relationship between the CT and PET scans, the resulting images may be combined without registration (i.e., they are inherently co-registered; see, also, paragraph [0036]). If one were to attempt to combine, for example, CT and PET images based on both the images and distinct associated measurements

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(i.e., sets of measurements associated with each set of images), such as those found in DeMurcia et al., then one would need to provide an altogether different technique from that found in Townsend et al. for combining the images obtained using the two techniques and the associated sets of measurements, and neither reference provides or suggests such a technique (i.e., a technique that would provide for the claimed "forming an image of the mobile object based on said plurality of first images and said associated plurality of first measurements and on said plurality of said second images and said associated plurality of second measurements" of Claim 15, and similar language in Claim 26). In particular, as discussed above, Townsend et al. does not use such a technique because there is no need for such a technique due to the inherent "co-registration" of the images, and DeMurcia et al. does not include such a technique because it is not combining multiple images/measurements obtained distinctly. Therefore, Applicants respectfully submit that the combination of DeMurcia et al. with Townsend et al. fails to teach or suggest the subject matter as claimed in Claims 15 and 26, and therefore, in their respective dependent claims (Claims 16-25 and 27-32).

Applicants also note that there are further reasons for which various dependent claims are allowable over the cited combination of references. For example, Claim 16 recites, "time-synchronizing said first measurements and said second measurements." The Office Action, at page 6, alleges that DeMurcia et al. discloses this at col. 3, lines 38-44. This portion of DeMurcia et al. states, "The sensors 3 having different incidences take a series of sets of measurements being receptive to photons at certain instants, synchronized on a given group of states of the heart 1, or the phases of its cycle. The means for the synchronization, control of sensors 3, displacement of the two-dimensional array 2 and the storage of measurements, which are already known, will not be described here." This fails to teach or suggest what is claimed in Claim 16 at least because there is no teaching or suggestion of synchronizing two (distinct) sets of measurements, as claimed.

Therefore, Applicants respectfully request that this rejection of Claims 15-32 under 35 U.S.C. § 103 be withdrawn.

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Disclaimer

Applicants may not have presented all possible arguments or have refuted the characterizations of either the claims or the prior art as found in the Office Action. However, the lack of such arguments or refutations is not intended to act as a waiver of such arguments or as concurrence with such characterizations.

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CONCLUSION

In view of the above, consideration and allowance are respectfully solicited.

In the event the Examiner believes an interview might serve in any way to advance the prosecution of this application, the undersigned is available at the telephone number noted below.

The Office is authorized to charge any necessary fees to Deposit Account No. 22-0185.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 22-0185, under Order No. 27592-00987-US from which the undersigned is authorized to draw.

Dated: February 19, 2010

Respectfully submitted,

Electronic signature: /Jeffrey W. Gluck/
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Registration No.: 44,457
CONNOLLY BOVE LODGE & HUTZ LLP
1875 Eye Street, NW
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Attorney for Applicant

LAG-VW00000851

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Volkswagen v. Longhorn - IPR2025-00925

Electronic Patent Application Fee Transmittal	
Application Number:	10955037
Filing Date:	30-Sep-2004
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Filer:	Burton A. Amernick/Mary Ann Taylor
Attorney Docket Number:	27592-00987- US
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Request for continued examination	1801	1	810	810
		Total in USD ($)		**810**

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Electronic Acknowledgement Receipt

EFS ID:	7048540
Application Number:	10955037
International Application Number:	
Confirmation Number:	4535
Title of Invention:	Method of reconstructing an image with data acquisition according to several imagery modes and synchronisation of image series
First Named Inventor/Applicant Name:	Stephane Bonnet
Customer Number:	30678
Filer:	Burton A. Amernick/Mary Ann Taylor
Filer Authorized By:	Burton A. Amernick
Attorney Docket Number:	27592-00987- US
Receipt Date:	19-FEB-2010
Filing Date:	30-SEP-2004
Time Stamp:	15:24:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$810
RAM confirmation Number	1825
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Request for Continued Examination (RCE)	RCE_Transmittal_02_19_10.pdf	65729 b6054b8cb331e080db4dec43331b3bdb543b1ca5	no	1
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		Response_02_19_10.pdf	115050 1f0db8eee7fdf097fb489c2cea52ec884a725a66	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment Submitted/Entered with Filing of CPA/RCE		1	1	
	Claims		2	5	
	Applicant Arguments/Remarks Made in an Amendment		6	11	
Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	30155 41ac729fe932609bc7af92b07527d0f5e7d3b6fc	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	210934		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/955,037	Filing Date 09/30/2004	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
AMENDMENT	02/19/2010	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 2	Minus	***3	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)					
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.

** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".

*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".

The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/MARQUETTA MCGEE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PLUS Search Results for S/N 10955037, Searched Tue Jul 06 09:19:15 EDT 2010

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

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6907100 72
20040086074 72
5574762 60
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PLUS Search Results for S/N 10955037, Searched Tue Jul 06 09:19:12 EDT 2010

The Patent Linguistics Utility System (PLUS) is a USPTO automated search system for U.S. Patents from 1971 to the present PLUS is a query-by-example search system which produces a list of patents that are most closely related linguistically to the application searched. This search was prepared by the staff of the Scientific and Technical Information Center, SIRA.

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/955,037	09/30/2004	Stephane Bonnet	27592-00987- US	4535

30678 7590 07/12/2010
CONNOLLY BOVE LODGE & HUTZ LLP
1875 EYE STREET, N.W.
SUITE 1100
WASHINGTON, DC 20006

EXAMINER	
LEE, JOHN W	
ART UNIT	PAPER NUMBER
2624	

MAIL DATE	DELIVERY MODE
07/12/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/955,037	BONNET ET AL.	
	Examiner	Art Unit	
	JOHN Wahnkyo LEE	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 February 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32* is/are pending in the application.

4a) Of the above claim(s) *1-14* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *15-32* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 September 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

- Claims 15-32 are pending; claims 1-14 are canceled; claims 15 and 26 are amended.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 19 February 2010 has been entered.

Response to Amendments/Arguments

2. Applicant's amendment filed 19 February 2010 is entered and has been fully considered.

3. Applicant's arguments of the rejected claims 15-32 under 35 U.S.C. § 112 have been considered. The claims was amended to the way to overcome the rejection under 35 U.S.C. § 112. So, the rejection will be withdrawn.

4. Applicant's arguments of the rejected claims 15-32 under 35 U.S.C. § 103(a)[1] have been considered but are moot in view of the new ground(s) of rejection.

---

[1] Claims 15-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over De Murcia et al. (US 5,889,525) in view of Townsend et al. (US 2003/0004405)

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Priority

5. Acknowledgment is made of applicant's claim benefit for foreign priority under 35 U.S.C. 119(a)-(d) or (f). The certified copy has been filed in parent Application (FR 03 50631), filed on 1 October 2003.

6. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d) or (f), which papers have been placed of record in the file.

Claim Rejections - 35 USC § 102

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

8. Claims 15-20 and 25-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Townsend et al. (US 2003/0004405 A1).

a. Regarding claim 15, Townsend discloses a method of forming an image (Fig.3; “image fusion” at ¶ 0080) of a mobile object (Fig. 2b; “patient” at ¶¶ 0070 and 0073), comprising:

obtaining a plurality of first images (“CT images” at ¶ 0075) of the mobile object (Fig. 2b; “patient” at ¶¶ 0070 and 0073) using a first imaging technique (“X-ray CT” at ¶¶ 0070 and 0073) and an associated plurality of first measurements (Fig. 2b-12; “X-ray CT detectors” at ¶ 0073) of the mobile object (Fig. 2b; “patient” at ¶¶ 0070 and 0073) at

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movement states (Fig. 2b-18; “patient bad [being] movable”) corresponding to movement states (“a patient may be … moved into position for … X-ray CT scan” at ¶ 0071) of said plurality of first images (“CT images” at ¶ 0075);

obtaining a plurality of second images (“PET images” at ¶0075) of the mobile object (Fig. 2b; “patient” at ¶¶ 0070 and 0073) using a second imaging technique (“PET” at ¶¶ 0070 and 0073) and an associated plurality of second measurements (Fig. 2b-14; “PET tomograph detectors” at ¶ 0073) of the mobile object (Fig. 2b; “patient” at ¶¶ 0070 and 0073) at movement states (Fig. 2b-18; “patient bad [being] movable”) corresponding to movement states (“a patient may be … moved into position for … PET scan” at ¶ 0071) of said plurality of second images (“PET images” at ¶0075), wherein the plurality of second measurements (Fig. 2b-14; “PET tomograph detectors” at ¶ 0073) are distinct from the plurality of first measurements(Fig. 2b-12; “X-ray CT detectors” at ¶ 0073; “The second measurements are PET tomograph detectors that are different and distinct with the first measurements, which are X-ray CT detectors”); and

forming an image (Fig.3; “image fusion” at ¶ 0080) of the mobile object (Fig. 2b; “patient” at ¶¶ 0070 and 0073) based on said plurality of first images (“CT images” at ¶ 0075) and said associated plurality of first measurements (Fig. 2b-12; “X-ray CT detectors” at ¶ 0073) and on said plurality of said second images (“PET images” at ¶0075) and said associated plurality of second measurements (Fig. 2b-14; “PET tomograph detectors” at ¶ 0073),

wherein the first imaging technique (“X-ray CT” at ¶¶ 0070 and 0073) is different from the second imaging technique (“PET” at ¶¶ 0070 and 0073; “The first imaging

technique is a X-ray CT that is different with the second imaging technique, which is a PET.") .

b. Regarding claim 16, Townsend discloses further comprising:

time-synchronizing said first measurements (Fig. 2b-12; "X-ray CT detectors" at ¶ 0073) and said second measurements(Fig. 2b-14; "PET tomograph detectors" at ¶ 0073; "The invention shows that synchronization, which "the CT scan is acquired before the PET scan, following a sixty (60) minute uptake period F-FDG activity has been injected into the patient"" at ¶ 0075).

c. Regarding claim 17, Townsend discloses further comprising:

forming first reconstructed images corresponding to said plurality of first images ("[t]he CT images [being] reconstructed" at ¶ 0075) and second reconstructed images corresponding to said plurality of second images ("the PET images [being] then reconstructed" ¶ 0075).

d. Regarding claim 18, Townsend discloses further comprising:

spatially-synchronizing ("image fusion" at ¶ 0080) said first reconstructed images and said second reconstructed images ("fused PET and CT images" at ¶ 0080).

e. Regarding claim 19, Townsend discloses wherein said first imaging technique being a radiation attenuation technique ("X-ray CT" at ¶¶ 0070 and 0073) and said second imaging technique being a radiation emission technique ("PET" at ¶¶ 0070 and 0073).

f. Regarding claim 20, Townsend discloses further comprising:

spatially-synchronizing information ("positional correspondence between the two image sets" at ¶ 0080) based on said plurality of first measurements (Fig. 2b-12; "X-ray CT detectors" at ¶ 0073) and information based on said plurality of second measurements (Fig. 2b-14; "PET tomograph detectors" at ¶ 0073).

g. Regarding claim 25, Townsend discloses wherein said plurality of first measurements (Fig. 2b-12; "X-ray CT detectors" at ¶ 0073) and said plurality of second measurements (Fig. 2b-14; "PET tomograph detectors" at ¶ 0073) are taken using separate measurement systems (Figs. 2b-12 and 2b-14; "X-ray CT detectors and PET tomograph detectors are different measurements in separate gantries" at ¶ 0073) respectively associated with separate imaging systems (Figs. 2b-12, 2b-14, 16A and 16b; "X-ray CT detectors are disposed in gantry 16A and PET tomograph detectors are disposed in gantry 16B. Gentries 16A and 16B are separate platforms." at ¶ 0073) used to obtain said plurality of first images ("CT images" at ¶ 0075) and said plurality of second images ("PET images" at ¶0075).

h. Regarding claim 26, claim 26 is a system claim analogous and corresponds to claim 15. See rejection of claim 15 for further explanation.

i. Regarding claim 27, claim 27 is a system claim analogous and corresponds to claim 17. See rejection of claim 17 for further explanation.

j. Regarding claim 28, claim 28 is a system claim analogous and corresponds to claim 19. See rejection of claim 19 for further explanation.

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Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 21-23 and 29-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Townsend et al. (US 2003/0004405 A1) in view of Acar et al. (US 2004/0141638 A1).

a Regarding claim 21, Townsend discloses all the previous claim limitations including said plurality of first images ("CT images" at ¶ 0075), said plurality of first measurements (Fig. 2b-12; "X-ray CT detectors" at ¶ 0073), said plurality of second images ("PET images" at ¶0075) and said plurality of second measurements (Fig. 2b-14; "PET tomograph detectors" at ¶ 0073).

However, Townsend does not disclose forming displacement fields.

Instead of Townsend, Acar, the same field of medical image processing discloses forming displacement fields (equation (1); FIG. 1; "It is shown that the EDF, "$v_{z=k}$ (x,y)" is computed from z=k to z=k+1" at ¶¶ 0013-0014 and 0015-0017).

Townsend and Acar are combinable because both are related to the field of medical image processing.

It would have been obvious at the tie the invention was made to one of the ordinary skill in the art to utilize the step of computing "EDF, $v_{z=k}$ (x,y) from z=k to z=k+1" (Acar; equation (1); FIG.1; ¶¶ 0013-0014 and 0015-0017) taught by Acar to the plurality

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of first images (Townsend; "CT images" at ¶ 0075) obtained by the plurality of first measurements (Townsend; Fig. 2b-12; "X-ray CT detectors" at ¶ 0073) and to the plurality of second images ("PET images" at ¶0075) obtained by the plurality of second measurements (Fig. 2b-14; "PET tomograph detectors" at ¶ 0073) of Townsend's "PET/CT scanner" (Townsend; FIG. 2B; ¶ 0073).

The suggestion/motivation for doing so would have been to "characteriz[e] the topology of the vector field for detection, identification or recognition tasks of a structure of interest" (Acar; ¶ 0006) "with a high specificity without sacrificing the sensitivity of detection" (Acar; ¶ 0006).

Therefore, it would have been obvious to combine Townsend and Acar to obtain the invention specified in claim 21.

b. Regarding claim 22, the combination of Townsend and Acar, as applied in claim 21, discloses all the previous claim limitations including said forming an image (Townsend; Fig.3; "image fusion" at ¶ 0080) of the mobile object (Townsend; Fig. 2b; "patient" at ¶¶ 0070 and 0073).

Moreover, Acar discloses combining said displacement fields (FIG. 1; "$v_{z=k}$ (x,y) for all k are summed ,,, to get a composite EDF" at ¶ 0017).

Townsend and Acar are combinable because both are related to the field of medical image processing.

It would have been obvious at the tie the invention was made to one of the ordinary skill in the art to utilize the step of computing "$v_{z=k}$ (x,y) for all k being summed ,,, to get a composite EDF" (Acar; FIG.1; ¶ 0017) taught by Acar to the step of forming an

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image (Townsend; Fig.3; "image fusion" at ¶ 0080) of the mobile object (Townsend; Fig. 2b; "patient" at ¶¶ 0070 and 0073) of the combination of Townsend and Acar.

The suggestion/motivation for doing so would have been to "determine parameters … [which] are used to classify the structure of interest" (Acar; ¶ 0007) and "refine the results of high sensitivity, low specificity pre-detection by increasing specificity without sacrificing sensitivity" (Acar; ¶ 0013).

Therefore, it would have been obvious to combine Townsend and Acar to obtain the invention specified in claim 22.

c. Regarding claim 23, the combination of Townsend and Acar, as applied in claim 21, discloses wherein said forming displacement fields (Acar; equation (1); FIG. 1; "It is shown that the EDF, "$v_{z=k}$ (x,y)" is computed from z=k to z=k+1" at ¶¶ 0013-0014 and 0015-0017) comprises:

estimating movement (Acar; equation (1); "EDF computation to represent the changes in the location of edges" at ¶ 0015) of the mobile object (Acar; "images such as tissue/air boundaries" at ¶ 0015) based, respectively, on said plurality of first images (Townsend; "CT images" at ¶ 0075), said plurality of second images (Townsend; "PET images" at ¶0075), said plurality of first measurements (Townsend; Fig. 2b-12; "X-ray CT detectors" at ¶ 0073), and said plurality of second measurements (Townsend; Fig. 2b-14; "PET tomograph detectors" at ¶ 0073), in order to form said displacement fields (Acar; equation (1); FIG. 1; "It is shown that the EDF, "$v_{z=k}$ (x,y)" is computed from z=k to z=k+1" at ¶¶ 0013-0014 and 0015-0017).

d. Regarding claim 29, claim 29 is analogous and corresponds to claim 21. See rejection of claim 21 for further explanation.

e. Regarding claim 30, claim 30 is analogous and corresponds to claim 22. See rejection of claim 22 for further explanation.

f. Regarding claim 31, claim 31 is analogous and corresponds to claim 23. See rejection of claim 23 for further explanation.

11. Claims 24 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Townsend et al. (US 2003/0004405 A1) in view of Acar et al. (US 2004/0141638 A1), and further in view of Perona et al. ("Scale-Space and Edge Detection Using Anisotropic Diffusion").

a. Regarding claim 24, the combination of Townsend and Acar, as applied in claim 23, discloses all the previous claim limitations including wherein at least one of said movement estimates (Acar; equation (1); "EDF computation to represent the changes in the location of edges" at ¶ 0015).

However, the combination of Townsend and Acar does not disclose the estimates being formed relative to a reference time.

Instead of the combination of Townsend and Acar, Perona, the same field of endeavor of image processing, discloses the estimates being formed relative to a reference time (equation (1); "It is shown that I (x, y, t) is obtained by convolving the original image I_0 (x,y) with a Gaussian kernel G (x,y; t) of variance t, which can be the reference time" at chapter I, page 629)

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Townsend, Acar and Perona are combinable because all of them are related to the field of image processing.

It would have been obvious at the time the invention was made one of ordinary skill in the art to utilize the step of "I (x, y, t) [being] obtained by convolving the original image I_0 (x,y) with a Gaussian kernel G (x,y; t) of variance t", which can be the reference time (Perona; equation (1); chapter I, page 629) taught by Perona to the "EDF computation [] [representing] the changes in the location of edges" (Acar; ¶ 0015) when "[t]he EDF equation for the xy plane is $\nabla I_{z=k} \cdot v_{z=k} + \frac{\partial I_{z=k}}{\partial z} = 0$" (Acar; equation (1); ¶ 0016) and "$I_{z=k}(x, y)$ is the associate image" (Acar; ¶ 0017) of the combination of Townsend and Acar.

The suggestion/motivation for doing so would have been to provide "[c]ausality [,] [which] [a]ny feature at a coarse level of resolution is required to possess (not a necessarily unique) "cause" at a finer level of resolution" (Perona; chapter 1, page 629) and "no spurious detail should be generated when the resolution is diminished" (Perona; chapter 1, page 629), "[h]omogenity [and] [i]sotropy … for the sake of simplicity" (Perona; chapter 1, page 629).

Therefore, it would have been obvious to combine Townsend, Acar and Perona to obtain the invention specified in claim 24.

b. Regarding claim 32, claim 32 is analogous and corresponds to claim 24. See rejection of claim 24 for further explanation.

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Conclusion

12. No claims are allowed.

13. The prior art made of record is considered pertinent to the disclosure of the application:

- Summers et al. (US 6,246,784 B1): A region growing method segments three-dimensional image data of an anatomical structure using a tortuous path length limit to constrain voxel growth. The path length limit constrains the number of successive generations of voxel growth from a seed point to prevent leakage of voxels outside the boundary of the anatomical structure. Once segmented, a process for detecting surface anomalies performs a curvature analysis on a computer model of the surface of the structure. This process detects surface anomalies automatically by traversing the vertices in the surface model, computing partial derivatives of the surface at the vertices, and computing curvature characteristics from the partial derivatives. To identify possible anomalies, the process compares the curvature characteristics with predetermined curvature characteristics of anomalies and classifies the vertices. The process further refines potential anomalies by segmenting neighboring vertices that are classified as being part of an anomaly using curvature characteristics. Finally, the process colorizes the anomalies and computes a camera position and direction for each one to assist the user in viewing 2D renderings of the computer model.

- Wilk et al. (US 2003/0212320): A method of determining linear and angular displacements of a first coordinate system of a field of view of a first imaging system relative to a second a coordinate system of a field of view of a second imaging system, the method comprising: providing a phantom having a plurality of fiducial regions that can be imaged by both imaging systems; acquiring first and second images of the phantom with the first and second imaging systems wherein spatial coordinates of features in the first and second images reference the first and second coordinate systems respectively; determining positions of a plurality of features of the fiducials in the first image and spatial coordinates of the same features in the second image; and using the coordinates to determine the linear and angular displacements.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN Wahnkyo LEE whose telephone number is (571)272-9554. The examiner can normally be reached on Monday - Friday (Alt.) 7:30 a.m. - 5:00 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Samir Ahmed can be reached on (571) 272-7413. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For

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more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John Wahnkyo Lee/
Examiner, Art Unit 2624

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Notice of References Cited	Application/Control No. 10/955,037	Applicant(s)/Patent Under Reexamination BONNET ET AL.	
	Examiner JOHN Wahnkyo LEE	Art Unit 2624	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,246,784 B1	06-2001	Summers et al.	382/128
*	B	US-2003/0004405 A1	01-2003	Townsend et al.	600/407
*	C	US-2003/0212320 A1	11-2003	Wilk et al.	600/407
*	D	US-2004/0141638 A1	07-2004	Acar et al.	382/131
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	Perona et al., "Scale-Space and Edge Detection using Anisotropic Diffusion," July 1990, IEEE, vol. 12, pages 629-639
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L15	11431	(commissariat$5.asnm. or intellectual$7.asnm.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/09 00:52
L16	2593	(bonnet-stephane.in. or bonnet.in.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/09 00:52
L17	96	(grangeat-pierre.in. or grangeat.in.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/09 00:52
L18	2686	L16 or L17	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/09 00:52

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L19	30	15 and L18	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/09 00:52
L20	284977	(mobile or techinque or measurement).clm.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/09 00:53
L21	17	19 and L20	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/09 00:53
S1	96	"6490476"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:10
S2	5	09/685222	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:11
S3	6	"6527090"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:15

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S4	41	"5124914"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:18
S5	5	"5333107"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:18
S6	1	07/788179	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:18
S7	9	"5408511"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:19
S8	8	"5475726"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:19
S9	4	"5406478"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:19

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S10	1	08/249993	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:20
S11	9	"5444792"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:21
S12	6	"5814817"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:21
S13	0	08/667879	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:22
S14	6	"5889525"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:22
S15	5	"5933517"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:24

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S16	5	"6103350"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:24
S17	2	"6920240"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:24
S18	4	"6888915"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:25
S19	2593	(bonnet-stephane.in. or bonnet.in.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:51
S20	96	(grangeat-pierre.in. or grangeat.in.)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:51
S21	2686	S19 or S20	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:51

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S22	283800	(mobile or techinque or measurement).clm.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:52
S23	54	S21 and S22	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/06/30 16:52
S25	2	"20040004405"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 00:08
S28	6918	382/128.ccls. or 345/420.ccls. or 600/427.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 00:09
S29	1	10/955037	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 00:19
S30	0	(displacement near3 fields) near3 PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:56

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S31	8	(displacement near3 fields) near3 CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:56
S32	3	(displacement near3 fields) with PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:57
S33	18	(displacement near3 fields) with CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:57
S34	1	S32 and S33	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:57
S35	8931	(displacement near3 fields)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:57
S36	81	S35 and CT and PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:57

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S37	18	S36 and S28	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 02:57
S38	1736832	(vector or displacement)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:06
S39	786	S38 near3 CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:07
S40	8098	S38 near3 PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:07
S41	75	S39 and S40	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:07
S42	3520	S38 with CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:07

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S43	12182	S38 WITH PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:07
S44	195	S42 and S43	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:08
S45	1854	vector with CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:38
S46	11867	vector with PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:39
S47	181	S45 and S46	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:39
S48	504	gradient with CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:40

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S49	425	gradient WITH PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:40
S50	11	S48 and S49	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:40
S51	4636	motion with CT	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:46
S52	1522	motion WITH PET	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:46
S53	164	S51 and S52	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:46
S54	54	S53 and vector	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:54

LAG-VW00000884

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Volkswagen v. Longhorn - IPR2025-00925

S55	79	S53 and (vector or displacement)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/01 03:54
S56	15542	displacement near3 (field or vector)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:36
S57	150	S56 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:36
S58	19316809	combin$3 or form$3 or fus$3	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:38
S59	13665	S56 and S58	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:39
S60	1486	S59 and medical	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:39

LAG-VW00000885

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Volkswagen v. Longhorn - IPR2025-00925

S61	144	S59 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:39
S62	994101	S58 near3 image	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:41
S63	3025	S62 and S56	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:42
S64	88	S63 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:42
S65	107	S56 with S62	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:54
S66	2	S65 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:54

LAG-VW00000886

Volkswagen Exhibit 1037, Page 886 of 2532
Volkswagen v. Longhorn - IPR2025-00925

S67	3	S65 and (x-ray and CT)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:56
S68	112890	goto.in.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:59
S69	59266	hitachi.asnm.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 21:59
S70	0	S68 and S69 and (displacment) and vector	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:00
S71	4	S68 and S69 and (displacement) and vector	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:00
S72	17	S68 and S69 and vector	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:00

LAG-VW00000887

Volkswagen Exhibit 1037, Page 887 of 2532
Volkswagen v. Longhorn - IPR2025-00925

S73	1	JP2006141534A	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:02
S74	25	S65 and "382".clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:03
S75	16464	gradient near3 time	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:24
S76	52	S75 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:24
S77	13	S76 and (x-ray and CT)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:24
S78	100	gradient near3 (reference near3 time)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:30

LAG-VW00000888

Volkswagen Exhibit 1037, Page 888 of 2532
Volkswagen v. Longhorn - IPR2025-00925

S79	0	S78 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:30
S80	4	S78 and (x-ray and CT)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:30
S81	0	S78 and "382".clas.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:31
S82	4551	total near3 derivative	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:33
S83	7	S82 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:33
S84	569	vector near3 (reference near3 time)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:35

LAG-VW00000889

Volkswagen Exhibit 1037, Page 889 of 2532
Volkswagen v. Longhorn - IPR2025-00925

S85	3	S84 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:35
S87	16464	gradient near3 time	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:37
S88	52	S87 and 382/128.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/07 22:37
S89	22	"5963665"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/07/08 21:22

7/9/2010 12:54:11 AM
C:\Documents and Settings\jlee15\My Documents\EAST\Workspaces\10955037 partial.wsp

LAG-VW00000890

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Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	**Art Unit**
	Lee, John W	2112

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	12/27/2006	09/07/2007	05/25/2008	11/07/2008	04/22/2009	11/20/2009	07/09/2010		
	1	✓	-	-	-	-	-	-		
	2	✓	-	-	-	-	-	-		
	3	✓	-	-	-	-	-	-		
	4	✓	-	-	-	-	-	-		
	5	✓	-	-	-	-	-	-		
	6	✓	-	-	-	-	-	-		
	7	✓	-	-	-	-	-	-		
	8	✓	-	-	-	-	-	-		
	9		✓	-	-	-	-	-		
	10		✓	-	-	-	-	-		
	11		✓	-	-	-	-	-		
	12		✓	-	-	-	-	-		
	13		✓	-	-	-	-	-		
	14		✓	-	-	-	-	-		
	15			✓	✓	✓	✓	✓		
	16			✓	✓	✓	✓	✓		
	17			✓	✓	✓	✓	✓		
	18			✓	✓	✓	✓	✓		
	19			✓	✓	✓	✓	✓		
	20			✓	✓	✓	✓	✓		
	21			✓	✓	✓	✓	✓		
	22			✓	✓	✓	✓	✓		
	23			✓	✓	✓	✓	✓		
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	25			✓	✓	✓	✓	✓		
	26			✓	✓	✓	✓	✓		
	27			✓	✓	✓	✓	✓		
	28			✓	✓	✓	✓	✓		
	29			✓	✓	✓	✓	✓		
	30			✓	✓	✓	✓	✓		
	31			✓	✓	✓	✓	✓		
	32			✓	✓	✓	✓	✓		

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10955037	BONNET ET AL.
	Examiner	Art Unit
	Lee, John W	2112

SEARCHED			
Class	Subclass	Date	Examiner
382	128	12/26/2006	John W. Lee
345	420	12/26/2006	John W. Lee
382	128	11/06/2008	John W. Lee

SEARCH NOTES		
Search Notes	Date	Examiner
Inventor Search	12/26/2006	John W. Lee
East Search	12/26/2006	John W. Lee
IEEE (Non- Patent Literature Search)	12/26/2006	John W. Lee
EAST Search	11/06/2008	John W. Lee
EAST Search	4/22/2009	John W. Lee
EAST Search	11/20/2009	John W. Lee
Inventor Search (using EDAN)	7/9/2010	John W. Lee
Inventor Search (using EAST)	7/9/2010	John W. Lee
Assignee Search (using EAST)	7/9/2010	John W. Lee
EAST Search	7/1/2010	John W. Lee
Plus Search	7/6/2010	John W. Lee
NPL search (using google)	7/5/2010	John W. Lee
382/128, 345/420 and 600/427 (combined with keyword search)	7/1/2010	John W. Lee

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

/JOHN W LEE/ Examiner.Art Unit 2624	

IAP6 Rec'd PCT/PTO 28 APR 2006

PTO-1390 (Rev. 07-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371	ATTORNEY'S DOCKET NUMBER: 095309.57635US U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 10/577797	
INTERNATIONAL APPLICATION NO. PCT/EP2004/011637	INTERNATIONAL FILING DATE October 15, 2004	PRIORITY DATE CLAIMED October 29, 2003

TITLE OF INVENTION
DIRECTLY INJECTING INTERNAL COMBUSTION ENGINE

APPLICANT(S) FOR DO/EO/US
Ruediger PFAFF, et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ Is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 (Int'l. Search Report; refs.)
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A preliminary amendment.
14. ☒ An Application Data Sheet under 37 CFR 1.76.
15. ☒ A substitute specification (clean/marked-up versions)
16. ☐ A power of attorney and/or change of address letter.
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20. ☒ Other items or information: PCT/IB/308; Credit Card Payment Form; four (4) sheets of drawings consisting of Figs. 1-10.

This collection of information is required by 37 CFR 1.414 and 1.491-1.492. The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 15 minutes to complete, including gathering information, preparing, and submitting the completed form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IAP17 Rec'd PCT/PTO 28 APR 2006

PTO-1390 (Rev. 02-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/577797	PCT/EP2004/011637	095309.57635US

The following fees have been submitted	CALCULATIONS	PTO USE ONLY
21. ☒ Basic national fee (37 C.F.R. §1.492(a)) $300.00	$ 300.00	
22. ☒ Examination fee (37 C.F.R. §1.492(c))		
If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) $0.00		
All other situations $200.00	$ 200.00	
23. ☒ Search fee (37 C.F.R. §1.492(b))		
If the written opinion of the ISA/US or the International preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) $0		
Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority $100		
International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB $400		
All other situations $500	$ 400.00	
TOTAL OF 21, 22 AND 23 =	$ 900.00	

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing or computer program listing filed in an electronic medium). The fee is **$250** for each additional 50 sheets of paper or fraction thereof.

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round up to a whole number)	RATE	
- 100	/ 50 =		x 250	$

Surcharge of **$130.00** for furnishing the oath or declaration later than 30 months from the earliest claimed priority date (37 CFR 1.492(h)). $ 130.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	18	0	x 50	$ 0.00
Independent claims	1	0	x 200	$ 0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ 360	$ 0.00

TOTAL OF ABOVE CALCULATIONS = $ 1030.00

☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by ½.

SUBTOTAL = $ 1030.00

Processing fee of **$130.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). + $

TOTAL NATIONAL FEE = $ 1030.00

Fee for recording the enclosed assignment (37 CFR 1.21 (h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property ..... + $

TOTAL FEES ENCLOSED = $ 1030.00

Amount to be refunded: $

Amount to be charged: $

a. ☐ A check in the amount of $ to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. **05-1323 (Attorney Docket No. 095309.57635US)** in the amount of $ to cover the above fees. **A duplicate copy of this sheet is enclosed.**

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **05-1323 (Attorney Docket No. 095309.57635US). A duplicate copy of this sheet is enclosed.**

d. ☒ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:
Crowell & Moring, LLP
Intellectual Property Group
P.O. Box 14300
Washington, D.C. 20044-4300
Tel. No. (202) 624-2500
Fax No. (202) 628-8844
/xxx (doc no.)

SIGNATURE
James F. McKeown
NAME
25,406
REGISTRATION NUMBER
April 28, 2006
DATE

2760229

IAP6 Rec'd PCT/PTO 28 APR 2006

PTO-1390 (Rev. 07-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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Volkswagen Exhibit 1037, Page 895 of 2532
Volkswagen v. Longhorn - IPR2025-00925

PTO-1390 (Rev. 02-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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22. ☒ Examination fee (37 C.F.R. §1.492(c))		
If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) $0.00		
All other situations $200.00	$ 200.00	
23. ☒ Search fee (37 C.F.R. §1.492(b))		
If the written opinion of the ISA/US or the International preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) $0		
Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority $100		
International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB $400		
All other situations $500	$ 400.00	
TOTAL OF 21, 22 AND 23 =	$ 900.00	

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing or computer program listing filed in an electronic medium). The fee is **$250** for each additional 50 sheets of paper or fraction thereof.

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round up to a whole number)	RATE	
- 100	/ 50 =		x 250	$

Surcharge of **$130.00** for furnishing the oath or declaration later than 30 months from the earliest claimed priority date (37 CFR 1.492(h)). $ 130.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	
Total claims	18	0	x 50	$ 0.00
Independent claims	1	0	x 200	$ 0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ 360	$ 0.00

TOTAL OF ABOVE CALCULATIONS = $ 1030.00

☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by ½.

SUBTOTAL = $ 1030.00

Processing fee of **$130.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). + $

TOTAL NATIONAL FEE = $ 1030.00

Fee for recording the enclosed assignment (37 CFR 1.21 (h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property ..... + $

TOTAL FEES ENCLOSED = $ 1030.00

Amount to be refunded: $

Amount to be charged: $

a. ☐ A check in the amount of $ to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. **05-1323 (Attorney Docket No. 095309.57635US)** in the amount of $ to cover the above fees. **A duplicate copy of this sheet is enclosed.**

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. **05-1323 (Attorney Docket No. 095309.57635US). A duplicate copy of this sheet is enclosed.**

d. ☒ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

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SIGNATURE
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NAME
25,406
REGISTRATION NUMBER
April 28, 2006
DATE

2760229

10/577797

IAP17 Rec'd PCT/PTO 28 APR 2006

P803662/WO/1

DaimlerChrysler AG

Directly injecting internal combustion engine

The invention relates to a directly injecting internal combustion engine with at least one cylinder which has a combustion space and in which a piston executes an oscillating movement, according to the type defined in more detail in the preamble of claim 1.

A generic internal combustion engine is known from US 2002/0117146 A1. In this case, the fuel is injected at a relatively steep injection angle into the combustion space, and the piston recess is adapted at least partially to the injection angle.

In an internal combustion engine described in DE 196 49 052 A1, a special shape of the piston recess is likewise provided, in order to achieve an additional reduction in the pollutants emitted by the internal combustion engine.

When early homogenization is to be achieved within the combustion space when an internal combustion engine, in particular a diesel internal combustion engine, is in operation, then injection time points of approximately 130 to 30° before the top dead center of the piston must be selected, since, at this time point, the combustion space pressure is still relatively low, so that the injected fuel can penetrate very deeply into the combustion space. In order to prevent the injection jet from impinging onto the cylinder wall or the liner, as steep an injection angle as possible at the injection nozzle should be selected, in order to ensure as long a free jet length as possible. This also requires the shape of the piston recess to be adapted to this injection, as is the case, for example, in

US 2002/0117146 A1.

Since, however, it is not possible to operate the internal combustion engine with a homogeneous combustion process over its entire characteristic map, the piston recess must be designed both for homogeneous and for conventional mixture formation. This is not easily possible in known solutions.

The object of the present invention, therefore, is to provide a directly injecting internal combustion engine, in which the shape of the piston recess is designed such that the internal combustion engine can be operated by means of both a homogeneous and a conventional combustion process.

This object is achieved, according to the invention, by means of the features mentioned in claim 1.

The solution according to the invention ensures that the injection jet always impinges on the piston recess such that the injected fuel can be intermixed optimally with the air located in the combustion space, specifically independently of the time point of injection. Particularly the fact that an injection jet injected at the latest possible time point always impinges onto the surface adjoining the elevation ensures that the momentum of the impinging injection jet is not nullified, with the result that it could no longer be used optimally for mixture formation, which, in turn, would entail an increased formation of black smoke.

An internal combustion engine is thus afforded which can easily be operated by means of both a homogeneous and a conventional combustion process.

Advantageous refinements of the invention may be

gathered from the subclaims. An exemplary embodiment of the invention is illustrated below, in principle, by means of the drawing in which:

fig. 1 shows an internal combustion engine according to the invention with a piston oscillating in a combustion space of the latter and with an injection jet impinging on the piston recess of the piston;

fig. 2 shows the configuration of the piston recess of the piston from fig. 1 in a first region;

fig. 3 shows the configuration of the piston recess of the piston from fig. 1 in a second region;

fig. 4 shows the configuration of the piston recess of the piston from fig. 1 in a third region;

fig. 5 shows the deflection of the injected fuel jet into that region of the piston recess which is illustrated in fig. 4;

fig. 6 shows the configuration of the piston recess of the piston from fig. 1 in a fourth region;

fig. 7 shows the air capture in a sixth region of the piston recess;

fig. 8 shows a first embodiment of a fifth region of a piston from fig. 1;

fig. 9 shows a second embodiment of a fifth region of a piston from fig. 1; and

fig. 10 shows a third embodiment of a fifth region of a piston from fig. 1.

Fig. 1 shows an internal combustion engine 1 which has a crankcase 2 and a cylinder head 3. Within the crankcase 2 of the internal combustion engine 1 is located at least one cylinder 4 which has a combustion space 5 and in which a piston 6 executes an oscillating movement in a way known per se. In the cylinder head 3 is arranged an injection nozzle 7 having a plurality of injection orifices 8 from which an injection jet 9 emerges. In the present case, the opening angle α of the injection jet 9 is relatively steep and lies in a range of between 50° and 120°. Thus, fuel is thereby injected directly into the combustion space 5, so that this is a directly injecting internal combustion engine 1.

Fig. 1 depicts two different injection jets, to be precise an injection jet 9a, which is obtained when the piston 6 is at a top dead center, and an injection jet 9b, which is obtained in the case of fuel injection at the latest possible injection time point. The injection jets 9a and 9b are in each case illustrated merely as axes of an injection cone being distributed within the combustion space 5.

The piston 6 has a piston recess 10 in its side facing the cylinder head 3. In the following figures, the contour of the piston recess 10 and its adaptation to the injection jets 9 are explained in more detail, for the sake of clarity the individual figures in each case indicating only those reference symbols which are relevant for describing the respective figure. The piston recess 10 is identical in all the figures.

As can be seen in fig. 2, the piston recess 10 has in its central region an elevation 11 extending in the direction of the cylinder head 3. The elevation 11 in this case has an angle β with respect of the axis of the piston which is smaller than half the injection

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angle α, so that the outermost edge of the injection jet 9a, illustrated here as a mid-axis, does not come into contact with the elevation 11.

As can be seen in fig. 2 and fig. 3, the elevation 11 has adjoining it in the direction of a recess edge 12, that is to say the end of the piston recess 10, a surface 13 which is connected to the elevation 11 via a radius 14 in such a way that the injection jet 9a injected at the earliest possible time point impinges onto the surface 13 at an impingement point 15 and is distributed both in the direction of the elevation 11 and in the direction of the recess edge 12. This distribution of the injection jet 9a is important in order to intermix the fuel as effectively as possible with the air located in the combustion space 5. Owing to the above-described steeper angle β of the elevation 11, as compared with the injection angle α, there is still sufficient free space in the region from the impingement point 15 of the injection jet 9a on the surface 13 to the elevation 11 to ensure that the fuel quantity deflected in the direction of the elevation 11 can be effectively distributed. The fuel deflected in the direction of the elevation 11 is designated by the arrow 16, whereas the fuel deflected in the direction of the recess edge 12 is designated by the arrow 17. It can be seen here that the fuel quantity deflected or distributed in the direction of the recess edge 12 is greater than the fuel quantity deflected in the direction of the elevation 11. The radius 14 should be selected, in this respect, such that an accumulation of the fuel flowing back is avoided.

It can be seen in fig. 4 that the surface 13 adjoining the elevation 11 in the direction of the recess edge 12 is of essentially planar design and has an ascending gradient in the direction of the recess edge 12. In other words, the surface 13 forms a plane which is at a

constant angle γ to the injection jet 9 over the entire maximum injection duration. The angle γ may be varied as a function of the required momentum deflection of an injection jet 9c in this case impinging in the middle region of the surface 13, the main momentum taking place in the direction of the recess edge 12, as already mentioned above. If appropriate, it may also be expedient for the surface 13 adjoining the elevation 11 in the direction of the recess edge 12 to have a curved design.

Fig. 5 illustrates by means of arrows 18 and 19 that, during the entire fuel injection, a smaller fraction of the injection jet 9 is thereby conducted in the direction of the elevation 11 and a larger fraction is thereby conducted in the direction of the recess edge 12. The arrow 18 in this case shows the fuel quantity conducted in the direction of the elevation 11, whereas the arrow 19 shows the fuel quantity conducted in the direction of the recess edge 12.

The distance of the surface 13 from the injection nozzle 7 should be selected such that the injection jet 9 can achieve a sufficiently free jet length and therefore an optimum jet velocity and the optimum momentum. Depending on the number of injection orifices 8 of the injection nozzle 7, an interaction of the fuel deflected on the piston recess 10 between two injection jets 9 is possible, thus additionally contributing to the capture of air in the combustion space 5. In addition, the division of the fuel may also be assisted by swirl.

Fig. 6 illustrates the injection jet 9b injected at the latest possible time point. In this case, it can be seen that the surface 13 has an extent in the direction of the recess edge 12 such that the injection jet 9b injected at the latest possible time point impinges

onto the surface 13. In this region, too, the surface 13 is designed in such a way that the injection jet 9b is distributed both in the direction of the elevation 11 and in the direction of the recess edge 12. The fuel quantity distributed in the direction of the elevation 11 is designated by an arrow 20 and the fuel quantity distributed in the direction of the recess edge 12 is designated by an arrow 21. Thus, a vertical impingement of the injection jet 9 on the piston recess 10 is prevented, and it is ensured that the momentum of the injection jet 9b is maintained.

It is apparent from fig. 7 that the surface 13 has adjoining it a surface 23 connected to the recess edge 12 via a radius 22. At the recess edge 12, a pinch gap region 24, as it may be referred to, at or above an upper surface 25 of the piston 6 occurs, which pinches the fuel/air mixture in the edge region in the direction of the piston recess 10 and thereby reduces the emission of hydrocarbons and carbon monoxide. The pinch gap region 24 selected should not be too large, since, even in this region, an air capture is required. The surface 23 contributes to the fact that the fuel jet following the arrow 21 is deflected such that an increased introduction of fuel into the pinch gap region 24 is prevented.

Figs 8, 9 and 10 illustrate various tie-ups of the surface 23 to the upper surface 25 of the piston 6.

In the embodiment according to fig. 8, the surface 23 connected to the recess edge 12 forms an acute angle with the upper surface 25 of the piston 6. The supply of fuel to a glow plug or spark plug, not illustrated, can thereby be improved.

In the version according to fig. 9, the surface 23 merges at a radius 26 into the upper surface 25 of the

piston 6.

Fig. 10 illustrates a version in which the surface 23 connected to the recess edge 12 forms an obtuse angle with the upper surface 25 of the piston 6.

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DaimlerChrylser AG

Patent claims

1. A directly injecting internal combustion engine, with at least one cylinder which has a combustion space and in which a piston executes an oscillating movement, and with an injection nozzle for the injection of fuel into the combustion space, the piston having a piston recess which has in its central region an elevation extending in the direction of a cylinder head, characterized in that a surface (13) of the piston recess (10) which adjoins the elevation (11) in the direction of the recess edge (12) is connected to the elevation (11) via a radius (14) in such a way that an injection jet (9a) impinging in this region and injected at the earliest possible time point is distributed both in the direction of the elevation (11) and in the direction of the recess edge (12), and in that the surface (13) adjoining the elevation (11) in the direction of the recess edge (12) has an extent in the direction of the recess edge (12) such that an injection jet (9b) injected at the latest possible time point impinges onto the surface (13), the injection jet (9b) injected at the latest possible time point being distributed both in the direction of the elevation (11) and in the direction of the recess edge (12).

2. The directly injecting internal combustion engine as claimed in claim 1, characterized in that a surface (23) connected to the recess edge (12) adjoins the surface (13) adjoining the elevation (11) in the direction of the recess edge (12).

3. The directly injecting internal combustion engine as claimed in claim 2, characterized in that the surface (23) connected to the recess edge (12) is

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connected via a radius (22) to the surface (13) adjoining the elevation (11) in the direction of the recess edge (12).

4. The directly injecting internal combustion engine as claimed in claim 2 or 3, characterized in that the surface (23) connected to the recess edge (12) forms an acute angle with the upper surface (25) of the piston (6).

5. The directly injecting internal combustion engine as claimed in claim 2 or 3, characterized in that the surface (23) connected to the recess edge (12) forms an obtuse angle with the upper surface (25) of the piston (6).

6. The directly injecting internal combustion engine as claimed in one of claims 2 to 5, characterized in that the surface (23) connected to the recess edge (12) merges in a radius (26) into the upper surface (25) of the piston (6).

7. The directly injecting internal combustion engine as claimed in one of claims 1 to 6, characterized in that the surface (13) adjoining the elevation (11) in the direction of the recess edge (12) has an ascending gradient in the direction of the recess edge (12).

8. The directly injecting internal combustion engine as claimed in claim 7, characterized in that the surface (13) adjoining the elevation (11) in the direction of the recess edge (12) is of essentially planar design.

9. The directly injecting internal combustion engine as claimed in claim 7, characterized in that the surface (13) adjoining the elevation (11) in the direction of the recess edge (12) is of curved design.

10. The directly injecting internal combustion engine as claimed in one of claims 1 to 9, characterized in that the injection angle (α) of the injection nozzle (7) is between 50° and 120°.

P803662/WO/1

DaimlerChrysler AG

Abstract

A directly injecting internal combustion engine (1) has at least one cylinder (4) which has a combustion space (5) and in which a piston (6) executes an oscillating movement, and an injection nozzle (7) for the injection of fuel into the combustion space (5). A piston (6) has a piston recess (10) which has in its central region an elevation extending in the direction of a cylinder head (3). A surface (13) of the piston recess (10) which adjoins the elevation (11) in the direction of the recess edge (12) is connected to the elevation (11) via a radius (14) in such a way that an injection jet (9a) impinging in this region and injected at the earliest possible time point is distributed both in the direction of the elevation (11) and in the direction of the recess edge (12). The surface (13) adjoining the elevation (11) in the direction of the recess edge (12) has an extent in the direction of the recess edge (12) such that an injection jet (9b) injected at the latest possible time point impinges onto the surface (13). The injection jet (9b) injected at the latest possible time point is distributed both in the direction of the elevation (11) and in the direction of the recess edge (12).

(Fig. 1)

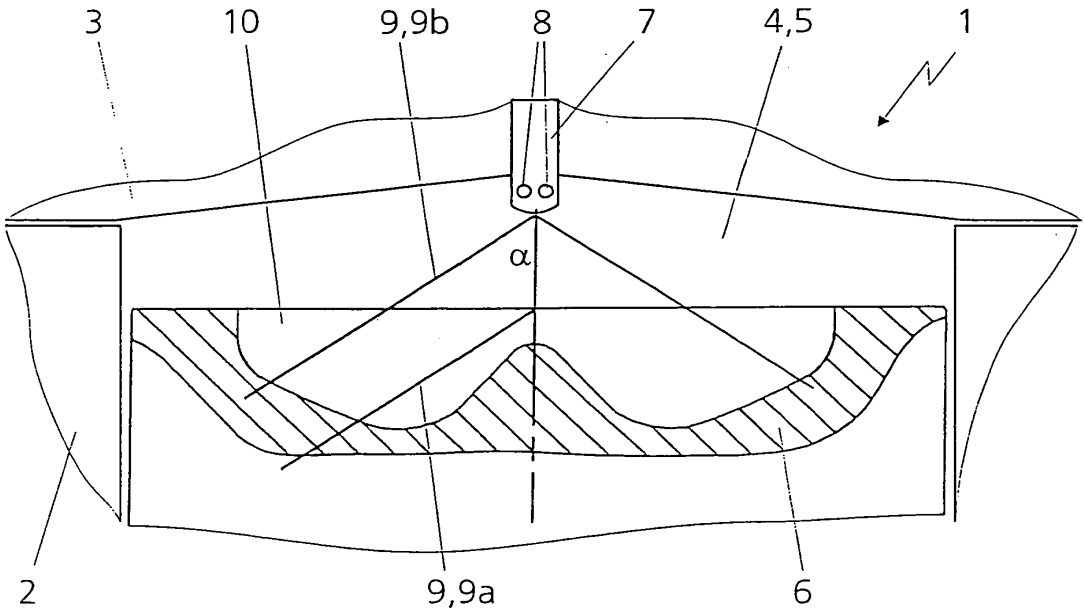


Fig. 1

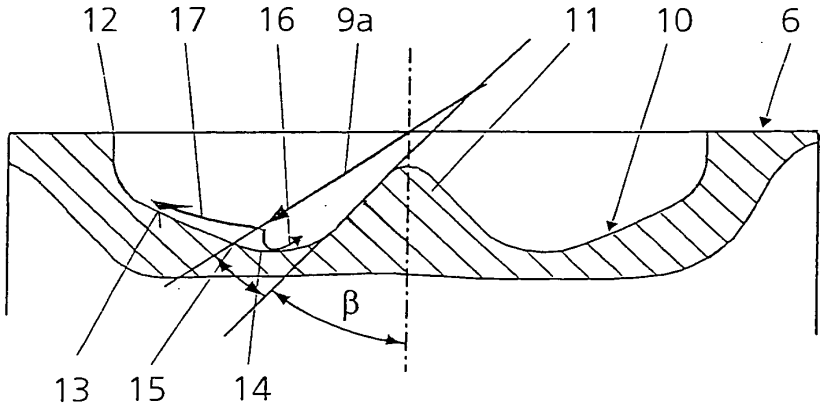


Fig. 2

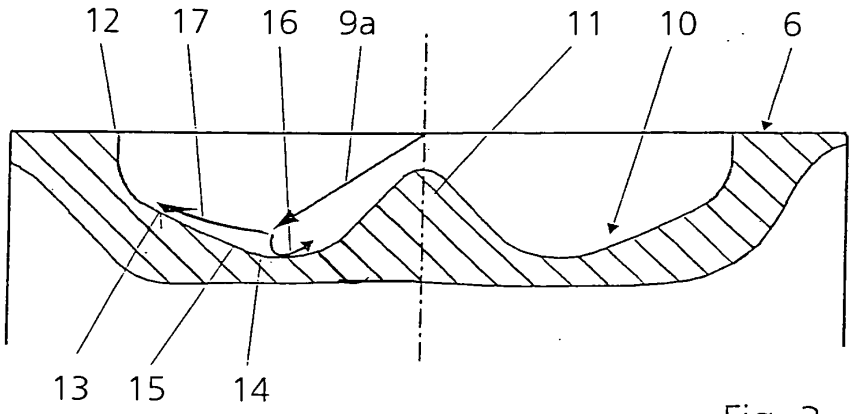


Fig. 3

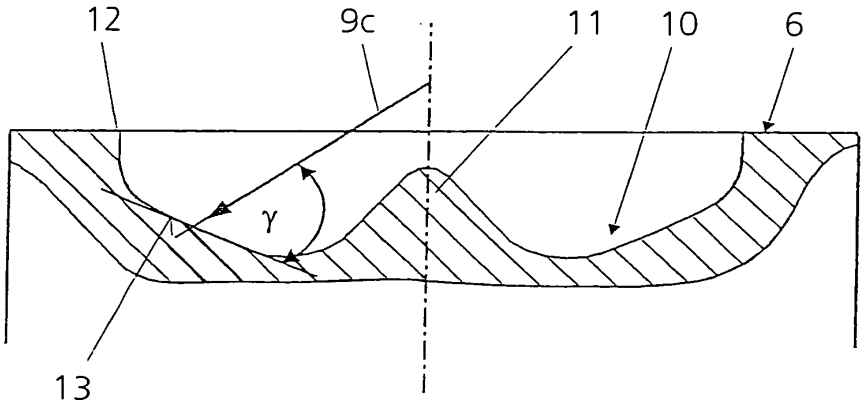


Fig. 4

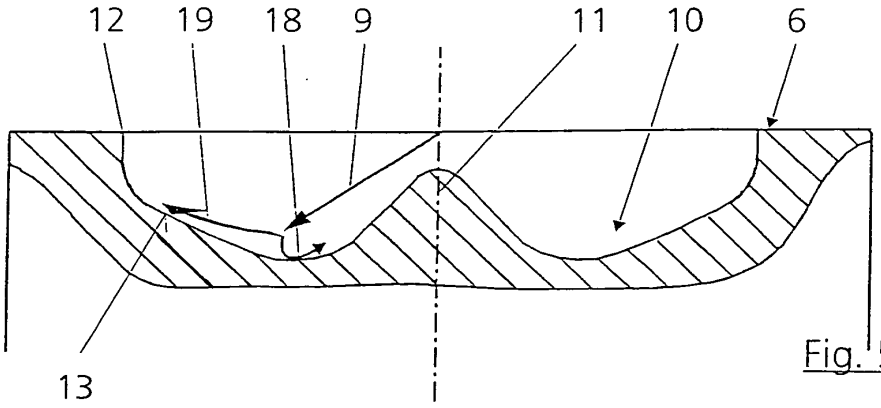


Fig. 5

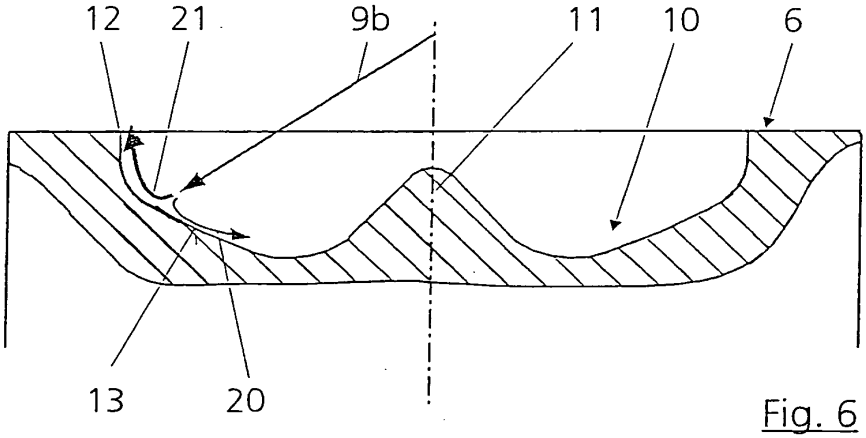


Fig. 6

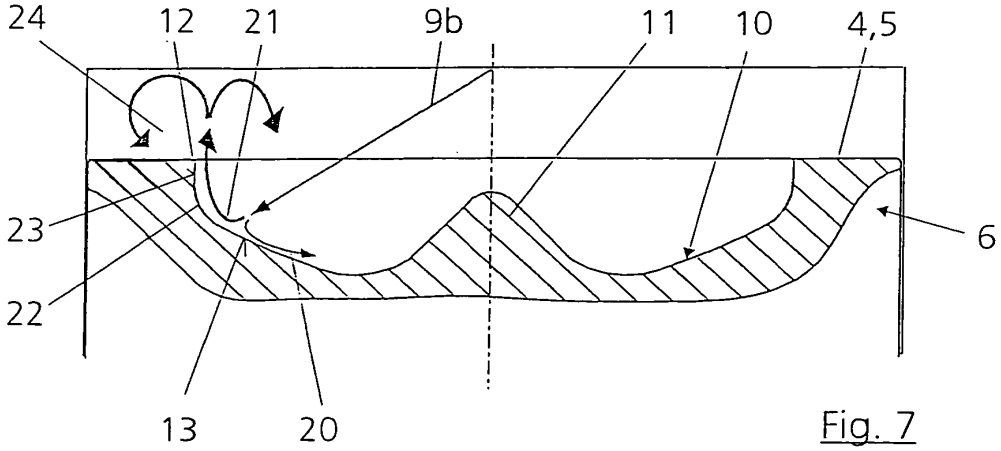


Fig. 7

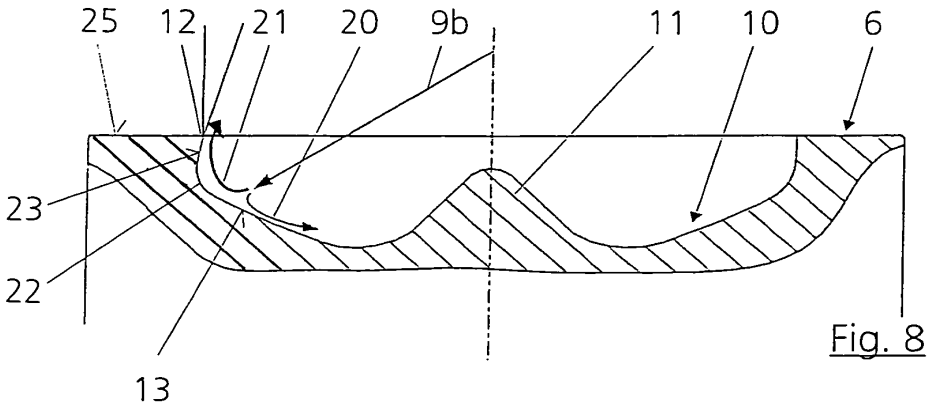


Fig. 8

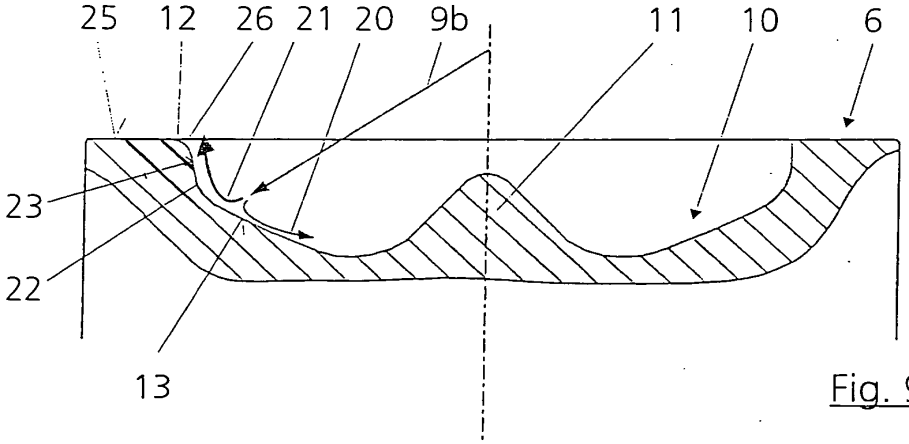


Fig. 9

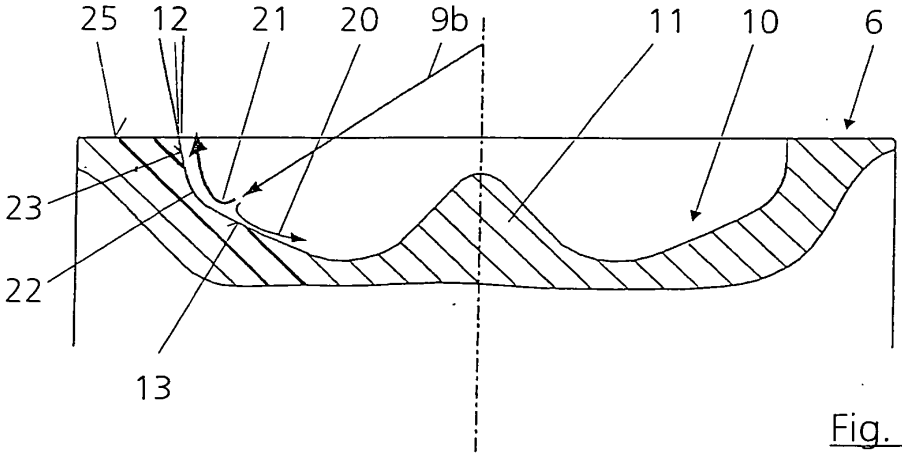


Fig. 10

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U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

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01 FC:1631	300.00	OP
02 FC:1633	200.00	OP
03 FC:1642	400.00	OP
04 FC:1617	130.00	OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 469-267/69033

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10/577797
IAP17 Rec'd PCT/PTO 28 APR 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	Not Yet Assigned
First Named Inventor	:	Ruediger PFAFF
Filed	:	Herewith (National Phase of PCT/EP2004/011637
TC/A.U.	:	Not Yet Assigned
Examiner	:	Not Yet Assigned
Docket No.	:	095309.57635US
Customer No.	:	23911
Title	:	Directly Injecting Internal Combustion Engine

PRELIMINARY AMENDMENT

Mail Stop PCT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please enter the following amendments to the specification, claims and abstract prior to the examination of the application.

Amendments to the Specification begin on page 2 of this paper. ***(A Substitute Specification with marked up version is submitted concurrently herewith).***

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Amendments to the Abstract are noted on page 7 and attached hereto as a separate unnumbered page.

Remarks begin on page 8 of this paper.

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Amendments to the Specification:

Submitted concurrently herewith is a substitute specification and marked up version thereof. No new matter has been added.

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Amendments to the Claims:

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claims 1-10 (canceled).

Claim 11 (new): A directly injecting internal combustion engine, comprising at least one cylinder which ahs a combustion space in which a piston executes an oscillating movement, and an injection nozzle for injection of fuel into the combustion space, wherein the piston ahs a piston recess, which, in a central region thereof, has an elevation extending in a cylinder head direction, and a surface of the piston recess adjoining the elevation in a recess edge direction is connected to the elevation via a radius so that an injection jet impinging in this region and injected as early as possible is distributed both in a elevation direction and in the recess edge direction, and the surface has an extent in the recess edge direction such that an injection jet injected as late as possible impinges onto the surface, the last-mentioned injection jet being distributed both in the elevation direction and in the recess edge direction.

Claim 12 (new): The directly injecting internal combustion engine as claimed in claim 11, wherein a surface connected to the recess edge adjoins the surface of the piston recess.

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Claim 13 (new): The directly injecting internal combustion engine as claimed in claim 12 ,wherein the surface connected to the recess edge is connected via a radius to the surface of the piston recess.

Claim 14 (new): The directly injecting internal combustion engine as claimed in claim 12, wherein the surface connected to the recess edge forms an acute angle with an upper surface of the piston.

Claim 15 (new): The directly injecting internal combustion engine as claimed in claim 14, wherein the surface connected to the recess edge is connected via a radius to the surface of the piston recess.

Claim 16 (new): The directly injecting internal combustion engine as claimed in claim 12, wherein the surface connected to the recess edge forms an obtuse angle with an upper surface of the piston.

Claim 17 (new): The directly injecting internal combustion engine as claimed in claim 16, wherein the surface connected to the recess edge is connected via a radius to the surface of the piston recess.

Claim 18 (new): The directly injecting internal combustion engine as claimed in claim 12, wherein the surface connected to the recess edge merges in a radius into an upper surface of the piston.

LAG-VW00000917

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Claim 19 (new): The directly injecting internal combustion engine as claimed in claim 11, wherein the surface of the piston recess has an ascending gradient in the recess edge direction.

Claim 20 (new): The directly injecting internal combustion engine as claimed in claim 19, wherein the surface of the piston recess in the recess edge direction is substantially planar.

Claim 21 (new): The directly injecting internal combustion engine as claimed in claim 19, wherein the surface of the piston recess in the recess edge direction is curved.

Claim 22 (new): The directly injecting internal combustion engine as claimed in claim 11, wherein an injection angle of the injection nozzle is between 50° and 120°.

Claim 23 (new): The directly injecting internal combustion engine as claimed in claim 22, wherein a surface connected to the recess edge adjoins the surface of the piston recess.

Claim 24 (new): The directly injecting internal combustion engine as claimed in claim 23, wherein the surface connected to the recess edge is connected via a radius to the surface of the piston recess.

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Claim 25 (new): The directly injecting internal combustion engine as claimed in claim 23, wherein the surface connected to the recess edge forms an acute angle with an upper surface of the piston.

Claim 26 (new): The directly injecting internal combustion engine as claimed in claim 23, wherein the surface connected to the recess edge forms an obtuse angle with an upper surface of the piston.

Claim 27 (new): The directly injecting internal combustion engine as claimed in claim 23, wherein the surface connected to the recess edge merges in a radius into an upper surface of the piston.

Claim 28 (new): The directly injecting internal combustion engine as claimed in claim 22, wherein the surface of the piston recess has an ascending gradient in the recess edge direction.

Claim 29 (new): The directly injecting internal combustion engine as claimed in claim 28, wherein the surface of the piston recess in the recess edge direction is substantially planar.

Claim 30 (new): The directly injecting internal combustion engine as claimed in claim 28, wherein an injection angle of the injection nozzle is between 50° and 120°.

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Amendments to the Abstract:

Please substitute the new Abstract of the Disclosure submitted herewith on a separate page for the original Abstract presently in the application.

LAG-VW00000920

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REMARKS

Entry of the amendments to the specification, claims and abstract before examination of the application is respectfully requested. These claims have been amended to remove multiple dependencies.

If there are any questions regarding this Preliminary Amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket # 095309.57635US).

Respectfully submitted,

April 28, 2006

James F. McKeown
Registration No. 25,406

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Intellectual Property Group
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JFM:aw

2760230

LAG-VW00000921

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ABSTRACT OF THE DISCLOSURE

A directly injecting internal combustion engine has at least one cylinder which has a combustion space and in which a piston executes an oscillating movement, and an injection nozzle for the injection of fuel into the combustion space. The piston has a piston recess which has in its central region an elevation extending in the direction of a cylinder head. A surface of the piston recess which adjoins the elevation in the direction of the recess edge is connected to the elevation via a radius so an injection jet impinging in this region and injected at the earliest possible time point is distributed both in the elevation direction and in the recess edge direction. The surface adjoining the elevation in that direction has an extent in that direction such that an injection jet injected at the latest possible time point impinges onto the surface and is distributed both in the elevation direction and in the recess edge direction.

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DIRECTLY INJECTING INTERNAL COMBUSTION ENGINE

BACKGROUND AND SUMMARY OF THE INVENTION

[0001] This application is a National Phase of PCT/EP2004/011637, filed October 15, 2004, and claims the priority of German patent document DE 103 50 795.7, filed October 29, 2003, the disclosure of which is expressly incorporated by reference herein.

[0002] The present invention relates to a directly injecting internal combustion engine with at least one cylinder which has a combustion space and in which a piston executes an oscillating movement.

[0003] A known internal combustion engine is described in U.S. patent publication No. 2002/0117146 A1. In this case, the fuel is injected at a relatively steep injection angle into the combustion space, and the piston recess is adapted at least partially to the injection angle.

[0004] In an internal combustion engine described in DE 196 49 052 A1, a special shape of the piston recess is likewise provided, in order to achieve an additional reduction in the pollutants emitted by the internal combustion engine.

[0005] When early homogenization is to be achieved within the combustion space of an operating internal combustion engine, in

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particular a diesel internal combustion engine, then injection time points of approximately 130 to 30° before the top dead center of the piston must be selected, since, at this time point, the combustion space pressure is still relatively low, so that the injected fuel can penetrate very deeply into the combustion space. In order to prevent the injection jet from impinging onto the cylinder wall or the liner, as steep an injection angle as possible at the injection nozzle should be selected, in order to ensure as long a free jet length as possible. This also requires the shape of the piston recess to be adapted to this injection, as is the case, for example, in US 2002/0117146 A1.

[0006] Since, however, it is not possible to operate the internal combustion engine with a homogeneous combustion process over its entire characteristic map, the piston recess must be designed both for homogeneous and for conventional mixture formation. This is not easily possible in known solutions.

[0007] An object of the present invention, therefore, is to provide a directly injecting internal combustion engine, in which the shape of the piston recess is configured such that the internal combustion engine can be operated by both a homogeneous and a conventional combustion process.

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[0008] This object has been achieved, according to the invention providing that a surface of the piston recess which adjoins the elevation in the direction of the recess edge is connected to the elevation vi a radius in such a way that an injection jet impinging in this region and injected at the earliest possible time point is distributed both in the direction of the elevation and in the direction of the recess edge, and in that the surface adjoining the elevation in the direction of the recess edge has an extent in the direction of the recess edge such that an injection jet injected at the latest possible time point impinges onto the surface, the injection jet injected at the latest possible time point being distributed both in the direction of the elevation and in the direction of the recess edge.

[0009] The solution according to the invention ensures that the injection jet always impinges on the piston recess such that the injected fuel can be intermixed optimally with the air located in the combustion space, specifically independently of the time point of injection. Particularly the fact that an injection jet injected at the latest possible time point always impinges onto the surface adjoining the elevation ensures that the momentum of the impinging injection jet is not nullified, i.e., with the result from nullification that it could no longer be used optimally for mixture formation, which, in turn, would entail an increased formation of black smoke.

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[0010] An internal combustion engine is thus afforded which can easily be operated by both a homogeneous and a conventional combustion process.

[0011] Other objects, advantages and novel features of the present invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Fig. 1 is a partial, cross-sectional view of an internal combustion engine according to the invention with a piston oscillating in a combustion space of the latter and with an injection jet impinging on the piston recess of the piston;

[0013] Fig. 2 is a cross-sectional view of the configuration of the piston recess of the piston shown in Fig. 1 in a first region;

[0014] Fig. 3 is a cross-sectional view of the configuration of the piston recess of the piston shown in Fig. 1 in a second region;

[0015] Fig. 4 is a cross-sectional view of the configuration of the piston recess of the piston shown in Fig. 1 in a third region;

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