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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 C.F.R. 1.53(b))

Attorney Docket No.	IMM253
First Inventor	Michael Levin
Title	Virtual Detents Through Vibrotactile Feedback
Express Mail Label No.	

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* 32]
   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* 10]
5. **Oath or Declaration** [*Total Sheets* 2]
   a. ☒ Newly executed (original or copy)
   b. ☐ A copy from a prior application (37 CFR 1.63 (d))
   (for a continuation/divisional with Box 18 completed)
   i. ☐ DELETION OF INVENTOR(S)
   Signed statement attached deleting inventor(s) named 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

ACCOMPANYING APPLICATIONS PARTS

9. ☐ **Assignment Papers** (cover sheet & document(s))
   Name of Assignee _____
10. ☐ **37 C.F.R. 3.73(b) Statement** ☐ **Power of Attorney**
    (when there is an assignee)
11. ☐ **English Translation Document** *(if applicable)*
12. ☐ **Information Disclosure Statement** (PTO/SB/08 or PTO-1449)
    ☐ Copies of foreign patent documents, publications, & other information
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: _____

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 34300 *OR* ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone		Email	

Signature	Christopher W. Bosken	Date	12/27/07
Name (Print/Type)	Christopher W. Bosken	Registration No. (Attorney/Agent)	58887

This collection of information is required by 37 CFR 1.53(b). 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. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Mail Stop Patent Application, 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.

Valve Exhibit 1002
Valve v. Immersion

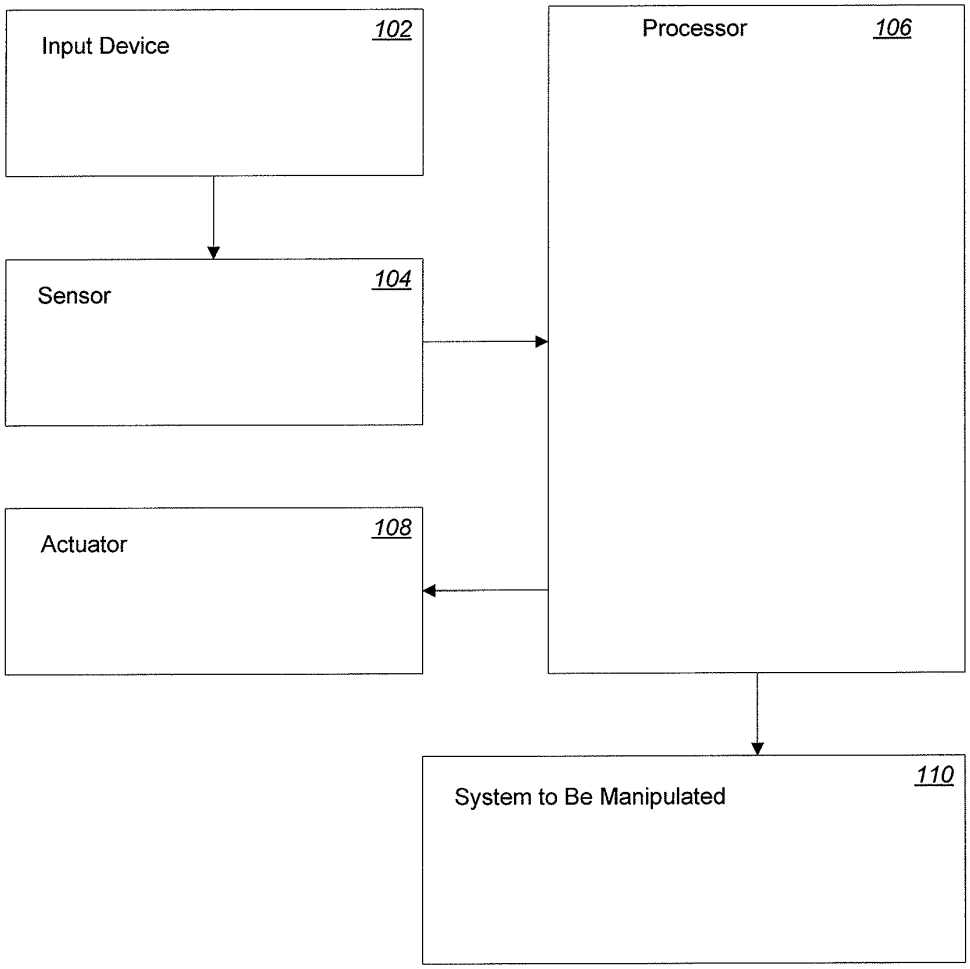

Input Device
102
Processor
106
Sensor
104
Actuator
108
System to Be Manipulated
110

Figure 1

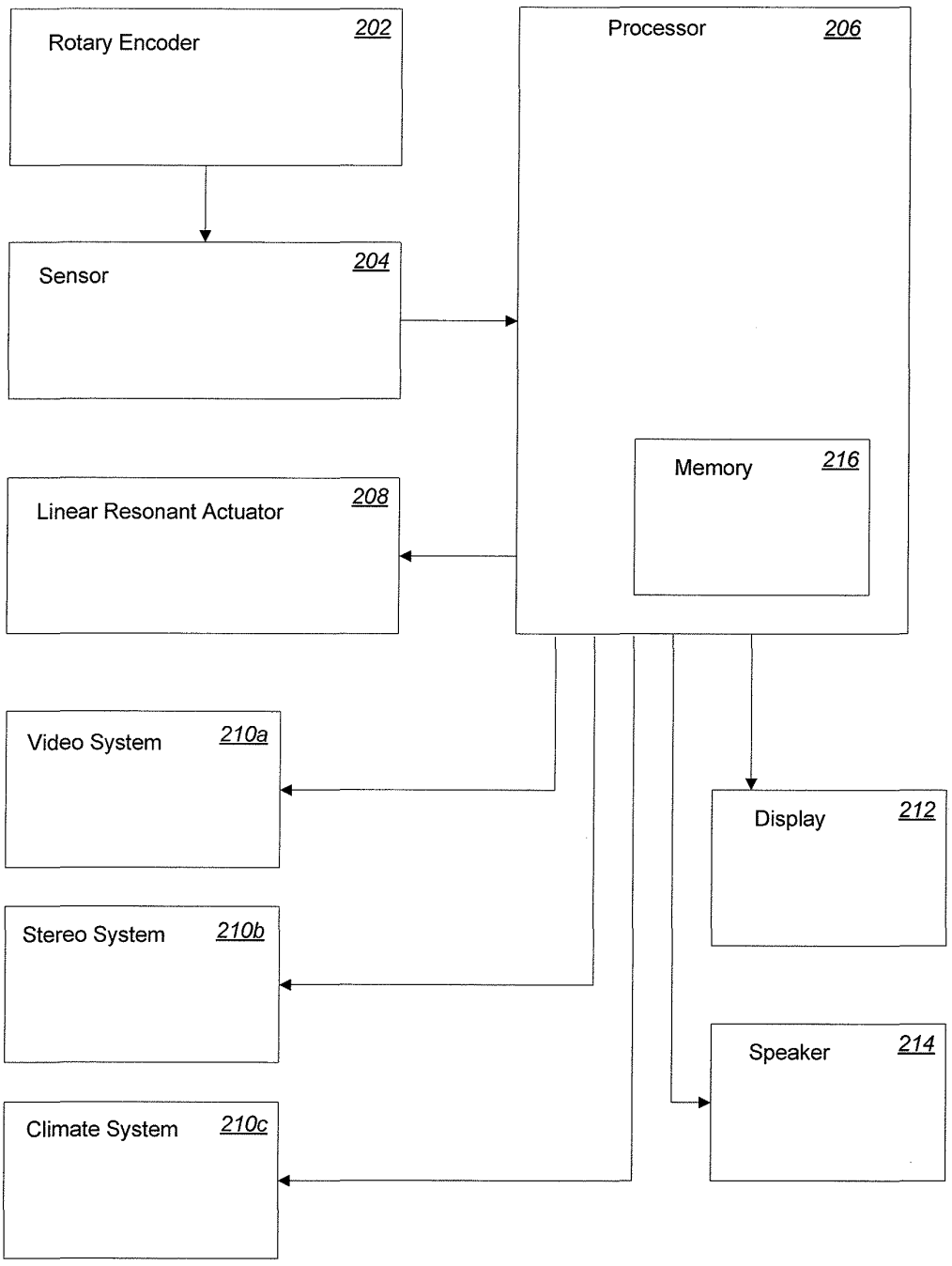

Rotary Encoder
202
Processor
206
Sensor
204
Memory
216
Linear Resonant Actuator
208
Video System
210a
Display
212
Stereo System
210b
Speaker
214
Climate System
210c

Figure 2

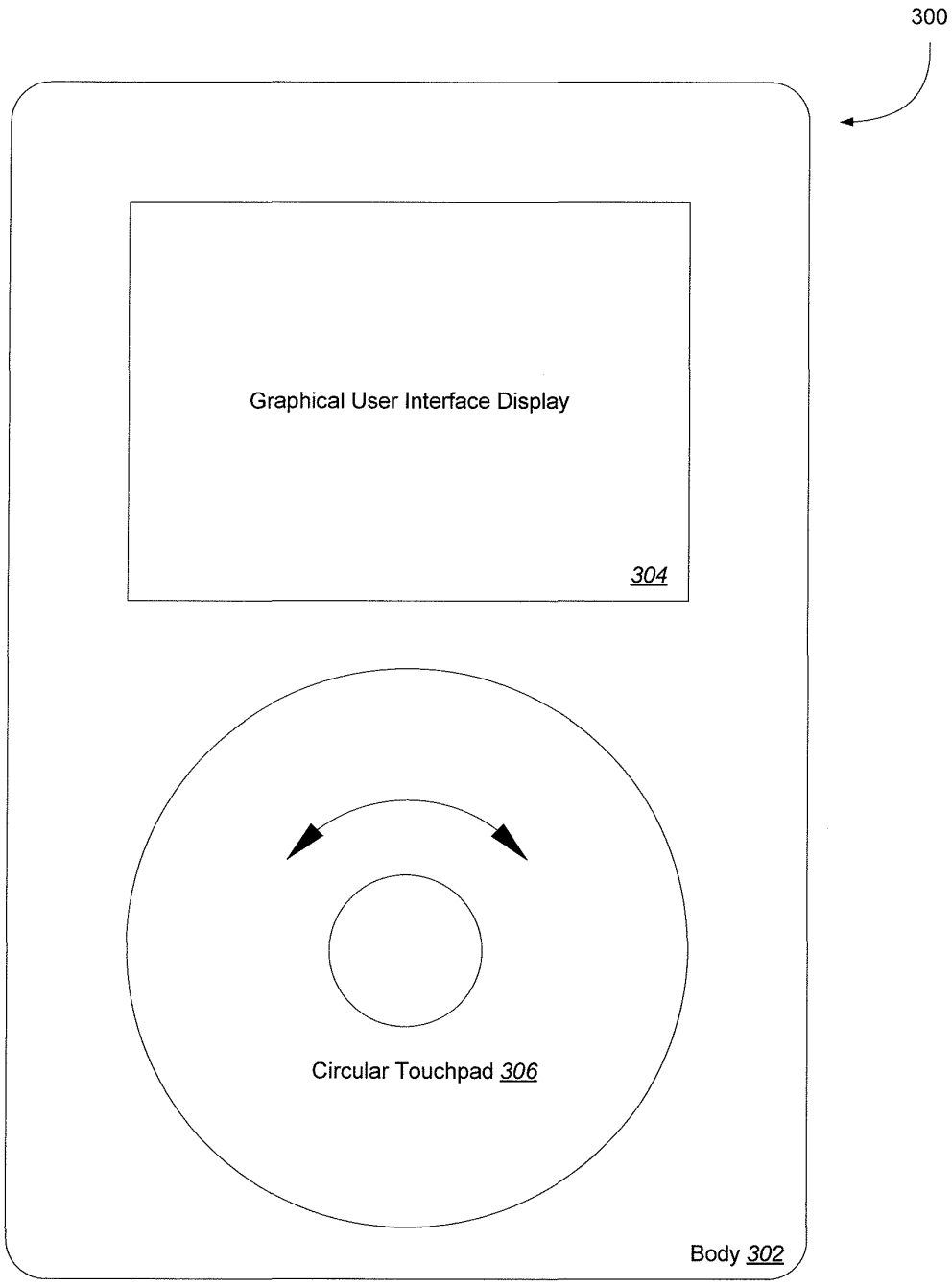

300
Graphical User Interface Display
304
Circular Touchpad 306
Body 302

Figure 3

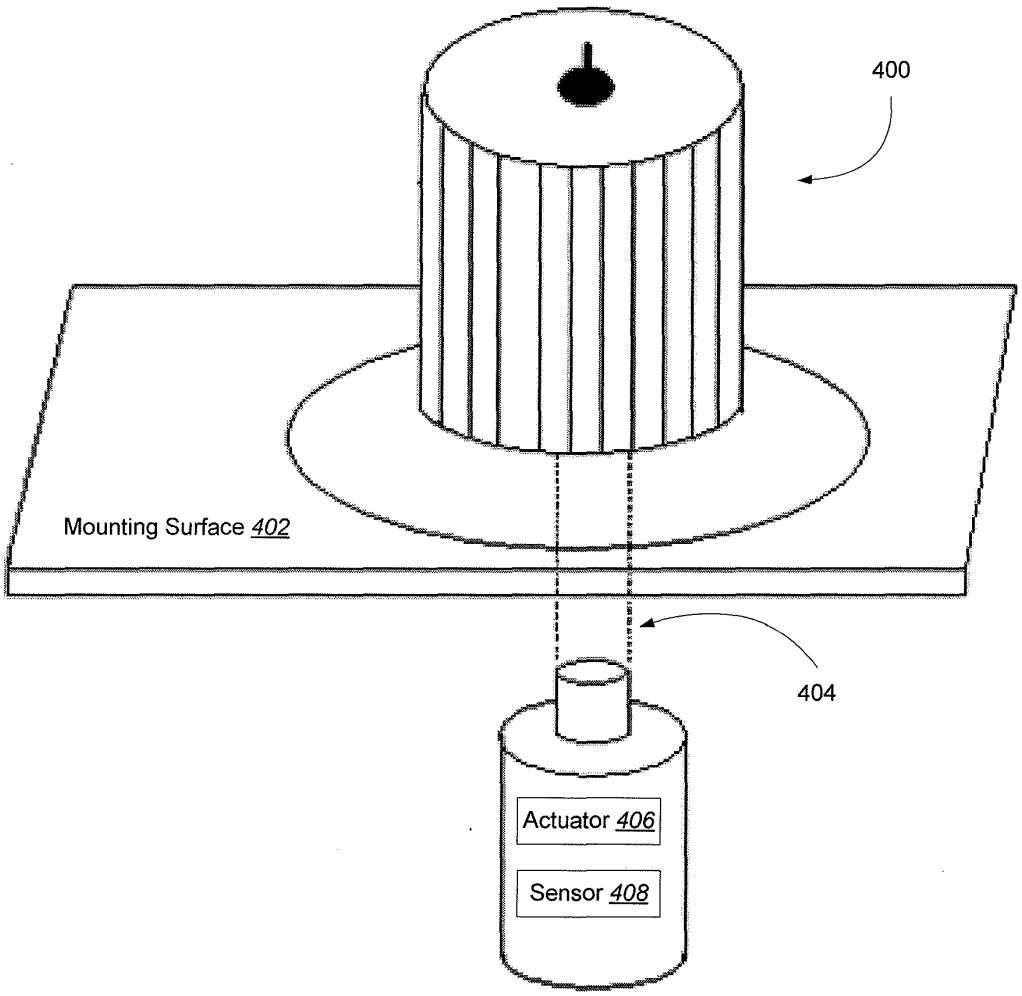


Figure 4

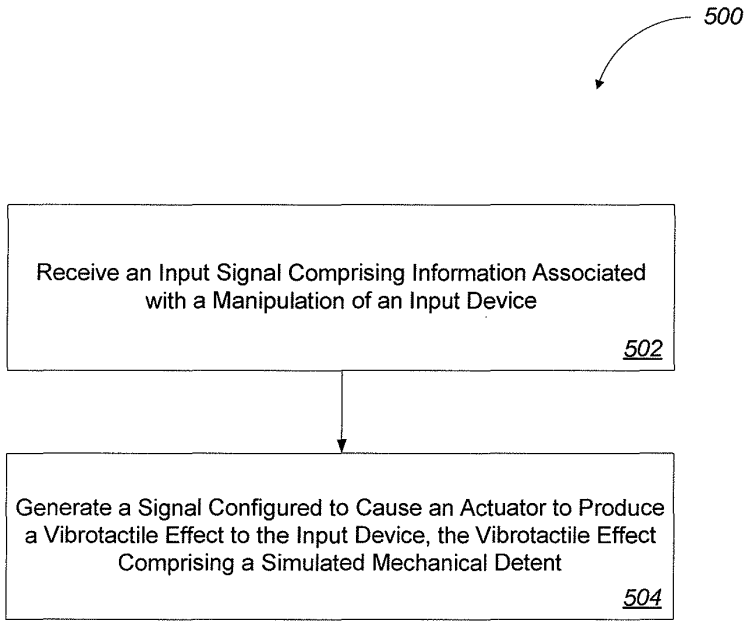

500
Receive an Input Signal Comprising Information Associated with a Manipulation of an Input Device
502
Generate a Signal Configured to Cause an Actuator to Produce a Vibrotactile Effect to the Input Device, the Vibrotactile Effect Comprising a Simulated Mechanical Detent
504

Figure 5

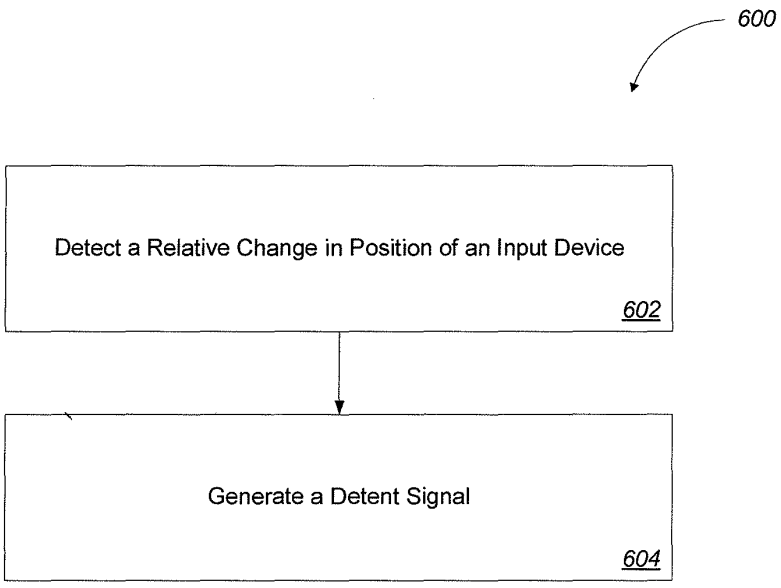

600
Detect a Relative Change in Position of an Input Device
602
Generate a Detent Signal
604

Figure 6

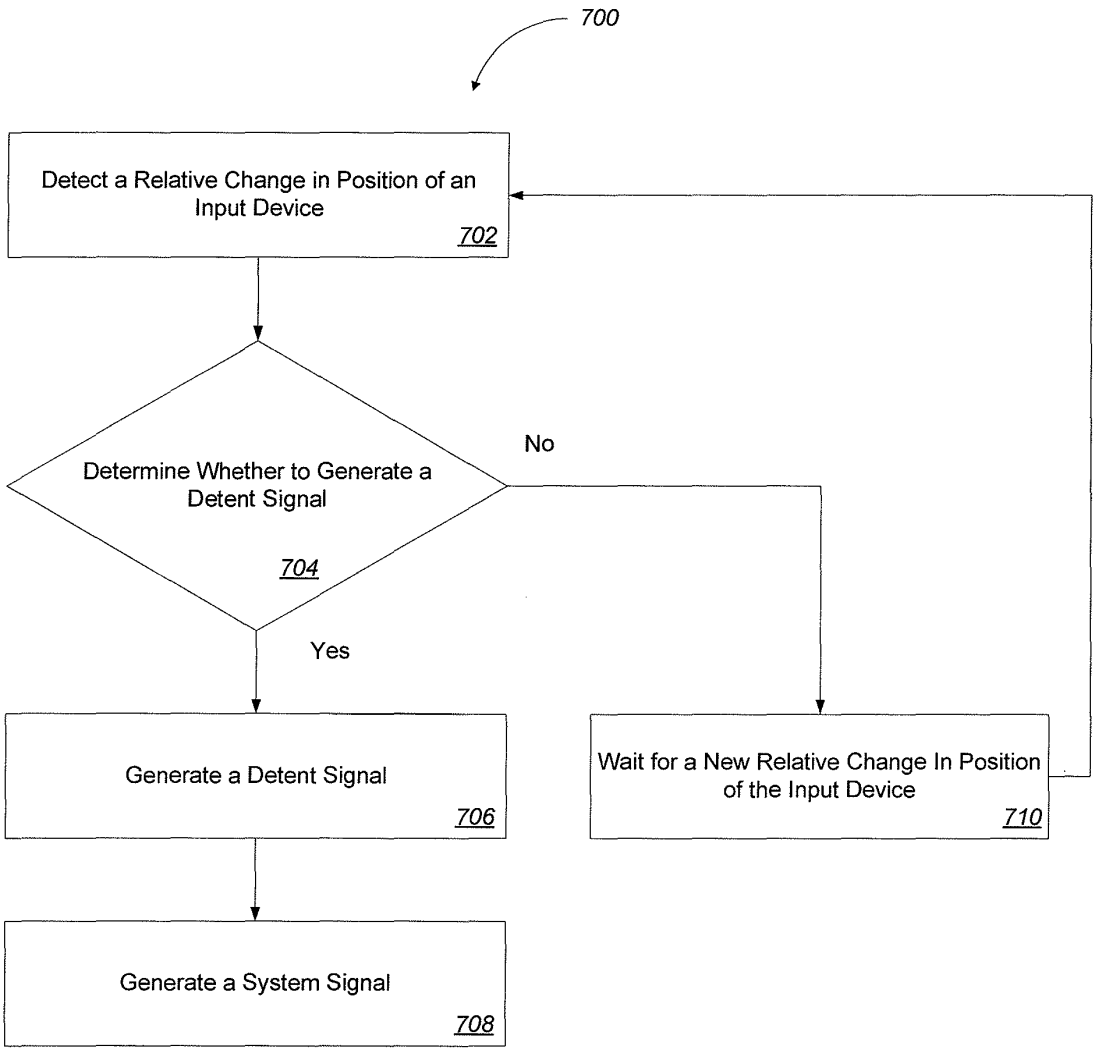

700
Detect a Relative Change in Position of an Input Device
702
Determine Whether to Generate a Detent Signal
704
No
Yes
Generate a Detent Signal
706
Generate a System Signal
708
Wait for a New Relative Change In Position of the Input Device
710

Figure 7

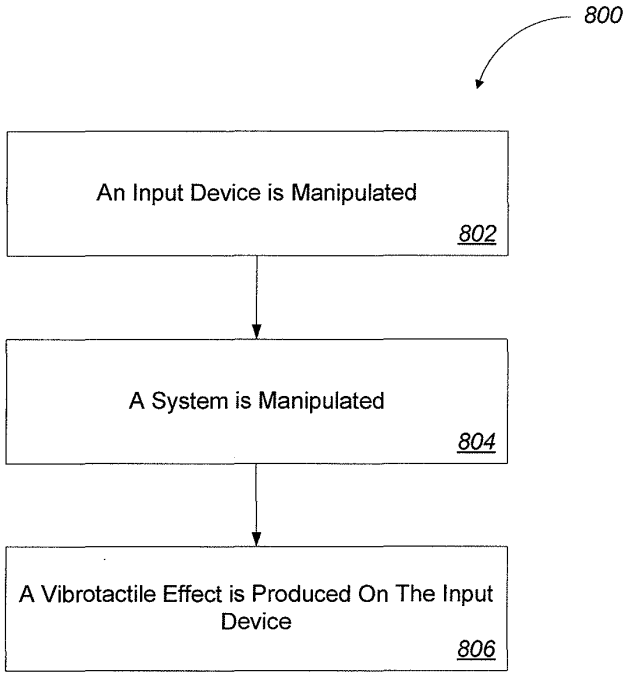
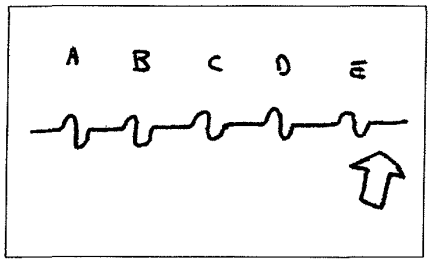

800
An Input Device is Manipulated
802
A System is Manipulated
804
A Vibrotactile Effect is Produced On The Input Device
806

Figure 8



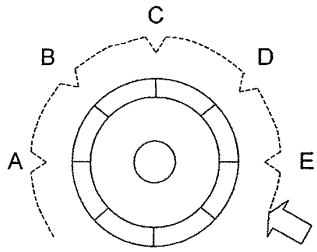
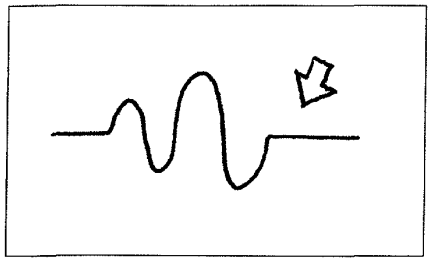


Figure 9A



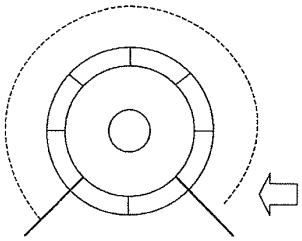
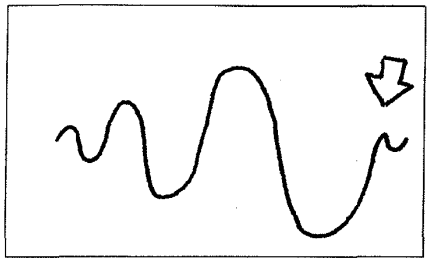


Figure 9B



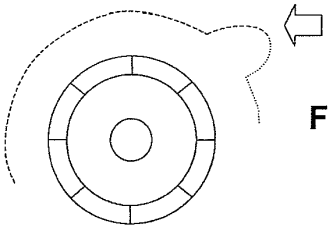
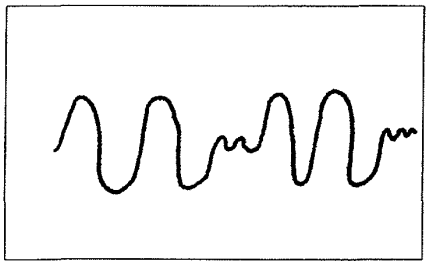


Figure 9C



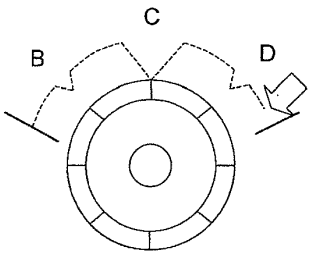
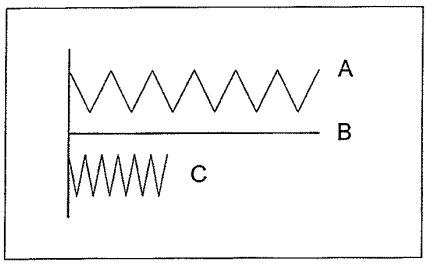


Figure 9D



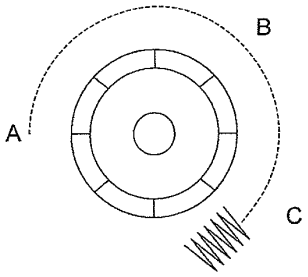
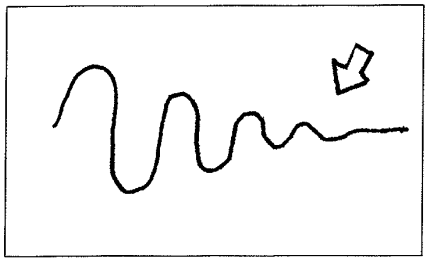


Figure 9E



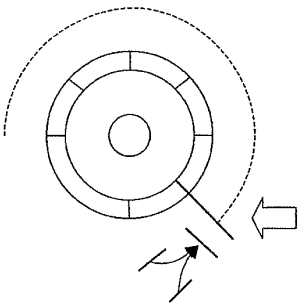
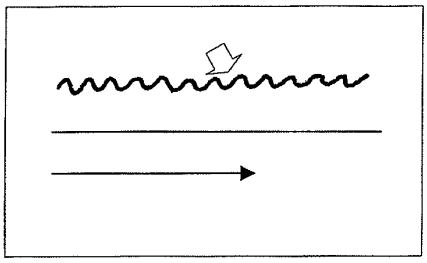


Figure 9F



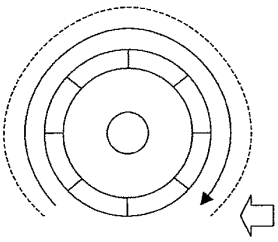
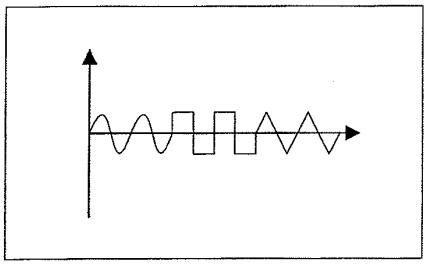


Figure 9G



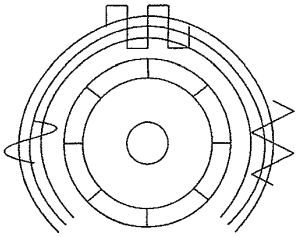


Figure 9H

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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☒ Declaration Submitted With Initial Filing **OR** ☐ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	IMM253
First Named Inventor	Michael D. Levin
COMPLETE IF KNOWN	
Application Number	/
Filing Date	
Art Unit	
Examiner Name	

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:

Virtual Detents Through Vibrotactile Feedback

the specification of which *(Title of the Invention)*

☒ is attached hereto

OR

☐ was filed on (MM/DD/YYYY) ☐ 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 CFR 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 Not Claimed	Certified Copy Attached? YES	NO
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐
			☐	☐	☐

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. 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 21 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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DECLARATION — Utility or Design Patent Application

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Country	Telephone	Email

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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.

NAME OF SOLE OR FIRST INVENTOR:	☐ A petition has been filed for this unsigned inventor
Given Name (first and middle [if any]) Michael D.	Family Name or Surname Levin
Inventor's Signature Michael Levin	Date 12/24/07

Residence: City **Los Altos**	State CA	Country United States	Citizenship United States
Mailing Address 1230 Gronwall Court			
City Los Altos	State CA	Zip 94024	Country United States

☐ Additional inventors or a legal representative are being named on the 2 supplemental sheet(s) PTO/SB/02A or 02LR attached hereto.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D Levin
Filer:	Christopher W. Bosken/Dee Jones
Attorney Docket Number:	IMM253

Filed as Large Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility application filing	1011	1	310	310
Utility Search Fee	1111	1	510	510
Utility Examination Fee	1311	1	210	210
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	210	210
Miscellaneous-Filing:				
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1240**

Electronic Acknowledgement Receipt	
EFS ID:	2643759
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D Levin
Customer Number:	34300
Filer:	Christopher W. Bosken/Dee Jones
Filer Authorized By:	Christopher W. Bosken
Attorney Docket Number:	IMM253
Receipt Date:	27-DEC-2007
Filing Date:	
Time Stamp:	14:11:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1240
RAM confirmation Number	6623
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)

1	Application Data Sheet	IMM253ApplicationDataSheet.pdf	212642 7be91613728a45a718186360cfbe059b076afce4	no	3
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
2	Specification	IMM253Spec.pdf	1430291 6f2bdd55ae7d337fd2c83a5bb09918580d2fba3c	no	32
Warnings:					
Information:					
3	Miscellaneous Incoming Letter	IMM253Transmittal.pdf	87896 84b0918e54b9bee872140537a1ab75a5d303f138	no	1
Warnings:					
Information:					
4	Drawings-only black and white line drawings	IMM253Drawings.pdf	129767 abbdc18eebed0e59fbd3aeb84a03e5c9964fe83d	no	10
Warnings:					
Information:					
5	Oath or Declaration filed	IMM253Declaration.pdf	131067 c1bc61747d54b2f56f52191c9ec5df89974a0543	no	2
Warnings:					
Information:					
6	Fee Worksheet (PTO-06)	fee-info.pdf	8480 1dd570ba4754d200a48ad8c1333f98d1455a2f95	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	2000143	

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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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IMM253
	Application Number	
Title of Invention	Virtual Detents Through Vibrotactile Feedback	

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Applicant Information:

Applicant 1

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Application Information:

Title of the Invention	Virtual Detents Through Vibrotactile Feedback		
Attorney Docket Number	IMM253	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)	10	Suggested Figure for Publication (if any)	

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IMM253
	Application Number	
Title of Invention	Virtual Detents Through Vibrotactile Feedback	

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.

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Prior Application Status	Pending	Remove	
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	non provisional of	60877333	2006-12-27

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Application Number	Country [i]	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	IMM253
	Application Number	
Title of Invention	Virtual Detents Through Vibrotactile Feedback	

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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	Christopher W. Bosken			Date (YYYY-MM-DD)	2007-12-27
First Name	Christopher W.	Last Name	Bosken	Registration Number	58887

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VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK

CROSS-REFERENCES TO RELATED APPLICATION

[0001] This application claims priority to U.S. Provisional Patent Application No. 60/877,333 entitled "Virtual Detents through Vibrotactile Feedback," filed December 27, 2006, the entirety of which is hereby incorporated by reference.

FIELD OF THE INVENTION

[0002] The present invention generally relates to vibrotactile feedback. More particularly, the present invention relates to methods and systems for providing virtual detents through vibrotactile feedback.

BACKGROUND

[0003] Traditional mechanical device controls include switches, knobs, levels, sliders, faders, and the like. In the past, such controls have been essentially mechanical in nature, e.g., a knob turning a shaft coupled to a potentiometer to control an electrical input to a device such as a radio or audio amplifier, a knob turning a shaft coupled to a fan control or heating/air conditioning control in an automobile, or a lever controlling the opening and closing of a vent in an automobile.

[0004] With many traditionally mechanical functions being replaced by electronics, operation of electronic controls has been made less intuitive to users. For example, without click-stops or "detents," or otherwise a sense of mechanical resistance, it may be difficult to obtain a similar experience from an electronic substitute for a traditional mechanical control device or even effectively and efficiently operate such a device. A detent, such as a mechanical detent, can refer to the resistance of rotation of a wheel or shaft. A detent can be used to divide a rotation into discrete increments, or may be used to arrest rotation in a direction. For instance, a

mechanical detent can be constructed from a notched wheel and a small gravity or spring-actuated lever.

SUMMARY

[0005] Embodiments of the present invention disclosed herein provide methods and systems for providing virtual detents through vibrotactile feedback.

[0006] One embodiment of the invention is a method comprising the steps of receiving an input signal that comprises information associated with the manipulation of an input device, and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect comprising a virtual detent to the input device. In another embodiment, a computer-readable medium (such as, for example, random access memory or a computer disk) comprises code for carrying out such a method.

[0007] Another embodiment of the invention is a system comprising an input device and a processor that is in communication with the input device and that is configured to receive an input signal comprising information associated with the manipulation of the input device. The processor may further be configured to generate a detent signal based at least in part on the manipulation of the input device. The system may further comprise an actuator coupled to the input device. The actuator may be in communication with the processor and configured to produce to the input device a vibrotactile effect comprising a virtual detent based at least in part on the detent signal.

[0008] Further details of embodiments of the invention are set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] These and other features, aspects, and advantages of the invention are better understood when the following Detailed Description is read with reference to the accompanying

drawings, wherein:

Figure 1 is a block diagram illustrating a first system for providing virtual detents through vibrotactile feedback in one embodiment of the invention;

Figure 2 is a block diagram illustrating a second system for providing virtual detents through vibrotactile feedback in one embodiment of the invention;

Figure 3 is an illustration of a first device for providing virtual detents through vibrotactile feedback in one embodiment of the present invention;

Figure 4 is an illustration of a second device for providing virtual detents through vibrotactile feedback in one embodiment of the present invention;

Figure 5 is a flow diagram illustrating a first method for virtual detents through vibrotactile feedback;

Figure 6 is a flow diagram illustrating a second method for virtual detents through vibrotactile feedback;

Figure 7 is a flow diagram illustrating a third method for virtual detents through vibrotactile feedback;

Figure 8 is a flow diagram illustrating a fourth method for virtual detents through vibrotactile feedback; and

Figures 9A, 9B, 9C, 9D, 9E, 9F, 9G, and 9H are eight illustrations of virtual detent profiles in various embodiments of the present invention.

DETAILED DESCRIPTION

[0010] Embodiments of the present invention provide methods and systems for virtual detents through vibrotactile feedback. In one illustrative embodiment, a rotary knob input device

is rotated. A sensor detects the rotation of the rotary knob and sends an input signal to a processor. The input signal comprises information related to the rotation of the rotary knob, such as how far the knob has been turned. The processor determines whether to manipulate an audio system based at least in part on the input signal. The processor further determines whether to generate a signal configured to cause an actuator to vibrate the rotary knob, the vibration based at least in part on the signal.

[0011] This example is given to introduce the reader to the general subject matter discussed. The invention is not limited to this example. Below, examples of methods and systems for virtual detents through vibrotactile feedback are described.

Illustrative Devices for Enhanced Haptic Feedback

[0012] In one illustrative embodiment of a device configured to provide virtual detents through vibrotactile feedback, a portable music player may be configured to play music through a speaker and produce a virtual detent on a touch pad with an actuator. In one such embodiment, the portable music player may comprise a touch pad configured to generate an input signal to a processor based on a user contact. The processor may analyze the input signal and determine whether to manipulate the audio system and whether to generate a vibrotactile effect. If the processor determines a vibrotactile effect should be generated, the processor may generate a signal. The signal may be configured to cause the actuator to produce a vibrotactile effect to the touch pad in the form of a virtual detent.

[0013] Such an illustrative embodiment may be advantageously employed to simulate mechanical detents through vibrotactile feedback. Such simulated mechanical detents, or virtual detents, may provide useful feedback to a user. For example, a virtual detent may indicate the successful change in volume of a sound system. As another example, the absence of a virtual

detent may indicate that a climate system is not turned on, or that it has reached the highest threshold of operation.

[0014] These further examples are given to introduce the reader to the general subject matter discussed herein. The invention is not limited to these examples. The following sections describe various embodiments of systems and methods for providing virtual detents through vibrotactile feedback.

Example of a First System for Virtual Detents through Vibrotactile Feedback

[0015] Referring now to the figures in which like numerals indicate like elements throughout the several figures, Figure 1 is a block diagram illustrating a first system for providing virtual detents through vibrotactile feedback in one embodiment of the invention. In the embodiment shown, the system comprises an input device 102, a sensor 104, a processor 106, an actuator 108, and a system to be manipulated 110.

The Input Device and Sensor

[0016] Systems of the invention comprise an input device 102 and a sensor 104. The input device 102 shown in Figure 1 is configured to provide an input signal to the processor when the input device 102 is manipulated. In other embodiments, sensor 104 can generate an input signal when the sensor 104 detects manipulation of the input device 102.

[0017] The input device 102 can be, for example, a mechanical input device. Examples of mechanical input devices include a rotary knob coupled to an encoder. Encoders of the input device 102 may comprise an optical encoder or a potentiometer. In other embodiments, the input device 102 may be a non-mechanical input device. For example, the input device 102 may be a touch-sensitive device, such as a touch pad or a touch screen.

[0018] The input device 102 is in communication with a sensor 104. The sensor detects movement of the input device 102. A sensor 104 can be configured to detect the movement of a rotary knob, or other aspects of manipulation of the input device 102, such as position, velocity, acceleration, torque, rate of rotation, or the time of rotation.

[0019] Sensor 104 shown in Figure 1 comprises a contact-type sensor, such as a switch, a resistive sensor, a capacitive sensor, an infrared sensor, or an optical sensor. Alternatively, sensor 104 may comprise a non-contact sensor such as a field effect sensor or a proximity sensor, and can be a surface or sub-surface sensor.

The Processor

[0020] The system illustrated in Figure 1 comprises a processor 106. The processor 106 may be configured to receive input signals from an input device 102 or a sensor 104 and to generate signals to an actuator 108. The signals may be configured to cause the actuator 108 to produce a vibrotactile effect. Further, the processor can generate signals provided to a system to be manipulated 110.

[0021] In one embodiment, a dedicated processor 106 may receive input signals and generate signals. Although there is a single processor shown in Figure 1, the system may comprise a plurality of processors. The processor 106 may be configured to perform a variety of tasks. For example, the processor 106 may comprise additional program code running on a native cellular phone processor.

[0022] The processor 106 may be configured to receive input signals. In some embodiments, the processor 106 may receive input signals from the input device 102. In other embodiments, the processor 106 may receive input signals from the sensor 104. In the embodiment shown in Figure 1, the input device 102, sensor 104 and the processor 106 are in

communication via a direct wired digital connection. For example, the input device 102, sensor 104, and the processor 106 may be in communication via a communication bus such as the Universal Serial Bus (USB). In other embodiments, communication between an input device 102, sensor 104 and the processor 106 may be through analog signals and/or may be wireless. For instance, the sensor 104 may be able to use Bluetooth, Wireless USB or Wi-Fi to communicate with the processor 106.

[0023] The processor 106 can also generate one or more signals. For example, a processor may generate a signal when a valid input signal is received. In the embodiment shown in Figure 1, as the input device 102 is manipulated, the processor 106 may generate a signal at the same time or immediately after the manipulation. In one embodiment, the processor 106 may process software code running as an application on the processor and utilize the input signal in the context of the software code to generate signals configured to cause virtual detents.

[0024] The processor 106 may generate a signal, such as a detent signal, to the actuator 108. The detent signal may be configured to cause an actuator 108 to produce a vibrotactile effect in the form of a virtual detent on the input device 102.

[0025] The processor 106 may generate a signal specific to an actuator 108. In one embodiment, the signal may be generated with parameters specific to the actuator 108. For example, the processor may analyze parameters associated with the actuator 108, such as the actuator's resonant frequency, and generate a signal based at least in part on the parameters. Other parameters of the actuator 108 may comprise, for example and without limitation, a resonant frequency of the actuator, a maximum peak-to-peak amplitude or magnitude of the actuator, or a minimum actuator response time.

[0026] The processor 106 may generate a signal by accessing a detent profile stored in a memory (not shown in Figure 1). In one embodiment, the processor 106 may access a specific detent profile based at least in part on the input signal. In certain embodiments, the processor 106 may determine which of a plurality of simulated mechanical detents to generate. For example, the processor 106 may analyze the input signal and determine that a hard stop is appropriate. Further, the processor 106 may then access the hard stop virtual detent profile in a memory, and generate a detent signal based on the hard stop virtual detent profile.

[0027] The processor 106 may be in communication with a system to be manipulated 110 or controlled. In some embodiments, the processor 106 may be configured to generate a system signal. The system signal may be provided to the system to be manipulated 110.

[0028] The system signal may be based at least in part on the manipulation of the input device. For example, an input device 102 in the form of a rotary knob may be rotated one entire revolution. The processor 106 may receive an input signal indicating the complete rotation of the input device 102 and generate a system signal configured to manipulate a system 110 by maximizing or minimizing a level of the system.

[0029] While the device shown comprises one processor 106, other devices may comprise two or more processors. Processor 106, as well as other processors incorporated into one or more embodiments of the present invention, may comprise a computer-readable medium, such as a random access memory (RAM) coupled to the processor (not shown in Figure 1). The processor executes computer-executable program instructions stored in memory, such as executing one or more computer programs for generating vibrotactile or other haptic effects. Such processors may comprise a microprocessor, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), field programmable gate arrays (FPGAs), and

state machines. Such processors may further comprise programmable electronic devices such as PLCs, programmable interrupt controllers (PICs), programmable logic devices (PLDs), programmable read-only memories (PROMs), electronically programmable read-only memories (EPROMs or EEPROMs), or other similar devices.

[0030] Such processors may comprise, or may be in communication with, media, for example computer-readable media, that may store instructions that, when executed by the processor, can cause the processor to perform the steps described herein as carried out, or assisted, by a processor. Embodiments of computer-readable media may comprise, but are not limited to, an electronic, optical, magnetic, or other storage or transmission device capable of providing a processor with computer-readable instructions. Other examples of media comprise, but are not limited to, a floppy disk, CD-ROM, magnetic disk, memory chip, ROM, RAM, ASIC, configured processor, all optical media, all magnetic tape or other magnetic media, or any other medium from which a computer processor can read. Also, various other forms of computer-readable media may transmit or carry instructions to a computer, such as a router, private or public network, or other transmission device or channel. The processor, and the processing, described may be in one or more structures, and may be dispersed through one or more structures. The processor may comprise code for carrying out one or more of the methods (or parts of methods) described herein. The instructions can comprise code from any suitable computer-programming language, including, for example, assembly code, C, C+, C++, Visual Basic, Java, Python, and JavaScript.

The Actuator

[0031] The system illustrated in Figure 1 further comprises one or more actuators 108. Each actuator 108 can be configured to receive a signal from the processor 106 and provide

vibrotactile effects to the user in the form of virtual detents. The actuator 108 can vibrate the input device 102 to provide vibrotactile feedback.

[0032] The actuator 108 can provide vibrotactile feedback based on signals received from the processor 106. For example, the actuator 108 may be configured to generate a vibration after receiving a detent signal from the processor 106. The actuator 108 can vibrate the input device 102 at substantially the same time the input device is being manipulated.

[0033] The actuator 108 may be configured to simulate mechanical feedback through vibrotactile feedback. Specifically, in some embodiments the actuator 108 may be configured to provide the perception of a detent (i.e. a virtual detent) without the traditional means necessary for a mechanical detent. For example, the actuator 108 may be used in place of various mechanical components which traditionally provided tactile feedback, such as springs, brakes or cams. In some embodiments, the vibrotactile feedback may comprise a click effect replicating a mechanical click. In other embodiments, the vibrotactile feedback may not comprise a click effect, but some other effect, such as a spring effect or a barrier effect.

[0034] The actuator 108 may be configured to generate vibrotactile feedback with a variety of different characteristics. For example, the actuator may be configured to generate vibrotactile feedback with different frequencies, amplitudes, or waveforms. In one embodiment, the virtual detent may comprise a simulated click generated through a single pulse. In a second embodiment, the virtual detent may comprise a click-and-release effect generated by a double pulse. Figure 9 provides illustrations of various virtual detent profiles.

[0035] Because the actuator 108 may be configured to generate vibrotactile feedback, in contrast to mechanical feedback, the actuator 108 may provide vibrotactile feedback to non-mechanical input devices 102, such as a touch-sensitive pad, i.e., a touch pad or touch screen.

[0036] The actuator 108 may be configured to generate various types of vibrotactile feedback. For example, the actuator 108 may be configured to produce different virtual detents. The vibrotactile feedback may be generated in various directions. For example, the actuator 108 may vibrate the input device orthogonal to the motion of the input device.

[0037] The actuator 108 can be any of a variety of different types of force producing devices, including an eccentric rotating mass (ERM) actuator, a multifunctional (MFT) actuator, a linear mass actuator, an electro-magnetic actuator, a motor, a voice coil, a pneumatic or hydraulic actuator, an electro-active polymer, or any other suitable actuator. In one embodiment, actuator 108 may comprise a plurality of actuators of the same or different design. For example, in one embodiment, two actuators may be employed. A first actuator may be configured to provide vibrotactile or other haptic effects having a high frequency of vibration (e.g. greater than 400Hz), while a second actuator may be configured to provide vibrotactile or other haptic effects having a low frequency of vibration (e.g. less than 400Hz).

[0038] Since some embodiments of the invention may use the actuator 108 to generate vibrotactile feedback, as opposed to mechanical feedback, a smaller actuator may be used than in other devices. For example, actuator 108 may comprise a circular actuator ten (10) millimeters in diameter and three and one half (3.5) millimeters thick.

[0039] Since the device may comprise a plurality of actuators, the number of actuators 108 may be based on the size and mass of the device. For example, an actuator 108 may be provided for every one hundred (100) grams of mass of the system. In such an example, a system measuring three hundred (300) grams may comprise three actuators. In another example, a cellular phone measuring three hundred (300) grams may only comprise a single but more powerful actuator.

[0040] In one embodiment, the number of actuators 108 may be based on what surface of the system is being vibrated. For example, if a PDA measures four hundred (400) grams, but only the display will be vibrated, the system may comprise only one actuator 108, especially if the display is isolated from the rest of the device such as by a suspension system. Alternatively, if vibrotactile feedback is provided to the entire PDA, the system may comprise two or more actuators.

[0041] Each actuator 108 of a plurality of actuators may be configured to generate vibrotactile feedback to the input device 102. In one embodiment, the vibrotactile feedback generated by each of a plurality of actuators is synchronized.

[0042] The actuator 108 can be mounted to a touch-sensitive display, such as a touch screen (not shown in Figure 1). In one embodiment, the actuator 108 is mounted underneath the display, or alternatively, to the edge of the display, or laterally mounted to the display. In embodiments where the actuator 108 is mounted to a display, the display may be mounted in a suspension of compliant material, such as a foam gasket. Mounting a display to a foam gasket may ensure that the display is vibrated alone or with a different strength than the entire device.

[0043] In one embodiment, two actuators may be mounted to either side of a display. In one example, both actuators may face the same direction and be in the same phase. In one embodiment, two side-mounted actuators may vibrate a screen side-to-side. Side-mounted actuators may produce consistent forces across a screen, since the screen may be moving in the direction of its rigidity.

[0044] In one embodiment, two actuators are mounted behind a display. In one example, both actuators mounted behind the display may face the same direction and can vibrate the display in and out.

The System to Be Manipulated

[0045] The system illustrated in Figure 1 comprises a system to be manipulated 110. One or more systems to be manipulated 110 can each receive system signals from the processor 106. The system to be manipulated 110 may comprise a system capable of electrical or electromechanical control, such as and without limitation, a stereo system, a video system, a climate system (e.g. air conditioning and/or heating), a navigation system, automotive systems, wireless communication devices, security systems, a television, a video game system, a washing machine or a drying machine, or an oven.

[0046] In one embodiment, the system to be manipulated 110 may comprise a single system, such as a lighting system. In another embodiment, the system to be manipulated 110 may comprise a complex system comprising one or more elements. For example, the system to be manipulated 110 may be a heating and cooling system.

Example of a Second System for Virtual Detents through Vibrotactile Feedback

[0047] Figure 2 is a block diagram illustrating a second system for providing virtual detents through vibrotactile feedback in one embodiment of the invention. In the embodiment shown, the system comprises a rotary encoder 202, a sensor 204, a processor 206, and a linear resonant actuator 208. The system further comprises a visual system 210a, an audio system 210b, a climate system 210c, a display 212, a speaker 214, and a memory 216. An example of a visual system 210a is a video game system. An example of an audio system 210b is a stereo system. An example of a climate system 210c is an air conditioning and heating system.

[0048] As shown in Figure 2, the input device can be the rotary encoder 202. The sensor 204 is in communication with the rotary encoder 202 and the processor 206. As the rotary

encoder 202 is manipulated, the sensor 204 generates input signals associated with the manipulation, and transmits the input signals to the processor 206.

[0049] Once the processor 206 receives an input signal, the processor 206 can determine whether to generate a detent signal and/or a system signal. For example, if the input signal indicates a rotation of a knob in more than 5 degrees of motion, the processor 206 may generate a system signal and a detent signal.

[0050] The processor 206 is in communication with the linear resonant actuator 208. The processor 206 can receive input signals comprising information associated with a manipulation of the rotary encoder 206 and generate a signal configured to cause the linear resonant actuator 208 to produce a vibrotactile effect to the rotary encoder 202, the vibrotactile effect comprising a simulated mechanical detent.

[0051] As shown in Figure 2, the processor 206 is in communication with three systems: a video system 210a, a stereo system 210b, and a climate system 210c. The processor is also in communication with a display 212 and a speaker 214. The processor may synchronize changes in the display 212, sounds played via a speaker 214, and vibrotactile feedback in the rotary encoder 202.

[0052] In other embodiments, the input device may comprise a different device, such as a touch pad. The touch pad (not shown) may be in communication with a sensor 204. The sensor 204 may be configured to detect movement on the touch pad.

[0053] The sensor 204 can directly transmit input signals to the processor 206. In a specific example, the sensor 204 may send an input signal to the processor 206 once the rotary encoder is rotated 2 degrees or more.

[0054] The processor 206 can be in communication with one or a plurality of systems to be controlled. The processor 206 can cause the display 212 to show a graphical representation of a menu structure. The processor 206 can synchronize vibrotactile feedback with other events, such as changes in the display 212 or sounds played on the stereo system 210b. In one example, as the navigation of a menu system is shown on display 212, the input device may be vibrated while each item on the menu is traversed.

[0055] The processor 206 can be configured to determine a specific detent signal to generate. The detent signal may be based at least in part on the system which is actively being controlled. For example, if the video system 210a is being controlled, the processor 206 may generate one type of detent signal, such as a click effect. Alternatively, if the stereo system 210b is being controlled, the processor 206 may generate a second type of detent signal, such as a hard stop virtual detent.

[0056] As shown in Figure 2, the processor 206 comprises memory 216. The memory 216 can be a high-speed cache memory, and configured to store vibrotactile feedback effects, such as virtual detent profiles. In one embodiment, the processor can access an effect profile stored in memory 216 after the processor 206 has determined what type of vibrotactile effect to generate.

[0057] A default library of vibrotactile effects, such as virtual detents, may be stored in the memory 216. For example, the processor 106 may store each virtual detent profile illustrated in Figure 9 in the memory 216. This profile may take the form of computer code. In one embodiment, the processor may be programmed with various types of vibrotactile effects not previously stored in memory 216. For example, each user of the system may author individual vibrotactile effects to store in memory 216. In a second embodiment, the processor 106 may

only store vibrotactile effects programmed by a manufacturer. In one embodiment, characteristics of the actuator may be stored in memory 216. For example, the frequency response of a system's actuator may be stored in memory 216.

Virtual Detents Through Vibrotactile Feedback

[0058] Figure 3 is an illustration of a first device for providing virtual detents through vibrotactile feedback in one embodiment of the present invention. Various embodiments of the invention may be used in devices without mechanical feedback. In other embodiments, the invention may be used to supplement mechanical feedback.

[0059] The device in Figure 3 comprises a portable music player 300 having a body 302, a graphical user interface display 304, and a circular touch pad 306. Although the touch pad 306 shown in Figure 3 is circular, in other embodiments the touch pad 306 may be linear, rectangular, or some other configuration. As shown in Figure 3, the input device 306 may be in communication with a display 304. As an example, the input device 306 may be configured to navigate a menu system which may be shown on the display 304. In other embodiments, the input device 306 may not be in communication with a display 304.

[0060] While the embodiment shown in Figure 3 comprises a portable music player, other embodiments may comprise other devices, such as a personal digital assistant (PDA), a portable video player, a portable game system, or a portable navigation device. Other examples may include other electronic devices or appliances, such as a television, oven, or a lighting system.

[0061] A user may interact with the portable music player 300 by activating the circular touch pad 306. For example, a user may select an object on a menu displayed on the graphical

user interface display 304 by dragging a finger around the circular touch pad 306 in a clockwise or counter-clockwise direction.

[0062] An actuator (not shown in Figure 3) is coupled to the touch pad. As a user manipulates the circular touch pad 306, vibrotactile feedback in the form of virtual detents are provided to the user when the actuator vibrates the touch pad. The actuator generates virtual detents through vibrotactile feedback, to simulate mechanical feedback.

[0063] Since the vibrotactile feedback may be programmable and variable, providing different types of vibrotactile feedback on the same input device will provide an enhanced interface. Vibrotactile feedback may aid in the selection of menus, control of levels (such as volume, bass, treble, balance, etc.), and navigation of lists.

[0064] Vibrotactile feedback may be based on the validity of an input. In one example, vibrotactile feedback is provided when a valid input is received, such as when a control is enabled and within an allowed range. If the controlled function is at or reaches a maximum or a minimum, vibrotactile feedback may be disabled, providing information that the attempted control is outside of the valid range of the system. Similarly, if the system is not active or powered on, the absence of vibrotactile feedback may inform the user of that state.

[0065] The frequency and strength of the vibrotactile feedback may also be varied to provide an enhanced interface. In one embodiment, the type of vibrotactile feedback may be based at least in part on the content selected by a user.

[0066] In one embodiment the frequency and strength of the vibrotactile feedback notifies the user of various levels of control. A stronger virtual detent can indicate a bigger decision in comparison to a weaker virtual detent indicative of a smaller decision. High and low strengths of vibrotactile feedback can indicate divisions in a list (i.e. separate words by letter, or

numbers at every multiple of 10). A high or low strength of vibrotactile feedback can also indicate one or more points in a range, for example, the center position of a balance control. The frequency of the vibrotactile feedback may represent the speed of navigation of the user's finger across the touch active surface or across the number of elements in a list.

[0067] In one embodiment, each system that is controlled by the input device may be associated with a type or profile of vibrotactile feedback. For example, the actuator vibrates the input device at a constant intensity when an audio system is being controlled by the input device, and vibrates the input device at a periodic intensity when a temperature system is being controlled.

[0068] In one embodiment, a combination of vibrotactile effects is linked as a vibrotactile theme. A vibrotactile theme can correspond with an individual function or system. One theme can comprise a combination of single clicks and double clicks to represent simulated mechanical feedback for a system being changed or a threshold being reached. Another theme can comprise a combination of a constant, low intensity vibration with a hard stop virtual detent effect. While the first theme can be assigned to one system, such as a climate system the second theme can be assigned to a second system, such as a stereo system.

[0069] Figure 4 is an illustration of a second device for providing virtual detents through vibrotactile feedback in one embodiment of the present invention. The device in Figure 4 comprises a mechanical device, specifically a rotary knob 400. While the embodiment shown in Figure 4 comprises a rotary knob 400, other embodiments may comprise other input devices. In some other embodiments, the input device may comprise a linear or rotary encoder, a potentiometer, or a fader. Alternatively, other embodiments may comprise non-mechanical input devices, such as a touch-sensitive pad or a touch-sensitive screen.

[0070] The rotary knob 400 is configured to rotate in a rotary degree of freedom about an axis extending through the knob. In some embodiments, the rotary knob may also be configured to move in a plane perpendicular to or along the rotary axis. The rotary knob 400 is coupled to a mounting surface 402. The mounting surface may be a surface on a control panel, dashboard, car console, mouse, joystick, industrial equipment, medical equipment, or any consumer electronics device.

[0071] A user interacts with the rotary knob 400 by rotating the knob in a clockwise or counter-clockwise direction. One or more actuators 406 can be coupled to the rotary knob 400 to generate vibrotactile feedback. As the knob is rotated, vibrotactile feedback may be generated in the form of virtual detents. For example, as the knob is rotated, an effect such as a hard stop may be generated by vibrating the knob.

[0072] The rotary knob 400 can be coupled to a sensor 408. Sensor 408 can detect movements in the rotary knob 400, and transmit data to a processor 106. A shaft 404 may connect the actuator 406 and sensor 408 with the rotary knob 400.

[0073] As shown in Figure 4, a rotary knob 400 is a generally cylindrical object. Other devices for providing virtual detents may have various designs, including but not limited to conical shapes, spherical shapes, oval shapes, cubical shapes, etc. The rotary knob 400 may have one or more textures on its surface, including but not limited to bumps, lines, grooves, other types of grips, or projections or members extending from the device's surface. Such shapes and textures may allow a user to easily grip or contact the knob and rotate it.

[0074] The rotary knob 400 may be configured to control a system. For example, the rotary knob 400 may be located on a stereo receiver, and configured to control the volume of the stereo. In one embodiment, the rotary knob 400 may control a plurality of systems, such as a

car's temperature system, navigation system, and/or communication system. For example, a user can pull a knob to a first elevation in order to control the temperature system of the car. To control a different system, a user may push the knob down to a different elevation. In another embodiment, a user selects a system to be controlled via a menu system navigated by the rotary knob 400 or other controls.

Examples of Methods for Virtual Detents through Vibrotactile Feedback

[0075] Figure 5 is a flow diagram illustrating a first method for providing virtual detents through vibrotactile feedback in one embodiment of the present invention. In step 502, the sensor generates an input signal based at least in part on a manipulation of an input device. In step 502, the processor 106 receives an input signal comprising information associated with the manipulation of an input device 102. In step 504, the processor 106 generates a signal configured to cause an actuator to produce a vibrotactile effect to the input device 102, the vibrotactile effect comprising a simulated mechanical detent.

[0076] The processor 106 can receive and generate signals as digital signals or analog signals, via wireless or wired connections. The input signal can comprise information related to a manipulation of the input device 102. For instance, the information related to the manipulation of the input device may be positional data, for example, comprising information related to the change in position of the input device. In another example, the input signal may comprise information related to the speed of the change in position of the input device as well as the change in position of the input device. As a further example, the input signal comprises information related to the direction of a continuous user contact with a rotary touch pad along with the speed at which the rotary touch pad is contacted.

[0077] In step 504, a signal is generated by the processor. The signal can be configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a simulated mechanical detent, and based at least in part on the detent signal. The signal comprises information relating to a specific virtual detent to be generated by an actuator.

[0078] The signal may be based at least in part on the input signal, for instance, if the input signal indicates a fast manipulation of the input device, than the detent signal may comprise a high frequency vibrotactile effect. The signal may be based at least in part on a status of a system to be manipulated. In one embodiment, a signal is not generated if a system is off. In another embodiment, if a system is off, than only a signal configured to produce a hard stop is generated.

[0079] In one embodiment, the signal is based on a system reaching a maximum or minimum threshold. For example, if a stereo system has reached the highest volume level, than the signal is configured to produce a hard stop virtual detent. Alternatively, if the system to be controlled has reached a threshold no signal is generated. In another example, if the stereo system has not reached the highest or lowest volume level, a signal configured to produce a click effect virtual detent is generated.

[0080] The signal generated by the processor 106 may be synchronized with changes in the system 110. For example, a detent signal can be configured to cause a vibrotactile effect at the same time as changes in a display, audio level or frequency, or control of an electromechanical system. The detent signal may also be synchronized with other types of feedback. For example, vibrotactile feedback produced by an actuator in response to the detent signal may be accompanied by an audible click or noise.

[0081] Figure 6 is a flow diagram illustrating a second method for providing virtual detents through vibrotactile feedback in one embodiment of the present invention. In step 602, a sensor 104 detects a change in position of an input device 102. The sensor 104 can detect the rotation of a knob 400. The sensor 104 may detect, for example, relative changes, or changes from a reference point, in the position of an input device 102.

[0082] In step 604, the sensor 104 generates a detent signal. The detent signal can be configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a simulated mechanical detent, the vibrotactile effect based at least in part on the detent signal.

[0083] The sensor 104 can be configured to only detect changes above a predetermined threshold. One sensor can be configured to detect movement of a rotary knob in one degree increments. Another sensor can be configured with a higher detection threshold, and only detect rotations of five degrees or more. The detection threshold can correspond to a determination of whether a user intended to manipulate the device, or if the manipulation was accidental or unintended.

[0084] One or more sensors 104 can be configured to detect pressure or movement on a touch pad. As an example, three sensors configured to detent changes in force may be coupled to a touch pad. The force sensors may detect input on the touch pad, such as when a user drags a finger across the surface of the touch pad.

[0085] A processor 106 can generate the detent signal. The detent signal may be based at least in part on the manipulation or change in position of the input device. For example, a first detent signal may correspond to a small change in position of the input device, whereas a second detent signal may correspond to a larger change in position of the input device.

[0086] Figure 7 is a flow diagram illustrating a third method for providing virtual detents through vibrotactile feedback in one embodiment of the present invention. In step 702, the sensor 104 detects a change in position of an input device. The sensor 104 can detect input from a rotary knob 400, or input via a touch pad or touch screen.

[0087] In step 704, the processor 106 determines whether to generate a detent signal. The processor 106 may determine whether to generate a detent signal based at least in part on a status of a system to be manipulated 110. For example, the processor 106 may generate a detent signal if the system to be manipulated is turned on. As another example, the processor 106 may not generate a detent signal if the system to be manipulated is turned off.

[0088] In step 706, the processor 106 generates a detent signal. The processor 106 can generate the detent signal as a digital signal sent to the actuator 108.

[0089] In step 708, the processor 106 generates a system signal. The system signal can be configured to manipulate a system to be controlled, such as an audio system, a video system, a climate system, or a menu system. As examples, the system signal can change the volume of a stereo system, increase the output of a heater or air conditioner, or zoom in on a map.

[0090] In step 710, if the processor determines not to generate a detent signal, than the processor may wait for a new change in position of the input device 710.

[0091] The processor 106 can generate detent signals and systems signals the system signal as digital signals or analog signals. The processor 106 can generate the detent signal 706 and the system signal 708 substantially simultaneously. In one embodiment, the system to be controlled is manipulated at substantially the same time as the vibrotactile feedback is generated on the input device. In some embodiments, a user may experience a virtual detent as a system is being manipulated, giving the user the impression of mechanical detents.

[0092] The system signal can be based at least in part on an input signal. In one embodiment, an input signal may indicate that the input device is being manipulated with a quick motion. A corresponding system signal may manipulate the system to be controlled in a like fashion. In one example, a rotary knob is quickly rotated. A processor may generate a system signal to a stereo system with a radio, the system signal moving through radio frequencies in large increments.

[0093] Figure 8 is a flow diagram illustrating a fourth method for virtual detents through vibrotactile feedback. In step 802, an input device, such as a knob or a touch pad, is manipulated. A user can rotate a knob, or drag her finger across a touch pad. In response to the user input, a system is manipulated 804. Finally, a vibrotactile effect is produced on the input device 806.

[0094] The system may be manipulated based at least in part on the manipulation of the input device. For example, if a knob is rotated to the right one full revolution, the volume of a stereo system may be doubled. In another example, if a circular touch pad is contacted in a counter-clockwise motion, a menu structure shown on a display may navigate up.

[0095] The vibrotactile effect 806 can be synchronized with the manipulation of the system 804. As a user navigates a menu shown on a display, a vibrotactile effect may be produced on a circular touch pad input device.

Examples of Virtual Detents

[0096] Figures 9A, 9B, 9C, 9D, 9E, 9F, 9G, and 9H are eight illustrations of virtual detent profiles in various embodiments of the present invention. In Figures 9A-9H, the rotary knob 202 is shown on the right along with a representation of the virtual detent profile on the left corresponding with the rotary knob. The virtual detent profiles illustrated in Figures 9A-9H are

exemplary embodiments of the invention. Other embodiments may be apparent to those skilled in the art. In some embodiments, various types of detents may be combined to produce a combination vibrotactile effect.

[0097] Figure 9A depicts a programmable virtual detent profile. Virtual detents are shown at A, B, C, D, and E. For example, as a rotary knob is rotated through each point A-E, the rotary knob may be vibrated to generate the feeling of a real detent. The magnitude and width of the vibrotactile feedback applied to the input device at each virtual detent may simulate the magnitude and width of a mechanical detent.

[0098] Figure 9B depicts a hard stop virtual detent profile. A hard stop, or barrier virtual detent, may simulate a mechanical hard stop or barrier. For example, a virtual hard stop may indicate that a system can no longer be manipulated. As an illustration, as a user turns a rotary knob, virtual detents may indicate each increasing fan level selected by a user. When the fan level reaches its maximum, the processor 106 may send a detent signal to the actuator 108 comprising a barrier detent instruction.

[0099] Figure 9C depicts a hill virtual detent profile. A hill effect may simulate the approach to the end of a menu system, or a maximum or minimum threshold of a system. For example, as the user approaches the last item in a menu, the vibrotactile effect may gradually increase. As another example, when the user is approaching the end of a wrap-around menu structure, the intensity of the vibrotactile feedback may increase until the user reaches the beginning item, which may be accompanied by vibrotactile feedback with lower intensity.

[00100] Figure 9D depicts a compound virtual detent profile. In some embodiments, the magnitude and/or width of the vibrotactile feedback may be varied at each point. In such embodiments, a compound effect may include two or more effects such as barriers or detents. A

compound effect may be related to the operational characteristics of a system. For example, a compound effect used in conjunction with a menu system may generate light intensity vibrotactile feedback while a menu is traversed within a subcategory, but generate heavier intensity vibrotactile feedback when larger categories of the menu are traversed. In one embodiment, a hill effect may be used as a user traverses contact names beginning with the same letter. When a new letter is reached, a hard stop effect may be used to indicate the new letter.

[00101] Figure 9E depicts a spring virtual detent profile. A spring virtual detent may indicate a preferred position of an input device. For example, as a user manipulates a rotary knob away from a home position, a spring effect virtual detent may increase in intensity as the knobs distance from the home position increases.

[00102] Figure 9F depicts a damper virtual detent profile. In a damper virtual detent, the vibrotactile force may increase or decrease based on the speed of the manipulation of an input device. For example, a light vibrotactile effect may accompany slow rotation of a rotary knob, while a heavier vibrotactile effect may accompany faster rotation of the rotary knob.

[00103] Figure 9G depicts a constant virtual detent profile. A constant force effect may be a continuous force independent of the position or manipulation of the input device. For example, as a rotary knob is rotated, the force of the vibrotactile effect may remain constant. A constant virtual detent profile may be used in combination with a null force profile, such that vibrotactile effects are generated at a constant intensity during part of a manipulation of an input device, and not generated at all at a later time. For example, a constant vibrotactile force may be produced on a rotary knob until a threshold is reached, upon which no vibrotactile force is generated in response to manipulation of the rotary knob. In another example, a constant vibrotactile force

may be output while a user has selected one item in a menu system, but not generated when a user selects a different item in a menu system.

[00104] Figure 9H depicts a periodic virtual detent profile. The periodic force effect profile may comprise a sine wave, square wave, or triangular wave profile. In one example of a triangular virtual detent, the intensity of a virtual detent may increase and decrease linearly over time. A periodic virtual detent may last for a set period of time.

General

[00105] The foregoing description of embodiments of the invention has been presented only for the purpose of illustration and description and is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Numerous modifications and adaptations thereof will be apparent to those skilled in the art without departing from the spirit and scope of the present invention.

CLAIMS

That which is claimed:

1. A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device, and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent.

2. The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. The method of claim 1, further comprising determining whether to generate a signal.

6. The method of claim 5, wherein determining whether to generate a signal is based at least in part on a status of the system to be manipulated.

7. The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

8. The method of claim 1, wherein the information associated with the manipulation of an input device comprises information associated with the rotation of a rotary knob or the sliding of a fader.

9. A method comprising:

detecting a change in position of an input device; and

generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. A computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device; and

program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent.

11. The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. A computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device, and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. A system comprising:

an input device;

a processor in communication with the input device, the processor configured to receive an input signal, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to

receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent.

16. The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. The system of claim 15, wherein the input device comprises a sensor.

ABSTRACT

Systems and methods for virtual detents through vibrotactile feedback are described. One described method includes receiving an input signal comprising information associated with the manipulation of an input device and generating a signal configured to cause an actuator to provide a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent.

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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 11/965,046

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	**310**
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	**510**
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	**210**
TOTAL CLAIMS (37 CFR 1.16(i))	**19** minus 20 =	**0**	X$ 25		OR	X$50	**0**
INDEPENDENT CLAIMS (37 CFR 1.16(h))	**5** minus 3 =	* **2**	X$105			X$210	**420**
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))			180			360	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	**0**		TOTAL	**1450**

APPLICATION AS AMENDED – PART II

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	SMALL ENTITY ADDI-TIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDI-TIONAL FEE ($)
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))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDI-TIONAL FEE ($)	OR	RATE ($)	ADDI-TIONAL FEE ($)
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))					N/A		OR	N/A	
					TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

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

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Substitute for Form PTO-875

Application or Docket Number: **11/965,046**

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 ($)	OTHER THAN SMALL ENTITY FEE ($)
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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))			180			360	
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	0		TOTAL	1450

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))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	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))					N/A		OR	N/A	
						TOTAL ADD'T FEE		OR	TOTAL ADD'T FEE	

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PTO/SB/07 (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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MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Application Number	Filing Date
11/965,046	12/27/2007

Applicant(s)

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT		*		*		*	
	Indep	Depend	Indep	Depend	Indep	Depend	Indep	Depend	Indep	Depend	Indep	Depend
1	1						51					
2		1					52					
3							53					
4		1					54					
5		1					55					
6							56					
7		1					57					
8		1					58					
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13		1					63					
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44							94					
45							95					
46							96					
47							97					
48							98					
49							99					
50							100					
Total Indep	5						Total Indep					
Total Depend							Total Depend					
Total Claims	19						Total Claims					

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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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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
11/965,046	12/27/2007	Michael D. Levin	IMM253

CONFIRMATION NO. 2809

34300
PATENT DEPARTMENT (51851)
KILPATRICK STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

FORMALITIES LETTER

OC000000027968860

Date Mailed: 01/30/2008

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).

- Additional claim fees of $**210** as a non-small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.

SUMMARY OF FEES DUE:

Total additional fee(s) required for this application is $**210** for a non-small entity
- Total additional claim fee(s) for this application is $**210**
  - $**210** for **2** independent claims over 3.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

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/ylueng/

Office of Initial Patent Examination (571) 272-4000 or 1-800-PTO-9199

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/965,046	12/27/2007	2629	1240	IMM253	19	5

CONFIRMATION NO. 2809

34300
PATENT DEPARTMENT (51851)
KILPATRICK STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

FILING RECEIPT

OC000000027968859

Date Mailed: 01/30/2008

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 write to the Office of Initial Patent Examination's Filing Receipt Corrections. 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)

Michael D. Levin, Los Altos, CA;

Assignment For Published Patent Application

Immersion Corporation, San Jose, CA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 60/877,333 12/27/2006

Foreign Applications

If Required, Foreign Filing License Granted: 01/28/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 11/965,046**

Projected Publication Date: 07/03/2008

Non-Publication Request: No

Early Publication Request: No

Title

Virtual Detents Through Vibrotactile Feedback

Preliminary Class

345

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

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Attorney Docket IMM253
Confirmation No. 2809

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	To be assigned
Art Unit	:	2629

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

TRANSMITTAL OF ADDITIONAL CLAIM FEES

Sir:

In response to the Notice to File Missing Parts mailed January 30, 2008, the following is enclosed:

Payment of Additional Claim Fees ($420)

Kindly direct any other comments or requests with respect to this application to the undersigned at (336) 607-7366.

Respectfully submitted,

Date: 2/15/08

Christopher Bosken (Reg. No. 58,887)

Kilpatrick Stockton LLP
1001 West Fourth Street
Winston-Salem, NC 27101

US2000 10625078.1

Electronic Patent Application Fee Transmittal

Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Christopher W. Bosken/Dee Jones
Attorney Docket Number:	IMM253

Filed as Large Entity

Utility Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Independent claims in excess of 3	1201	2	210	420
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**420**

Electronic Acknowledgement Receipt	
EFS ID:	2870343
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Christopher W. Bosken/Dee Jones
Filer Authorized By:	Christopher W. Bosken
Attorney Docket Number:	IMM253
Receipt Date:	15-FEB-2008
Filing Date:	27-DEC-2007
Time Stamp:	18:01:22
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$420
RAM confirmation Number	3021
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)

1	Miscellaneous Incoming Letter	IMM253TransmittalAddFees.pdf	29923 078f560e309d5c035023bd87a8fedd00d7c833db	no	1
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	8156 4328fcc3d25b8300042b9b8171435db56ba55b3d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	38079		

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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.

Electronic Acknowledgement Receipt

EFS ID:	2870343
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Christopher W. Bosken/Dee Jones
Filer Authorized By:	Christopher W. Bosken
Attorney Docket Number:	IMM253
Receipt Date:	15-FEB-2008
Filing Date:	27-DEC-2007
Time Stamp:	18:01:22
Application Type:	Utility under 35 USC 111(a)

Adjustment date: 02/26/2008 MTEKLEMI
12/27/2007 INTEFSW 00006623 11965046
04 FC:1201 -210.00 DP
Adjustment date: 02/26/2008 MTEKLEMI
12/27/2007 INTEFSW 00006623 11965046
04 FC:1201 -210.00 DP

Refund Ref:
02/26/2008 0030051034

Credit Card Refund Total: $210.00

Am Exp..: XXXXXXXXXXX2008

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$420
RAM confirmation Number	3021
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes) /Message Digest	Multi Part /.zip	Pages (if appl.)

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
11/965,046	12/27/2007	2629	1450	IMM253	19	5

CONFIRMATION NO. 2809

UPDATED FILING RECEIPT

34300
PATENT DEPARTMENT (51851)
KILPATRICK STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

OC00000028498255

Date Mailed: 02/27/2008

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 write to the Office of Initial Patent Examination's Filing Receipt Corrections. 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)

Michael D. Levin, Los Altos, CA;

Assignment For Published Patent Application

Immersion Corporation, San Jose, CA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This appln claims benefit of 60/877,333 12/27/2006

Foreign Applications

If Required, Foreign Filing License Granted: 01/28/2008

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 11/965,046**

Projected Publication Date: 07/03/2008

Non-Publication Request: No

Early Publication Request: No

Title

Virtual Detents Through Vibrotactile Feedback

Preliminary Class

345

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

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.

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For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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United States Patent and Trademark Office
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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
11/965,046	12/27/2007	Michael D. Levin	IMM253

CONFIRMATION NO. 2809

34300
PATENT DEPARTMENT (51851)
KILPATRICK STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC27101

Title: Virtual Detents Through Vibrotactile Feedback

Publication No. US-2008-0158149-A1
Publication Date: 07/03/2008

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.

Pre-Grant Publication Division, 703-605-4283

PTO/SB/08a (04-07)
Approved for use through 09/30/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	3,618,070	11/02/1971	Kagan	
	2.	3,911,416	10/07/1975	Feder	
	3.	4,028,502	06/07/1977	Moricca et al.	
	4.	4,127,752	11/28/1978	Lowthorp	
	5.	4,227,319	10/14/1980	Guy et al.	
	6.	4,262,549	04/021/1981	Schwellenbach	
	7.	4,278,920	07/14/1981	Ruoff, Jr.	
	8.	4,333,070	06/01/1982	Barnes	
	9.	4,352,091	09/28/1982	Yamasaki	
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Sheet 2 of 6

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Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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Examiner Signature		Date Considered	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 3 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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Sheet 4 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
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NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 5 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 6 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

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Electronic Acknowledgement Receipt

EFS ID:	3635290
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Christopher W. Bosken/Amber Johnson
Filer Authorized By:	Christopher W. Bosken
Attorney Docket Number:	IMM253
Receipt Date:	17-JUL-2008
Filing Date:	27-DEC-2007
Time Stamp:	16:36:06
Application Type:	Utility under 35 USC 111(a)

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Warnings:					
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20	Information Disclosure Statement (IDS) Filed	08A.pdf	574780 b3dc7cc0acb01eef7b2340763cb47ab40c43d168	no	6
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22	NPL Documents	PATRICK3.pdf	634207 805d5a8ddf6997136fa3df61fd5e01a79c8ac956	no	8
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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.

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	**Virtual Detents through Vibrotactile Feedback**
Examiner	:	Unknown
Art Unit	:	2629

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

Information Disclosure Statement Letter

Form PTO/SB/08a

Non-Patent Literature Documents

The Commissioner is hereby authorized to charge any deficiency to Deposit Account Number 16-1435.

Respectfully submitted,

Date: 7/17/08

By: Christopher W. Bosken

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(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with The United States Patent Office via EFS-Web, on 7/17/08.

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Amber C. Johnson

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin.
Serial No.	:	11/965,046
For	:	**Virtual Detents through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Unknown
Art Group	:	2629

Certification Statement

This Information Disclosure Statement is being submitted prior to the mailing date of a first Office Action in this application. Accordingly, no fee is believed to be required. However, should any fees be due, the Commissioner is authorized to charge such fees to Deposit Account No. 16-1435.

Respectfully submitted,

Date: 7/17/08

Christopher W. Bosken (Reg. No. 58,887)

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Ｇ０６Ｆ	3/033	３８０	Ｇ０６Ｆ	3/033	３８０Ａ

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(54)【発明の名称】　ゲーム機用操作装置及びゲーム装置

(57)【要約】
【課題】ビデオゲーム機に使用される複数の操作ボタンを備えたゲーム機用操作装置側にゲーム機本体からのフイードバツクにより作動する応答手段を設けて臨場感を醸し出すゲーム機用操作装置を提供する。
【解決手段】複数の操作ボタンの操作による操作データをゲーム機本体に送出し、且つゲーム機本体からのデータを適宜受信する双方向の通信手段によりゲームを進行するゲーム機用操作装置において、ゲーム機用操作装置にゲーム機本体からの特定の応答信号により作動する応答手段を設ける。また、ゲーム機本体からゲーム機用操作装置に送信する動的伝達データとして、応答手段を指定する識別コード領域及び当該識別コードによつて指定された応答手段に対する複数の制御データ領域を設けることより、単数又は複数の応答手段に対して種々の制御データを送信することができる。

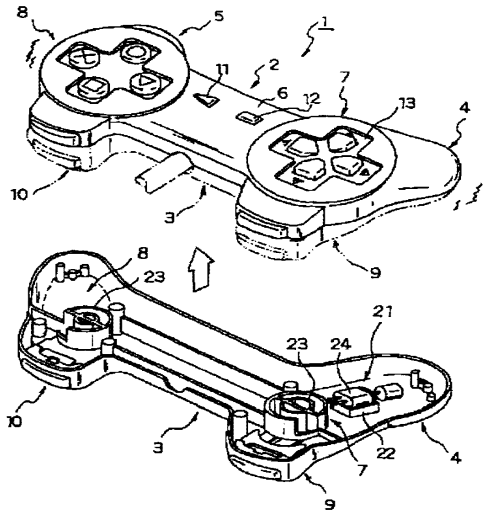


図１　第１の実施の形態の構成

1

【特許請求の範囲】
【請求項１】ビデオ記録媒体の再生機能を有するゲーム機本体に接続され、複数の操作ボタンの操作による操作データを前記ゲーム機本体に送出し、且つ前記ゲーム機本体からのデータを適宜受信する双方向の通信手段によりゲームを進行する操作装置であつて、
前記操作装置の適宜位置に前記ゲーム機本体からの特定の動的伝達用データにより作動する応答手段を設けたことを特徴とするゲーム機用操作装置。
【請求項２】前記応答手段は、動的伝達、音、光の一種又は２種以上の組み合わせであることを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項３】前記動的伝達は、モータの回転軸に偏心させて取り付けた回転部の回転による振動であることを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項４】前記応答手段に与える前記応答手段の駆動信号波形は、
前記ゲーム機本体から前記ゲーム機用操作装置に対して所定間隔で送信される前記動的伝達用データとして、当該データの送信間隔を複数に分割した各期間ごとの駆動波形値を前記ゲーム機本体から受信することにより生成することを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項５】前記応答手段を作動させる電源は、ビデオ記録媒体の再生機能を有するゲーム機本体から供給されるようにしたことを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項６】前記応答手段を作動させる電源は、前記ゲーム機用操作装置側に設けてあることを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項７】前記電源は、交換可能なバツテリからなることを特徴とする請求項６に記載のゲーム機用操作装置。
【請求項８】前記応答手段の作動は、その強弱を任意に設定できることを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項９】前記ゲーム機用操作装置は、前記応答手段を複数配設してなることを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項１０】前記ゲーム機用操作装置は、
前記ゲーム機用操作装置の姿勢を検出する検出手段を具え、
前記検出手段の検出結果に基づいて、前記応答手段に対する前記動的伝達用データを補正することを特徴とする請求項１に記載のゲーム機用操作装置。
【請求項１１】ビデオ記録媒体の再生機能を有するゲーム機本体と、
前記ゲーム機本体に接続され、複数の操作ボタンの操作による操作データを前記ゲーム機本体に送出し、且つ前記ゲーム機本体からのデータを適宜受信する双方向の通

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信手段によりゲームを進行するゲーム機用操作装置と、
前記操作装置の適宜位置に設けられ、前記ゲーム機本体からの特定の動的伝達用データにより作動する応答手段とを具えることを特徴とするゲーム装置。
【請求項１２】前記動的伝達用データは、
前記応答手段を指定する識別データ領域と、
前記応答手段に対する複数の制御データ領域とを具えることを特徴とする請求項１１に記載のゲーム装置。
【請求項１３】前記ゲーム装置は、前記応答手段を複数配設し、
前記動的伝達用データの前記複数の制御データ領域に、前記複数の応答手段に対応した制御データを割り当てることを特徴とする請求項１２に記載のゲーム装置。
【請求項１４】前記応答手段に与える前記応答手段の駆動信号波形は、
前記ゲーム機本体から前記ゲーム機用操作装置に対して所定間隔で送信される前記動的伝達用データとして、当該データの送信間隔を複数に分割した各期間ごとの駆動波形値を前記ゲーム機本体から前記ゲーム機用操作装置に送信することにより、前記ゲーム機用操作装置側で生成することを特徴とする請求項１１に記載のゲーム装置。
【発明の詳細な説明】
【０００１】
【目次】以下の順序で本発明を説明する。
【０００２】発明の属する技術分野
従来の技術（図６０）
発明が解決しようとする課題
課題を解決するための手段
発明の実施の形態
（１）第１の実施の形態（図１～図１３）
（２）第２の実施の形態（図１４～図３５）
（３）第３の実施の形態（図３６～図５９）
（４）他の実施の形態
発明の効果
【０００３】
【発明の属する技術分野】本発明は、複数の操作ボタンの操作によりゲームを行うゲーム機用操作装置に関するものであり、特にビデオ記録媒体を再生する機能を有するゲーム機本体からの特定信号に基づいて臨場感を醸し出すように応答する手段を備えたゲーム機用操作装置に関する。
【０００４】
【従来の技術】従来技術におけるゲーム機用操作装置ＣＭは、図６０に示すように、メガネ形状に形成し、上下に分割できる上ケース２と下ケース３とからハウジング本体が構成されている。このハウジング本体の長手方向の両端側には、両手の掌でグリツプして支持する角状に突出した第１及び第２の操作支持部４、５が形成されており、ハウジング本体の中央の位置であつて括れた部分

に、ゲームの開始及び選択等に使用されるスイツチからなるスタートセレクト部６と、ハウジング本体の両側の左右対称な位置に円形状に形成され、その略中央部分に配設されている複数のスイツチ群からなる第１及び第２の操作部７、８と、ハウジング本体の前部の側壁面側の側面の左右対称位置に、主として人差し指と中指とで操作できる複数のスイツチからなる第３及び第４の操作部９、１０とから構成されている。

【０００５】スタートセレクト部６は、いわゆるスイツチであり第１の操作部７と第２の操作部８との中間位置に配置されたスタートスイツチ１１とセレクトスイツチ１２とを備えている。セレクトスイツチ１２は、例えばゲームを開始する時に、難易度等を選択するものであり、スタートスイツチ１１はゲームを実際に開始させるスイツチである。

【０００６】第１の操作部７は、ハウジング本体の端部であつて、円形状をした中央部分に略十字形状をした凹部に相当する窪み部１３と、この窪み部１３内には４個のキートツプ１４ａ、１４ｂ、１４ｃ、１４ｄが内部から外方向に突出するための窓部１５を設けた構造となつている。この窓部１５は、略十字形状の窪み部１３に合わせて十字方向に４個のキートツプ１４ａ、１４ｂ、１４ｃ、１４ｄの頭部が向かい合うようにして配置される構造となつている。

【０００７】第２の操作部８は、図６０に示すように、円形状の中央部分に略十字形状をした凹部に相当する窪み部１６を設け、その十字形をした窪み部１６の上下左右の夫々の位置に円筒形状のキートツプ１６ａ、１６ｂ、１６ｃ、１６ｄをそれぞれ内部から外方向に突出できる大きさの開口部を有する４個の筒部１７とを有する構造となつている。

【０００８】４個のそれぞれのキートツプ１６ａ、１６ｂ、１６ｃ、１６ｄの頂面には、視認しやすい認識符号、例えば、○、△、□、×等の機能を表す符号（マーク）を付けて容易にスイツチの機能を識別できるようになつている。又、これらキートツプ１６ａ、１６ｂ、１６ｃ、１６ｄの下端部と筒部１７の下部側には、組み立て時において、他の筒部１７に入らないように特有の突起及び切欠きを設けた構造となつている。

【０００９】第３及び第４の操作部９、１０は、図６０に示すように、第１及び第２の操作部７、８の前部側の壁面に突出させて形成し、この突出した壁面に上下に平行して２列の細長い孔からなる開口部１８と、この開口部１８に略嵌まる細長い形状をしたキートツプ１９ａ、１９ｂ、１９ｃ、１９ｄを内側から外側方向に突出して形成した動作指示操作スイツチとから構成されている。

【００１０】このような構成を有するゲーム機用操作装置ＣＭは、図示しないビデオ記録媒体であるＣＤ－ＲＯＭを再生するビデオ機本体に所定のコネクタを介して接続し、ビデオ機本体とテレビジヨン受像機等のモニタに

接続する。そして、通常は両手の掌で操作装置を持ち、両手の指で第１～第４の操作部７、８、９、１０の操作ボタン群を操作して、モニタ画面上のキヤラクタ等の動作ターゲツトの動きを指示してゲームを行う。

【００１１】

【発明が解決しようとする課題】しかしながら、上記説明した従来技術における特に家庭用ゲーム機用操作装置ＣＭにおいては、第１～第４の操作部のボタン群を指で操作することにより、モニタ画面上の動作ターゲツトの動作を指示してゲームを行うようになつており、モニタ画面上のキヤラクタを見る、即ち視覚、及びモニタから発生する音、即ち聴覚でしか体感できず、両手及び腕をさまざまに動かして操作する操作装置自体は、実質的に指で操作して一方向を指示する機能しか活用されていないので、フイードバツクによる体感機能を有しない。

【００１２】従つて、ボタン群の操作によつて、特定の操作及び場面に遭遇した時に、ゲーム機本体からフイードバツクした体感が操作装置自体で得られるようにして臨場感を高めてゲーム性能を向上させることに解決しなければならない課題を有している。

【００１３】

【課題を解決するための手段】上記課題を解決するために、本発明に係るゲーム機用操作装置は、ビデオ記録媒体の再生機能を有するゲーム機本体に接続され、複数の操作ボタンの操作による操作データを前記ゲーム機本体に送出し、且つ前記ゲーム機本体からのデータを適宜受信する双方向の通信手段によりゲームを進行する操作装置であつて、前記操作装置の適宜位置に前記ゲーム機本体からの特定の応答信号により駆動する応答手段を設けた。

【００１４】また、この応答手段は、動的伝達、音、光の一種又は２種以上の組み合せで形成され、動的伝達は、モータの回転軸に偏心させて取り付けた回転部の回転による振動、または、コイルによつて駆動される振動子の振動で形成することである。

【００１５】さらに、ゲーム機本体からゲーム機用操作装置に送信される動的伝達データとして、応答手段を指定する識別コード領域と、当該識別コードによつて指定された応答手段に対する制御データ領域を複数備えることにより、単数又は複数の応答手段に対して種々の制御データを送信することができる。

【００１６】上記構成にしたことにより、本発明に係るゲーム機用操作装置は、特定の操作をしたときや動作ターゲツトがヒツトしたとき等に聴覚、視覚による体感に加えて操作装置自体の振動等による動的伝達での体感を得ることができる。

【００１７】

【発明の実施の形態】本発明に係るゲーム機用操作装置の種々の実施の形態について、図面を参照して説明する。なお、本発明に係るゲーム機用操作装置は従来技術

で説明した形状と同様であるので、理解し易いように同一部材には同一符号を付与してその説明をする。

【００１８】（１）第１の実施の形態

本発明に係る第１の実施の形態のゲーム機用操作装置１は、図１に示すように、メガネ形状に形成した長手方向の両端側に両手の掌でグリツプして支持する角状に突出した第１及び第２の操作支持部４、５を備えたハウジング本体と、ハウジング本体の中央の位置であつて括れた部分に、ゲームの開始及び選択等に使用されるボタンを内部から外方向に突出させて形成したスタートセレクト部６と、ハウジング本体の長手方向の両側の頂部に内部から外方向にボタンを突出させた第１及び第２の操作部７、８と、ハウジング本体の長手方向両側の前方側の壁面に内部から外方向に突出させたボタンを備えた第３及び第４の操作部９、１０と、図示しないハウジング本体の内部に装着してあるスイツチ群、及び図示しないビデオ記録媒体であるＣＤ－ＲＯＭを収納して再生可能なゲーム機本体との通信を司る基板と、ゲーム機本体を電気的に接続するケーブルを備えたコネクタ２０（図４参照）と、ハウジング本体内部の所定空間に配置した応答手段２１とから構成されている。この内、図３８を用いて説明した従来技術との相違は、適宜の応答手段２１を設けた点であり、その他は従来技術と同様の構造及び構成となつている。

【００１９】即ち、上ケース２と下ケース３とから構成されたハウジング本体は、下ケース３において角状に突出した部位である第１の操作支持部４に、応答手段２１を装備するための応答手段配置部２２を設けた構造となつている。

【００２０】下ケース３の第１及び第２の操作部７、８は、図１に示すように、基板及びスイツチ群をセツトするための円筒形状の載置部２３を設け、且つ第１及び第２の操作部７、８の前面側に突出させた長方形状の第３及び第４の操作部９、１０を設けた構造となつている。

【００２１】このような構造からなる下ケース３において、応答手段２１をセツトできる空間としては、図１及び図４に示すように、掌でグリツプして支持する第１及び第２の操作支持部４、５の部位、又は括れたスタートセレクト部６の前側位置に存在する空間を利用することができる。本実施の形態においては左手の掌でグリツプする第１の操作支持部４に収納配置した構造となつている。

【００２２】ここで、応答手段２１は、図２に示すように、モータ２４と、このモータ２４の回転軸２５に中心位置をずらした、即ち偏心させた位置に円柱形状の回転部２６を取り付けた構造となつている。このような構造において、モータ２４が回転駆動すると、回転部２６は偏心回転して振動が発生する仕組みになつており、この振動が一種の動的伝達である。この振動は、図１及び図３において、第１の操作支持部４のみに限らず下ケース３及び上ケース２の筐体に伝達して装置全体が振動しているようになる。この偏心して発生する振動の具合は、応答手段２１のモータ２４の回転速度およびトルクにより任意に変化させることができ、それによつて応答手段の強弱を変化させることができるのである。

【００２３】下ケース３に設けた応答手段配置部２２は、図１に示すように、第１の操作支持部４の掌が当接する部位の底部に設けた構造となつており、応答手段２１のモータ２４を固定できる構造となつている。

【００２４】このようにして応答手段２１を下ケース３の第１の操作支持部４、即ち、左手の掌でグリツプして支持する部位に取り付けたことにより、図５に示すように、ゲーム機用操作装置１とゲーム機本体２７をテレビジョン受像機等のモニタ３３に接続してゲームを行う際に、ゲームの種類、例えば格闘技のゲームにおいて相手を倒した時、シユーテイングゲームで命中した時、動作ターゲツトが飛行機で画面上で攻撃を受けた時等において、ゲーム機本体２７からの特定の応答信号により応答手段２１のモータ２４を回転駆動させてゲーム機用操作装置１全体を一定時間振動させることができるのである。このようにしてユーザの操作ボタンによる操作によつてゲーム機用操作装置１自体が振動を起こし、利用するユーザに体感としてフイードバツクし臨場感をより一層向上させることができる。

【００２５】ここで、ゲーム機本体２７は、図５に示すように、ビデオ記録媒体であるＣＤ－ＲＯＭを再生する機能を有するＣＤ－ＲＯＭドライバが内蔵されており、ゲーム機本体２７の上面には、ＣＤ－ＲＯＭを収納して蓋をする蓋部材２８と、蓋部材２８の開閉をする開閉スイツチ２９と、電源を供給する電源スイツチ３０と、ゲーム機本体２７の動作を初期状態にするリセツトスイツチ３１と、２系統の操作装置が接続可能な接続部３２を設けた構造となつている。この接続部３２にゲーム機用操作装置１のコネクタ２０を接続することにより、ゲーム機本体２７との双方向通信が可能になる。なお本実施の形態においては１系統のゲーム機用操作装置１を接続した構成で説明する。

【００２６】前記したように応答手段２１を駆動させてゲーム機用操作装置１全体を振動させるためには、ゲーム機用操作装置１とゲーム機本体２７との間は双方向通信機能を備えた構成であることが必要である。

【００２７】この双方向通信機能は、図６に示すように、ゲーム機用操作装置１と双方向のシリアル通信を行うコネクタ２０をゲーム機本体２７と接続して行うことができる。

【００２８】ゲーム機用操作装置１側の双方向通信機能を行う構成は、ゲーム機本体２７とシリアル通信を行うシリアルＩ／ＯインターフエースＳＩＯと、複数の操作ボタンからの操作データを入力するパラレルＩ／ＯインターフエースＰＩＯ、ＣＰＵ、ＲＡＭ及びＲＯＭである

ワンチツプマイクロコンピユータ（以下これをマイコンと呼ぶ）と、応答手段２１のモータ２４を回転駆動させるモータドライバ３４とから構成され、モータ２４はモータドライバ３４からの供給電圧及び電流により回転駆動する。

【００２９】ゲーム機本体２７側には、ゲーム機用操作装置１間でシリアル通信を行うシリアルＩ／ＯインターフエースＳＩＯを設けた構造となつており、ゲーム機用操作装置１のコネクタ２０を接続すると、このコネクタ２０を介してゲーム機用操作装置１側のシリアルＩ／Ｏインターフエースと接続され、双方向の通信手段、即ち、双方向のシリアル通信を行うことができる構成となつている。なお、ゲーム機本体２７のその他の詳細な構成は省略してある。

【００３０】双方向のシリアル通信を行う信号線及び制御線は、ゲーム機本体２７からゲーム機用操作装置１に対してデータを送るデータ伝送用の信号線ＴＸＤ（TransmitX' for Data）と、ゲーム機用操作装置１側からゲーム機本体２７側にデータを送るデータ伝送用の信号線ＲＸＤ（Received X' for Data）と、各データ伝送用の信号線ＴＸＤ、ＲＸＤからデータを抜き出すシリアル同期クロツク用の信号線ＳＣＫ（Serial Clock）と、ターミナル側であるゲーム機用操作装置１の通信の確立及び中断等を行うための制御線ＤＴＲ（Data Terminal Ready）と、大量のデータ転送を行うためのフロー制御用の制御線ＤＳＲ（Data Set Ready）とから構成されている。

【００３１】また、この双方向のシリアル通信を行う信号線及び制御線からなるケーブルには、図６に示すように、信号線及び制御線の他にゲーム機本体２７側の電源から直接に取り出した電源用ケーブル３５が含まれており、この電源用ケーブル３５はゲーム機用操作装置１側のモータドライバ３４に接続され、モータ２４を回転させる電源を供給する。

【００３２】このような構成からなる双方向のシリアル通信手順は、例えば図４に示すゲーム機本体２７がゲーム機用操作装置１と通信をして、第１～第４の操作部７、８、９、１０の操作ボタンの操作データ（ボタン情報）を取り込むために、先ずゲーム機本体２７は制御線ＤＴＲに選択データを出力する。この結果、ゲーム機用操作装置１は制御線ＤＴＲによつて選択されたことを確認して、それに続く信号線ＴＸＤの受信待状態になる。続いてゲーム機本体２７は、データ伝送用の信号線ＴＸＤにゲーム機用操作装置１を示す識別コードを送出する。これによりゲーム機用操作装置１が信号線ＴＸＤよりこの識別コードを受け取る。

【００３３】識別コードがゲーム機用操作装置１を示すことにより、これ以降ゲーム機本体２７との通信を開始する。即ち、ゲーム機本体２７からは制御データ等がデータ伝送用の信号線ＴＸＤを介してゲーム機用操作装置１側に送信され、逆にゲーム機用操作装置１からは操作ボタンで操作された操作データ等がデータ伝送用の信号線ＲＸＤを介してゲーム機本体２７に送信される。このようにしてゲーム機本体２７とゲーム機用操作装置１との間で双方向のシリアル通信が行われ、この通信はゲーム機本体２７が制御線ＤＴＲを通じて選択中止データを出力することにより終了する。

【００３４】このようにして双方向のシリアル通信機能を備えていればゲーム機用操作装置１側からの主として操作ボタンの操作データをゲーム機本体２７側に送信することができると共にゲーム機本体２７側からは、データ伝送用信号線ＴＸＤを介して応答手段２１のモータ２４を回転させる動的伝達用データをゲーム機用操作装置１側に送出することができる。このモータ２４を回転させる動的伝達用データは、ゲーム機本体２７に搭載したゲーム用ＣＤ－ＲＯＭによつて予め設定されており、ゲームを行う利用者の動作ターゲツトに応じてゲーム機本体２７からゲーム機用操作装置１自体に一定時間の動的伝達によるフイードバツクが行われる。この点に関して図１及び図６を参照しながら図７及び図８のフローチヤートに沿つて以下詳細に説明する。

【００３５】特定のゲーム用ＣＤ－ＲＯＭをゲーム機本体２７に装着して、図１に示したゲーム機用操作装置１のスタートスイツチ１１によりゲームの開始をセツトし、且つセレクトスイツチ１２の操作により種々の機能を設定し、第１～第４の操作部７、８、９、１０の操作によりゲームが行われる状態になつている。

【００３６】そして、ゲーム開始に伴つて、図６に示したゲーム機用操作装置１のＣＰＵ、ＲＡＭ、ＲＯＭからなるマイコンはシリアルインターフエースＳＩＯを介してヒツトの動的伝達用データがゲーム機本体２７側からシリアルＩ／Ｏインターフエースを介して送られてきているかを常時監視している。この動的伝達用データには、図６に示すモータ２４を駆動する電圧及び電流の制御信号及びモータ２４を駆動する時間が含まれている。そして、ゲームが進行している中で、もし、ゲーム機本体２７側から送られてくるデータの中に動的伝達用データがある場合には、モータドライバ３４を駆動させ、ゲーム機本体２７から供給されている電圧をモータ２４に所定時間供給する。即ち、図７のステツプＳＴ２１においてゲーム機用操作装置１側で受けたデータ信号の中の動的伝達用データをステツプＳＴ１で判定しステツプＳＴ２のマイコンで処理して、ステツプＳＴ３で図６に示すモータドライバ３４を駆動し、ステツプＳＴ４で振動を発生させる。

【００３７】また、ステツプＳＴ１で動的伝達用データでない場合に、ステツプＳＴ５において操作ボタンが操作されると、ステツプＳＴ６において操作された操作データが図６に示すパラレルＩ／ＯインターフエースＰＩＯを介してマイコンに入力される。

【００３８】マイコンに入力された操作データは、ステツプＳＴ２においてマイコンで処理され、ステツプＳＴ７においてシリアルデータに変換され、図６に示すシリアルＩ／ＯインターフエースＳＩＯを介してゲーム機本体２７に送信される。その後、ゲーム機用操作装置１はステツプＳＴ２５においてゲーム機本体２７からのデータを待ち受ける。

【００３９】ゲーム機本体２７が図８のステツプＳＴ２６においてシリアルデータに変換された操作データを受信すると、続くステツプＳＴ８において、動作ターゲツトのデータと、受信したシリアルデータとの比較を行つて、ヒツト状態を判別する。

【００４０】もし、ステツプＳＴ９において、動作ターゲツトのデータとシリアルデータとが一致したとき、即ち、ヒツトしたときは、ステツプＳＴ１０においてヒツトした動作ターゲツトをモニタの画面上に表示すると共に、ステツプＳＴ１１において動的伝達用データを出力し、ステツプＳＴ１２においてシリアルデータに変換して図６に示すシリアルＩ／ＯインターフエースＳＩＯを介してゲーム機用操作装置１に特定の応答信号として返信する。その後、ゲーム機本体２７はステツプＳＴ２７においてゲーム機用操作装置１からのデータを待ち受ける。ゲーム機本体２７からゲーム機用操作装置１に返信された動的伝達データは、ステツプＳＴ１、ＳＴ２、ＳＴ３で説明したように、ゲーム機用操作装置１のマイコンにより検出されると、図６に示すモータドライバ３４から電源をモータ３４に供給して回転させ、その回転によつてゲーム機用操作装置１全体が振動する。

【００４１】もし、ヒツトしていない時には、ステツプＳＴ１３において操作ボタンに基づいた動作ターゲツトをモニタの画面上に表示して、ステツプＳＴ５（図７）によるゲーム機用操作装置１からの操作ボタンの操作結果によつて、次の動作を行うようになる。

【００４２】又、上記説明したヒツトしたときに発生する動的伝達用データは、ゲーム機本体２７から特定の応答信号としてゲーム機用操作装置１が受け取る構成になつているが、ゲーム機本体２７から一方向の通信によつてゲーム機用操作装置１に送出する構成でも良い。

【００４３】次に、本発明に係るモータ２４による応答手段を用いた操作装置の他の実施の形態について、図９～図１１を参照して説明する。

【００４４】この実施の形態のゲーム機用操作装置１は、図９～図１１に示すように、応答手段２１は掌でグリツプする部位が膨縮又は変形する構造となつている。即ち、ゲーム機用操作装置１は、左手の掌でグリツプして支持する第１の操作支持部４であつて、掌が当接する部位の一部を切り欠き、その切り欠き部を塞ぐようにして弾性部材３７Ａ、３７Ｂを取り付け、この弾性部材３７Ａ、３７Ｂを内部から相対的に又は部分的に押し出すようにして変形又は膨縮させ、それによつて掌内に動的伝達を与える、いわゆる手応えの体感をフイードバツクさせる構造となつている。

【００４５】なお、弾性部材３７Ａ、３７Ｂとしては、例えばゴム部材又は樹脂部材又は布部材等が使用できる。

【００４６】応答手段２１の取付構造以外は、前記図１について説明した第１の実施の形態と実質的に同様であるので同一符号を付与して説明し、双方向のシリアル通信も同様の手法により行う。

【００４７】応答手段２１は、上ケース２及び下ケース３の第１の操作支持部４の掌が当接する部位の一部を切り欠き、切り欠いた部分を塞ぐようにして弾性部材３７Ａ、３７Ｂを装着した構造となつている。そして、その内部には図１０に示すように、回転駆動するモータ３８と、モータ３８の回転軸３９に取り付けられ外周の適宜位置に複数の突起４０を備えた円形状の回転部４１とから構成されている。このようにして取り付けられた弾性部材３７Ａ、３７Ｂは、図１１に示すように、第１の操作支持部４の掌が当接する部位が縦方向の寸法が短く、横方向の寸法が長い構造となつている。従つて、円形状の回転部４１が回転すると回転部４１の突起４０が上ケース２の弾性部材３７Ａの上部位置及び下ケース３の弾性部材３７Ｂの下部位置を押圧して外側方向に押し出すようにして回転する。これは、図９及び図１１に示すように、第１の操作支持部４の掌が当接する部位の上側及び下側位置において外側に変形又は膨縮させ、及び突起４０による弾性部材３７Ａ、３７Ｂの叩き現象によつて振動を発生させることができ、掌での動的伝達による感触とフイードバツク機能によつて利用者に与える臨場感を高めることができる。

【００４８】さらに、本発明に係るモータ２４による応答手段を用いた操作装置の他の実施の形態について、図１２～図１３を参照して説明する。

【００４９】このゲーム機用操作装置１は、図１２及び図１３に示すように、ゲーム機用操作装置１に設けた応答手段２１が変形又は膨縮するようにした構造となつている。即ち、ゲーム機用操作装置１は、左手の掌でグリツプして支持する第１の操作支持部４において、掌が当接する一部分を弾性部材４２で形成し、その内部にモータ４３及び、モータ４３の回転軸４４に取り付けたカム形状の回転部４５とを設けた構造となつている。

【００５０】カム形状をした回転部４５は、モータ４３が回転駆動するとカムの突出した部分が弾性部材４２を内側から叩いたり押圧したりして外側に突出変形すると共に、振動も発生させ、その動的伝達を掌で体感として受けることにより、臨場感を得ることができる。

【００５１】（２）第２の実施の形態

図１との対応部分に同一符号を付して示す図１４は本発明によるゲーム機用操作装置の第２の実施の形態を示し、下ケース３の第１の操作支持部４の内部に形成され

た応答手段配置部５２に応答手段５１が設けられている。この応答手段５１は、直線方向に往復する振動子５３を有する。

【００５２】即ち図１５に示すように、第２の実施の形態の応答手段５１は、円筒形状のコイルボビン５７のほぼ中央に重り６３を固定することによつて振動子５３を形成するとともに、この振動子５３をコイルボビン５７の軸線方向に往復振動させる２つの磁性体５５及び５６によつて固定子５４を形成する。

【００５３】コイルボビンの両端には導電線がそれぞれ逆方向に巻回され、第１のコイル５８及び第２のコイル５９を形成する。このように左右両端にコイル５８及び５９が設けられたコイルボビン５７は、その両端部を、磁性体５５及び５６にそれぞれ穿設された遊嵌孔５５Ｅ及び５６Ｅ（図１５）に遊嵌し、支持部材６１及び板ばね６２からなる釣支部６０によつて往復運動し得る状態に保持されている。

【００５４】図１６は応答手段５１の断面を示し、固定子５４を形成する２つの磁性体５５及び５６は、それぞれ外装形状をほぼ円柱形状とし、その中心軸線に沿つて円柱形状の磁極部（Ｓ極）５５Ａ及び５６Ａが突設されている。磁性体５５及び５６はこれら２つの磁極部５５Ａ及び５６Ａ間に鉄心６４を介挿固定することによつて接続されている。因みに、磁性体５５及び５６を接続する部材は鉄心６４に限らず、非磁性体の樹脂部材でも良い。

【００５５】また、磁極部５５Ａ及び５６Ａのそれぞれの周側面に所定の間隙を隔てて対向した位置には、円環状に突設した磁極部（Ｎ極）５５Ｂ及び５６Ｂが形成されている。従つて磁性体５５においては、磁極部５５Ａ及び磁極部５５Ｂ間の間隙（遊嵌孔５５Ｅ）に磁束密度Ｂが存在し、磁性体５６においては、磁極部５６Ａ及び磁極部５６Ｂ間の間隙（遊嵌孔５６Ｅ）に磁束密度Ｂが存在する。磁性体５５の遊嵌孔５５Ｅには振動子５３を形成するコイルボビン５７の一方の端部が遊嵌され、この端部に巻回されたコイル５８が磁束を横切るように配置されている。また、磁性体５６においても同様にして、遊嵌孔５６Ｅにはコイルボビン５７の他方の端部が遊嵌され、この端部に巻回されたコイル５９が磁束を横切るように配置されている。

【００５６】ここで、図１７（Ａ）に示すように振動子５３のコイル５８が形成された端部が磁性体５５に当接する左方向に移動した状態を初期状態として、コイル５８に対して図１８（Ａ）に示すような駆動電流I_{58}を加えるとともに、コイル５９に対して図１８（Ｂ）に示すような駆動電流I_{59}を加えると、初期状態（時間ｔ＝０）においては、コイル５８に駆動電流I_{58}が流れ、コイル５９には駆動電流I_{59}が流れない状態となる。

【００５７】これにより、コイル５８には力Ｆ＝I_{58}×Ｂが加わることにより、振動子５３は右方向（すなわち磁性体５６に向かう方向）に移動し、図１７（Ｂ）に示すように振動子５３のコイル５９が形成された端部が磁性体５６に当接する位置で停止する。

【００５８】そして、時間ｔ＝Ｔとなつた時点で、図１８（Ｂ）に示すようにコイル５９には駆動電流I_{59}が流れ、図１８（Ａ）に示すようにコイル５８には駆動電流I_{58}が流れない状態となる。従つて、コイル５８及び５９の巻回方向が逆方向であることによりコイル５９には－Ｆなる力が加わる。この結果、振動子５３は左方向（即ち磁性体５５に向かう方向）に移動し、図１７（Ａ）に示した初期状態に戻る。

【００５９】以下、同様にして、コイル５８及び５９に加える駆動電流I_{58}及びI_{59}を交互に通電することにより、振動子５３は磁性体５５及び５６の間で往復運動、即ち振動することになる。

【００６０】因みに、駆動電流I_{58}及びI_{59}の周期を変えると、振動子５３の振動周波数を変化させることができ、駆動電流I_{58}及びI_{59}の電流値を変えると、振動子５３に加わる力Ｆ（即ち加速度）を変化させることができる。なお、磁性体５５及び５６を大きくすれば磁束密度Ｂが大きくなり、振動子５３に加わる力Ｆを大きくすることができる。この場合、磁性体５５及び５６を固定子５４とすることにより、当該磁性体５５及び５６を振動子側に設ける場合に比べて、磁性体５５及び５６を大きくしても固定子側の質量が増加するだけで振動子側の質量は変わらず、これにより実用上十分な振動を発生させることができる。

【００６１】かくして、コイル５８及び５９に駆動電流I_{58}及びI_{59}（以下、これらをまとめて駆動電流Ｉとする）を加えて振動子５３を振動させると、この振動は、固定子５４を下ケース２（図１４）に固定した応答手段配置部５２を介して第１の操作支持部４に伝達される（図１９）。第１の操作支持部４に伝達された振動は、当該第１の操作支持部４のみに限らず下ケース３及び上ケース２の筐体に伝達して装置全体が振動するようになる。この振動子５３によつて発生する振動の具合は、応答手段５１のコイル５８及び５９に加える駆動電流Ｉによつて任意に変化させることができ、それによつて応答手段５１の振動の強弱を変化させることができる。

【００６２】因みに、応答手段５１をセツトし得る空間としては、図１４及び図２０に示すように、掌でグリツプして支持する第１及び第２の操作支持部４、５の部位、又は２つの操作部７及び８に挟まれたスタートセレクト部６の前側位置に存在する空間を利用することができる。本実施の形態においては左手の掌でグリツプする第１の操作支持部４に収納配置した構造となつている。

【００６３】このようにして、応答手段５１を下ケース３の第１の操作支持部４、即ち、左手の掌でグリツプして支持する部位に取り付けたことにより、図２１に示すように、ゲーム機用操作装置５０とゲーム機本体２７を

テレビジョン受像機等のモニタ３３に接続してゲームを行う際に、ゲームの種類、例えば格闘技のゲームにおいて相手を倒した時、シューテイングゲームで命中した時、動作ターゲツトが飛行機で画面上で攻撃を受けた時等において、ゲーム機本体２７からの特定の応答信号により応答手段５１の振動子５３を振動させてゲーム機用操作装置５０全体を一定時間振動させることができる。このようにしてユーザの操作ボタンによる操作によつて操作装置５０自体が振動を起こし、利用するユーザに体感としてフイードバツクし臨場感をより一層向上させることができる。

【００６４】ここで、ゲーム機本体２７は、図２１に示すように、ビデオ記録媒体であるＣＤ－ＲＯＭを再生する機能を有するＣＤ－ＲＯＭドライバが内蔵されており、ゲーム機本体２７の上面には、ＣＤ－ＲＯＭを収納して蓋をする蓋部材２８と、蓋部材２８の開閉をする開閉スイツチ２９と、電源を供給する電源スイツチ３０と、ゲーム機本体２７の動作を初期状態にするリセツトスイツチ３１と、２系統の操作装置が接続可能な接続部３２を設けた構造となつている。この接続部３２にゲーム機用操作装置５０のコネクタ２０を接続することにより、ゲーム機本体２７との双方向通信が可能になる。なお、この実施の形態においては１系統のゲーム機用操作装置５０を接続した構成で説明する。

【００６５】前記したように応答手段５１を駆動させてゲーム機用操作装置５０全体を振動させるためには、ゲーム機用操作装置５０とゲーム機本体２７との間は双方向通信機能を備えた構成であることが必要である。この双方向通信機能は、図２２に示すように、ゲーム機用操作装置５０と双方向のシリアル通信を行うコネクタ２０をゲーム機本体２７と接続して行うことができる。

【００６６】ゲーム機用操作装置５０側の双方向通信機能を行う構成は、ゲーム機本体２７とシリアル通信を行うＩ／Ｏインターフエースｓｉｏと、複数の操作ボタンからの操作データを入力するパラレルＩ／Ｏインターフエースｐｉｏ、ＣＰＵ、ＲＡＭ及びＲＯＭであるワンチツプマイクロコンピユータ（以下これをマイコンと呼ぶ）と、応答手段５１の振動子５３を振動させるコイルドライバ６４とから構成され、振動子５３のコイル５８及び５９はコイルドライバ６４からの供給電圧及び電流により振動する。

【００６７】ゲーム機本体２７側には、ゲーム機用操作装置５０間でシリアル通信を行うシリアルＩ／Ｏインターフエースｓｉｏを設けた構造となつており、ゲーム機用操作装置５０のコネクタ２０を接続すると、このコネクタ２０を介してゲーム機用操作装置５０側のシリアルＩ／Ｏインターフエースｓｉｏと接続され、双方向の通信手段、即ち、双方向のシリアル通信を行うことができる構成となつている。なお、ゲーム機本体２７のその他の詳細な構成は省略してある。

【００６８】双方向のシリアル通信を行う信号線及び制御線は、ゲーム機本体２７からゲーム機用操作装置５０に対してデータを送るデータ伝送用の信号線ＴＸＤ（Transmit X' for Data）と、ゲーム機用操作装置５０側からゲーム機本体２７側にデータを送るデータ伝送用の信号線ＲＤＸ（Received X' for Data）と、各データ伝送用の信号線ＴＸＤ、ＲＸＤからデータを抜き出すシリアル同期クロツク用の信号線ＳＣＫ(Serial Clock)と、ターミナル側であるゲーム機用操作装置５０の通信の確立及び中断等を行うための制御線ＤＴＲ(Data Terminal Ready)と、大量のデータ転送を行うためのフロー制御用の制御線ＤＳＲ(Data Set Ready)とから構成されている。

【００６９】また、この双方向のシリアル通信を行う信号線及び制御線からなるケーブルには、図２１に示すように、信号線及び制御線の他にゲーム機本体２７側の電源から直接に取り出した電源用ケーブル３５が含まれており、この電源用ケーブル３５はゲーム機用操作装置５０側のコイルドライバ６４に接続され、振動子５３を振動させる電源を供給する。

【００７０】このような構成からなる双方向のシリアル通信手順は、例えば図２２に示すゲーム機本体２７がゲーム機用操作装置５０と通信をして、第１～第４の操作部７、８、９、１０の操作ボタンの操作データ（ボタン情報）を取り込むために、先ずゲーム機本体２７は制御線ＤＴＲによつて選択されたことを確認して、それに続く信号線ＴＸＤの受信待状態になる。続いてゲーム機本体２７は、データ伝送用の信号線ＴＸＤにゲーム機用操作装置５０を示す識別コードを送出する。これによりゲーム機用操作装置５０が信号線ＴＸＤよりこの識別コードを受け取る。識別コードがゲーム機用操作装置５０を示すことにより、これ以降ゲーム機本体２７との通信を開始する。即ち、ゲーム機本体２７からは制御データ等がデータ伝送用の信号線ＴＸＤを介してゲーム機用操作装置５０側に送信され、逆にゲーム機用操作装置５０からは操作ボタンで操作された操作データ等がデータ伝送用の信号線ＲＸＤを介してゲーム機本体２７に送信される。このようにしてゲーム機本体２７とゲーム機用操作装置５０との間で双方向のシリアル通信が行われ、この通信はゲーム機本体２７が制御線ＤＴＲを通じて選択中止データを出力することにより終了する。

【００７１】このようにして双方向のシリアル通信機能を備えていれば、ゲーム機用操作装置５０側からの主として操作ボタンの操作データをゲーム機本体２７側に送信することができると共にゲーム機本体２７側からは、データ伝送用信号線ＴＸＤを介して応答手段５１の振動子５３を振動させる動的伝達用データをゲーム機用操作装置５０側に送出することができる。この振動子５３を振動させる動的伝達用データは、ゲーム機本体２７に搭載したゲーム用ＣＤ－ＲＯＭによつて予め設定されてお

り、ゲームを行う利用者の動作ターゲツトに応じてゲーム機本体２７からゲーム機用操作装置５０自体に一定時間の動的伝達によるフイードバツクが行われる。この点に関して図１４及び図２２を参照しながら図７及び図８との対応部分に同一符号を付して示す図２３及び図２４のフローチヤートに沿つて以下詳細に説明する。

【００７２】特定のゲーム用ＣＤ－ＲＯＭをゲーム機本体２７に装着して、図１４に示したゲーム機用操作装置５０のスタートスイツチ１１によりゲームの開始をセツトし、且つセレクトスイツチ１２の操作により種々の機能を設定し、第１～第４の操作部７、８、９、１０の操作によりゲームが行われる状態になつている。

【００７３】そして、ゲーム開始に伴つて、図２２に示したゲーム機用操作装置５０のＣＰＵ、ＲＡＭ、ＲＯＭからなるマイコンはシリアルインターフエースＳＩＯを介してヒツトの動的伝達用データがゲーム機本体２７側からシリアルＩ／ＯインターフエースＳＩＯを介して送られてきているかを図２３に示すステツプＳＴ２１において常時監視している。この動的伝達用データには、図２２に示す振動子５３を駆動する電圧及び電流の制御信号及び振動子５３を駆動する時間が含まれている。そして、ゲームが進行している中で、もし、ゲーム機本体２７側から送られてくるデータの中に動的伝達用データがある場合には、コイルドライバ６４を駆動させ、ゲーム機本体２７から供給されている電圧及び電流を振動子５３のコイル５８及び５９に所定時間供給する。

【００７４】即ち、ゲーム機用操作装置５０側で受けたデータ信号の中の動的伝達用データをステツプＳＴ１で判定した後、ステツプＳＴ２においてマイコン処理する。この結果得られる動的伝達用データはステツプＳＴ２２においてアナログ信号に変換され、続くステツプＳＴ２３において当該アナログ信号によつてコイルドライバ６４（図２２）を駆動する。かくしてコイルドライバ６４から駆動電流Ｉが振動子５３のコイル５８及び５９に供給されることにより、ステツプＳＴ２４において振動子５３が振動する。

【００７５】また、ゲーム機本体２７からゲーム機用操作装置５０に供給されたデータ信号が動的伝達用データではないとき、ゲーム機用操作装置５０のマイコンは、図２３のステツプＳＴ１からステツプＳＴ５に移つて操作ボタンが操作される状態を待ち受ける。ここで肯定結果が得られると、このことはゲーム機用操作装置５０の操作ボタンが操作されたことを表しており、このときマイコンはステツプＳＴ６に移つて、操作データをパラレルＩ／ＯインターフエースＰＩＯを介して取り込む。

【００７６】マイコンに入力された操作データは、図２３のステツプＳＴ２において処理され、ステツプＳＴ７においてシリアルデータに変換され、シリアルＩ／ＯインターフエースＳＩＯ（図２２）を介してゲーム機本体２７に送信される。その後、ゲーム機用操作装置５０はステツプＳＴ２５においてゲーム機本体２７からのデータを待ち受ける状態となる。

【００７７】ゲーム機本体２７は、図２４に示すステツプＳＴ２６においてゲーム機用操作装置５０からのデータを受信し、続くステツプＳＴ８において、動作ターゲツトのデータと、受信したシリアルデータとの比較を行つて、ステツプＳＴ９においてヒツト状態を判別する。

【００７８】ここで動作ターゲツトのデータと受信したシリアルデータとが一致したとき、即ち、ヒツトしたときは、ステツプＳＴ９からステツプＳＴ１０に移つてヒツトした動作ターゲツトをモニタの画面上に表示すると共に、ステツプＳＴ１１において動的伝達用データを出力し、ステツプＳＴ１２においてシリアルデータに変換してシリアルＩ／ＯインターフエースＳＩＯ（図２２）を介してゲーム機用操作装置５０に特定の応答信号として返信する。この動的伝達用データは、図２３のステツプＳＴ１、ステツプＳＴ２及びステツプＳＴ３で説明したように、ゲーム機用操作装置５０のマイコンにより検出されると、電源をコイルドライバ６４（図２２）から振動子５３のコイル５８及び５９に供給してこれを振動させ、その振動によつてゲーム機用操作装置５０全体が振動する。

【００７９】これに対して、ステツプＳＴ９（図２４）において否定結果が得られると、このことは動作ターゲツトのデータとゲーム機用操作装置５０からのシリアルデータとが一致していないこと、すなわちヒツトしていないことを表しており、このときゲーム機本体２７のＣＰＵ(Central Processing Unit）は、ステツプＳＴ１３に移つて操作ボタンに基づいた動作ターゲツトをモニタの画面上に表示した後、ステツプＳＴ２７に移つてゲーム機用操作装置５０からのデータを待ち受ける。

【００８０】因みに、上記説明したヒツトしたときに発生する動的伝達用データは、ゲーム機本体２７から特定の応答信号としてゲーム機用操作装置５０が受け取る構成になつているが、ゲーム機本体２７から一方向の通信によつてゲーム機用操作装置５０に送出する構成でも良い。

【００８１】ここで図２５（Ａ）は、ゲーム機本体２７からゲーム機用操作装置５０に送信される動的伝達用データのうち、特に振動子５３のコイル５８及び５９を駆動するためのパケツトデータＰＡを示し、この実施の形態の場合４つの電流値データによつて１パケツトが構成されている。ゲーム機本体２７及びゲーム機用操作装置５０の各マイコンは1/60秒（１フレーム）ごとにデータ処理が行われており、これに応じてパケツトデータＰＡもゲーム機本体２７からゲーム機用操作装置５０に1/60秒ごとに送信される。

【００８２】従つて、１パケツト内の４つの電流値データを 1/4フレーム期間ずつ１フレーム期間内に振り分けることにより、１フレーム期間においてパケツト内の電

流値データの数だけ振動子５３のコイル５８及び５９に加える駆動電流値を変化させることができる。

【００８３】すなわち、ある１フレーム期間にゲーム機本体２７からゲーム機用操作装置５０に転送された動的伝達用データは、当該ゲーム機用操作装置５０のマイコンによつてデータ処理され、パケツトデータＰＡが読み出される。図２５（Ａ）の場合、パケツトデータＰＡとして４つの電流値データ「２」、「３」、「５」、「３」が読み出され、これらの電流値データはアナログ信号に変換された後、図２１について上述したコイルドライバ６４に送出される。

【００８４】コイルドライバ６４はアナログ信号に変換された電流値をゲーム機本体２７から供給される電源によつてアナログ増幅することによつて図２５（Ｂ）に示す駆動電流信号ＳＤを得る。この駆動電流信号ＳＤは、パケツトデータＰＡの電流値データ「２」、「３」、「５」、「３」に対応し、コイルドライバ６４からコイル５８及び５９に供給される第１のフレーム期間ＦＬ１（時点ｔ１１～ｔ１５）において、始めの 1/4フレーム期間（時点ｔ１１～ｔ１２）では第１の電流値データ「２」に対応した電流値となり、当該始めの 1/4フレーム期間に続く 1/4フレーム期間（時点ｔ１２～ｔ１３）では第２の電流値データ「３」に対応した電流値となり、さらにこれに続く 1/4フレーム期間（時点ｔ１３～ｔ１４）では第３の電流値データ「５」に対応した電流値となり、最後の 1/4フレーム期間〈時点ｔ１４～ｔ１５）では第４の電流値データ「３」に対応した電流値となる。

【００８５】このようにゲーム機本体２７からゲーム機用操作装置５０に転送される動的伝達用データの転送タイミングが1/60秒ごとであつても、当該動的伝達用データのパケツトに複数（この実施の形態の場合４つ）の電流値データを格納して転送することにより、ゲーム機用操作装置５０において当該複数の電流値データを１フレーム期間に振り分けて駆動電流信号ＳＤとすることができる。

【００８６】この結果、振動子５３は動的伝達用データが送信される時間間隔（１フレーム期間）よりも細かい時間間隔で変化する駆動電流信号ＳＤによつて駆動される。このように細かい時間間隔かつ種々の電流値データで任意に駆動電流信号ＳＤの波形を変化させることにより、パケツト内に割り当てられる電流値データの数によつて振動子５３の周波数を設定し得ると共に、電流値によつて振動子５３の加速度を設定することができる。

【００８７】因みに、パケツトデータＰＡに設定される電流値データは、ゲーム機本体２７においてゲームの進行上動作ターゲツトに加わる衝撃の度合いに応じて種々の値が設定される。この場合、１パケツト内に割り当てられる電流値データの数も、４つ以外に種々の数が割り当てられる。従つて、ゲームの進行状況に応じて種々の駆動電流波形が設定されることにより、例えば動作ターゲツトに大きな衝撃力が加わるようなシーンの場合には、大きな電流値が短時間だけコイル５８及び５９に交互に加わることにより、ゲーム機用操作装置５０に衝撃のような大きな振動が発生する。これに対して、例えば自動車のアイドリングのように、動作ターゲツトに小さくかつ連続した振動が発生するようなシーンの場合には、小さな電流値が長時間コイル５８及び５９に交互に加わることにより、ゲーム機用操作装置５０にはあたかも自動車のアイドリングのような振動が発生する。

【００８８】かくして、振動子５３を有する応答手段５１を用いることにより、モニタの画面上で繰り広げられるゲームの進行状況に応じて、仮想の動作ターゲツトに生じる振動と同様の振動がゲーム機用操作装置５０に生じることにより、当該ゲーム機用操作装置５０を操作する利用者は、臨場感のあるゲームを体験することができる。

【００８９】なお上述の第２の実施の形態においては、２つの磁性体５５及び５６の間を振動子５３が往復運動するようにした場合について述べたが、本発明はこれに限らず、例えば図１６との対応部分に同一符号を付して示す図２６に示すように、１つの磁性体７１によつて振動子７４を振動させるようにしても良い。

【００９０】この場合、振動子７４は円筒形状のコイルボビン７２の一方の端部のみにコイル７３を形成し、このコイル７３を磁性体７１の磁極部７１Ａ及び７１Ｂ間に形成される遊嵌孔７１Ｅに遊嵌させる。このとき、コイルボビン７２に形成されるコイル７３の形成領域は、コイルボビン７２が最も右方向（すなわち磁性体７１に向かう方向）に移動した場合と、最も左方向（すなわち磁性体７１から離れる方向）に移動をした場合のそれぞれにおいて、いずれも遊嵌孔７１Ｅ内の磁束を横切る位置にコイル７３が存在するように設定されている。

【００９１】このように１つの磁性体７１によつて振動子７４を振動させる構成にすることにより、応答手段７０全体としてその大きさを小型にすることができる。

【００９２】また上述の第２の実施の形態においては、コイル５８及び５９（図１５及び図１６）を形成したコイルボビン５７を振動子５３として振動させる場合について述べたが、本発明はこれに限らず、例えば図１５及び図１６との対応部分に同一符号を付して示す図２７及び図２８に示すように、コイル５８及び５９を固定子とし、磁性体８１及び８２を振動子として振動させるようにしても良い。

【００９３】すなわち図２７において、応答手段７５はゲーム機用操作装置の上ケース２及び又は下ケース３に固定された支持部材７６Ａ及び７６Ｂに、コイルボビン７７Ａ及び７７Ｂを固定している。このコイルボビン７７Ａ及び７７Ｂにはコイル５８及び５９が導電線を互いに逆向きに巻回して形成されている。

【００９４】磁性体８１及び８２は、図２８に断面を示すように、それぞれ中心部に突設した円柱形状の磁極部８１Ａ及び８２Ａを有し、磁極部８１Ａ及び８２Ａの周側面に所定の間隙を隔てて対向する位置に円環状の磁極部８１Ｂ及び８２Ｂを有する。

【００９５】磁性体８１は磁極部８１Ａ及び８１Ｂ間に形成される遊嵌孔８１Ｅにコイル５８を遊嵌するように保持され、磁性体８２は磁極部８２Ａ及び８２Ｂ間に形成される遊嵌孔８２Ｅにコイル５９を遊嵌するように保持される。また、磁性体８１及び８２は互いにその背面で一体に固定され、釣支部６０によつて左右に移動自在に保持されている。

【００９６】かくして、図１８について上述した場合と同様にして、コイル５８及び５９に交互に駆動電流を加えることにより、一体化された磁性体８１及び８２を振動させることができ、当該磁性体８１及び８２の振動は支持部材７６Ａ及び７６Ｂを介してゲーム機用操作装置全体に伝達される。

【００９７】また上述の第２の実施の形態においては、コイル５８及び５９（図１５及び図１６）を形成したコイルボビン５７を振動子５３として振動させる場合について述べたが、本発明はこれに限らず、図２９に示すように、コイル８８を固定子とし、磁性体９０を振動子として振動させるようにしても良い。

【００９８】すなわち図２９において、応答手段８５はゲーム機用操作装置の上ケース２及び又は下ケース３に固定された支持部材８６Ａ及び８６Ｂ間にコイルボビン８７が固定され、当該コイルボビン８７に導電線が巻回されてコイル８８が形成されている。

【００９９】このコイル８８に対して所定の間隙を隔てて円環状の磁性体９０が遊嵌され、ばね８９によつて矢印ａ方向及びこれとは逆方向に振動自在に保持されている。コイル８８に駆動電流を加えない状態では、磁性体９０はばね８９によつてコイル８８のほぼ中心付近に保持される。

【０１００】この状態において図３０（Ａ）に示すように、コイル８８の所定方向に駆動電流Ｉを加えることによりコイル８８による磁界が形成され、磁性体９０には図３０（Ａ）において右方向（支持部材８６Ｂに向かう方向）に移動する力Ｆが加わる。この結果、磁性体９０は支持部材８６Ｂ側に移動する。

【０１０１】これに対して、コイル８８に加える電流の向きを逆向きに切り換えると、図３０（Ｂ）に示すように、磁性体９０には図３０（Ａ）の場合とは逆向きの力－Ｆが加わる。この結果、磁性体９０は支持部材８６Ａ側に移動する。このようにして、コイル８８に加える電流の向きを切り換えることにより、磁性体９０を左右に振動させることができる。

【０１０２】かくして当該磁性体９０の振動は支持部材８６Ａ及び８６Ｂを介してゲーム機用操作装置全体に伝達される。

【０１０３】また上述の第２の実施の形態においては、硬質樹脂でなる上ケース２及び下ケース３によつてゲーム機用操作装置５０を構成した場合について述べたが、本発明はこれに限らず、当該上ケース２及び下ケース３の一部を弾性部材によつて形成し、当該弾性部材を上述の応答手段５１、７０、７５又は８５によつて振動させるようにしても良い。

【０１０４】すなわち図９との対応部分に同一符号を付して示す図３１は、上ケース２及び下ケース３の一部にそれぞれ設けられた弾性部材３７Ａ及び３７Ｂを応答手段７５によつて振動させるようにしたものであり、左手の掌でグリツプして支持する第１の操作支持部４において、掌が当接する部位の一部を切り欠き、その切り欠き部を塞ぐようにして弾性部材３７Ａ及び３７Ｂを取り付け、この弾性部材３７Ａ、３７Ｂを内部から相対的に又は部分的に押し出すようにして変形又は膨縮させ、それによつて掌内に動的伝達を与える、いわゆる手応えの体感をフイードバツクさせる構造となつている。

【０１０５】なお、弾性部材３７Ａ、３７Ｂとしては、例えばゴム部材、樹脂部材又は布部材等が使用できる。

【０１０６】応答手段７５は、上ケース２及び下ケース３の第１の操作支持部４の掌が当接する部位の一部を切り欠き、切り欠いた部分を塞ぐようにして弾性部材３７Ａ、３７Ｂを装着した構造となつている。そして、その内部には図３２及び図３３に示すように、応答手段７５がその振動子（磁性体８１及び８２）を上下動し得る方向に釣支部６０によつて保持されている。

【０１０７】この場合、応答手段７５のコイル５８はそのコイルボビン７７Ａ（図２８）と共に下ケース３の弾性部材３７Ｂに固定され、コイル５９はそのコイルボビン７７Ｂ（図２８）と共に上ケース２の弾性部材３７Ａに固定されている。また、磁性体８１の円柱形状の磁極部８１Ａ（図３３）は、コイル５８が形成された円柱状のコイルボビン７７Ａ（図２８）の内部を介して下ケース３の弾性部材３７Ｂに当接し、磁性体８２の円柱形状の磁極部８２Ａ（図３２及び図３３）は、コイル５９が形成された円柱状のコイルボビン７７Ｂ（図２８）の内部を介して上ケース２の弾性部材３７Ａに当接している。

【０１０８】従つてこの状態において、コイル５８及び５９に駆動電流を交互に加えることにより、振動子（磁性体８１及び８２）は上下方向に振動し、各磁極部８１Ａ及び８２Ａによつて弾性部材３７Ｂ及び３７Ａが膨縮する。この結果、第１の操作支持部４の掌が当接する部位の上側及び下側位置において、弾性部材３７Ａ及び３７Ｂが外側に変形又は膨縮することにより、掌での動的伝達による感触とフイードバツク機能によつて利用者に与える臨場感を高めることができる。

【０１０９】また上述の第２の実施の形態においては、

硬質樹脂でなる上ケース２及び下ケース３によつてゲーム機用操作装置５０を構成した場合について述べたが、本発明はこれに限らず、利用者が左手の掌でグリツプして支持する第１の操作支持部４において、掌が当接する一部分を弾性部材によつて形成し、当該弾性部材を上述の応答手段５１、７０、７５又は８５によつて振動させるようにしても良い。すなわち図１２及び図１３との対応部分に同一符号を付して示す図３４及び図３５は、操作支持部４の一部に設けられた弾性部材４２を応答手段７５によつて振動させるようにしたものであり、その内部に応答手段７５が釣支部６０によつて保持されている。

【０１１０】図３５において支持部材７６Ａは上ケース２又は下ケース３に固定され、当該支持部材に釣支部６０と、コイル５９を形成したコイルボビン７７Ｂ（図２８）が固定されている。また弾性部材４２の内面側にはコイル５８を形成したコイルボビン７７Ａ（図２８）が固定され、当該コイルボビン７７Ａの内部を介して磁性体８１の磁極部８１Ａが当接している。

【０１１１】従つて、コイル５８及び５９に駆動電流を交互に加えることにより、磁性体８１及び８２が矢印ａ方向及びこれとは逆方向に振動し、この結果、磁性体８１の磁極部８１Ａが弾性部材４２を外側に変形又は膨縮させる。かくして弾性部材４２に当接する掌を介してその動的伝達が利用者に対して体感として伝達されることにより、利用者の臨場感を高めることができる。

【０１１２】また上述の第２の実施の形態においては、振動子を直線的に振動させる場合について述べたが、本発明はこれに限らず、所定の曲線に沿つて往復運動するような振動方法を用いても良い。

【０１１３】また上述の第２の実施の形態においては、振動子を板ばね６２によつて釣支する場合について述べたが、本発明はこれに限らず、例えばコイルばね等、他の種々の釣支手段を用いることができる。この場合、釣支手段の数は１つに限らず、複数の釣支手段を用いて振動子を複数箇所から釣支するようにしても良い。

【０１１４】また上述の第２の実施の形態においては、応答手段５１（７０、７５、８５）の各コイルに加える駆動電流の各タイミングにおける電流値をゲーム機本体２７からゲーム機用操作装置５０にパケツトデータで転送する場合について述べたが、本発明はこれに限らず、駆動電流波形の形状を表すデータをゲーム機本体２７からゲーム機用操作装置５０に転送し、当該ゲーム機用操作装置５０側で波形データに応じた電流波形を生成するようにしても良い。

【０１１５】（３）第３の実施の形態

図１との対応部分に同一符号を付して示す図３６は本発明によるゲーム機用操作装置の第３の実施の形態を示し、下ケース３の第１の操作支持部４の内部に形成された応答手段配置部１３３に応答手段１３０がほぼ水平に設けられているとともに、当該下ケース３のほぼ中心領域に当該ゲーム機用操作装置１２０の角速度センサ（ジヤイロセンサ）１５５が設けられている。

【０１１６】応答手段１３０は図３７に示すように、６つの側面を有するほぼ立方体形状の筐体１３１内に、振動部材１４０が複数のコイルばね１５１Ａ～１５１Ｈによつて振動自在に釣支されている。

【０１１７】この振動部材１４０は、図３７との対応部分に同一符号を付して示す図３８に示すように、Ｘ軸方向に振動するＸ軸振動子１４１Ａ及び１４１Ｂと、Ｙ軸方向に振動するＹ軸振動子１４１Ｃ及び１４１Ｄと、Ｚ軸方向に振動するＺ軸振動子１４１Ｅ及び１４１Ｆとを有し、各振動子１４１Ａ～１４１Ｆは振動部材１４０の中心部分で固定され、全体として一体化されている。

【０１１８】Ｘ軸振動子１４１Ａ及び１４１Ｂにはそれぞれ鉄心に導電線が同一方向に巻回されてコイル１４３Ａ及び１４３Ｂが形成されている。従つて、当該コイル１４３Ａ及び１４３Ｂに駆動電流Ｉを通電すると、当該駆動電流Ｉの向きに応じた方向に磁界Ｈａ及びＨｂが発生する。

【０１１９】このときＸ軸振動子１４１Ａは当該Ｘ軸振動子１４１Ａの先端部に対向する筐体１３１（図３７）の磁石１３２Ａから引力を受けることにより、当該磁石１３２Ａに接近する方向に移動するとともに、Ｘ軸振動子１４１Ｂは当該Ｘ軸振動子１４１Ｂの先端部に対向する筐体１３１（図３７）の磁石１３２Ｂから反発力を受けることにより、当該磁石１３２Ｂから離れる方向に移動する。この結果、Ｘ軸振動子１４１Ａ及び１４１Ｂと一体化された振動部材１４０は全体として、Ｘ軸振動子１４１Ａ及び１４１Ｂと同様方向（Ｘ軸の正方向）に移動する。

【０１２０】これに対して、当該Ｘ軸信号子１４１Ａ及び１４１Ｂのコイル１４３Ａ及び１４３Ｂに駆動電流Ｉとは逆向きの駆動電流（－Ｉ）を通電すると、当該駆動電流－Ｉの向きに応じた方向に磁界－Ｈａ及び－Ｈｂが発生する。

【０１２１】このときＸ軸振動子１４１Ａは磁石１３２Ａから反発力を受けることにより、当該磁石１３２Ａから離れる方向に移動するとともに、Ｘ軸振動子１４１Ｂは磁石１３２Ｂから引力を受けることにより、当該磁石１３２Ｂに接近する方向に移動する。この結果、Ｘ軸振動子１４１Ａ及び１４１Ｂと一体化された振動部材１４０は全体として、Ｘ軸振動子１４１Ａ及び１４１Ｂと同様方向（Ｘ軸の負方向）に移動する。

【０１２２】かくして、Ｘ軸振動子１４１Ａ及び１４１Ｂに通電する駆動電流Ｉの向きを短時間で変化させることにより、振動部材１４０は全体として磁石１３２Ａ及び１３２Ｂ間をＸ軸方向に振動する。

【０１２３】また、Ｙ軸振動子１４１Ｃ及び１４１Ｄにおいても同様にして、当該Ｙ軸振動子１４１Ｃ及び１４

１Ｄにそれぞれ巻回されたコイル１４３Ｃ及び１４３Ｄに駆動電流をその方向を切り換えながら通電することにより、Ｙ軸振動子１４１Ｃ及び１４１Ｄはそれぞれの先端部に対向する筐体１３１（図３７）の磁石１３２Ｃ及び１３２Ｄ間でＹ軸方向に振動する。この結果、Ｙ軸振動子１４１Ｃ及び１４１Ｄと一体化された振動部材１４０は全体として、Ｙ軸振動子１４１Ｃ及び１４１Ｄと同様方向（Ｙ軸方向）に振動する。

【０１２４】さらに、Ｚ軸振動子１４１Ｅ及び１４１Ｆにおいても同様にして、当該Ｚ軸振動子１４１Ｅ及び１４１Ｆにそれぞれ巻回されたコイル１４３Ｅ及び１４３Ｆに駆動電流をその方向を切り換えながら通電することにより、Ｚ軸振動子１４１Ｅ及び１４１Ｆはそれぞれの先端部に対向する筐体１３１（図３７）の磁石１３２Ｅ及び１３２Ｆ間でＺ軸方向に振動する。この結果、Ｚ軸振動子１４１Ｅ及び１４１Ｆと一体化された振動部材１４０は全体として、Ｚ軸振動子１４１Ｅ及び１４１Ｆと同様方向（Ｚ軸方向）に振動する。

【０１２５】因みに、駆動電流Ｉの通電方向を切り換える周期を変化させると、振動部材１４０の振動周波数を変化させることができ、駆動電流Ｉの電流値を変えると、振動部材１４０に加わる力（すなわち加速度）を変化させることができる。

【０１２６】かくして、各軸に対応したコイル１４３Ａ～１４３Ｆに駆動電流Ｉを通電して振動部材１４０を振動させると、この振動は、図３９に示すように応答手段配置部１３３（図３６）を介して第１の操作支持部４に伝達される。第１の操作支持部４に伝達された振動は、当該第１の操作支持部４のみに限らず下ケース３及び上ケース２の筐体に伝わつて装置全体が振動するようになる。このように、振動部材１４０によつて発生する振動の方向、振幅、加速度等の振動状態は、応答手段１３０の振動部材１４０に設けられた各コイル１４３Ａ～１４３Ｆに加える駆動電流Ｉによつて任意に変化させることができる。

【０１２７】因みに、応答手段１３０をセツトし得る空間としては、図４０に示すように、掌でグリツプして支持する第１の操作支持部４又は第２の操作支持部５を利用することができ、さらには図４１に示すように、第１の操作支持部４及び５に挟まれたゲーム機用操作装置１２０のほぼ中心部分の空間を大きく形成し、この領域を利用することができる。

【０１２８】このようにして、応答手段１３０を例えば下ケース３の第１の操作支持部４、即ち、左手の掌でグリツプして支持する部位に取り付けたことにより、図４２に示すように、ゲーム機用操作装置１２０とゲーム機本体２７をテレビジヨン受像機等のモニタ３３に接続してゲームを行う際に、ゲームの種類、例えば格闘技のゲームにおいて相手を倒した時、シユーテイングゲームで命中した時、動作ターゲツトが飛行機で画面上で攻撃を受けた時等において、ゲーム機本体２７からの特定の応答信号により、応答手段１３０の振動部材１４０を振動させてゲーム機用操作装置１２０全体を一定時間振動させることができる。

【０１２９】このようにしてユーザの操作ボタンによる操作によつて装置装置１２０自体が振動を起こし、利用するユーザに体感としてフイードバツクし臨場感をより一層向上させることができる。

【０１３０】ここで図４２に示すように、ゲーム機本体２７は、ビデオ記録媒体であるＣＤ－ＲＯＭドライバが内蔵されており、ゲーム機本体２７の上面には、ＣＤ－ＲＯＭを収納して蓋をする蓋部材２８と、蓋部材２８の開閉をする開閉スイツチ２９と、電源を供給する電源スイツチ３０と、ゲーム機本体２７の動作を初期状態にするリセツトスイツチ３１と、２系統の操作装置が接続可能な接続部３２を設けた構造となつている。この接続部３２にゲーム機用操作装置１２０のコネクタ２０を接続することにより、ゲーム機本体２７との双方向通信が可能になる。なお、この実施の形態においては、１系統のゲーム機用操作装置１２０を接続した構成で説明する。

【０１３１】前記したように応答手段１３０を駆動させてゲーム機用操作装置１２０全体を振動させるためには、ゲーム機用操作装置１２０とゲーム機本体２７との間は双方向通信機能を備えた構成であることが必要である。この双方向通信機能は、図４３に示すように、ゲーム機用操作装置１２０と双方向のシリアル通信を行うコネクタ２０をゲーム機本体２７と接続して行うことができる。

【０１３２】ゲーム機用操作装置１２０側の双方向通信機能を行う構成は、ゲーム機本体２７とシリアル通信を行うＩ／ＯインターフエースＳＩＯと、複数の操作ボタンからの操作データを入力するパラレルＩ／ＯインターフエースＰＩＯ、ＣＰＵ、ＲＡＭ及びＲＯＭであるワンチツプマイクロコンピユータ（以下これをマイコンと呼ぶ）と、応答手段１３０の振動部材１４０を振動させるコイルドライバ１６４とから構成される。

【０１３３】振動部材１４０のＸ軸振動子１４１Ａ及び１４１Ｂのコイル１４３Ａ及び１４３Ｂはコイルドライバ１６４からのＸ軸方向駆動電流ＳＤＸにより振動し、振動部材１４０のＹ軸振動子１４１Ｃ及び１４１Ｄのコイル１４３Ｃ及び１４３Ｄはコイルドライバ１６４からのＹ軸方向駆動電流ＳＤＹにより振動し、振動部材１４０のＺ軸振動子１４１Ｅ及び１４１Ｆのコイル１４３Ｅ及び１４３Ｆはコイルドライバ１６４からのＺ軸方向駆動電流ＳＤＺにより振動する。

【０１３４】ゲーム機本体２７側には、ゲーム機用操作装置１２０との間でシリアル通信を行うシリアルＩ／ＯインターフエースＳＩＯを設けた構造となつており、ゲーム機用操作装置１２０のコネクタ２０を接続すると、このコネクタ２０を介してゲーム機用操作装置１２０側

のシリアルＩ／ＯインターフエースＳＩＯと接続され、双方向の通信手段、即ち、双方向のシリアル通信を行うことができる構成となつている。なお、ゲーム機本体２７のその他の詳細な構成は省略してある。

【０１３５】双方向のシリアル通信を行う信号線及び制御線は、ゲーム機本体２７からゲーム機用操作装置１２０に対してデータを送るデータ伝送用の信号線ＴＸＤ(Transmit X' for Data)と、ゲーム機用操作装置１２０側からゲーム機本体２７側にデータを送るデータ伝送用の信号線ＲＸＤ(Received X' for Data)と、各データ伝送用の信号線ＴＸＤ、ＲＸＤからデータを抜き出すシリアル同期クロツク用の信号線ＳＣＫ(Serial Clock)と、ターミナル側であるゲーム機用操作装置１２０の通信の確立及び中断等を行うための制御線ＤＴＲ(Data Terminal Ready)と、大量のデータ転送を行うためのフロー制御用の制御線ＤＳＲ(Data Set Ready)とから構成されている。

【０１３６】また、この双方向のシリアル通信を行う信号線及び制御線からなるケーブルには、図４３に示すように、信号線及び制御線の他にゲーム機本体２７側の電源から直接に取り出した電源用ケーブル３５が含まれており、この電源用ケーブル３５はゲーム機用操作装置１２０側のコイルドライバ１６４に接続され、振動部材１４０を振動させる電源を供給する。

【０１３７】ここで図３６について上述したように、ゲーム機用操作装置１２０には、当該ゲーム機用操作装置１２０の各回転軸（Ｘ軸、Ｙ軸及びＺ軸）回りの回転角速度を検出する角速度センサ１５５が設けられている。この角速度センサ１５５は、Ｘ軸回りの回転角速度を検出するＸ軸角速度センサ１５５Ａ、Ｙ軸回りの回転角速度を検出するＹ軸角速度センサ１５５Ｂ及びＺ軸回りの回転角速度を検出するＺ軸角速度センサ１５５Ｃを有し、ゲーム機用操作装置１２０の角度変化に応じて、各軸（Ｘ軸、Ｙ軸及びＺ軸）回りの回転角速度成分が検出される。

【０１３８】図４４はＺ軸角速度センサ１５５Ｃを構成する圧電振動型のジヤイロセンサ(Gyroscope Sensor)１５６の構成を示し、正三角柱の恒弾性金属材料エリンバ(Elinvar)材１５６Ｄを、その中心線がＺ軸方向に向かうように設けている。この恒弾性金属材料エリンバ材１５６の表面に圧電セラミツク素子１５６Ａ、１５６Ｂ及び１５６Ｃを貼り付け、当該ジヤイロセンサ１５６が固定されたゲーム機用操作装置１２０の動きのＺ軸回りの動き成分を、コリオリの力を検出することにより、恒弾性金属材料エリンバ材１５６Ｄの振動を音叉の振動数と等しい振動トルクに変換し、これによりＺ軸回りの回転角速度成分を電圧の変位量として取り出すようになされている。

【０１３９】因みに、Ｘ軸角速度センサ１５５Ａ及びＹ軸角速度センサ１５５Ｂにおいても図４４に示すジヤイロセンサ１５６と同様構成のジヤイロセンサがそれぞれＸ軸方向及びＹ軸方向に向かうように設けられている。

【０１４０】ここで図４５はジヤイロセンサ１５６を含むＺ軸角速度センサ１５５Ｃの構成を示し、発振回路１５５Ｅは発振信号Ｓ１５６Ａを励振用の圧電セラミツク素子１５６Ａに送出することにより、当該圧電セラミツク素子１５６Ａを振動させる。励振用の圧電セラミツク素子１５６Ａの振動は、無回転時には他の２つの圧電セラミツク素子１５６Ｂ及び１５６Ｃに同様に到達することにより、これら２つの圧電セラミツク素子１５６Ｂ及び１５６Ｃからそれぞれ等しい振幅の振動検出信号Ｓ１５６Ｂ及びＳ１５６Ｃが位相補正回路１５６Ｇによる位相に合わせられて差動増幅回路１５６Ｆに送出される。

【０１４１】このとき差動増幅回路１５６Ｆから出力される差動増幅出力信号Ｓ１５６Ｆの信号レベルはほぼ「０」となり、直流増幅回路１５６Ｉから出力される角速度検出信号Ｓ１５５Ｚの電圧値もこれに応じてほぼ０〔Ｖ〕となる。

【０１４２】これに対して、ゲーム機用操作装置１２０が動かされた場合には、当該動きのＺ軸回りの回転成分に応じてＺ軸角速度センサ１５５Ｃのジヤイロセンサ（恒弾性金属材料エリンバ材１５６Ｄ）がひずみを受け、２つの圧電セラミツク素子１５６Ｂ及び１５６Ｃから出力される振動検出信号Ｓ１５６Ｂ及びＳ１５６Ｃの振幅が互いに異なる値となる。

【０１４３】これにより、差動増幅回路１５６Ｆから振幅差に応じた信号レベルの差動増幅出力信号Ｓ１５６Ｆが検波回路１５６Ｈに送出される。検波回路１５６Ｈは差動増幅出力信号Ｓ１５６Ｆの信号レベルが正側の成分を検波し、これを直流増幅回路１５６Ｉに送出する。

【０１４４】直流増幅回路１５６Ｉは、検波回路１５６Ｈから送出される検波出力波形の直流分を増幅することにより、ジヤイロセンサ１５６のＺ軸回りの回転角速度成分に応じた電圧レベルの角速度検出信号Ｓ１５５Ｚを出力する。このようにして得られたＺ軸回りの角速度検出信号Ｓ１５５Ｚは、図４３においてアナログ／デイジタル変換回路１５７に送出され、デイジタル信号に変換されてマイコンに送出される。

【０１４５】因みに、Ｘ軸角速度センサ１５５Ａ及びＹ軸角速度センサ１５５Ｂも、図４５について上述したＺ軸角速度センサ１５５Ｃと同様構成でなり、それぞれＸ軸回りの回転角速度成分に応じた角速度検出信号Ｓ１５５Ａ及びＹ軸回りの回転角速度成分に応じた角速度検出信号Ｓ１５５Ｂをアナログ／デイジタル変換回路１５７を介してマイコンに送出する。

【０１４６】ゲーム機用操作装置１２０のマイコンは、かかる角速度センサ１５５から得られる各軸（Ｘ軸、Ｙ軸及びＺ軸）回りの回転角速度成分に基づいて、ゲーム機用操作装置１２０の姿勢を判断し、振動部材１４０に与えられるＸ軸方向駆動電流ＳＤＸ、Ｙ軸方向駆動電流

ＳＤＹ及びＺ軸方向駆動電流ＳＤＺを補正することにより、筐体１３１（図３７）に釣支された振動部材１４０の自重による振動変化を回避して、常にゲーム機本体２７側によつて指定された動的伝達用データ通りの振動を発生させることができる。

【０１４７】ここで、ゲーム機用操作装置１２０及びゲーム機本体２７間において行われる双方向のシリアル通信手順は、例えば図４３に示すゲーム機本体２７がゲーム機用操作装置１２０と通信をして、第１～第４の操作部７、８、９、１０の操作ボタンの操作データ（ボタン情報）を取り込むために、先ずゲーム機本体２７は制御線ＤＴＲによつて選択されたことを確認して、それに続く信号線ＴＸＤの受信待状態になる。続いてゲーム機本体２７は、データ伝送用の信号線ＴＸＤにゲーム機用操作装置１２０を示す識別コードを送出する。これによりゲーム機用装置装置１２０が信号線ＴＸＤによりこの識別コードを受け取る。

【０１４８】識別コードがゲーム機用操作装置１２０を示すことにより、これ以降ゲーム機本体２７との通信を開始する。即ち、ゲーム機本体２７からは制御データ等がデータ伝送用の信号線ＴＸＤを介してゲーム機用操作装置１２０側に送信され、逆にゲーム機用操作装置１２０からは操作ボタンで操作された操作データ等がデータ伝送用の信号線ＲＸＤを介してゲーム機本体２７に送信される。このようにしてゲーム機本体２７とゲーム機用操作装置１２０との間で双方向のシリアル通信が行われ、この通信はゲーム機本体２７が制御線ＤＴＲを通じて選択中止データを出力することにより終了する。

【０１４９】このような双方向のシリアル通信機能を備えていれば、ゲーム機用操作装置１２０側からの主として操作ボタンの操作データをゲーム機本体２７側に送信することができると共にゲーム機本体２７側からは、データ伝送用信号線ＴＸＤを介して応答手段１３０の振動部材１４０を振動させる動的伝達用データをゲーム機用操作装置１２０側に送出することができる。この振動部材１４０を振動させる動的伝達用データは、ゲーム機本体２７に搭載したゲーム用ＣＤ－ＲＯＭによつて予め設定されており、ゲームを行う利用者の動作ターゲツトに応じてゲーム機本体２７からゲーム機用操作装置１２０自体に一定時間の動的伝達によるフイードバツクが行われる。

【０１５０】このようにゲーム機本体２７及びゲーム機用操作装置１２０間において送受信されるデータは、図４６に示すように、５バイトのデータから構成され各バイトごとにパケツト化されて送信される。

【０１５１】図４６においてゲーム機本体２７から信号線ＴＸＤを介してゲーム機用操作装置１２０に送信されるデータは、１バイト目及び２バイト目にプロトコル識別子として16進数で表されるデータ0x01及び0x42が送信され、３バイト目はデータの割り当てが不定であり、４バイト目及び５バイト目の動的伝達データＴＸＤ１及びＴＸＤ２としてゲーム機用操作装置１２０の応答手段１３０（振動部材１４０）に対する振動制御データが送信される。

【０１５２】すなわち、図４７に示すように、４バイト目のデータにおいては、最上位２ビツトに振動装置の制御コマンドであることを表すデータ「０１」（２進数）が割り当てられ、これに続く３ビツト分のデータとして振動部材１４０の振動方向を表す振動方向制御データD_{COM}が割り当てられる。

【０１５３】この振動方向制御データD_{COM}は、図３７について上述した振動部材１４０の各方向（Ｘ軸、Ｙ軸及びＺ軸）に対応して設けられたＸ軸振動子１４１Ａ、１４１Ｂ、Ｙ軸振動子１４１Ｃ、１４１Ｄ及びＺ軸振動子１４１Ｅ、１４１Ｆのうち、いずれかの軸方向に対応して設けられた振動子、又は、これらの組み合わせを表すデータであり、３ビツトのデータによつて７通りの振動方向が指定される。因みに、この７通りの振動方向とは、Ｘ軸方向、Ｙ軸方向、Ｚ軸方向、Ｘ軸方向及びＹ軸方向の組み合わせ、Ｘ軸方向及びＺ軸方向の組み合わせ、Ｙ軸方向及びＺ軸方向の組み合わせ、及びすべての軸方向の組み合わせである。

【０１５４】また、図４７に示すデータにおいては、振動方向を指定する振動方向制御データD_{COM}とともに、４バイト目の最下位３ビツトにＸ軸方向の振動データＤＸが付加され、５バイト目の最上位３ビツトにＹ軸方向の振動データＤＹが付加され、当該Ｙ軸方向の振動データＤＹに続く３ビツトにＺ軸方向の振動データＤＺが付加される。これにより、４バイト目の振動方向制御データD_{COM}によつて指定された振動方向又はその組み合わせに応じて、各軸方向の振動データＤＸ、ＤＹ及びＤＺが使用される。

【０１５５】これらの振動データＤＸ、ＤＹ及びＤＺは、それぞれ３ビツトのデータによつて各軸の振動子を振動させる際の電流値を表し、ゲーム機用操作装置１２０のマイコンは、当該各振動データＤＸ、ＤＹ及びＤＺをアナログ値に変換し、当該アナログ信号によつてコイルドライバ１６４（図４３）を駆動することにより、このとき受信データによつて指定された軸に対応する振動子のコイルに振動データＤＸ、ＤＹ及びＤＺによつて表された電流値の駆動電流が加えられる。

【０１５６】この点に関して、図３６及び図４３を参照しながら図２３及び図２４との対応部分に同一符号を付して示す図４８及び図４９のフローチヤートに沿つて以下詳細に説明する。

【０１５７】特定のゲーム用ＣＤ－ＲＯＭをゲーム機本体２７に装着して、図３６に示したゲーム機用操作装置１２０のスタートスイツチ１１によりゲームの開始をセツトし、且つセレクトスイツチ１２の操作により種々の機能を設定し、第１～第４の操作部７、８、９、１０の

操作によりゲームが行われる状態になつている。

【０１５８】そして、ゲーム開始に伴つて、図４３に示したゲーム機用操作装置１２０のＣＰＵ、ＲＡＭ、ＲＯＭからなるマイコンはシリアルインターフエースＳＩＯを介してヒツトの動的伝達用データがゲーム機本体２７側からシリアルＩ／Ｏインターフエースを介して送られてきているかを図４８に示すステツプＳＴ２１において常時監視している。この動的伝達用データには、図４３に示す振動部材１４０の振動方向及び電流値データが含まれている。そして、ゲームが進行している中で、もし、ゲーム機本体２７側から送られてくるデータの中に動的伝達用データがある場合には、コイルドライバ１６４を駆動させ、ゲーム機本体２７から供給されている電流をＸ軸方向駆動電流ＳＤＸ、Ｙ軸方向駆動電流ＳＤＹ及びＺ軸方向駆動電流ＳＤＺとして振動部材１４０のコイル１４３Ａ～１４３Ｆに所定時間供給する。

【０１５９】即ち、ゲーム機用操作装置１２０側で受信したデータの中の動的伝達データＴＸＤ１、ＴＸＤ２（図４７）をステツプＳＴ１で判定した後、ステツプＳＴ２においてマイコン処理する。このとき、マイコンは図４４及び図４５において上述した角速度センサから得られる角速度検出信号Ｓ１５５Ｘ、Ｓ１５５Ｙ及びＳ１５５Ｚをステツプ３１において予め取り込んでおき、当該角速度検出信号Ｓ１５５Ｘ、Ｓ１５５Ｙ及びＳ１５５Ｚに基づいてゲーム機用操作装置１２０の姿勢を判断するとともに、当該姿勢情報に基づいて、動的伝達用データＴＸＤ１、ＴＸＤ２を補正する。

【０１６０】この補正は、振動部材１４０の各コイル１４３Ａ～１４３Ｆに対して印加する駆動電流値として、振動部材１４０が重力によつて引かれる方向には磁力を少なく発生させるような駆動電流値とするとともに、振動部材１４０が重力によつて引かれる方向とは逆方向には磁力を多く発生させるような駆動電流値とするようになされている。

【０１６１】従つて、ゲーム機用操作装置１２０が鉛直方向に対していかなる角度（姿勢）であつても、重力による振動部材１４０の振動変化を回避して、ゲーム機本体２７側のＣＰＵによつて設定されるゲーム進行に応じた適切な振動を振動部材１４０によつて発生させることができる。

【０１６２】このようにして補正された動的伝達データのうち、振動方向制御データD_{CM}（図４７）によつて指定された方向（Ｘ軸方向、Ｙ軸方向及びＺ軸方向、又はこれらの組み合わせ）の各軸方向の振動成分を表す振動データＤＸ、ＤＹ及びＤＺに基づいて補正されたデータがステツプＳＴ２２Ａ、ステツプＳＴ２２Ｂ及びステツプＳＴ２２Ｃにおいてそれぞれアナログ信号に変換され、続くステツプＳＴ２３Ａ、ステツプＳＴ２３Ｂ及びステツプＳＴ２３Ｃにおいて、それぞれアナログ信号によつてコイルドライバ１６４（図４３）を駆動する。かくしてコイルドライバ１６４から駆動電流Ｉが振動部材１４０のコイル１４１Ａ～１４１Ｆに供給されることにより、ステツプＳＴ２４Ａ、ステツプＳＴ２４Ｂ及びステツプＳＴ２４Ｃにおいて、このとき指定されている方向に振動部材１４０が振動する。

【０１６３】これに対して、ゲーム機本体２７からゲーム機用操作装置１２０に供給されたデータが動的伝達データＴＸＤ１Ｔ、ＴＸＤ２を含まない場合、ゲーム機用操作装置１２０のマイコンは、図４８のステツプＳＴ１からステツプＳＴ５に移つて操作ボタンが操作される状態を待ち受ける。ここで肯定結果が得られると、このことはゲーム機用操作装置１２０の操作ボタンが操作されたことを表しており、このときマイコンはステツプＳＴ６に移つて、操作データをパラレルＩ／ＯインターフエースＰＩＯを介して取り込むと共に、続くステツプＳＴ３１に移つて角速度センサ１５５からの角速度検出信号Ｓ１５５Ｘ、Ｓ１５５Ｙ及びＳ１５５Ｚによつてゲーム機用操作装置１２０の姿勢を取り込む。

【０１６４】マイコンに入力された角速度検出信号Ｓ１５５Ｘ、Ｓ１５５Ｙ及びＳ１５５Ｚは、ステツプＳＴ２２Ａ～ＳＴ２４Ａ、ステツプＳＴ２２Ｂ～ＳＴ２４Ｂ、ステツプＳＴ２２Ｃ～ＳＴ２４Ｃについて上述したゲーム機用操作装置１２０の姿勢に基づく補正用データとして用いられる。

【０１６５】また、マイコンに入力された操作データは、図４８のステツプＳＴ２において処理され、ステツプＳＴ７においてシリアルデータに変換され、シリアルＩ／ＯインターフエースＳＩＯ（図４３）を介してゲーム機本体２７に送信される。その後、ゲーム機用操作装置１２０はステツプＳＴ２５においてゲーム機本体２７からのデータを待ち受ける状態となる。

【０１６６】ゲーム機用操作装置１２０からゲーム機本体２７に送信されるデータは、図４６に示すように、２バイト目の上位４ビツトにゲーム機用操作装置１２０の識別子を割り当て、当該２バイト目の下位４ビツトにデータ長／２のデータを割り当てる。また、３バイト目には当該データが応答データであることを表す識別子（ＡＣＫ）を割り当て、これに続く４バイト目及び５バイト目にはゲーム機用操作装置１２０において操作されたボタンのデータが割り当てられる。

【０１６７】かかるゲーム機用操作装置１２０からのデータがゲーム機本体２７に送信されると、ゲーム機本体２７は図４９に示すステツプＳＴ２６においてゲーム機用操作装置１２０からのデータを受信し、続くステツプＳＴ８において、動作ターゲツトのデータと、受信したシリアルデータとの比較を行つて、ステツプＳＴ９においてヒツト状態を判別する。

【０１６８】ここで動作ターゲツトのデータと受信したシリアルデータとが一致したとき、即ち、ヒツトしたときは、ステツプＳＴ９からステツプＳＴ１０に移つてヒ

ツトした動作ターゲツトをモニタの画面上に表示するとともに、ステツプＳＴ１１において動的伝達用データを出力し、ステツプＳＴ１２においてシリアルデータに変換してシリアルＩ／ＯインターフエースＳＩＯ（図４３）を介してゲーム機用操作装置１２０に特定の応答信号として返信する。この動的伝達用データは、図４８のステツプＳＴ１、ステツプＳＴ２及びステツプＳＴ３で説明したように、ゲーム機用操作装置１２０のマイコンにより検出されると、電源をコイルドライバ１６４（図４３）から振動部材１４０のコイル１４３Ａ～１４３Ｆに供給してこれを振動させ、その振動によつてゲーム機用操作装置１２０全体が振動する。

【０１６９】これに対して、ステツプＳＴ９（図４９）において否定結果が得られると、このことは動作ターゲツトのデータとゲーム機用操作装置１２０からのシリアルデータとが一致していないこと、すなわちヒツトしていないことを表しており、このときゲーム機本体２７のＣＰＵは、ステツプＳＴ１３に移つて操作ボタンに基づいて動作ターゲツトをモニタの画面上に表示した後、ステツプＳＴ２７に移つてゲーム機用操作装置１２０からのデータを待ち受ける。

【０１７０】ゲーム機本体２７のＣＰＵでは、1/60秒（１フレーム）ごとにデータ処理が行われており、これに応じて動的伝達データＴＸＤ１、ＴＸＤ２もゲーム機本体２７からゲーム機用操作装置１２０に1/60秒ごとに送信される。従つて、ゲーム機用操作装置１２０の各コイル１４３Ａ～１４３Ｆに通電される駆動電流値及びその方向は1/60秒ごとに動的伝達データに基づいて変化する。

【０１７１】かくして、ゲーム機本体２７からゲーム機用操作装置１２０に対して動的伝達データを送信し、これに基づいて振動部材１４０を所定方向に振動させることにより、ゲーム機用操作装置１２０を操作するユーザは、モニタの画面上に繰り広げられるゲームに応じた体感をゲーム機用操作装置１２０の振動としてフイードバツクされ、一段と臨場感の高いゲームを進行させることができる。

【０１７２】なお、上述の第３の実施の形態においては、図４７について上述したように、1/60秒ごとにゲーム機本体２７からゲーム機用操作装置１２０に送信される動的伝達データＴＸＤ１、ＴＸＤ２によつて振動部材１４０の各コイル１４３Ａ～１４３Ｆに加える駆動電流値を指定することにより、当該各コイル１４３Ａ～１４３Ｆの電流値及びその方向は最短で1/60秒ごとに変化する場合について述べたが、本発明はこれに限らず、例えば図４７に示すデータのバイト数を増やして、各軸方向の振動データＤＸ、ＤＹ及びＤＺを複数伝達することにより、1/60秒間をさらに複数の期間に分割し、各分割期間ごとに駆動電流値及びその方向を指定するようにしても良い。

【０１７３】このようにすれば、１フレーム期間において振動データＤＸ、ＤＹ及びＤＺの数だけ振動部材１４０の各コイル１４３Ａ～１４３Ｆに加える駆動電流値及びその方向を変化させることができることにより、ゲーム機本体２７からゲーム機用操作装置１２０に転送される動的伝達データＴＸＤ１、ＴＸＤ２の転送タイミングが１フレーム（1/60秒）ごとであつても、当該１フレーム期間よりも細かい時間間隔でアナログ信号のように変化する駆動電流を各コイル１４３Ａ～１４３Ｆに加えることができる。

【０１７４】また上述の第３の実施の形態においては、振動部材１４０の各コイル１４３Ａ～１４３Ｆに加える駆動電流の各タイミングにおける電流値及びその方向を動的伝達データＴＸＤ１、ＴＸＤ２としてゲーム機本体２７からゲーム機用操作装置１２０にパケツトデータで転送する場合について述べたが、本発明はこれに限らず、駆動電流波形の形状を表すデータをゲーム機本体２７からゲーム機用操作装置１２０に転送し、当該ゲーム機用操作装置１２０側で波形データに応じた電流波形を生成するようにしても良い。

【０１７５】また上述の第３の実施の形態においては、筐体１３１にコイルばね１５１Ａ～１５１Ｆによつて振動部材１４０を釣支する場合について述べたが、釣支手段はこれに限らず、例えば板ばねを用いたり、さらには液体に振動部材１４０を浮遊させるようにしても良い。

【０１７６】また上述の第３の実施の形態においては、各軸（Ｘ軸、Ｙ軸及びＺ軸）方向にコイル部として突起を有する振動部材１４０を用いる場合について述べたが、本発明はこれに限らず、例えば球状部材の各軸方向（Ｘ軸方向、Ｙ軸方向及びＺ軸方向）にそれぞれマグネツトを埋め込み、当該マグネツトに対向する筐体側にＸ軸方向、Ｙ軸方向及びＺ軸方向のコイル部を設けるようにしても良い。

【０１７７】また上述の第３の実施の形態においては、各軸方向（Ｘ軸方向、Ｙ軸方向及びＺ軸方向）にそれぞれ振動する振動子（Ｘ軸振動子１４１Ａ、１４１Ｂ、Ｙ軸振動子１４１２Ｃ、１４１Ｄ及びＺ軸振動子１４１Ｅ、１４１Ｆ）を一体化した振動部材１４０を用いる場合について述べたが、本発明はこれに限らず、各軸方向にそれぞれ個別に振動する振動子を別体に設けるようにしても良い。

【０１７８】この場合、例えば図２７及び図２８について上述したボイスコイル構成の応答手段７５を、図５０に示すように、Ｘ軸方向、Ｙ軸方向及びＺ軸方向にそれぞれ振動するような向きで個別に配置する。このような構成において、図４７について上述した各軸方向の振動データＤＸ、ＤＹ及びＤＺを各応答手段７５の駆動電流値として与えて振動させることにより、このゲーム機用操作装置１６０においては、各軸方向に振動する複数の応答手段７５の振動が合成され、図３７について上述し

た一体の振動部材１４０（図３７）と同様に任意の方向に振動が発生する。

【０１７９】この場合においても、角速度センサ１５５によつてゲーム機用操作装置１６０の姿勢を監視し、各応答手段７５に供給する駆動電流値を補正することにより、ゲーム機用操作装置１６０に対して、その姿勢に関わらず常にゲーム機本体２７から指定された振動を発生させることができる。

【０１８０】また図５０のゲーム機用操作装置１６０においては、振動子が直線方向に往復して振動を１次元方向に発生させる応答手段７５を各軸方向（Ｘ軸方向、Ｙ軸方向及びＺ軸方向）にそれぞれ配置する場合について述べたが、本発明はこれに限らず、例えば図５１に示すように、各軸方向に配置される３つの応答手段７５に加えて、図２について上述したモータ２４による応答手段２１を設けるようにしても良い。

【０１８１】この場合、ボイスコイル構成の応答手段７５は消費電流が多く強い振動を発生させることができ、モータ２４による応答手段２１は消費電流が少なく弱い振動を発生させる点に着目して、比較的短時間の振動を強く発生させる場合には、各軸方向に設けられたボイスコイル構成の応答手段７５を、要求される振動方向に応じて組み合わせて振動させ、比較的長い時間の弱い振動を発生させる場合には、モータ２４による応答手段２１を駆動することにより、ゲームの進行に応じた種々の方向及び強さの振動を臨場感豊かに発生させることができるとともに、消費電流の大きな応答手段７５を必要なときのみに駆動させることができることにより、当該ゲーム機用操作装置１７０全体としての振動に要する消費電流を低減させることができる。

【０１８２】また図５０のゲーム機用操作装置１６０においては、振動子が直線方向に往復して振動を発生させる応答手段７５を各軸方向（Ｘ軸方向、Ｙ軸方向及びＺ軸方向）にそれぞれ配置する場合について述べたが、本発明はこれに限らず、例えば各軸方向に設けられる応答手段のうちの一つ又は二つを、図１について上述したモータ２４による応答手段２１としても良い。

【０１８３】すなわち図５２に示すゲーム機用操作装置１８０は、Ｘ－Ｚ平面の２次元方向に振動を発生させる手段として、図２について上述したモータ２４による応答手段２１を設けた場合を示し、当該応答手段２１と、Ｙ軸方向（１次元方向）に振動を発生させるボイスコイル構成の応答手段７５とを有する。

【０１８４】このように応答手段７５及び２１を配置すれば、ゲーム機用操作装置１８０を操作するユーザに対して、特に前後方向にボイスコイル構成の応答手段７５を用いて強い衝撃（振動）を体感させることができるとともに、上下左右方向には比較的小さな振動を長時間体感させることができる。

【０１８５】また図５０のゲーム機用操作装置１６０において、各軸方向（Ｘ軸方向、Ｙ軸方向及びＺ軸方向）にそれぞれボイスコイル構成の応答手段７５を配置する場合について述べたが、本発明はこれに限らず、例えば図５３に示すように、ボイスコイル構成の応答手段７５に代えて、それぞれモータ２４を有する２つの応答手段２１Ａ及び２１Ｂをその振動方向がＸ－Ｚ平面方向及びＹ－Ｚ平面方向（又はＸ－Ｙ平面方向）となるように配置しても良い。

【０１８６】このゲーム機用操作装置１９０によれば、２つの平面方向に対して振動を発生させることにより、ゲームの進行に応じた多様な振動をユーザにフイードバツクすることができる。因みに、２つの応答手段２１Ａ及び２１Ｂを設けたゲーム機用操作装置１９０に対してゲーム機本体２７から送信される振動データは、図５４に示すように、４バイト目の最上位２ビツトに振動装置の制御コマンドであることを表すデータ「０１」（２進数）が割り当てられ、当該４バイト目の最下位３ビツトには第１の応答手段２１Ａに加えられる駆動電流値を表すアナログ制御データＭＡ１が割り当てられる。また、５バイト目の最上３ビツトには第２の応答手段２１Ｂに加えられる駆動電流値を表すアナログ制御データＭＡ２が割り当てられる。これにより、当該２つのアナログ制御データＭＡ１及びＭＡ２を受信したゲーム機用操作装置１９０のマイコンは、アナログ制御データＭＡ１及びＭＡ２をアナログ値に変換し、当該アナログ信号によつてコイルドライバを駆動することにより、各応答手段２１Ａ及び２１Ｂに対して、アナログデータＭＡ１及びＭＡ２によつて指定された駆動電流を通電する。

【０１８７】また、図５４において５バイト目の最下位ビツトには第１の応答手段２１Ａに対して予め決められた値の駆動電流を通電するか否かを表すデイジタル制御データ$CONT_{D1}$が割り当てられる。このデイジタル制御データ$CONT_{D1}$として「１」又は「０」を割り当てることにより、第１の応答手段２１Ａに対して駆動電流を通電するか否かが決定される。

【０１８８】またこれと同様にして、５バイト目の最下位から２番目のビツトには第２の応答手段２１Ｂに対して予め決められた値の駆動電流を通電するか否かを表すデイジタル制御データ$CONT_{D2}$が割り当てられる。このデイジタル制御データ$CONT_{D2}$として「１」又は「０」を割り当てることにより、第２の応答手段２１Ｂに対して駆動電流を通電するか否かが決定される。

【０１８９】この点に関して、図５５のフローチヤートに沿つて以下詳細に説明する。ゲーム機用操作装置１９０（図５３）のマイコンは、ゲーム機本体２７から例えば図５４に示すデータを受信すると、図５５のステツプＳＴ２から受信データに基づく処理手順に入り、ステツプＳＴ４１においてデータの読み込みを完了した後、続くステツプＳＴ４２において受信データの４バイト目の最上位２ビツトを検出することにより、当該受信データ

が振動装置付きのゲーム機用操作装置に対する制御データであるか否かを判断する。

【０１９０】ここで否定結果が得られると、このことは受信データが振動装置付き操作装置に対する制御データではないこと、すなわちこのときゲーム機本体２７に接続されているゲーム機用操作装置１９０に対する制御データではないことを表しており、このときゲーム機用操作装置１９０のマイコンは上述のステップＳＴ４１に戻つて、新たな受信データを待ち受ける。

【０１９１】これに対してステップＳＴ４２において肯定結果が得られると、このことは受信したデータが振動装置付きのゲーム機用操作装置１９０に対する制御データであることを表しており、このとき当該ゲーム機用操作装置１９０のマイコンは、続くステップＳＴ４３において、受信データの４バイト目に第１の応答手段２１Ａに対するアナログ制御データＭＡ１が存在するか否かを判断する。

【０１９２】ここで肯定結果が得られると、受信データの４バイト目の最下位３ビツトにアナログ制御データＭＡ１が存在することを表しており、このときゲーム機用操作装置１９０のマイコンは、ステップＳＴ４４に移つて第１の応答手段２１Ａのモータ２４に対してアナログ制御データＭＡ１によつて指定された値の駆動電流を加える。

【０１９３】これに対してステップＳＴ４３において否定結果が得られると、このことは受信データの４バイト目の最下位３ビツトにアナログ制御データＭＡ１が存在しないこと（例えばアナログ制御データＭＡ１が「０」であること）を表しており、このときゲーム機用操作装置１９０のマイコンは、ステップＳＴ４５に移つて受信データ（図５４）の５バイト目の最下位ビツトに割り当てられている第１の応答手段２１Ａに対するデイジタル制御データ$ＣＯＮＴ_{D1}$を読み取り、当該デイジタル制御データ$ＣＯＮＴ_{D1}$に基づいて第１の応答手段２１Ａのモータ２４をオン又はオフ状態に制御する。

【０１９４】その後、ゲーム機用操作装置１９０のマイコンはステップＳＴ４６に移つて、受信データの５バイト目に第２の応答手段２１Ｂに対するアナログ制御データＭＡ２が存在するか否かを判断する。

【０１９５】ここで肯定結果が得られると、受信データの５バイト目の最上位３ビツトにアナログ制御データＭＡ２が存在することを表しており、このときゲーム機用操作装置１９０のマイコンは、ステップＳＴ４７に移つて第２の応答手段２１Ｂのモータ２４に対してアナログ制御データＭＡ２によつて指定された値の駆動電流を加える。

【０１９６】これに対してステップＳＴ４６において否定結果が得られると、このことは受信データの５バイト目の最上位３ビツトにアナログ制御データＭＡ２が存在しないこと（例えばアナログ制御データＭＡ１が「０」であること）を表しており、このときゲーム機用操作装置１９０のマイコンは、ステップＳＴ４８に移つて受信データ（図５４）の５バイト目の最下位から２ビツト目に割り当てられている第２の応答手段２１Ｂに対するデイジタル制御データ$ＣＯＮＴ_{D2}$を読み取り、当該デイジタル制御データ$ＣＯＮＴ_{D2}$に基づいて第２の応答手段２１Ｂのモータ２４をオン又はオフ状態に制御する。

【０１９７】かくして、ゲーム機用操作装置１９０のマイコンは、ゲーム機本体２７からデータを受信する度に図５５に示す処理を繰り返すことにより、受信データに含まれるアナログ制御データＭＡ１、ＭＡ２又はデイジタル制御データ$ＣＯＮＴ_{D1}$、$ＣＯＮＴ_{D2}$に基づいて応答手段２１Ａ及び２１Ｂをアナログ制御又はデイジタル制御することができる。

【０１９８】この処理において、アナログ制御データＭＡ１及びＭＡ２が受信データに存在する場合には、当該アナログ制御データＭＡ１及びＭＡ２を優先して用いることにより、応答手段２１Ａ及び２１Ｂの各モータ２４には、それぞれアナログ制御データＭＡ１及びＭＡ２に応じて細かく指定された電流値の駆動電流を加えることができる。

【０１９９】なお、図５５に示すマイコン処理においては、第２の応答手段２１Ｂに対するアナログ制御データＭＡ２が存在しない場合、当該第２の応答手段２１Ｂに対するデイジタル制御データ$ＣＯＮＴ_{D2}$を検出する場合について述べたが、本発明はこれに限らず、例えば図５５との対応部分に同一符号を付して示す図５６に示すように、ステップＳＴ４６における判断結果として、受信データに第２の応答手段２１Ｂに対するアナログ制御データＭＡ２が存在しない場合、第２の応答手段２１Ｂに対するデイジタル制御データ$ＣＯＮＴ_{D2}$を検出せずにステップＳＴ４１に戻つて新たなデータの受信を待ち受けるようにしても良い。

【０２００】このようにすれば、第２の応答手段２１Ｂに対するデイジタル制御データ$ＣＯＮＴ_{D2}$を割り当てないシステムにおいて、第２の応答手段２１Ｂをアナログ制御するか否かを判断することができる。

【０２０１】また図５４に示すデータにおいては、第１及び第２の応答手段２１Ａ及び２１Ｂに対するアナログ制御データＭＡ１及びＭＡ２（３ビツト）をそれぞれ１つずつ割り当てる場合について述べたが、本発明はこれに限らず、他の空き領域を用いて、第１及び第２の応答主端２１Ａ及び２１Ｂに対してそれぞれ複数のアナログ制御データを割り当てるようにしても良い。

【０２０２】このようにすれば、当該データを送出するタイミングが１フレーム（1/60秒）ごとであつても、１つの応答手段に対するアナログ制御データの数だけ、１フレーム期間を分割した期間ごとに応答手段に対して加える駆動電流値を変化させることができる。これにより一段とアナログ信号に近い電流値の変化によつて応答手

段を制御することができる。

【０２０３】また上述の第３の実施の形態においては、ゲーム機用操作装置１２０（図３６）に設けられた角速度センサ１５５から得られる角速度検出信号Ｓ１５５Ａ、Ｓ１５５Ｂ及びＳ１５５Ｃに基づいてゲーム機用操作装置１２０側のマイコンが当該ゲーム機用操作装置１２０の姿勢を判断し、当該姿勢に応じて振動部材１４０の振動を補正する場合について述べたが、本発明はこれに限らず、角速度センサからの角速度検出信号Ｓ１５５Ａ、Ｓ１５５Ｂ及びＳ１５５Ｃを一旦ゲーム機本体２７側に送信し、当該ゲーム機本体２７側のマイコン（ＣＰＵ）によつてゲーム機用操作装置１２０の姿勢を判断し、これによりゲーム機用操作装置１２０に送信する制御データ（図５４）の各振動データＤＸ、ＤＹ及びＤＺをゲーム機本体２７から送信する前に予め補正するようにしても良い。

【０２０４】また上述の第３の実施の形態においては、ゲーム機用操作装置１２０に設けられた角速度センサ１５５からの角速度検出信号Ｓ１５５Ａ、Ｓ１５５Ｂ及びＳ１５５Ｃに基づいて、振動部材１４０の各コイル１４３Ａ～１４３Ｆに加える駆動電流値を補正する場合について述べたが、本発明はこれに限らず、例えば角速度センサ１５５からの角速度検出信号Ｓ１５５Ａ、Ｓ１５５Ｂ及びＳ１５５Ｃに基づいてゲーム機用操作装置１２０の姿勢を判断し、当該姿勢の変化をユーザの操作ボタン入力に代えてゲーム機本体２７に送信するようにしても良い。

【０２０５】このようにすれば、ユーザはゲーム機用操作装置１２０の操作ボタンを操作することなく、ゲーム機用操作装置１２０の姿勢を変化させるだけで、例えばモニタ画面上の動作ターゲツトを所望の方向に移動させる等のコマンド入力を行うことができる。

【０２０６】（４）他の実施の形態

（４－１）上述の第１、第２及び第３の実施の形態においては、応答手段２１（５１、７０、７５、８５、１３０）を駆動する電源をゲーム機本体２７から供給する場合について述べたが、本発明はこれに限らず、図５７に示すように、応答手段２１（５１、７０、７５、８５、１３０）を駆動する電源をゲーム機用操作装置１（５０、１２０、１６０、１７０、１８０、１９０）側に設けるようにしても良い。

【０２０７】この場合、図５７に示すように、ゲーム機用操作装置１（５０、１２０、１６０、１７０、１８０、１９０）の操作が不自由にならない場所、例えばゲーム機本体２７と接続するコネクタ２０に近接した位置にモータ用又はコイル用の電源部９５を設け、内部に取り替え自由なバツテリ、例えば乾電池９６を備えるようにすれば良い。このような構成とすることにより、ゲーム機本体２７から電源を供給する必要がなくなり、ゲーム機本体２７は従来と同等の構成で良く、接続するケーブルのみを変更すれば良いことになる。

【０２０８】（４－２）上述の第１、第２及び第３の実施の形態においては、ゲーム機用操作装置１（５０、１２０、１６０、１７０、１８０、１９０）に振動を発生させることによつて利用者に臨場感を与える場合について述べたが、本発明はこれに限らず、例えば図５８に示すように、ゲーム機用操作装置１００の括れたスタートセレクト部６の前部側の空間、又は左手の掌でグリツプして支持する第１の操作支持部４、又は右手の掌でグリツプして支持する第２の操作支持部５の空間に応答手段である音声発生部１０１を設け、特に重低音を発生させるようにしても良い。

【０２０９】このような構成にすると、ゲーム機本体２７からのフイードバツクを、手元での音による体感として得ることができると共に、重低音にすれば振動をも同時に発生させることができ、音と振動とで臨場感を向上させることができる。

【０２１０】（４－３）上述の第１、第２及び第３の実施の形態においては、ゲーム機用操作装置１（５０、１２０、１６０、１７０、１８０、１９０）に振動を発生させることによつて利用者に臨場感を与える場合について述べたが、本発明はこれに限らず、例えば図５９に示すように、ゲーム機用操作装置１０５の括れたスタートセレクト部６の上面前方位置に応答手段として発光する部材、例えばＬＥＤ１０６を備えるようにしても良い。この場合、図５９においては、１個のＬＥＤを設けた構造となつているが、１個に限らず例えば一列に数個並べても良く、また、点滅状態としても良い。

【０２１１】このようにして応答手段として発光する部材（１０６）を設けることにより、動作ターゲツトがヒツトした時にゲーム機用操作装置１０５側でも、手元が光輝くことによりヒツトしたことの臨場感を得ることができる。

【０２１２】（４－４）なお、上記説明した実施の形態に限定されることなく、要はゲームを行う利用者が直接手に持つて使用する操作装置において、動作ターゲツトがヒツトした時に、何らかの応答する部材を組み込んだ構成全てに適用できることは云うまでもないことであり、また、上記実施の形態の動的伝達を音又は光とを適宜組み合わせてもよいことは言うまでもない。さらに上述の実施の形態においては、モニタの画面上に展開されるゲームに応じてゲーム機用操作装置が何らかの応答を行う場合について述べたが、本発明はこれに限らず、例えば利用者が音声のみによつて疑似体験をするようなゲーム機においても本発明を適用することができる。

【０２１３】

【発明の効果】上述のように本発明によれば、ゲーム上の動作ターゲツトの変化を視覚及び又は聴覚で体感したことに加えて、動作ターゲツトの変化に同期して、フイードバツクされた応答手段を操作装置自体に設けたこと

【図６０】

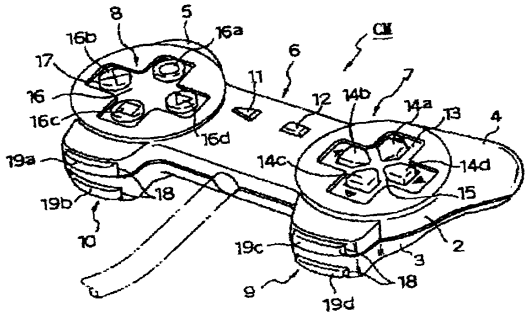

8
5
16b
16a
17
16
16c
16d
19a
19b
18
10
6
11
12
14b
7
14a
T3
4
14c
14d
15
2
19c
3
18
9
19d

図６０　従来例

特定のデータを補正することを特徴とする請求項１又は２に記載のゲーム機用操作装置。
【請求項１１】　ゲーム機本体と、
複数の操作ボタンを備えたゲーム機用操作装置と、をそれぞれ有したゲーム装置であって、
前記ゲーム機用操作装置には、前記複数の操作ボタンから入力される操作データを前記ゲーム機本体に送出するとともに前記ゲーム機本体から入力されるデータを受信する双方向の通信手段が設けられており、
更に、前記ゲーム機用操作装置は、前記ゲーム機用操作装置自体の所定の位置に設けられるとともに、前記ゲーム機本体から前記通信手段を通じて前記ゲーム機用操作装置に入力される特定のデータに応答して作動する応答手段を有し、
前記応答手段は、前記特定のデータに応答して、動的伝達、音、光の一種又は２種以上の組み合わせによる応答を行うように作動するものであることを特徴とするゲーム装置。
【請求項１２】　ゲーム機本体と、
複数の操作ボタンを備えたゲーム機用操作装置と、をそれぞれ有したゲーム装置であって、
前記ゲーム機用操作装置には、前記複数の操作ボタンから入力される操作データを前記ゲーム機本体に送出するとともに前記ゲーム機本体から入力されるデータを受信する双方向の通信手段が設けられており、
更に、前記ゲーム機用操作装置は、前記ゲーム機用操作装置自体の所定の位置に設けられるとともに、前記ゲーム機本体から前記通信手段を通じて前記ゲーム機用操作装置に入力される特定のデータに応答して作動する応答手段を有し、
前記応答手段は、前記特定のデータに応答して、前記ゲーム機用操作装置を操作するユーザの臨場感が向上するように作動するものであることを特徴とするゲーム機用操作装置。
【請求項１３】　前記特定のデータは、前記応答手段を指定する識別データ領域と、前記応答手段に対する複数の制御データ領域とを具えることを特徴とする請求項１１又は１２に記載のゲーム装置。
【請求項１４】　前記ゲーム装置は、前記応答手段を複数配設し、前記特定のデータの前記複数の制御データ領域に、前記複数の応答手段に対応した制御データを割り当てることを特徴とする請求項１３に記載のゲーム装置。
【請求項１５】　前記応答手段に与える前記応答手段の駆動信号波形は、前記ゲーム機本体から前記ゲーム機用操作装置に対して所定間隔で送信される前記特定のデータとして、当該データの送信間隔を複数に分割した各期間ごとの駆動波形値を前記ゲーム機本体から前記ゲーム機用操作装置に送信することにより、前記ゲーム機用操作装置側で生成することを特徴とする請求項１１又は１２に記載のゲーム装置。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００１３
【補正方法】変更
【補正内容】
【００１３】
【課題を解決するための手段】上記課題を解決するために、本発明に係るゲーム機用操作装置は、複数の操作ボタンを備えたゲーム機用操作装置であって、前記操作ボタンから入力される操作データを前記ゲーム機本体に送出するとともに前記ゲーム機本体から入力されるデータを受信する双方向の通信手段を有し、前記ゲーム機用操作装置自体の所定の位置に設けられるとともに、前記ゲーム機本体から前記通信手段を通じて前記ゲーム機用操作装置に入力される特定のデータに応答して作動する応答手段を有し、前記応答手段は、前記特定のデータに応答して、動的伝達、音、光の一種又は２種以上の組み合わせによる応答を行うように作動する構成とした。
【手続補正３】
【補正対象書類名】明細書
【補正対象項目名】００１４
【補正方法】変更
【補正内容】
【００１４】また、動的伝達は、モータの回転軸に偏心させて取り付けた回転部の回転による振動、または、コイルによつて駆動される振動子の振動によりなされることができる。

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Sheet 1 of 1

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U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	US-6,917,867 B2	07-12-2005	Huang et al.	
	2.	US- 2006/0119573	06-08-2006	Grant et al.	
		US-			
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
	3.	Patent Cooperation Treaty, International Preliminary Report on Patentability, International Application No. PCT/US2007/026355, mailed July 9, 2009.	

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. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST. 16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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.

Electronic Acknowledgement Receipt

EFS ID:	5781239
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Carl E. Sanders/Amber Johnson
Filer Authorized By:	Carl E. Sanders
Attorney Docket Number:	IMM253
Receipt Date:	28-JUL-2009
Filing Date:	27-DEC-2007
Time Stamp:	12:20:49
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	Miscellaneous Incoming Letter	Transmittal.pdf	34569 bb4d359f4c190b9218348e5513f1077dfb9b70a5	no	1

Warnings:	
Information:	

2	Transmittal Letter	Certification.pdf	25551 c09dce9f5fa5a1211590504a444f2c354d15ec62	no	1
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Filed (SB/08)	08A.pdf	86932 8ae07a443af095785de579e6d4687ccbe27fc51c	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	NPL Documents	PRP.pdf	74583 f07bbe9a1fbbc353267e85b13f0e6309abcbe2ee	no	5
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
			Total Files Size (in bytes):	221635	

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	**Virtual Detents through Vibrotactile Feedback**
Examiner	:	Unassigned
Art Unit	:	2629
Confirmation No.	:	2809

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

Information Disclosure Statement Letter;

Form PTO/SB/08a; and

Non-Patent Literature Document.

The Commissioner is hereby authorized to charge any deficiency to Deposit Account Number 16-1435.

Respectfully submitted,

Date: July 28, 2009

By: _____
Carl Sanders (Reg. No. 57,203)

KILPATRICK STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with The United States Patent Office via EFS-Web, on 7/28/2009.

_____
Amber C. Johnson

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Serial No.	:	11/965,046
For	:	**Virtual Detents through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Unassigned
Art Group	:	2629

Information Disclosure Statement Letter

This Information Disclosure Statement is being submitted prior to the mailing date of a first Office Action in this application. Accordingly, no fee is believed to be required. However, should any fees be due, the Commissioner is authorized to charge such fees to Deposit Account No. 16-1435.

Respectfully submitted,

Date: July 28, 2009

Carl Sanders (Reg. No. 57,203)

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.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 09/29/2010

PATENT DEPARTMENT (51851)
KILPATRICK STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2629	

MAIL DATE	DELIVERY MODE
09/29/2010	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)	
	11/965,046	LEVIN, MICHAEL D.	
	Examiner	Art Unit	
	JENNIFER ZUBAJLO	2629	

-- 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 *12/27/07*.

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) *1-19* 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) *1-19* 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 *27 December 2007* 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 *7/17/08 & 7/28/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. 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.

2. Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danny A. Grant (Pub. No.: US 2006/0119573 A1) in view of Xiaodong Huang (Patent No.: US 6,917,867 B2).

As to claims 1, 10 and 15, Grant teaches a method (and system and corresponding program code, see [0006]) comprising: receiving an input signal comprising information associated with a manipulation of an input device (see [0016]), and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device (see [0017])

Grant does not specifically teach the vibrotactile effect comprising a virtual detent.

Huang teaches the vibrotactile effect comprising a virtual detent (see col 4, ln 25-48).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Huang because adding

virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 9 and 14, Grant teaches a method (and corresponding program code, see [0006]) comprising: detecting a change in position of an input device (detect incoming call, see [0016]); and generating a detent signal based at least in part on the change in position (generates driving signal, see [0016]), the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device (see pare [0017]).

Grant does not specifically teach the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

Huang teaches the vibrotactite effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal (see col 4, ln 25-48).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Huang because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 2 and 11, Grant further teaches generating a system signal associated with a system to be manipulated (see [0016]), the system signal based at least in part on the input signal (see [0016]), and wherein generating a system signal

and generating the vibrotactile signal occur substantially simultaneously (see [0016]-[0017]).

As to claim 3, Grant further teaches wherein the vibrotactile signal is based at least in part on the input signal (see [0016]).

As to claim 4, Huang further teaches wherein the vibrotactile signal is further based in part on the status of the input device (see col 2, ln 51 - col 3, ln 4).

As to claims 5 and 12, Grant further teaches determining whether to generate a signal (see [0016]-[0017] and [0021]).

As to claim 6, Grant further teaches wherein determining whether to generate a signal is based at least in part on a statue of the system to be manipulated (whether cell phone is receiving a call, see [0016]-[0017]).

As to claim 7, Huang further teaches determining one of a plurality of virtual detente to generate (see col 5, ln 63-67).

As to claim 8, Huang further teaches wherein the information associated with the manipulation of an input device comprises information associated with a rotation of a rotary knob or the sliding of a fader (see col 3, ln 56 - col 4, ln 3 and col 4, ln 54-60).

As to claim 13, Huang further teaches determining a virtual detent to generate (col 4, In 25-46 end cot 5, In 63-67).

As to claim 16, Grant further teaches wherein the processor is further configured to control a system based at least in part on a manipulation of the input device (see [0016] and Fig 1).

As to claim 17, Huang further teaches wherein the processor is further configured to determine whether to generate a detent signal (see col 4. In 25-48 and col 5, In 63-67).

As to claim 18, Grant further discloses wherein the at least one actuator is coupled to a housing of the input device (see [0046] and Fig 1).

As per claim 19, Huang further discloses wherein the input device comprises a sensor (abstract).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER ZUBAJLO whose telephone number is

(571)270-1551. The examiner can normally be reached on Monday-Friday, 8 am - 5 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amare Mengistu can be reached on (571) 272-7674. 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.

/Jennifer Zubajlo/
Examiner, Art Unit 2629
9/20/10

/Amare Mengistu/

Supervisory Patent Examiner, Art Unit 2629

Notice of References Cited	Application/Control No. 11/965,046	Applicant(s)/Patent Under Reexamination LEVIN, MICHAEL D.	
	Examiner JENNIFER ZUBAJLO	Art Unit 2629	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0119573	06-2006	Grant et al.	345/156
*	B	US-6,917,867	07-2005	Huang et al.	701/50
	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
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

✓	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	09/20/2010								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

SEARCHED			
Class	Subclass	Date	Examiner
345	156	9/20/10	JZ

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search	9/20/10	JZ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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BIB DATA SHEET

CONFIRMATION NO. 2809

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/965,046	12/27/2007	345	2629	IMM253

APPLICANTS
Michael D. Levin, Los Altos, CA;

**** CONTINUING DATA **************************
This appln claims benefit of 60/877,333 12/27/2006

**** FOREIGN APPLICATIONS **************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
01/28/2008

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /JENNIFER L ZUBAJLO/ Examiner's Signature	☐ Met after Allowance /JZ/ Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	10	19	5

ADDRESS

PATENT DEPARTMENT (51851)
KILPATRICK STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101
UNITED STATES

TITLE

Virtual Detents Through Vibrotactile Feedback

FILING FEE RECEIVED	FEES: Authority has been given in Paper
1450	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

PTO/SB/08a (04-07)
Approved for use through 09/30/2007. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
/J.Z./	1.	3,618,070	11/02/1971	Kagan	
	2.	3,911,416	10/07/1975	Feder	
	3.	4,028,502	06/07/1977	Moricca et al.	
	4.	4,127,752	11/28/1978	Lowthorp	
	5.	4,227,319	10/14/1980	Guy et al.	
	6.	4,262,549	04/021/1981	Schwellenbach	
	7.	4,278,920	07/14/1981	Ruoff, Jr.	
	8.	4,333,070	06/01/1982	Barnes	
	9.	4,352,091	09/28/1982	Yamasaki	
	10.	4,421,953	12/20/1983	Zielinski	
	11.	4,436,188	03/13/1984	Jones	
	12.	4,464,117	08/07/1984	Foerst	
	13.	4,484,191	11/20/1984	Vavra	
	14.	4,581,972	04/15/1986	Hoshino	
	15.	4,603,284	07/29/1986	Perzley	
	16.	4,692,756	09/08/1987	Clark	
	17.	4,782,327	11/01/1988	Kley et al.	
	18.	4,791,416	12/13/1988	Adler	
	19.	4,794,392	12/27/1988	Selinko	
	20.	4,798,919	01/17/1989	Miessler et al.	
	21.	4,821,030	04/11/1989	Batson et al.	
	22.	4,823,634	04/25/1989	Culver	
	23.	4,853,674	08/01/1989	Kiss	
	24.	4,918,438	04/17/1990	Yamasaki	
	25.	4,931,765	06/05/1990	Rollins et al.	
	26.	4,964,004	10/16/1990	Barker	
	27.	4,983,786	01/08/1991	Stevens et al.	
	28.	5,003,984	04/02/1991	Muraki et al.	
	29.	5,053,585	10/01/1991	Yaniger	
	30.	5,086,296	02/04/1992	Clark	
	31.	5,117,449	05/26/1992	Metroka et al.	
	32.	5,165,897	11/24/1992	Johnson	
	33.	5,175,459	12/29/1992	Danial et al.	
	34.	5,189,389	02/23/1993	DeLuca et al.	
	35.	5,237,327	08/17/1993	Saitoh et al.	
	36.	5,241,308	08/31/1993	Young	
	37.	5,283,970	02/08/1994	Aigner	
	38.	5,293,158	03/08/1994	Soma	
	39.	5,355,148	10/11/1994	Anderson	
	40.	5,366,376	11/22/1994	Copperman et al.	
	41.	5,368,484	11/29/1994	Copperman et al.	
	42.	5,414,337	05/09/1995	Schuler	
	43.	5,436,622	07/25/1995	Gutman et al.	
	44.	5,437,607	08/01/1995	Taylor	
	45.	5,459,382	10/17/1995	Jacobus et al.	

Examiner Signature	/Jennifer Zubajlo/	Date Considered	09/20/2010

PTO/SB/08a (04-07)
Approved for use through 09/30/2007. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 2 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

U.S. PATENT DOCUMENTS

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/J.Z./	46.	5,482,051	01/09/1996	Reddy et al.	
	47.	5,489,812	02/06/1996	Furuhata et al.	
	48.	5,496,174	03/05/1996	Garner	
	49.	5,506,605	04/09/1996	Paley	
	50.	5,508,688	04/16/1996	Mochizuki	
	51.	5,521,336	05/28/1996	Buchanan et al.	
	52.	5,729,249	03/17/1998	Yasutake	
	53.	5,767,457	06/16/1998	Gergheide et al.	
	54.	5,887,995	03/30/1999	Holehan	
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Examiner Signature	/Jennifer Zubajlo/	Date Considered	09/20/2010

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Sheet 3 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
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Sheet 4 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
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Examiner Initials *	Cite No.[1]	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[2]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 5 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

NON PATENT LITERATURE DOCUMENTS

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 6 of 6

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Unknown
Attorney Docket Number	IMM253

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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 [2]
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Examiner Signature	/Jennifer Zubajlo/	Date Considered	09/20/2010

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Sheet 1 of 1

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Levin
Art Unit	2629
Examiner Name	Unassigned
Attorney Docket Number	IMM253

U.S. PATENT DOCUMENTS

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/J.Z./	1.	US-6,917,867 B2	07-12-2005	Huang et al.	
/J.Z./	2.	US- 2006/0119573	06-08-2006	Grant et al.	
		US-			
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/J.Z./	3.	Patent Cooperation Treaty, International Preliminary Report on Patentability, International Application No. PCT/US2007/026355, mailed July 9, 2009.	

Examiner Signature	/Jennifer Zubajlo/	Date Considered	09/20/2010

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Attorney Docket IMM253 (51851/339922)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629

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

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION

Sir:

The following Amendment and Remarks are submitted in response to the Office Action mailed September 29, 2010.

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

Remarks begin on page 6 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device, wherein the input device comprises a touch-pad; and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent.

2. (Original) The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. (Original) The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. (Original) The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. (Currently Amended) The method of claim 1, further comprising determining whether to generate a vibrotactile signal.

6. (Currently Amended) The method of claim 5, wherein determining whether to generate a vibrotactile signal is based at least in part on a status of the system to be manipulated.

7. (Original) The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

8. (Cancelled)

9. (Currently Amended) A method comprising:

detecting a change in position of an input device, wherein the input device comprises a touch-pad; and

generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device, wherein the input device comprises a touch-pad; and

program code for generating a detent signal configured to cause an

actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent.

11. (Original) The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. (Original) The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. (Original) The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device, wherein the input device comprises a touch-pad; and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. (Currently Amended) A system comprising:

an input device, wherein the input device comprises a touch-pad;

a processor in communication with the input device, the processor configured to receive an input signal, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising a virtual detent.

16. (Original) The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. (Original) The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. (Original) The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. (Original) The system of claim 15, wherein the input device comprises a sensor.

REMARKS

I. General

Applicants file this paper in response to the Non-Final Office Action mailed September 29, 2010. Claims 1-19 are currently pending in the present application. The Office Action rejects 1-19 under 35 USC § 103(a) as allegedly obvious over the combination of U.S. Pub. No. 2006/0119573 to Grant (hereinafter "Grant") in combination with U.S. 6,917,867 to Huang (hereinafter "Huang"). In light of the amendments and remarks herein, Applicants respectfully request allowance of all pending claims.

II. Claim Amendments

This paper amends claims 1, 9, 10, 14, and 15 to recite in part: "wherein the input device comprises a touch-pad . . . ." Support for this amendment may be found at least at Fig. 3 and paragraphs [0068] and [0070] of U.S. Pub. No. 2008/0158149. Thus, no new matter is added by this amendment.

This paper amends claims 5-6 to correct minor typographical errors. No new matter is added by these amendments.

III. Claims 1-19 Rejected Under 35 USC § 103(a)

At pages 2-3 the Office Action rejects claim 1 under 35 USC § 103(a) over Grant in combination with Huang. In order to advance prosecution, Applicants have amended claim 1 to recite in part "wherein the input device comprises a touch-pad . . . ." In view of this amendment, Applicants respectfully assert that the Office Action has failed to establish *prima facie* obviousness. To establish *prima facie* obviousness of a claimed invention under 35 U.S.C. § 103, the Office Action must show, either from the references themselves or in the knowledge generally available to one of ordinary skill in the art, that the cited references disclose or suggest each claimed element and that it would have been obvious under *Graham v. John Deere Co.* to modify the references or to combine teachings in the references to arrive at the claimed invention. *See* MPEP §§ 2141 and

2143; *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d at 1395-96.

Neither Grant nor Huang disclose or suggest "wherein the input device comprises a touch-pad." The Office Action cites paragraph [0016] of Grant as disclosing an input device. However, paragraph [0016] of Grant does not disclose or suggest using a touch-pad as an input device. Further, Grant's deficiency is not cured by Huang which describes an operator interface mechanism. Huang's operator interface mechanism is shown as item 12 in Figure 1, and is described as including a first shaft 14. *See* Huang Col. 3:56-62. Thus, Huang's interface mechanism is a mechanical manipulandum, which does not disclose or suggest a touch-screen as recited by amended claim 1. Thus, the Office Action has failed to establish *prima facie* obviousness with respect to amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 1. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 2-7, which depend from and further limit claim 1, and are thus allowable for at least the same reasons as claim 1. This paper cancels claim 8, thus rendering its rejection moot.

Applicants have amended claim 9 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 9 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 9.

Applicants have amended claim 10 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 10 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 10. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

Applicants have amended claim 14 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 14 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 14.

Applicants have amended claim 15 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 15 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 15. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 16-19, which depend from and further limit claim 15, and are thus allowable for at least the same reasons as claim 15.

CONCLUSION

Applicants respectfully assert that in view of the amendments and remarks above, all pending claims are allowable and Applicants respectfully request the allowance of all claims.

Should the Examiner have any comments, questions, or suggestions of a nature necessary to expedite the prosecution of the application, or to place the case in condition for allowance, the Examiner is courteously requested to telephone the undersigned at the number listed below.

Respectfully submitted,

Date: 1/5/2011

Michael Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND &
STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101
(336) 607-7391 (voice)
(336) 734-2756 (fax)

Electronic Patent Application Fee Transmittal

Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Michael T. Morlock/Laura Smith
Attorney Docket Number:	IMM253

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:				
Extension - 1 month with $0 paid	1251	1	130	130

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**130**

Electronic Acknowledgement Receipt	
EFS ID:	9166705
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Laura Smith
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	05-JAN-2011
Filing Date:	27-DEC-2007
Time Stamp:	11:59:09
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$130
RAM confirmation Number	8177
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Miscellaneous Incoming Letter	Transmittal339922.pdf	44186 186cb5df0c7370d02ce771fcc73744e449676193	no	1
Warnings:					
Information:					
2	Extension of Time	ExtensionofTime339922.pdf	72543 31dcb6b7ad06df78dc43217cf7762322a405f572	no	1
Warnings:					
Information:					
3	Amendment Copy Claims/Response to Suggested Claims	Response339922.pdf	291507 934f84162f9835f264bb76c168b85702f5cb90ec	no	8
Warnings:					
Information:					
4	Fee Worksheet (PTO-875)	fee-info.pdf	29796 f26aaa06045ecc5cde929eefe3983c903af047d7	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	438032		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	Virtual Detents Through Vibrotactile Feedback
Examiner	:	Zubajlo, Jennifer L.
Art Unit	:	2629
Confirmation No.	:	2809

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

1. Transmittal;
2. Petition for Extension of Time (1 month);
3. Amendment and Response to Non-Final Office Action; and
4. EFS-Web Payment in the amount of $130.00

Shown below are the fees for the presentation of the amended claims:

	Claims Remaining	Highest # Previously Paid For	Extra	Rate	Fee
TOTAL	18	20	0	$ 52	$ 0
Ind. Cls.	5	5	0	$220	$ 0
Multiple Dependent Claim Added..... NO					
				TOTAL	$0

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 11-0855.

Respectfully submitted,

Date: 1/5/2011

By: _____
Michael T. Morlock (Reg. No. 62,245)

KILPATRICK TOWNSEND &
STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web, on January 5, 2011.

_____
Laura J. Smith

US2000 11971747.1

PTO/SB/22 (07-09)
Approved for use through 07/31/2012. 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 it displays a valid OMB control number.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) **FY 2009** ***(Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).)***	Docket Number (Optional) IMM253 (51851/339922)
Application Number 11/965,046	Filed December 27, 2007
For Virtual Detents Through Vibrotactile Feedback	
Art Unit 2629	Examiner Zubajlo, Jennifer L.

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))	$130	$65	$ 130.00
☐ Two months (37 CFR 1.17(a)(2))	$490	$245	$
☐ Three months (37 CFR 1.17(a)(3))	$1110	$555	$
☐ Four months (37 CFR 1.17(a)(4))	$1730	$865	$
☐ Five months (37 CFR 1.17(a)(5))	$2350	$1175	$

☐ 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 11-0855.

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 62,245

☐ attorney or agent under 37 CFR 1.34.
Registration number if acting under 37 CFR 1.34 _____

Signature	Date
	1/5/2011
Michael Morlock	336/607-7300
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 _____ 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.

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	Filing Date	☐ To be Mailed
11/965,046	12/27/2007	

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

AMENDMENT	01/05/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 18	Minus	** 20	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 5	Minus	***5	= 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

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) 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:
/Susan K. 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.

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.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 03/29/2011

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	PAPER NUMBER
2629	

MAIL DATE	DELIVERY MODE
03/29/2011	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)	
	11/965,046	LEVIN, MICHAEL D.	
	Examiner	Art Unit	
	JENNIFER ZUBAJLO	2629	

-- 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 *05 January 2011*.

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) *1-19* 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) *1-19* 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

Claim Rejections - 35 USC § 103

1. 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.

2. Claims 1-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danny A. Grant (Pub. No.: US 2006/0119573 A1) in view of Xiaodong Huang (Patent No.: US 6,917,867 B2).

As to claims 1, 10 and 15, Grant teaches a method (and system and corresponding program code, see [0006]) comprising: receiving an input signal comprising information associated with a manipulation of an input device, wherein the input device comprises a touch-pad (see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads), and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device (see [0017]).

Grant does not specifically teach the vibrotactile effect comprising a virtual detent.

Huang teaches the vibrotactile effect comprising a virtual detent (see col 4, ln 25-48).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Huang because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 9 and 14, Grant teaches a method (and corresponding program code, see [0006]) comprising: detecting a change in position of an input device, wherein the input device comprises a touch-pad (detect incoming call, see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads); and generating a detent signal based at least in part on the change in position (generates driving signal, see [0016]), the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device (see pare [0017]).

Grant does not specifically teach the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

Huang teaches the vibrotactite effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal (see col 4, ln 25-48).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Huang because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 2 and 11, Grant further teaches generating a system signal associated with a system to be manipulated (see [0016]), the system signal based at least in part on the input signal (see [0016]), and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously (see [0016]-[0017]).

As to claim 3, Grant further teaches wherein the vibrotactile signal is based at least in part on the input signal (see [0016]).

As to claim 4, Huang further teaches wherein the vibrotactile signal is further based in part on the status of the input device (see col 2, ln 51 - col 3, ln 4).

As to claims 5 and 12, Grant further teaches determining whether to generate a vibrotactile signal (see [0016]-[0017] and [0021]).

As to claim 6, Grant further teaches wherein determining whether to generate a vibrotactile signal is based at least in part on a statue of the system to be manipulated (whether cell phone is receiving a call, see [0016]-[0017]).

As to claim 7, Huang further teaches determining one of a plurality of virtual detente to generate (see col 5, ln 63-67).

As to claim 13, Huang further teaches determining a virtual detent to generate (col 4, ln 25-46 end cot 5, ln 63-67).

As to claim 16, Grant further teaches wherein the processor is further configured to control a system based at least in part on a manipulation of the input device (see [0016] and Fig 1).

As to claim 17, Huang further teaches wherein the processor is further configured to determine whether to generate a detent signal (see col 4. ln 25-48 and col 5, ln 63-67).

As to claim 18, Grant further discloses wherein the at least one actuator is coupled to a housing of the input device (see [0046] and Fig 1).

As per claim 19, Huang further discloses wherein the input device comprises a sensor (abstract).

Response to Arguments

3. Applicant's arguments filed 1/5/11 have been fully considered but they are not persuasive.

Applicant argues that "Neither Grant nor Huang disclose or suggest wherein the input device comprises a touch-pad." Examiner disagrees. Grant paragraph [0046] discloses "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" and note that it is well known in the art for cell phones and PDAs to comprise touch-pads. Therefore, the teaching of a touch-pad is obvious.

Conclusion

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). 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 date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER ZUBAJLO whose telephone number is (571)270-1551. The examiner can normally be reached on Monday-Friday, 8 am - 5 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amare Mengistu can be reached on (571) 272-7674. 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.

/Jennifer Zubajlo/
Examiner, Art Unit 2629
3/15/11

/Amare Mengistu/

Supervisory Patent Examiner, Art Unit 2629

Notice of References Cited	Application/Control No. 11/965,046	Applicant(s)/Patent Under Reexamination LEVIN, MICHAEL D.	
	Examiner JENNIFER ZUBAJLO	Art Unit 2629	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0119573	06-2006	Grant et al.	345/156
*	B	US-6,917,867	07-2005	Huang et al.	701/50
	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
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

✓	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	09/20/2010	03/15/2011							
	1	✓	✓							
	2	✓	✓							
	3	✓	✓							
	4	✓	✓							
	5	✓	✓							
	6	✓	✓							
	7	✓	✓							
	8	✓	✓							
	9	✓	✓							
	10	✓	✓							
	11	✓	✓							
	12	✓	✓							
	13	✓	✓							
	14	✓	✓							
	15	✓	✓							
	16	✓	✓							
	17	✓	✓							
	18	✓	✓							
	19	✓	✓							

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

SEARCHED			
Class	Subclass	Date	Examiner
345	156-179	3/15/11	JZ

SEARCH NOTES		
Search Notes	Date	Examiner
EAST Search	3/15/11	JZ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

Attorney Docket IMM253 (51851/339922)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629

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

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

The following Amendment and Remarks are submitted in response to the Office Action mailed March 29, 2011.

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

Remarks begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device configured to control a system, wherein the input device comprises a touch-pad;

receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent.

2. (Original) The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. (Original) The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. (Original) The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. (Previously Presented) The method of claim 1, further comprising determining whether to generate a vibrotactile signal.

6. (Previously Presented) The method of claim 5, wherein determining whether to generate a vibrotactile signal is based at least in part on a status of the system to be manipulated.

7. (Original) The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

8. (Cancelled)

9. (Currently Amended) A method comprising:

detecting a change in position of an input device configured to control a system, wherein the input device comprises a touch-pad;

receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; and

generating a detent signal based at least in part on the detent profile and the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device configured to control a system, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent.

11. (Original) The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. (Original) The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. (Original) The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device configured to control a system, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. (Currently Amended) A system comprising:

an input device configured to control a system, wherein the input device comprises a touch-pad;

a processor in communication with the input device, the processor configured to receive an input signal and a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent.

16. (Original) The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. (Original) The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. (Original) The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. (Original) The system of claim 15, wherein the input device comprises a sensor.

20. (New) The system of claim 1, wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile.

REMARKS

I. General

Applicants file this paper in response to the Final Office Action mailed March 29, 2011. Claims 1-7 and 9-19 are currently pending in the present application, claim 8 was previously cancelled. The Office Action rejects 1-7 and 9-19 under 35 USC § 103(a) as allegedly obvious over the combination of U.S. Pub. No. 2006/0119573 to Grant (hereinafter "Grant") in combination with U.S. 6,917,867 to Huang (hereinafter "Huang"). In light of the amendments and remarks herein, Applicants respectfully request allowance of all pending claims.

II. Claim Amendments and New Claims

This paper amends claims 1, 9, 10, 14, and 15 to recite in part a limitation similar to: "an input device configured to control a system" and "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." Support for these amendments may be found at least at paragraphs [0035], [0036], and [0076] of U.S. Pub. No. 2008/0158149. Thus, no new matter is added by this amendment.

This paper adds new claim 20, support for new claim 20 may be found at least at paragraphs [0035], [0036], and [0076] of U.S. Pub. No. 2008/0158149. Thus, no new matter is added by new claim 20.

III. Claims 1-19 Rejected Under 35 USC § 103(a)

At pages 2-3 the Office Action rejects claim 1 under 35 USC § 103(a) over Grant in combination with Huang. In order to advance prosecution, Applicants have amended claim 1 to recite in part "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." In view of this amendment, Applicants respectfully assert that the Office Action has failed to establish *prima facie* obviousness. To establish *prima facie* obviousness of a claimed invention under 35 U.S.C. § 103, the Office Action must show, either from the references

themselves or in the knowledge generally available to one of ordinary skill in the art, that the cited references disclose or suggest each claimed element and that it would have been obvious under *Graham v. John Deere Co.* to modify the references or to combine teachings in the references to arrive at the claimed invention. *See* MPEP §§ 2141 and 2143; *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d at 1395-96.

Neither Grant nor Huang disclose or suggest "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." For example, as the Office Action states, "Grant does not specifically teach the vibrotactile effect comprising a virtual detent." Office Action, p. 2. Grant's deficiency is not cured by Huang, which describes applying a haptic effect to an operator interface mechanism. *See* Huang Col. 3:56-62. Huang teaches that this haptic effect may comprise a detent function. *See* Huang Col. 1:50. But Huang does not disclose or suggest "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." Rather, Huang discloses that "[t]he brake controller 18 may be programmed with a map to provide a detent or virtual detent function which correlates the brake position signal with the position signal and/or the other sensor signals." Huang Col. 4:25-28. Thus, Huang discloses a virtual detent function associated with a *position signal*. In contrast, amended claim 1 recites a detent profile associated with *a system* controlled by the interface device. For example, as described in paragraph [0076] of U.S. Pub. No. 2008/0158149, one detent profile may be associated with an audio system controlled by the input device, and another type of profile may be used when a different system (e.g. a temperature system) is being controlled by the input device.

Thus, the Office Action has failed to establish *prima facie* obviousness with respect to amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 1. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 2-7, which depend from and further limit claim 1, and are thus allowable for at least the same reasons as claim 1.

Applicants have amended claim 9 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 9 is allowable for at least the same reasons

as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 9.

Applicants have amended claim 10 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 10 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 10. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

Applicants have amended claim 14 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 14 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 14.

Applicants have amended claim 15 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 15 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 15. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 16-19, which depend from and further limit claim 15, and are thus allowable for at least the same reasons as claim 15.

CONCLUSION

Applicants respectfully assert that in view of the amendments and remarks above, all pending claims are allowable and Applicants respectfully request the allowance of all claims.

Should the Examiner have any comments, questions, or suggestions of a nature necessary to expedite the prosecution of the application, or to place the case in condition for allowance, the Examiner is courteously requested to telephone the undersigned at the number listed below.

Respectfully submitted,

Date: 5/31/2011

Michael Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND &
STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101
(336) 607-7391 (voice)
(336) 734-2756 (fax)

Electronic Acknowledgement Receipt

EFS ID:	10197060
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Laura Smith
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	31-MAY-2011
Filing Date:	27-DEC-2007
Time Stamp:	15:47:03
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	Miscellaneous Incoming Letter	Transmittel339922.pdf	45615 ead582638103aa35bb969e4c87191cb0bea79589	no	1

Warnings:	
Information:	

2	Amendment After Final	Response339922.pdf	369664 5ee47237ec872a7cf67730beae0f7aa9e4d2c41c	no	10

Warnings:	
Information:	
Total Files Size (in bytes):	415279

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	Virtual Detents Through Vibrotactile Feedback
Examiner	:	Zubajlo, Jennifer L.
Art Unit	:	2629
Confirmation No.	:	2809

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

1. Transmittal; and
2. Amendment and Response to Final Office Action

Shown below are the fees for the presentation of the amended claims:

	Claims Remaining	Highest # Previously Paid For	Extra	Rate	Fee
TOTAL	19	20	0	$ 52	$ 0
Ind. Cls.	5	5	0	$220	$ 0
Multiple Dependent Claim Added..... NO					
				TOTAL	$0

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 11-0855.

Respectfully submitted,

Date: 5/31/2011

By: _____
Michael T. Morlock (Reg. No. 62,245)

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web, on May 31, 2011.

Laura J. Smith

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	Filing Date	☒ To be Mailed
11/965,046	12/27/2007	

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	
☐ 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

AMENDMENT	05/31/2011	(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 ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 5	Minus	***5	= 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

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	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:
/KATRINA HARLING/

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.

Please do not enter.
/JZ/
6/2/11

Attorney Docket IMM253 (51851/339922)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629

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

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

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

Remarks begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

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generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent.

2. (Original) The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. (Original) The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. (Original) The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. (Previously Presented) The method of claim 1, further comprising determining whether to generate a vibrotactile signal.

6. (Previously Presented) The method of claim 5, wherein determining whether to generate a vibrotactile signal is based at least in part on a status of the system to be manipulated.

7. (Original) The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

8. (Cancelled)

9. (Currently Amended) A method comprising:

detecting a change in position of an input device configured to control a system, wherein the input device comprises a touch-pad;

receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; and

generating a detent signal based at least in part on the detent profile and the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device configured to control a system, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent.

11. (Original) The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. (Original) The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. (Original) The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device configured to control a system, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. (Currently Amended) A system comprising:

an input device configured to control a system, wherein the input device comprises a touch-pad;

a processor in communication with the input device, the processor configured to receive an input signal and a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising [[a]] the virtual detent.

16. (Original) The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. (Original) The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. (Original) The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. (Original) The system of claim 15, wherein the input device comprises a sensor.

20. (New) The system of claim 1, wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile.

REMARKS

I. General

Applicants file this paper in response to the Final Office Action mailed March 29, 2011. Claims 1-7 and 9-19 are currently pending in the present application, claim 8 was previously cancelled. The Office Action rejects 1-7 and 9-19 under 35 USC § 103(a) as allegedly obvious over the combination of U.S. Pub. No. 2006/0119573 to Grant (hereinafter "Grant") in combination with U.S. 6,917,867 to Huang (hereinafter "Huang"). In light of the amendments and remarks herein, Applicants respectfully request allowance of all pending claims.

II. Claim Amendments and New Claims

This paper amends claims 1, 9, 10, 14, and 15 to recite in part a limitation similar to: "an input device configured to control a system" and "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." Support for these amendments may be found at least at paragraphs [0035], [0036], and [0076] of U.S. Pub. No. 2008/0158149. Thus, no new matter is added by this amendment.

This paper adds new claim 20, support for new claim 20 may be found at least at paragraphs [0035], [0036], and [0076] of U.S. Pub. No. 2008/0158149. Thus, no new matter is added by new claim 20.

III. Claims 1-19 Rejected Under 35 USC § 103(a)

At pages 2-3 the Office Action rejects claim 1 under 35 USC § 103(a) over Grant in combination with Huang. In order to advance prosecution, Applicants have amended claim 1 to recite in part "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." In view of this amendment, Applicants respectfully assert that the Office Action has failed to establish *prima facie* obviousness. To establish *prima facie* obviousness of a claimed invention under 35 U.S.C. § 103, the Office Action must show, either from the references

themselves or in the knowledge generally available to one of ordinary skill in the art, that the cited references disclose or suggest each claimed element and that it would have been obvious under *Graham v. John Deere Co.* to modify the references or to combine teachings in the references to arrive at the claimed invention. *See* MPEP §§ 2141 and 2143; *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d at 1395-96.

Neither Grant nor Huang disclose or suggest "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." For example, as the Office Action states, "Grant does not specifically teach the vibrotactile effect comprising a virtual detent." Office Action, p. 2. Grant's deficiency is not cured by Huang, which describes applying a haptic effect to an operator interface mechanism. *See* Huang Col. 3:56-62. Huang teaches that this haptic effect may comprise a detent function. *See* Huang Col. 1:50. But Huang does not disclose or suggest "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." Rather, Huang discloses that "[t]he brake controller 18 may be programmed with a map to provide a detent or virtual detent function which correlates the brake position signal with the position signal and/or the other sensor signals." Huang Col. 4:25-28. Thus, Huang discloses a virtual detent function associated with a *position signal*. In contrast, amended claim 1 recites a detent profile associated with *a system* controlled by the interface device. For example, as described in paragraph [0076] of U.S. Pub. No. 2008/0158149, one detent profile may be associated with an audio system controlled by the input device, and another type of profile may be used when a different system (e.g. a temperature system) is being controlled by the input device.

Thus, the Office Action has failed to establish *prima facie* obviousness with respect to amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 1. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 2-7, which depend from and further limit claim 1, and are thus allowable for at least the same reasons as claim 1.

Applicants have amended claim 9 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 9 is allowable for at least the same reasons

as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 9.

Applicants have amended claim 10 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 10 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 10. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

Applicants have amended claim 14 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 14 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 14.

Applicants have amended claim 15 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 15 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 15. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 16-19, which depend from and further limit claim 15, and are thus allowable for at least the same reasons as claim 15.

CONCLUSION

Applicants respectfully assert that in view of the amendments and remarks above, all pending claims are allowable and Applicants respectfully request the allowance of all claims.

Should the Examiner have any comments, questions, or suggestions of a nature necessary to expedite the prosecution of the application, or to place the case in condition for allowance, the Examiner is courteously requested to telephone the undersigned at the number listed below.

Respectfully submitted,

Date: 5/31/2011

Michael Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND &
STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101
(336) 607-7391 (voice)
(336) 734-2756 (fax)

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.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 06/02/2011

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2629	

MAIL DATE	DELIVERY MODE
06/02/2011	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.

Advisory Action Before the Filing of an Appeal Brief	**Application No.** 11/965,046	**Applicant(s)** LEVIN, MICHAEL D.	
	Examiner JENNIFER ZUBAJLO	**Art Unit** 2629	

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

THE REPLY FILED 31 May 2011 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

1. ☒ The reply was filed after a final rejection, but prior to or on the same day as filing a Notice of Appeal. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   Examiner Note: If box 1 is checked, check either box (a) or (b). ONLY CHECK BOX (b) WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendment(s) filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   (a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   (b) ☐ They raise the issue of new matter (see NOTE below);
   (c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   (d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): a) ☒ will not be entered, or b) ☐ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.
   The status of the claim(s) is (or will be) as follows:
   Claim(s) allowed: _____.
   Claim(s) objected to: _____.
   Claim(s) rejected: *1-19*.
   Claim(s) withdrawn from consideration: _____.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after a final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing a Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing a good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: same reasons as set forth in previous office action.
12. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
13. ☐ Other: _____.

/Amare Mengistu/
Supervisory Patent Examiner, Art Unit 2629

/Jennifer Zubajlo/
Examiner, Art Unit 2629
6/2/11

Continuation of 3. NOTE: Newly added claim limitations "configured to control a system" and "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a vitual detent" require further search and consideration.

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
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	11/965,046	Filing Date	2007-12-27	Docket Number (if applicable)	IMM253	Art Unit	2629
First Named Inventor	Michael D. Levin			Examiner Name	Zubajlo, Jennifer L.		

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 Amendment and Response to Final Office Action e-filed May 31, 2011

☐ 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 110855

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

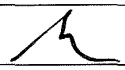
☒ Patent Practitioner Signature

☐ Applicant Signature

EFS - Web 2.1.15

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

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Signature of Registered U.S. Patent Practitioner			
Signature		Date (YYYY-MM-DD)	2011-06-29
Name	Michael Morlock	Registration Number	62245

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.

Electronic Patent Application Fee Transmittal	
Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Michael T. Morlock/Laura Smith
Attorney Docket Number:	IMM253
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**

Electronic Acknowledgement Receipt	
EFS ID:	10414197
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Laura Smith
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	29-JUN-2011
Filing Date:	27-DEC-2007
Time Stamp:	13:55:17
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	152
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Miscellaneous Incoming Letter	Transmittal339922.pdf	37036 c1a1526177240b10c17122aa918f28effd54bba6	no	1
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	RCE339922.pdf	90009 871bce11553187e808bf426e66f2a87620d51ab6	no	2
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30013 4705585e9bc586a6a389a9a8e4dcd071df72ad03	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	157058	

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	Virtual Detents Through Vibrotactile Feedback
Examiner	:	Zubajlo, Jennifer L.
Art Unit	:	2629
Confirmation No.	:	2809

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

1. Transmittal;
2. Request for Continued Examination (RCE) Transmittal; and
3. EFS-Web Payment in the amount of $810.00

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 11-0855.

Respectfully submitted,

Date: 6/29/2011

By: _____
Michael T. Morlock (Reg. No. 62,245)

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web, on June 29, 2011.

Laura J. Smith

PTO/SB/06 (07-06)
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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	Filing Date	☐ To be Mailed
11/965,046	12/27/2007	

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

AMENDMENT	06/29/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 5	Minus	***5	= 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

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	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:
/STANLEY JORDAN/

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.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 07/20/2011

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2629	

MAIL DATE	DELIVERY MODE
07/20/2011	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)	
	11/965,046	LEVIN, MICHAEL D.	
	Examiner	Art Unit	
	JENNIFER ZUBAJLO	2629	

-- 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 *29 June 2011*.

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) *1-7 and 9-20* 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) *1-7 and 9-20* 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

Claim Rejections - 35 USC § 103

1. 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.

2. Claims 1-7 and 9-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danny A. Grant (Pub. No.: US 2006/0119573 A1) in view of Xiaodong Huang (Patent No.: US 6,917,867 B2).

As to claims 1, 10 and 15, Grant teaches a method (and system and corresponding program code, see [0006]) comprising: receiving an input signal comprising information associated with a manipulation of an input device configured to control a system, wherein the input device comprises a touch-pad (see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads), and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device (see [0017]).

Grant does not specifically teach receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent.

Huang teaches receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent (see col 4, ln 25-48).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Huang because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 9 and 14, Grant teaches a method (and corresponding program code, see [0006]) comprising: detecting a change in position of an input device configured to control a system, wherein the input device comprises a touch-pad (detect incoming call, see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads); and generating a detent signal based at least in part on the change in position (generates driving signal, see [0016]), the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device (see pare [0017]).

Grant does not specifically teach receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

Huang teaches receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal (see col 4, ln 25-48).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Huang because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 2 and 11, Grant further teaches generating a system signal associated with a system to be manipulated (see [0016]), the system signal based at least in part on the input signal (see [0016]), and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously (see [0016]-[0017]).

As to claim 3, Grant further teaches wherein the vibrotactile signal is based at least in part on the input signal (see [0016]).

As to claim 4, Huang further teaches wherein the vibrotactile signal is further based in part on the status of the input device (see col 2, ln 51 - col 3, ln 4).

As to claims 5 and 12, Grant further teaches determining whether to generate a vibrotactile signal (see [0016]-[0017] and [0021]).

As to claim 6, Grant further teaches wherein determining whether to generate a vibrotactile signal is based at least in part on a statue of the system to be manipulated (whether cell phone is receiving a call, see [0016]-[0017]).

As to claim 7, Huang further teaches determining one of a plurality of virtual detente to generate (see col 5, ln 63-67).

As to claim 13, Huang further teaches determining a virtual detent to generate (col 4, ln 25-46 end cot 5, ln 63-67).

As to claim 16, Grant further teaches wherein the processor is further configured to control a system based at least in part on a manipulation of the input device (see [0016] and Fig 1).

As to claim 17, Huang further teaches wherein the processor is further configured to determine whether to generate a detent signal (see col 4. ln 25-48 and col 5, ln 63-67).

As to claim 18, Grant further discloses wherein the at least one actuator is coupled to a housing of the input device (see [0046] and Fig 1).

As per claim 19, Huang further discloses wherein the input device comprises a sensor (abstract).

As per claim 20, Huang further discloses wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile (see col 4, ln 25-48 – note that it would be obvious for multiple maps to be used and therefore multiple detent profiles).

Response to Arguments

3. Applicant's arguments filed 5/31/11 have been fully considered but they are not persuasive.

Applicant argues that “Huang does not disclose or suggest "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent .... " Rather, Huang discloses that "[t]he brake controller 18 may be

programmed with a map to provide a detent or virtual detent function which correlates the brake position signal with the position signal and/or the other sensor signals." Huang Col. 4:25-28."

Examiner disagrees and points to Huang Col. 4:25-28 as described above. The map as mentioned above is read as the detent profile and since the system is not defined, it is broadly interpreted as any set of interacting or interdependent components forming an integrated whole and therefore Huang does disclose "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent .... ".

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER ZUBAJLO whose telephone number is (571)270-1551. The examiner can normally be reached on Monday-Friday, 10 am - 7 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amare Mengistu can be reached on (571) 272-7674. 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.

/Jennifer Zubajlo/
Examiner, Art Unit 2629
7/14/11

/Amare Mengistu/

Supervisory Patent Examiner, Art Unit 2629

Notice of References Cited	Application/Control No. 11/965,046	Applicant(s)/Patent Under Reexamination LEVIN, MICHAEL D.	
	Examiner JENNIFER ZUBAJLO	Art Unit 2629	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0119573	06-2006	Grant et al.	345/156
*	B	US-6,917,867	07-2005	Huang et al.	701/50
	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
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

✓	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	09/20/2010	03/15/2011	07/14/2011						
	1	✓	✓	✓						
	2	✓	✓	✓						
	3	✓	✓	✓						
	4	✓	✓	✓						
	5	✓	✓	✓						
	6	✓	✓	✓						
	7	✓	✓	✓						
	8	✓	✓	-						
	9	✓	✓	✓						
	10	✓	✓	✓						
	11	✓	✓	✓						
	12	✓	✓	✓						
	13	✓	✓	✓						
	14	✓	✓	✓						
	15	✓	✓	✓						
	16	✓	✓	✓						
	17	✓	✓	✓						
	18	✓	✓	✓						
	19	✓	✓	✓						
	20			✓						

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

SEARCHED			
Class	Subclass	Date	Examiner
345	156-179	7/14/11	JZ
all	all - word search	7/14/11	JZ

SEARCH NOTES		
Search Notes	Date	Examiner
Updated EAST Search	7/14/11	JZ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

Attorney Docket IMM253 (51851/339922)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629
Confirmation No.	:	2809

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

AMENDMENT AND RESPONSE TO NON-FINAL OFFICE ACTION

Sir:

The following Amendment and Remarks are submitted in response to the Office Action mailed July 20, 2011.

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

Remarks begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Currently Amended) A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

2. (Original) The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. (Original) The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. (Original) The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. (Previously Presented) The method of claim 1, further comprising determining whether to generate a vibrotactile signal.

6. (Previously Presented) The method of claim 5, wherein determining whether to generate a vibrotactile signal is based at least in part on a status of the system to be manipulated.

7. (Original) The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

8. (Cancelled)

9. (Currently Amended) A method comprising:

detecting a change in position of an input device configured to control one of a plurality of [[a]] systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a detent signal based at least in part on the detent profile and the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device configured to control one of a plurality of [[a]] systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

11. (Original) The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. (Original) The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. (Original) The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. (Currently Amended) A computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device configured to control one of a plurality of [[a]] systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. (Currently Amended) A system comprising:

an input device configured to control one of a plurality of [[a]] systems, wherein the input device comprises a touch-pad;

a processor in communication with the input device, the processor configured to receive an input signal and a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

16. (Original) The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. (Original) The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. (Original) The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. (Original) The system of claim 15, wherein the input device comprises a sensor.

20. (Currently Amended) The ~~system~~ method of claim 1, wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile.

REMARKS

I. General

Applicants file this paper in response to the Non-Final Office Action mailed July 20, 2011. Claims 1-7 and 9-20 are currently pending in the present application. The Office Action rejects 1-7 and 9-20 under 35 USC § 103(a) as allegedly obvious over the combination of U.S. Pub. No. 2006/0119573 to Grant (hereinafter "Grant") in combination with U.S. 6,917,867 to Huang (hereinafter "Huang"). In light of the amendments and remarks herein, Applicants respectfully request allowance of all pending claims.

II. Claim Amendments

This paper amends claims 1, 9,10, 14, and 15 to recite limitations similar to: "an input device configured to control a plurality of systems . . . receiving a detent profile associated with one of the systems . . . ." Support for this amendment may be found at least in the claims as filed and Paragraphs [0052]-[0053] and [0074] of Applicants' specification as filed.. Thus, no new matter is added by this amendment.

III. Claims 1-19 Rejected Under 35 USC § 103(a)

At pages 2-3 the Office Action rejects claim 1 under 35 USC § 103(a) over Grant in combination with Huang. In order to advance prosecution, Applicants have amended claim 1 to recite in part "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems . . . receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent . . . ." Based on this amendment Applicants respectfully assert that the Office Action has failed to establish *prima facie* obviousness. To establish *prima facie* obviousness of a claimed invention under 35 U.S.C. § 103, the Office Action must show, either from the references themselves or in the knowledge generally available to one of ordinary skill in the art, that the cited references disclose or suggest each claimed element and that it would have been obvious

under *Graham v. John Deere Co.* to modify the references or to combine teachings in the references to arrive at the claimed invention. *See* MPEP §§ 2141 and 2143; *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d at 1395-96.

Neither Grant nor Huang disclose or suggest "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . ." As the Office Action states, "Grant does not specifically teach the vibrotactile effect comprising a virtual detent." Office Action, p.2. As Applicants previously argued, Grant's deficiency is not cured by Huang, which describes applying a haptic effect to an operator interface mechanism, wherein this haptic effect is based on the position signal, as opposed to the system controlled by the interface. *See* Huang Col. 3:56-62. In the Office Action, the Examiner disagreed and instead pointed to Huang Col. 4:25-28, saying "[t]he map as mentioned above is read as the detent profile and since the system is not defined, it is broadly interpreted as any set of interacting or interdependent components forming an integrated whole and therefore Huang does disclose[s] "receiving a detent profile associated with the system, the detent profile comprising haptic data associated with a virtual detent . . . .'" Office Action, p.7.

Applicants respectfully disagree, and note that Huang discloses that "[t]he brake controller 18 may be programmed with a map to provide a detent or virtual detent function *which correlates the brake position signal with the position signal* and/or the other sensor signals." Huang Col. 4:25-28 (emphasis added). Thus, Huang discloses a virtual detent function associated with a *position signal*. In contrast, amended claim 1 recites a detent profile associated with *systems* controlled by the interface device.

But in order to advance prosecution, Applicants have further amended claim 1 to recite in part "an input device configured to control a plurality of systems . . . receiving a detent profile associated with one of the systems . . . ." Applicants respectfully assert that while Huang may disclose an input device configure to control a system, *e.g.* a brake controller, Huang does not teach an "an input device configured to control *a plurality of systems* . . . ." *See* Huang Col. 4:25-26. Furthermore, because this input device is configured to control only one system, the detent profile that the Office Action asserts is disclosed could be associated with only that one system. Instead, claim 1 recites in part,

"*receiving a detent profile associated with one of the systems . . . .*" Such functionality enables the claimed device to receive one detent profile, and that profile may be associated with one system controlled by the input device (*e.g.* an audio system), and another type of profile may be used when a different system (*e.g.* a temperature system) is being controlled by the input device. *See* Paragraph [0074] of Applicants' specification as filed. Such functionality is not disclosed or suggested by Huang.

Thus, the Office Action has failed to establish *prima facie* obviousness with respect to amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 1. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 2-7, which depend from and further limit claim 1, and are thus allowable for at least the same reasons as claim 1.

Applicants have amended claim 9 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 9 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 9.

Applicants have amended claim 10 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 10 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 10. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

Applicants have amended claim 14 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 14 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 14.

Applicants have amended claim 15 to recite limitations similar to amended claim 1. Thus, Applicants respectfully assert that claim 15 is allowable for at least the same reasons as amended claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 15. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 16-19, which depend from and further limit claim 15, and are thus allowable for at least the same reasons as claim 15.

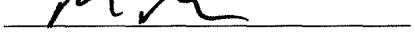
CONCLUSION

Applicants respectfully assert that in view of the amendments and remarks above, all pending claims are allowable and Applicants respectfully request the allowance of all claims.

Should the Examiner have any comments, questions, or suggestions of a nature necessary to expedite the prosecution of the application, or to place the case in condition for allowance, the Examiner is courteously requested to telephone the undersigned at the number listed below.

Respectfully submitted,

Date: 10/20/2011



Michael Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND &
STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101
(336) 607-7391 (voice)
(336) 734-2756 (fax)

PTO/SB/08a (07-09)
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/965,046
Filing Date	Dec 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Jennifer L. Zubajlo
Attorney Docket Number	51851-339922

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		US- 6,876,891	04-05-2005	Schuler et al.	
		US- 2006-0038781	02-23-2006	Levin	
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

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. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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, 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 (1-800-786-9199) and select option 2.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Michael D. Levin	)	
	)	Conf No.: 2809
Serial No. 11/965,046	)	
	)	Art Unit: 2629
Filed: December 27, 2007	)	
	)	Examiner: Jenifer L. Zubajlo
For: **VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK**	)	
Attorney Ref. IMM253 (51851-3)	)	

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Pursuant to 37 C.F.R. §§ 1.97 and 1.98, applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I.. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the PTO/SB/08 forms attached hereto.

II. COPIES (check at least one box)

a. ☐ This application was filed before June 30, 2003. Accordingly, submitted herewith is a legible copy of (i) each U.S. and foreign patent; (ii) each publication or that portion which caused it to be listed; and (iii) all other information or that portion which caused it to be listed.

b. ☒ This application was filed on or after June 30, 2003. Accordingly, copies of cited U.S. patents and patent application publications therefore are not included. Copies of foreign patent documents and non-patent literature are included.

c. ☐ Some or all of the documents listed on the PTO/SB/08 forms are not enclosed because they were cited in the International Search Report and copies should already be in the PTO file. If copies are needed, please contact the undersigned.

III. CONCISE EXPLANATION OF THE RELEVANCE
(check at least one box)

a. ☒ **DOCUMENTS IN THE ENGLISH LANGUAGE**
The patents, publications, or other information listed on the attached PTO/SB/08 forms are in the English language and therefore, do not require a statement of relevancy.

b. ☐ **DOCUMENTS NOT IN THE ENGLISH LANGUAGE**

A concise explanation of the relevance of all patents, publications, or other information listed that is not in the English language is as follows:

c. ☐ **ENGLISH LANGUAGE SEARCH REPORT**
An English language version of the search report or action that indicates the degree of relevance found by the foreign office is attached, thereby satisfying the requirement for a concise explanation. See MPEP 609(III)(A)(3).

d. ☐ **OTHER**
The following additional information is provided for the Examiner's consideration.

FEES

IV. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(b):
(check one box)

a. ☐ within three months of the filing date of a national application (37 C.F.R. § 1.97(b)(1)). No fee or statement is required. *(This section is not to be used with RCE's.)*

b. ☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application (37 C.F.R. § 1.97(b)(2)). No fee or statement is required.

c. ☐ before the mailing of a first Office action after the filing of or concurrently with a Request for Continued Examination under § 1.114 (37 C.F.R. § 1.97(b)(4)). No fee or statement is required.

d. ☐ before the mailing date of a first Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or statement is required.

In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) below, or, if no statement has been made, charge our deposit account in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

V. ☑ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(c):(check one box)
before the mailing date of a Final Office Action under 37 C.F.R. § 1.113 (See 37 C.F.R. § 1.97(c)(1)) or before the mailing date of a Notice of Allowance under 37 C.F.R. § 1.311 (See 37 C.F.R. § 1.97(c)(2)).

a. ☑ No statement; therefore, a fee in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

b. ☐ See the statement below. No fee is required.

VI. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(d)
after the period specified in 37 C.F.R. 1.97(c) but before payment of the issue fee; see statement and payment of fees below.

VII. STATEMENT UNDER 37 C.F.R. § 1.97(e) (check only one box)
The undersigned hereby states that

a. ☐ each item of information contained in the IDS was first cited in any communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS;

b. ☐ no item of information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

c. ☐ Some of the items of information were cited in a communication from a foreign Patent Office. As to this information, the undersigned states that each item of information contained in the IDS was first cited in a communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS. As to the remaining information, the undersigned hereby states that no item of this remaining information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application and, to the best of my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

VIII. ☐ PATENT TERM ADJUSTMENT

Each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.704(d).

IX. PAYMENT OF FEES (check one box)

☒ Payment by credit card Form PTO-2038 in the amount of $180 required by 37 C.F.R. § 1.17(p) is enclosed for the above-identified fee.

☐ Please charge Deposit Account No. 11-0855 in the amount required by 37 C.F.R. § 1.17(p) for the above-indicated fee. A triplicate copy of this paper is attached.

☐ No fee is required.

If the Examiner has any questions concerning this IDS, he/she is requested to contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 11-0855.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 20-1430 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17.

Respectfully submitted,

Date: 10/20/2011

By: _____
Michael T. Morlock (Reg. No. 62,245)

Attachment(s):
- ☒ PTO/SB/08
- ☐ Documents
- ☒ Fee
- ☒ Other: Response to Non-Final Office Action

Electronic Patent Application Fee Transmittal

Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Michael T. Morlock/Laura Smith
Attorney Docket Number:	IMM253

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**

Electronic Acknowledgement Receipt

EFS ID:	11230043
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Laura Smith
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	20-OCT-2011
Filing Date:	27-DEC-2007
Time Stamp:	15:16:33
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	1411
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Miscellaneous Incoming Letter	Transmittal339922.pdf	44997 8e77d8eafafaec503a68ce91ba6bfe660a0faf53	no	1
Warnings:					
Information:					
2	Amendment Copy Claims/Response to Suggested Claims	Response339922.pdf	394592 ef559dab14f08a2e2b5977c55e57d199f8ce1de2	no	10
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	IDSByApplicant339922.pdf	87529 49dfa7cd6d572a7da24305f85013551c4fd366ee	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Transmittal Letter	IDSLetter1339922.pdf	205416 ada3056162fc4f0769788b08846b008403c147ec	no	5
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	29737 c08eec5d6fa086eae97a01fa23c4a042bcad7dc2	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	762271		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	Virtual Detents Through Vibrotactile Feedback
Examiner	:	Zubajlo, Jennifer L.
Art Unit	:	2629
Confirmation No.	:	2809

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

1. Transmittal;
2. Amendment and Response to Non-Final Office Action;
3. Information Disclosure Statement Letter;
4. IDS By Applicant (Form PTO/SB/08a); and
5. EFS-Web Payment in the amount of $180.00 (IDS Fee)

Shown below are the fees for the presentation of the amended claims:

	Claims Remaining	Highest # Previously Paid For	Extra	Rate	Fee
TOTAL	19	20	0	$ 60	$ 0
Ind. Cls.	5	5	0	$250	$ 0

Multiple Dependent Claim Added..... NO

TOTAL $0

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 20-1430.

Respectfully submitted,

Date: 10/20/2011

By: _____
Michael T. Morlock (Reg. No. 62,245)

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web, on October 20, 2011.

Laura J. Smith

US2000 12274287.1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Michael D. Levin	)	
	)	Conf No.: 2809
Serial No. 11/965,046	)	
	)	Art Unit: 2629
Filed: December 27, 2007	)	
	)	Examiner: Jenifer L. Zubajlo
For: **VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK**	)	
Attorney Ref. IMM253 (51851-3)	)	

INFORMATION DISCLOSURE STATEMENT

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P.O. Box 1450
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b. ☒ This application was filed on or after June 30, 2003. Accordingly, copies of cited U.S. patents and patent application publications therefore are not included. Copies of foreign patent documents and non-patent literature are included.

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III. CONCISE EXPLANATION OF THE RELEVANCE
(check at least one box)

a. ☒ **DOCUMENTS IN THE ENGLISH LANGUAGE**
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b. ☐ **DOCUMENTS NOT IN THE ENGLISH LANGUAGE**

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d. ☐ **OTHER**
The following additional information is provided for the Examiner's consideration.

FEES

IV. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(b):
(check one box)

a. ☐ within three months of the filing date of a national application (37 C.F.R. § 1.97(b)(1)). No fee or statement is required. *(This section is not to be used with RCE's.)*

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d. ☐ before the mailing date of a first Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or statement is required.

In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) below, or, if no statement has been made, charge our deposit account in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

V. ☑ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(c):(check one box)
before the mailing date of a Final Office Action under 37 C.F.R. § 1.113 (See 37 C.F.R. § 1.97(c)(1)) or before the mailing date of a Notice of Allowance under 37 C.F.R. § 1.311 (See 37 C.F.R. § 1.97(c)(2)).

a. ☑ No statement; therefore, a fee in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

b. ☐ See the statement below. No fee is required.

VI. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(d)
after the period specified in 37 C.F.R. 1.97(c) but before payment of the issue fee; see statement and payment of fees below.

VII. STATEMENT UNDER 37 C.F.R. § 1.97(e) (check only one box)
The undersigned hereby states that

a. ☐ each item of information contained in the IDS was first cited in any communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS;

b. ☐ no item of information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

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VIII. ☐ PATENT TERM ADJUSTMENT

Each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.704(d).

IX. PAYMENT OF FEES (check one box)

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☐ No fee is required.

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If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 20-1430 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17.

Respectfully submitted,

Date: 10/20/2011

By: _____
Michael T. Morlock (Reg. No. 62,245)

Attachment(s):
- ☒ PTO/SB/08
- ☐ Documents
- ☒ Fee
- ☒ Other: Response to Non-Final Office Action

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	Filing Date	☐ To be Mailed
11/965,046	12/27/2007	

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

AMENDMENT	10/20/2011	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $ =		OR	X $60=	0
	Independent (37 CFR 1.16(h))	* 5	Minus	***5	= 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

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	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:
/TINA M. BELL/

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

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 02/28/2012

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2629	

MAIL DATE	DELIVERY MODE
02/28/2012	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)	
	11/965,046	LEVIN, MICHAEL D.	
	Examiner	Art Unit	
	JENNIFER ZUBAJLO	2629	

-- 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 *20 October 2011*.

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) *1-7 and 9-20* 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) *1-7 and 9-20* 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 _____ 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 *10/20/11*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 101

1. 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 10-14 are rejected under 35 U.S.C. 101 because the claims recite "a computer – readable medium". The specification (paragraph [0039]) defines the computer readable medium to include signal or carrier wave.

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 1-7 and 9-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danny A. Grant (Pub. No.: US 2006/0119573 A1) in view of Tuomo Nyyssonen (Pub. No.: US 2007/0222765).

As to claims 1, 10 and 15, Grant teaches a method (and system and corresponding program code, see [0006]) comprising: receiving an input signal comprising information associated with a manipulation of an input device configured to

control a plurality of systems, wherein the input device comprises a touch-pad (see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads), and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device (see [0017]).

Grant does not specifically teach receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent.

Nyyssonen teaches receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent (see [0053], [0057], claims 1 & 22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Nyyssonen because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 9 and 14, Grant teaches a method (and corresponding program code, see [0006]) comprising: detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad (detect incoming call, see [0016] and [0046] – "The housing 103 may be, for

example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads); and generating a detent signal based at least in part on the change in position (generates driving signal, see [0016]), the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device (see pare [0017]).

Grant does not specifically teach receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

Nyyssonen teaches receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal (see [0053], [0057], claims 1 & 22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Nyyssonen because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 2 and 11, Nyyssonen further teaches generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously (see [0053], [0057], claims 1 & 22).

As to claim 3, Nyyssonen further teaches wherein the vibrotactile signal is based at least in part on the input signal (see [0053], [0057]).

As to claim 4, Nyyssonen further teaches wherein the vibrotactile signal is further based in part on the status of the input device (see [0053], [0057]).

As to claims 5 and 12, Grant further teaches determining whether to generate a vibrotactile signal (see [0016]-[0017] and [0021]) and also see Nyyssonen (see [0053], [0057]).

As to claim 6, Grant further teaches wherein determining whether to generate a vibrotactile signal is based at least in part on a statue of the system to be manipulated (whether cell phone is receiving a call, see [0016]-[0017]) and see also Nyyssonen (see [0053], [0057]).

As to claim 7, Nyyssonen further teaches determining one of a plurality of virtual detents to generate (see [0053], [0057]).

As to claim 13, Nyyssonen further teaches determining a virtual detent to generate (see [0053], [0057]).

As to claim 16, Grant further teaches wherein the processor is further configured to control a system based at least in part on a manipulation of the input device (see [0016] and Fig 1) and see also Nyyssonen (see Abstract, [0053], [0057]).

As to claim 17, Nyyssonen further teaches wherein the processor is further configured to determine whether to generate a detent signal (see [0053], [0057]).

As to claim 18, Grant further discloses wherein the at least one actuator is coupled to a housing of the input device (see [0046] and Fig 1).

As per claim 19, Nyyssonen further discloses wherein the input device comprises a sensor (see Abstract).

As per claim 20, Nyyssonen further discloses wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile (see [0053], [0057] – note that it would be obvious for different detents to be used with different functions).

Response to Arguments

4. Applicant's arguments filed 10/20/11 have been considered but are moot because the arguments do not apply to any of the references being used in the current rejection.

Conclusion

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Patent No. US 7,720,552 and Pub. No.: US 2006/0187216 both teach virtual knobs used with touch devices that could replace the Nyyssonen reference for a 103 rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER ZUBAJLO whose telephone number is (571)270-1551. The examiner can normally be reached on Monday-Friday, 10 am - 7 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amare Mengistu can be reached on (571) 272-7674. 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.

/Jennifer Zubajlo/
Examiner, Art Unit 2629
2/25/12

/ABBAS ABDULSELAM/
Primary Examiner, Art Unit 2629

Notice of References Cited	Application/Control No. 11/965,046	Applicant(s)/Patent Under Reexamination LEVIN, MICHAEL D.	
	Examiner JENNIFER ZUBAJLO	Art Unit 2629	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0119573	06-2006	Grant et al.	345/156
*	B	US-2007/0222765	09-2007	Nyyssonen, Tuomo	345/173
*	C	US-2006/0187216	08-2006	Trent et al.	345/173
*	D	US-7,720,552	05-2010	Lloyd, Robert F.	700/10
*	E	US-6,917,867	07-2005	Huang et al.	701/50
	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
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

✓	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	09/20/2010	03/15/2011	07/14/2011	02/25/2012					
	1	✓	✓	✓	✓					
	2	✓	✓	✓	✓					
	3	✓	✓	✓	✓					
	4	✓	✓	✓	✓					
	5	✓	✓	✓	✓					
	6	✓	✓	✓	✓					
	7	✓	✓	✓	✓					
	8	✓	✓	-	-					
	9	✓	✓	✓	✓					
	10	✓	✓	✓	✓					
	11	✓	✓	✓	✓					
	12	✓	✓	✓	✓					
	13	✓	✓	✓	✓					
	14	✓	✓	✓	✓					
	15	✓	✓	✓	✓					
	16	✓	✓	✓	✓					
	17	✓	✓	✓	✓					
	18	✓	✓	✓	✓					
	19	✓	✓	✓	✓					
	20			✓	✓					

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

SEARCHED			
Class	Subclass	Date	Examiner
345	156-179	2/25/12	JZ
all	all - word search	2/25/12	JZ

SEARCH NOTES		
Search Notes	Date	Examiner
Updated EAST Search	2/25/12	JZ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
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Substitute for form 1449/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/965,046
Filing Date	Dec 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Jennifer L. Zubajlo
Attorney Docket Number	51851-339922

U. S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
/J.Z./		US- 6,876,891	04-05-2005	Schuler et al.	
/J.Z./		US- 2006-0038781	02-23-2006	Levin	
		US-			
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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages Or Relevant Figures Appear	T[6]

Examiner Signature	/Jennifer Zubajlo/	Date Considered	02/25/2012

*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. [1] Applicant's unique citation designation number (optional). [2] See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. [3] Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). [4] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [5]Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [6] Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. 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 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, 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 (1-800-786-9199) and select option 2.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.Z./

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629
Confirmation No.	:	2809

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

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

The following Amendment and Remarks are submitted in response to the Office Action mailed February 28, 2012.

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

Remarks begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Previously Presented) A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

2. (Original) The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. (Original) The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. (Original) The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. (Previously Presented) The method of claim 1, further comprising determining whether to generate a vibrotactile signal.

6. (Previously Presented) The method of claim 5, wherein determining whether to generate a vibrotactile signal is based at least in part on a status of the system to be manipulated.

7. (Original) The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

8. (Cancelled)

9. (Previously Presented) A method comprising:

detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a detent signal based at least in part on the detent profile and the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. (Currently Amended) A non-transitory computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

11. (Original) The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. (Original) The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. (Original) The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. (Currently Amended) A non-transitory computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. (Previously Presented) A system comprising:

an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

a processor in communication with the input device, the processor configured to receive an input signal and a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

16. (Original) The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. (Original) The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. (Original) The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. (Original) The system of claim 15, wherein the input device comprises a sensor.

20. (Previously Presented) The method of claim 1, wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile.

REMARKS

I. General

Applicants file this paper in response to the Final Office Action mailed February 28, 2012. Claims 1-7 and 9-20 are currently pending in the present application. The Office Action rejects all pending claims. Specifically, the Office Action rejects claims 10-14 under 35 USC § 101. The Office Action rejects claims 1-7 and 9-20 under 35 USC § 103(a) as allegedly obvious over the combination of U.S. Pub. No. 2006/0119573 to Grant (hereinafter "Grant") in combination with U.S. Pub. No. 2006/0119573 to Tuomo Nyyssonen (hereinafter "Tuomo").

In light of the amendments and remarks herein, Applicants respectfully request allowance of all pending claims.

II. Claims 10-14 - 35 USC § 101

The Office Action rejects claims 10-14 under 35 USC 101 because Applicants' specification defines a computer readable medium to include a signal or carrier wave. In response, Applicants have amended claims 10 and 14 to recite "A non-transitory computer-readable medium." The USPTO has noted that computer-readable medium claims that cover "both transitory and non-transitory embodiments may be amended to narrow the claim to cover only statutory embodiments to avoid a rejection under 35 U.S.C. § 101 by adding the limitation 'non-transitory' to the claim."[1] Further, the USPTO has noted that:

> [s]uch an amendment would typically not raise the issue of new matter, even when the specification is silent because the broadest reasonable interpretation relies on the ordinary and customary meaning that includes signals *per se*. The limited situations in which such an amendment could raise issues of new matter occur, for example, when the specification does not support a non-transitory embodiment because a signal *per se* is the only viable embodiment such that the amended claim is impermissibly broadened beyond the supporting disclosure.[2]

[1] Subject Matter Eligibility of Computer Readable Media, signed by Director Kappos on Jan. 26, 2010.
[2] *Id.*

For the purposes of this application, the term "non-transitory" is intended to encompass computer-readable media as defined within the present specification and those that would otherwise be known to one of skill in the art, but excludes transitory, propagating signals as defined in Nuijten.[3] The specification provides multiple examples of non-transitory computer readable media, including "floppy disk, CD-ROM, magnetic disk, memory chip, ROM, RAM, ASIC, configured processor, all optical media, all magnetic tape or other magnetic media"[4] etc.\\FWIN1\DeeJones$\My Documents\Prosecution\UNCC\02-031 CIP\UNCC - 02-031 CIP - Response to Office Action mailed 10.4.10.docx - _ftn4 Each of these is a non-transitory computer-readable medium. Further, given the USPTO's position that (a) such an amendment obviates a rejection under 35 U.S.C. § 101, and (b) that such an amendment does not constitute the addition of new matter so long as non-transitory embodiments are disclosed, Applicants respectfully assert that amended claims 10 and 14 are directed to patentable subject matter. Therefore, Applicants respectfully requests the Examiner withdraw the rejections of claims 10 and 14. Applicants further request withdrawal of the 35 USC § 101 rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

III. Claims 1-19 - 35 USC § 103(a)

At pages 2-3 the Office Action rejects claim 1 under 35 USC § 103(a) over Grant in combination with Tuomo. Applicants respectfully assert that the Office Action has failed to establish *prima facie* obviousness. To establish *prima facie* obviousness of a claimed invention under 35 U.S.C. § 103, the Office Action must show, either from the references themselves or in the knowledge generally available to one of ordinary skill in the art, that the cited references disclose or suggest each claimed element and that it would have been obvious under *Graham v. John Deere Co.* to modify the references or to combine teachings in the references to arrive at the claimed invention. *See* MPEP §§ 2141 and 2143; *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d at 1395-96.

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[3] In re Nuijten, 500 F.3d 1346, 1352, 1357 (Fed. Cir. 2007).
[4] Specification, ¶ [0030].

Neither Grant nor Tuomo disclose or suggest "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad; receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent . . . ." As the Office Action states, "Grant does not specifically teach the vibrotactile effect comprising a virtual detent." Office Action, p.2. Tuomo does not cure Grant's deficiency.

Tuomo may disclose a switch for changing the functionality of a touch screen to respond to a set of user interface inputs. *See* Tuomo paragraph [0005]. But Tuomo does not disclose or suggest "receiving a *detent profile* associated with one of the systems, the *detent profile* comprising haptic data associated with *a virtual detent*," as recited by claim 1. In fact, Tuomo only mentions vibrotactile effects briefly in paragraph [0053] and claim 22. And Tuomo does not describe any types of vibrotactile effects. Furthermore, Tuomo does not even use the word detent. Thus, Tuomo cannot cure Grant's deficiency.

Thus, the Office Action has failed to establish *prima facie* obviousness with respect to claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 1. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 2-7, which depend from and further limit claim 1, and are thus allowable for at least the same reasons as claim 1.

Claim 9 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 9 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 9.

Claim 10 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 10 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 10. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

Claim 14 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 14 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 14.

Claim 15 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 15 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 15. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 16-19, which depend from and further limit claim 15, and are thus allowable for at least the same reasons as claim 15.

CONCLUSION

Applicants respectfully assert that in view of the amendments and remarks above, all pending claims are allowable and Applicants respectfully request the allowance of all claims.

Should the Examiner have any comments, questions, or suggestions of a nature necessary to expedite the prosecution of the application, or to place the case in condition for allowance, the Examiner is courteously requested to telephone the undersigned at the number listed below.

Respectfully submitted,

Date: 4/27/2012

Michael Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101
(336) 607-7391 (voice)
(336) 734-2756 (fax)

Electronic Acknowledgement Receipt

EFS ID:	12644918
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Dee Jones
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	27-APR-2012
Filing Date:	27-DEC-2007
Time Stamp:	14:08:29
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	Miscellaneous Incoming Letter	IMM253Transmittal.pdf	39008 9520d483142bdd508ff33b895170992fc4683803	no	1

Warnings:	
Information:	

2	Amendment After Final	IMM253Response.pdf	379709 8973658316bd98bf6c3bcba7ae6804f6963d0deb	no	10

Warnings:	
Information:	
Total Files Size (in bytes):	418717

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	Virtual Detents Through Vibrotactile Feedback
Examiner	:	Zubajlo, Jennifer L.
Art Unit	:	2629
Confirmation No.	:	2809

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

1. Transmittal; and
2. Amendment and Response to Final Office Action

Shown below are the fees for the presentation of the amended claims:

	Claims Remaining	Highest # Previously Paid For	Extra	Rate	Fee
TOTAL	19	20	0	$ 0	$ 0
Ind. Cls.	5	5	0	$ 0	$ 0

Multiple Dependent Claim Added..... NO

TOTAL $0

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 20-1430.

Respectfully submitted,

Date: 4/27/2012

By: _____
Michael T. Morlock (Reg. No. 62,245)

KILPATRICK TOWNSEND &
STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web, on April 27, 2012.

_____
Dee Jones

US2000 12416186.1

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	Filing Date	☐ To be Mailed
11/965,046	12/27/2007	

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

AMENDMENT	04/27/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $ =		OR	X $60=	0
	Independent (37 CFR 1.16(h))	* 5	Minus	***5	= 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

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	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:
/MARQUITA JONES/

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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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 08/21/2012

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	PAPER NUMBER
2629	

MAIL DATE	DELIVERY MODE
08/21/2012	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)	
	11/965,046	LEVIN, MICHAEL D.	
	Examiner	Art Unit	
	JENNIFER ZUBAJLO	2629	

-- 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 *27 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) *1-7 and 9-20* 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) *1-7 and 9-20* 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 _____ 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 _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. 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.

2. Claims 1-7 and 9-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danny A. Grant (Pub. No.: US 2006/0119573 A1) in view of Tuomo Nyyssonen (Pub. No.: US 2007/0222765).

As to claims 1, 10 and 15, Grant teaches a method (and system and corresponding program code, see [0006]) comprising: receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad (see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads), and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device (see [0017]).

Grant does not specifically teach receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent.

Nyyssonen teaches receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent (see [0053], [0057], claims 1 & 22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Nyyssonen because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 9 and 14, Grant teaches a method (and corresponding program code, see [0006]) comprising: detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad (detect incoming call, see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads); and generating a detent signal based at least in part on the change in position (generates driving signal, see [0016]), the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device (see pare [0017]).

Grant does not specifically teach receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

Nyyssonen teaches receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal (see [0053], [0057], claims 1 & 22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Nyyssonen because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 2 and 11, Nyyssonen further teaches generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously (see [0053], [0057], claims 1 & 22).

As to claim 3, Nyyssonen further teaches wherein the vibrotactile signal is based at least in part on the input signal (see [0053], [0057]).

As to claim 4, Nyyssonen further teaches wherein the vibrotactile signal is further based in part on the status of the input device (see [0053], [0057]).

As to claims 5 and 12, Grant further teaches determining whether to generate a vibrotactile signal (see [0016]-[0017] and [0021]) and also see Nyyssonen (see [0053], [0057]).

As to claim 6, Grant further teaches wherein determining whether to generate a vibrotactile signal is based at least in part on a statue of the system to be manipulated (whether cell phone is receiving a call, see [0016]-[0017]) and see also Nyyssonen (see [0053], [0057]).

As to claim 7, Nyyssonen further teaches determining one of a plurality of virtual detents to generate (see [0053], [0057]).

As to claim 13, Nyyssonen further teaches determining a virtual detent to generate (see [0053], [0057]).

As to claim 16, Grant further teaches wherein the processor is further configured to control a system based at least in part on a manipulation of the input device (see [0016] and Fig 1) and see also Nyyssonen (see Abstract, [0053], [0057]).

As to claim 17, Nyyssonen further teaches wherein the processor is further configured to determine whether to generate a detent signal (see [0053], [0057]).

As to claim 18, Grant further discloses wherein the at least one actuator is coupled to a housing of the input device (see [0046] and Fig 1).

As per claim 19, Nyyssonen further discloses wherein the input device comprises a sensor (see Abstract).

As per claim 20, Nyyssonen further discloses wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile (see [0053], [0057] – note that it would be obvious for different detents to be used with different functions).

Response to Arguments

3. Applicant's arguments filed 4/27/12 have been fully considered but they are not persuasive.

Applicant argues that “Tuomo does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent," as recited by claim 1. In fact, Tuomo only mentions vibrotactile effects briefly in paragraph [0053] and claim 22. And Tuomo does not describe any types of vibrotactile effects. Furthermore, Tuomo does not even use the word detent.” Examiner disagrees.

Detents are defined as a device used to mechanically resist or arrest the rotation of a wheel, axle, or spindle; as click-stops, used to divide a rotation into discrete increments. Therefore, even though Tuomo Nyyssonen does not use the word “detent”, he teaches virtual knobs which are obviously divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents. Further, these virtual knobs are combined with vibro-tactile feedback in response to user inputs which teaches the the detent profile comprising haptic data associated with a virtual detent.

Therefore, the combination of Grant and Tuomo Nyyssonen teach "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad; receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent ....”.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Patent No. US 7,720,552 and Pub. No.: US 2006/0187216 both teach virtual knobs used with touch devices that could replace the Nyyssonen reference for a 103 rejection.

5. **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 JENNIFER ZUBAJLO whose telephone number is (571)270-1551. The examiner can normally be reached on Monday-Friday, 10 am - 7 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amare Mengistu can be reached on (571) 272-7674. 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.

/Jennifer Zubajlo/
Examiner, Art Unit 2629
8/14/12

/Amare Mengistu/

Supervisory Patent Examiner, Art Unit 2629

Notice of References Cited	Application/Control No. 11/965,046	Applicant(s)/Patent Under Reexamination LEVIN, MICHAEL D.	
	Examiner JENNIFER ZUBAJLO	Art Unit 2629	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0119573	06-2006	Grant et al.	345/156
*	B	US-2007/0222765	09-2007	Nyyssonen, Tuomo	345/173
*	C	US-2006/0187216	08-2006	Trent et al.	345/173
*	D	US-7,720,552	05-2010	Lloyd, Robert F.	700/10
*	E	US-6,917,867	07-2005	Huang et al.	701/50
	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
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

✓	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	09/20/2010	03/15/2011	07/14/2011	02/25/2012	08/14/2012				
	1	✓	✓	✓	✓	✓				
	2	✓	✓	✓	✓	✓				
	3	✓	✓	✓	✓	✓				
	4	✓	✓	✓	✓	✓				
	5	✓	✓	✓	✓	✓				
	6	✓	✓	✓	✓	✓				
	7	✓	✓	✓	✓	✓				
	8	✓	✓	-	-	-				
	9	✓	✓	✓	✓	✓				
	10	✓	✓	✓	✓	✓				
	11	✓	✓	✓	✓	✓				
	12	✓	✓	✓	✓	✓				
	13	✓	✓	✓	✓	✓				
	14	✓	✓	✓	✓	✓				
	15	✓	✓	✓	✓	✓				
	16	✓	✓	✓	✓	✓				
	17	✓	✓	✓	✓	✓				
	18	✓	✓	✓	✓	✓				
	19	✓	✓	✓	✓	✓				
	20			✓	✓	✓				

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11965046	LEVIN, MICHAEL D.
	Examiner	Art Unit
	JENNIFER ZUBAJLO	2629

SEARCHED			
Class	Subclass	Date	Examiner
345	156-179	8/14/12	JZ
all	all - word search	8/14/12	JZ

SEARCH NOTES		
Search Notes	Date	Examiner
Updated EAST Search	8/14/12	JZ

INTERFERENCE SEARCH			
Class	Subclass	Date	Examiner

Attorney Docket IMM253 (51851/339922)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629
Confirmation No.	:	2809

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

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

The following Amendment and Remarks are submitted in response to the Office Action mailed August 21, 2012.

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

Remarks begin on page 7 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Previously Presented) A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

2. (Original) The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. (Original) The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. (Original) The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. (Previously Presented) The method of claim 1, further comprising determining whether to generate a vibrotactile signal.

6. (Previously Presented) The method of claim 5, wherein determining whether to generate a vibrotactile signal is based at least in part on a status of the system to be manipulated.

7. (Original) The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

8. (Cancelled)

9. (Previously Presented) A method comprising:

detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a detent signal based at least in part on the detent profile and the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. (Previously Presented) A non-transitory computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

11. (Original) The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. (Original) The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. (Original) The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. (Previously Presented) A non-transitory computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. (Previously Presented) A system comprising:

an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

a processor in communication with the input device, the processor configured to receive an input signal and a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

16. (Original) The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. (Original) The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. (Original) The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. (Original) The system of claim 15, wherein the input device comprises a sensor.

20. (Previously Presented) The method of claim 1, wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile.

REMARKS

I. General

Applicants file this paper in response to the Final Office Action mailed August 21, 2012. Claims 1-7 and 9-20 are currently pending in the present application. The Office Action rejects all pending claims. Specifically, the Office Action rejects claims 1-7 and 9-20 under 35 USC § 103(a) as allegedly obvious over the combination of U.S. Pub. No. 2006/0119573 to Grant (hereinafter "Grant") in combination with U.S. Pub. No. 2006/0119573 to Tuomo Nyyssonen (hereinafter "Tuomo").

In light of the remarks herein, Applicants respectfully request allowance of all pending claims.

II. Claims 1-7 and 19-20 - 35 USC § 103(a)

At pages 2-3 the Office Action rejects claim 1 under 35 USC § 103(a) over Grant in combination with Tuomo. Applicants respectfully assert that the Office Action has failed to establish *prima facie* obviousness. To establish *prima facie* obviousness of a claimed invention under 35 U.S.C. § 103, the Office Action must show, either from the references themselves or in the knowledge generally available to one of ordinary skill in the art, that the cited references disclose or suggest each claimed element and that it would have been obvious under *Graham v. John Deere Co.* to modify the references or to combine teachings in the references to arrive at the claimed invention. *See* MPEP §§ 2141 and 2143; *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d at 1395-96.

Neither Grant nor Tuomo disclose or suggest "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad; receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent . . . ." As the Office Action states, "Grant does not specifically teach the vibrotactile effect comprising a virtual detent." Office Action, p.2.

As Applicants previously argued, Tuomo does not cure Grant's deficiency. In the Response to Arguments section, the Examiner states:

> Detents are defined as a device used to mechanically resist or arrest the rotation of a wheel, axle, or spindle; as click-stops, used to divide a rotation into discrete increments. Therefore, even though Tuomo Nyyssonen does not use the word "detent", he teaches virtual knobs which are obviously divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents. Further, these virtual knobs are combined with vibro-tactile feedback in response to user inputs which teaches the the [sic] detent profile comprising haptic data associated with a virtual detent.
>
> Office Action, p. 7.

Applicants respectfully note that the Office Action provides no citation to Tuomo, or any other reference, for the statement "virtual knobs which are obviously divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents." Office Action, p. 7. Applicants respectfully disagree, and note that Tuomo does not disclose or suggest that a virtual knob is, or must be, divided into discrete increments. Applicants further note that even if a knob was divided into a "discrete increment," this still does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1.

Applicants further note that in the rejection, the Office Action cites Tuomo paragraphs [0053], [0057], and claims 1 and 22. Office Action, p. 3. With regard to these paragraphs, Applicants respectfully note that paragraph [0053] recites only "[f]urther, embodiments are envisioned in which the construction can be combined with vibro-tactual and/or audio feedback in response to VI inputs." Tuomo paragraph [0053]. Applicants respectfully note that this paragraph does not mention detents. Rather, it merely suggests using a vibrotactile feedback response, without providing any embodiment that implements vibrotactile feedback or a description of the type of vibrotactile feedback. Accordingly, this paragraph does not disclose or suggest

"receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1.

With regard to paragraph [0057], Applicants respectfully note that this paragraph discloses a knob for controlling audio components, for example, volume, bass, or treble. *See* Tuomo paragraph [0057]. But paragraph [0057] does not disclose using detents with this knob. With regard to claim 1, Applicants respectfully note that this claim does not disclose or suggest a haptic effect, much less "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1. Finally, with regard to claim 22, Applicants respectfully note that this claim recites only "wherein the special set of user inputs are combined with a vibro-tactile and/or audio response." Tuomo claim 2. As discussed above with regard to paragraph [0053], this does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1.

Thus, the Office Action has failed to establish *prima facie* obviousness with respect to claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 1. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 2-7, which depend from and further limit claim 1, and are thus allowable for at least the same reasons as claim 1.

Claim 9 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 9 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 9.

Claim 10 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 10 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 10. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

Claim 14 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 14 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 14.

Claim 15 recites limitations similar to claim 1. Thus, Applicants respectfully assert that claim 15 is allowable for at least the same reasons as claim 1, and Applicants respectfully request withdrawal of the 35 USC § 103(a) rejection of claim 15. Applicants further request withdrawal of the 35 USC § 103(a) rejections of claims 16-19, which depend from and further limit claim 15, and are thus allowable for at least the same reasons as claim 15.

III. Prior Art Made of Record and Not Relied Upon

At page 8, the Office Action lists references which were made of record and not relied upon. Applicants respectfully traverse the characterization and relevance of these references as prior art or otherwise, and respectfully reserves the right to present such arguments and other material should the Examiner maintain rejection of Applicants' claims, based upon the references made of record and not relied upon or otherwise.

CONCLUSION

Applicants respectfully assert that in view of the amendments and remarks above, all pending claims are allowable and Applicants respectfully request the allowance of all claims.

Should the Examiner have any comments, questions, or suggestions of a nature necessary to expedite the prosecution of the application, or to place the case in condition for allowance, the Examiner is courteously requested to telephone the undersigned at the number listed below.

Respectfully submitted,

Date: 10/22/2012

Michael Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
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(336) 607-7391 (voice)
(336) 734-2756 (fax)

Electronic Acknowledgement Receipt

EFS ID:	14042261
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Laura Smith
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	22-OCT-2012
Filing Date:	27-DEC-2007
Time Stamp:	15:05:11
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	Transmittal Letter	Transmittal339922.pdf	42422 7af89cab8afb15e87c8172ded5e4500dc7a62ead	no	1

Warnings:	
Information:	

2		Response339922.pdf	415621 8655aca3d278c652e460a1dbd4ae98832013caec	yes	10

	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	10

Warnings:	
Information:	
Total Files Size (in bytes):	458043

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of:	:	Michael D. Levin
Application No.	:	11/965,046
Filed	:	December 27, 2007
For	:	Virtual Detents Through Vibrotactile Feedback
Examiner	:	Zubajlo, Jennifer L.
Art Unit	:	2629
Confirmation No.	:	2809

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

TRANSMITTAL

Sir:

Transmitted herewith are copies of the following documents for filing in the above-identified application:

1. Transmittal; and
2. Amendment and Response to Final Office Action

Shown below are the fees for the presentation of the amended claims:

	Claims Remaining	Highest # Previously Paid For	Extra	Rate	Fee
TOTAL	19	20	0	$ 62.00	$ 0
Ind. Cls.	5	5	0	$250.00	$ 0

Multiple Dependent Claim Added..... NO

TOTAL $0

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 20-1430.

Respectfully submitted,

Date: 10/22/2012

By: _____
Michael T. Morlock (Reg. No. 62,245)

KILPATRICK TOWNSEND &
STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing

I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web, on October 22, 2012.

_____
Laura J. Smith

US2000 12609046 1

PTO/SB/06 (07-06)
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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/965,046	12/27/2007	

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

AMENDMENT	10/22/2012	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 19	Minus	** 20	= 0	X $ =		OR	X $62=	0
	Independent (37 CFR 1.16(h))	* 5	Minus	***5	= 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

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)	OR	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:
/MINNIE JACKSON/

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.

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/956,046
Filing Date	December 27, 20007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Zubajlo, Jennifer L.
Attorney Docket Number	IMM253 (51851/339922)

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	7,215,320 B2	05-08-2007	Takeuchi et al.	
	2.	2003/0018835 A1	01-23-2003	Nonaka	
	3.	2005/0231466 A1	10-20-2005	Tada	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	4.	WO 2006/020305 A2	02-23-2006	Apple Computer, Inc.		
	5.	JP 2008-508600 B	03-21-2008			X
	6.	JP 2004-171157	06-17--2004	Fuji Xerox Co. Ltd.		
	7.	JP 2005-71157	03-17-2005	Yamaha Corp.		
	8.	JP 2003-29914	01-31-2003	Alps Electric Co. Ltd.		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
	9.	Translation of Notice of Reasons for Rejection mailed August 28, 2012 for corresponding Japanese Application No. 2009-544090.	

Examiner Signature		Date Considered	

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(71) Applicant *(for all designated States except US)*: **APPLE COMPUTER, INC.** [US/US]; 1 Infinite Loop, Cupertino, California 95014 (US).

(72) Inventors; and

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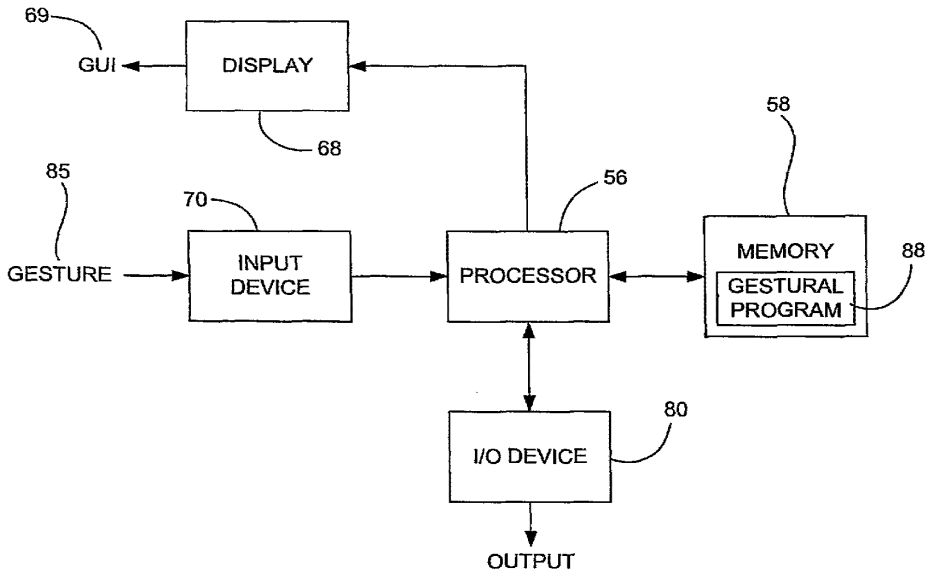
(74) Agent: **HOELLWARTH, Quin, C.**; Beyer Weaver & Thomas, LLP, P. O. BOX 70250, Oakland, California 94612-0250 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: 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, KM, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

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[Continued on next page]

(54) Title: GESTURES FOR TOUCH SENSITIVE INPUT DEVICES



(57) Abstract: Methods and systems for processing touch inputs are disclosed. The invention in one respect includes reading data from a multipoint sensing device such as a multipoint touch screen where the data pertains to touch input with respect to the multipoint sensing device, and identifying at least one multipoint gesture based on the data from the multipoint sensing device.

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GESTURES FOR TOUCH SENSITIVE INPUT DEVICES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to gesturing associated with touch sensitive devices.

2. Description of the Related Art

There exist today many styles of input devices for performing operations in a computer system. The operations generally correspond to moving a cursor and making selections on a display screen. The operations may also include paging, scrolling, panning, zooming, etc. By way of example, the input devices may include buttons, switches, keyboards, mice, trackballs, touch pads, joy sticks, touch screens and the like. Each of these devices has advantages and disadvantages that are taken into account when designing the computer system.

Buttons and switches are generally mechanical in nature and provide limited control with regards to the movement of the cursor and making selections. For example, they are generally dedicated to moving the cursor in a specific direction (e.g., arrow keys) or to making specific selections (e.g., enter, delete, number, etc.).

In mice, the movement of the input pointer corresponds to the relative movements of the mouse as the user moves the mouse along a surface. In trackballs, the movement of the input pointer corresponds to the relative movements of a ball as the user moves the ball within a housing. Mice and trackballs also include one or more buttons for making selections. Mice may also include scroll wheels that allow a user to move through the GUI by simply rolling the wheel forward or backward.

With touch pads, the movement of the input pointer corresponds to the relative movements of the user's finger (or stylus) as the finger is moved along a surface of the touch pad. Touch screens, on the other hand, are a type of display screen that has a touch-sensitive transparent panel covering the screen. When using a touch screen, a user makes a selection on the display screen by pointing directly to GUI objects on the screen (usually with a stylus or finger).

In order to provide additionally functionality, gestures have been implemented with some of these input devices. By way of example, in touch pads, selections may be made when one or more taps are detected on the surface of the touch pad. In some cases, any portion of the touch pad may be tapped, and in other cases a dedicated

portion of the touch pad may be tapped. In addition to selections, scrolling may be initiated by using finger motion at the edge of the touch pad.

U.S. Patent 5,612,719 and 5,590,219, assigned to Apple Computer, Inc. describe some other uses of gesturing. 5,612, 719 discloses an onscreen button that is responsive to at least two different button gestures made on the screen on or near the button. 5,590, 219 discloses a method for recognizing an ellipse-type gesture input on a display screen of a computer system.

In recent times, more advanced gestures have been implemented. For example, scrolling may be initiated by placing four fingers on the touch pad so that the scrolling gesture is recognized and thereafter moving these fingers on the touch pad to perform scrolling events. The methods for implementing these advanced gestures, however, has several drawbacks. By way of example, once the gesture is set, it cannot be changed until the user resets the gesture state. In touch pads, for example, if four fingers equals scrolling, and the user puts a thumb down after the four fingers are recognized, any action associated with the new gesture including four fingers and the thumb will not be performed until the entire hand is lifted off the touch pad and put back down again (e.g., reset). Simply put, the user cannot change gesture states midstream. Along a similar vein, only one gesture may be performed at any given time. That is, multiple gestures cannot be performed simultaneously.

Based on the above, there is a need for improvements in the way gestures are performed on touch sensitive devices.

SUMMARY OF THE INVENTION

The invention relates, in one embodiment, to a computer implemented method for processing touch inputs. The method includes reading data from a multipoint touch screen. The data pertains to touch input with respect to the touch screen. The method also includes identifying at least one multipoint gesture based on the data from the multipoint touch screen.

The invention relates, in another embodiment to a gestural method. The method includes detecting multiple touches at different points on a touch sensitive surface at the same time. The method also includes segregating the multiple touches into at least two separate gestural inputs occurring simultaneously. Each gestural input has a different function such as zooming, panning, rotating and the like.

The invention relates, in another embodiment to a gestural method. The method includes concurrently detecting a plurality of gestures that are concurrently

performed with reference to a touch sensing device. The method also includes producing different commands for each of the gestures that have been detected.

The invention relates, in another embodiment to a gestural method. The method includes displaying a graphical image on a display screen. The method also includes detecting a plurality of touches at the same time on a touch sensitive device. The method further includes linking the detected multiple touches to the graphical image presented on the display screen.

The invention relates, in another embodiment to a method of invoking a user interface element on a display via a multipoint touch screen of a computing system. The method includes detecting and analyzing the simultaneous presence of two or more objects in contact with the multipoint touch screen. The method also includes selecting a user interface tool, from a plurality of available tools, to display on a display for interaction by a user of the computing system based at least in part the analyzing. The method further includes controlling the interface tool based at least in part on the further movement of the objects in relation to the multipoint touch screen.

The invention relates, in another embodiment, to a touch-based method. The method includes detecting a user input that occurs over a multipoint sensing device. The user input includes one or more inputs. Each input has a unique identifier. The method also includes, during the user input, classifying the user input as a tracking or selecting input when the user input includes one unique identifier or a gesture input when the user input includes at least two unique identifiers. The method further includes performing tracking or selecting during the user input when the user input is classified as a tracking or selecting input. The method additionally includes performing one or more control actions during the user input when the user input is classified as a gesturing input. The control actions being based at least in part on changes that occur between the at least two unique identifiers.

The invention relates, in another embodiment, to a touch-based method. The method includes outputting a GUI on a display. The method also includes detecting a user input on a touch sensitive device. The method further includes analyzing the user input for characteristics indicative of tracking, selecting or a gesturing. The method additionally includes categorizing the user input as a tracking, selecting or gesturing input. The method further includes performing tracking or selecting in the GUI when the user input is categorized as a tracking or selecting input. Moreover, the method includes performing control actions in the GUI when the user input is

categorized as a gesturing input, the actions being based on the particular gesturing input.

The invention relates, in another embodiment, to a touch-based method. The method includes capturing an initial touch image. The method also includes determining the touch mode based on the touch image. The method further includes capturing the next touch image. The method further includes determining if the touch mode changed between the initial and next touch images. The method additionally includes, if the touch mode changed, setting the next touch image as the initial touch image and determining the touch mode based on the new initial touch image. Moreover, the method includes, if the touch mode stayed the same, comparing the touch images and performing a control function based on the comparison.

The invention relates, in another embodiment, to a computer implemented method for processing touch inputs. The method includes reading data from a touch screen. The data pertaining to touch input with respect to the touch screen, and the touch screen having a multipoint capability. The method also includes converting the data to a collection of features. The method further includes classifying the features and grouping the features into one or more feature groups. The method additionally includes calculating key parameters of the feature groups and associating the feature groups to user interface elements on a display.

The invention relates, in another embodiment, to a computer implemented method. The method includes outputting a graphical image. The method also includes receiving a multitouch gesture input over the graphical image. The method further includes changing the graphical image based on and in unison with multitouch gesture input.

The invention relates, in another embodiment, to a touch based method. The method includes receiving a gestural input over a first region. The method also includes generating a first command when the gestural input is received over the first region. The method further includes receiving the same gestural input over a second region. The method additionally includes generating a second command when the same gestural input is received over the second region. The second command being different than the first command.

The invention relates, in another embodiment, to a method for recognizing multiple gesture inputs. The method includes receiving a multitouch gestural stroke on a touch sensitive surface. The multitouch gestural stroke maintaining continuous

contact on the touch sensitive surface. The method also includes recognizing a first gesture input during the multitouch gestural stroke. The method further includes recognizing a second gesture input during the multitouch gestural stroke.

The invention relates, in another embodiment, to a computer implemented method. The method includes detecting a plurality of touches on a touch sensing device. The method also includes forming one or more touch groups with the plurality of touches. The method further includes monitoring the movement of and within each of the touch groups. The method additionally includes generating control signals when the touches within the touch groups are moved or when the touch groups are moved in their entirety.

It should be noted that in each of the embodiments described above, the methods may be implemented using a touch based input device such as a touch screen or touch pad, more particularly a multipoint touch based input device, and even more particularly a multipoint touch screen. It should also be noted that the gestures, gesture modes, gestural inputs, etc. may correspond to any of those described below in the detailed description. For example, the gestures may be associated with zooming, panning, scrolling, rotating, enlarging, floating controls, zooming targets, paging, inertia, keyboarding, wheeling, and/or the like.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements, and in which:

Fig. 1 is a block diagram of a computer system, in accordance with one embodiment of the present invention.

Fig. 2 is a multipoint processing method, in accordance with one embodiment of the present invention.

Figs. 3A and B illustrate an image, in accordance with one embodiment of the present invention.

Fig. 4 illustrates a group of features, in accordance with one embodiment of the present invention.

Fig. 5 is a parameter calculation method, in accordance with one embodiment of the present invention.

Figs. 6A-6H illustrate a rotate gesture, in accordance with one embodiment of the present invention.

Fig. 7 is a diagram of a touch-based method, in accordance with one embodiment of the present invention.

Fig. 8 is a diagram of a touch-based method, in accordance with one embodiment of the present invention.

Fig. 9 is a diagram of a touch-based method, in accordance with one embodiment of the present invention.

Fig. 10 is a diagram of a zoom gesture method, in accordance with one embodiment of the present invention.

Figs. 11A-11J illustrates a zooming sequence, in accordance with one embodiment of the present invention.

Fig. 12 is a diagram of a pan method, in accordance with one embodiment of the present invention.

Figs. 13A-13D illustrate a panning sequence, in accordance with one embodiment of the present invention.

Fig. 14 is a diagram of a rotate method, in accordance with one embodiment of the present invention.

Figs. 15A-15C illustrate a rotating sequence, in accordance with one embodiment of the present invention.

Fig. 16 is a diagram of a GUI operational method, in accordance with one embodiment of the present invention.

Figs. 17A-17E illustrate a floating control sequence, in accordance with one embodiment of the present invention.

Fig. 18 is a diagram of a GUI operational method, in accordance with one embodiment of the present invention.

Figs. 19A-19D illustrate a zooming target sequence, in accordance with one embodiment of the present invention.

Fig. 20 is a diagram of a GUI operational method, in accordance with one embodiment of the present invention.

Figs. 21A-21E illustrate a page turning sequence, in accordance with one embodiment of the present invention.

Fig. 22 is a diagram of a GUI operational method, in accordance with one embodiment of the present invention.

Figs. 23A-23D illustrate an inertia sequence, in accordance with one embodiment of the present invention.

Fig. 24 is a diagram of a GUI operational method, in accordance with one embodiment of the present invention.

Figs. 25A-25D illustrates a keyboard sequence, in accordance with one embodiment of the present invention.

Fig. 26 is a diagram of a GUI operational method, in accordance with one embodiment of the present invention.

Figs. 27A-27D illustrates a scroll wheel sequence, in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The invention generally pertains to gestures and methods of implementing gestures with touch sensitive devices. Examples of touch sensitive devices include touch screens and touch pads. One aspect of the invention relates to recognizing at least two simultaneously occurring gestures. Another aspect of the invention relates to displaying a graphical image and linking different touches that occur to the graphical image. Another aspect of the invention relates to immediately recognizing gestures so that actions associated with the gestures can be implemented at the same time. Another aspect of the invention relates to changing a displayed image based on and in unison with a gestural input, i.e., the displayed image continuously changes with changes in the gestural input such that the displayed image continuously follows the gestural input. Another aspect of the invention relates to implementing an input mode based on the number of fingers (or other object) in contact with the input device. Another aspect of the invention relates to providing region sensitivity where gestures mean different things when implemented over different areas of the input device. Another aspect of the invention relates to changing an input while making continuous contact with the touch sensitive surface of the touch sensitive device.

These and other aspects of the invention are discussed below with reference to Figs. 1-27. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these figures is for explanatory purposes as the invention extends beyond these limited embodiments.

Fig. 1 is a block diagram of an exemplary computer system 50, in accordance with one embodiment of the present invention. The computer system 50 may correspond to a personal computer system, such as a desktops, laptops, tablets or

handheld computer. The computer system may also correspond to a computing device, such as a cell phone, PDA, dedicated media player, consumer electronic device, and the like.

The exemplary computer system 50 shown in Fig. 1 includes a processor 56 configured to execute instructions and to carry out operations associated with the computer system 50. For example, using instructions retrieved for example from memory, the processor 56 may control the reception and manipulation of input and output data between components of the computing system 50. The processor 56 can be implemented on a single-chip, multiple chips or multiple electrical components. For example, various architectures can be used for the processor 56, including dedicated or embedded processor, single purpose processor, controller, ASIC, and so forth.

In most cases, the processor 56 together with an operating system operates to execute computer code and produce and use data. Operating systems are generally well known and will not be described in greater detail. By way of example, the operating system may correspond to OS/2, DOS, Unix, Linux, Palm OS, and the like. The operating system can also be a special purpose operating system, such as may be used for limited purpose appliance-type computing devices. The operating system, other computer code and data may reside within a memory block 58 that is operatively coupled to the processor 56. Memory block 58 generally provides a place to store computer code and data that are used by the computer system 50. By way of example, the memory block 58 may include Read-Only Memory (ROM), Random-Access Memory (RAM), hard disk drive and/or the like. The information could also reside on a removable storage medium and loaded or installed onto the computer system 50 when needed. Removable storage mediums include, for example, CD-ROM, PC-CARD, memory card, floppy disk, magnetic tape, and a network component.

The computer system 50 also includes a display device 68 that is operatively coupled to the processor 56. The display device 68 may be a liquid crystal display (LCD) (e.g., active matrix, passive matrix and the like). Alternatively, the display device 68 may be a monitor such as a monochrome display, color graphics adapter

(CGA) display, enhanced graphics adapter (EGA) display, variable-graphics-array (VGA) display, super VGA display, cathode ray tube (CRT), and the like. The display device may also correspond to a plasma display or a display implemented with electronic inks.

The display device 68 is generally configured to display a graphical user interface (GUI) 69 that provides an easy to use interface between a user of the computer system and the operating system or application running thereon. Generally speaking, the GUI 69 represents, programs, files and operational options with graphical images. The graphical images may include windows, fields, dialog boxes, menus, icons, buttons, cursors, scroll bars, etc. Such images may be arranged in predefined layouts, or may be created dynamically to serve the specific actions being taken by a user. During operation, the user can select and activate various graphical images in order to initiate functions and tasks associated therewith. By way of example, a user may select a button that opens, closes, minimizes, or maximizes a window, or an icon that launches a particular program. The GUI 69 can additionally or alternatively display information, such as non interactive text and graphics, for the user on the display device 68.

The computer system 50 also includes an input device 70 that is operatively coupled to the processor 56. The input device 70 is configured to transfer data from the outside world into the computer system 50. The input device 70 may for example be used to perform tracking and to make selections with respect to the GUI 69 on the display 68. The input device 70 may also be used to issue commands in the computer system 50. The input device 70 may include a touch sensing device configured to receive input from a user's touch and to send this information to the processor 56. By way of example, the touch-sensing device may correspond to a touchpad or a touch screen. In many cases, the touch-sensing device recognizes touches, as well as the position and magnitude of touches on a touch sensitive surface. The touch sensing means reports the touches to the processor 56 and the processor 56 interprets the touches in accordance with its programming. For example, the processor 56 may initiate a task in accordance with a particular touch. A dedicated processor can be used to process touches locally and reduce demand for the main processor of the computer system. The touch sensing device may be based on sensing technologies

including but not limited to capacitive sensing, resistive sensing, surface acoustic wave sensing, pressure sensing, optical sensing, and/or the like. Furthermore, the touch sensing means may be based on single point sensing or multipoint sensing. Single point sensing is capable of only distinguishing a single touch, while multipoint sensing is capable of distinguishing multiple touches that occur at the same time.

The input device 70 may be a touch screen that is positioned over or in front of the display 68. The touch screen 70 may be integrated with the display device 68 or it may be a separate component. The touch screen 70 has several advantages over other input technologies such as touchpads, mice, etc. For one, the touch screen 70 is positioned in front of the display 68 and therefore the user can manipulate the GUI 69 directly. For example, the user can simply place their finger over an object to be controlled. In touch pads, there is no one–to-one relationship such as this. With touchpads, the touchpad is placed away from the display typically in a different plane. For example, the display is typically located in a vertical plane and the touchpad is typically located in a horizontal plane. This makes its use less intuitive, and therefore more difficult when compared to touch screens. In addition to being a touch screen, the input device 70 can be a multipoint input device. Multipoint input devices have advantages over conventional singlepoint devices in that they can distinguish more than one object (finger). Singlepoint devices are simply incapable of distinguishing multiple objects. By way of example, a multipoint touch screen, which can be used herein, is shown and described in greater detail in copending and commonly assigned U.S. Patent Application No.: 10/840,862, which is hereby incorporated herein by reference.

The computer system 50 also includes capabilities for coupling to one or more I/O devices 80. By way of example, the I/O devices 80 may correspond to keyboards, printers, scanners, cameras, speakers, and/or the like. The I/O devices 80 may be integrated with the computer system 50 or they may be separate components (e.g., peripheral devices). In some cases, the I/O devices 80 may be connected to the computer system 50 through wired connections (e.g., cables/ports). In other cases, the I/O devices 80 may be connected to the computer system 80 through wireless connections. By way of example, the data link may correspond to PS/2, USB, IR, RF, Bluetooth or the like.

In accordance with one embodiment of the present invention, the computer system 50 is designed to recognize gestures 85 applied to the input device 70 and to control aspects of the computer system 50 based on the gestures 85. In some cases, a gesture is defined as a stylized interaction with an input device that is mapped to one or more specific computing operations. The gestures 85 may be made through various hand, and more particularly finger motions. Alternatively or additionally, the gestures may be made with a stylus. In all of these cases, the input device 70 receives the gestures 85 and the processor 56 executes instructions to carry out operations associated with the gestures 85. In addition, the memory block 58 may include a gesture operational program 88, which may be part of the operating system or a separate application. The gestural operation program 88 generally includes a set of instructions that recognizes the occurrence of gestures 85 and informs one or more software agents of the gestures 85 and/or what action(s) to take in response to the gestures 85.

When a user performs one or more gestures, the input device 70 relays gesture information to the processor 56. Using instructions from memory 58, and more particularly, the gestural operational program 88, the processor 56 interprets the gestures 85 and controls different components of the computer system 50, such as memory 58, a display 68 and I/O devices 80, based on the gestures 85. The gestures 85 may be identified as commands for performing actions in applications stored in the memory 58, modifying GUI objects shown on the display 68, modifying data stored in memory 58, and/or for performing actions in I/O devices 80. By way of example, the commands may be associated with zooming, panning, scrolling, paging, rotating, sizing, and the like. As further examples, the commands may also be associated with launching a particular program, opening a file or document, viewing a menu, making a selection, executing instructions, logging onto the computer system, permitting authorized individuals access to restricted areas of the computer system, loading a user profile associated with a user's preferred arrangement of the computer desktop, and/or the like.

A wide range of different gestures can be utilized. By way of example, the gestures may be single point or multipoint gestures; static or dynamic gestures;

continuous or segmented gestures; and/or the like. Single point gestures are those gestures that are performed with a single contact point, e.g., the gesture is performed with a single touch as for example from a single finger, a palm or a stylus. Multipoint gestures are those gestures that can be performed with multiple points, e.g., the gesture is performed with multiple touches as for example from multiple fingers, fingers and palms, a finger and a stylus, multiple styli and/or any combination thereof. Static gestures are those gestures that do not include motion, and dynamic gestures are those gestures that do include motion. Continuous gestures are those gestures that are performed in a single stroke, and segmented gestures are those gestures that are performed in a sequence of distinct steps or strokes.

In one embodiment, the computer system 50 is configured to register multiple gestures at the same time, i.e., multiple gestures can be performed simultaneously. By way of example, a zoom gesture may be performed at the same time as a rotate gesture, or a rotate gesture may be performed at the same time as a pan gesture. In one particular implementation, zoom, rotate and pan gestures can all occur simultaneously in order to perform zooming, rotating and panning at the same time.

In another embodiment, the system is configured to immediately recognize the gestures so that actions associated with the gestures can be implemented at the same time as the gesture, i.e., the gesture and action simultaneously occur side by side rather than being a two-step process. By way of example, during a scrolling gesture, the screen moves with the finger motion.

In another embodiment, an object presented on a display 68 continuously follows the gesture occurring on a touch screen. There is a one to one relationship between the gesture being performed and the objects shown on the display 68. For example, as the gesture is performed, modifications simultaneously occur to the objects located underneath the gesture. For example, during a zooming gesture, the fingers may spread apart or close together in order to cause the object shown on the display 68 to zoom in during the spreading and zoom out during the closing. During this operation, the computer system 50 recognizes the user input as a zoom gesture, determines what action should be taken, and outputs control data to the appropriate device, in this case the display 68.

In another embodiment, the computer system 50 provides region sensitivity where gestures mean different things when implemented over different areas of the input device 68. For example, a rotation gesture over a volume knob causes volume increase/decrease, whereas a rotation gesture over a photo causes rotation of the photo.

In another embodiment, the number of fingers in contact with the touch screen may indicate an input mode. For example, a single touch as for example by a single finger may indicate the desire to perform tracking, i.e., pointer or cursor movements, or selections, whereas multiple touches as for example by a group of fingers may indicate the desire to perform gesturing. The number of fingers for implementing gesturing may be widely varied. By way of example, two fingers may indicate a first gesture mode, three fingers may indicate a third gesture mode, etc. Alternatively, any number of fingers, i.e., more than one, may be used for the same gesture mode, which can include one ore more gesture controls. The orientation of the fingers may similarly be used to denote the desired mode. The profile of the finger may be detected to permit different modal operations based on whether the user has used his thumb or index finger, for example.

In another embodiment, an input can be changed while making a continuous stroke on the input device without stopping the stroke (e.g., lifting off the touch sensitive surface). In one implementation, the user can switch from a tracking (or selection) mode to gesturing mode while a stroke is being made. For example, tracking or selections may be associated with a single finger and gesturing may be associated with multiple fingers; therefore, the user can toggle between tracking/selection and gesturing by picking up and placing down a second finger on the touch screen. In another implementation, the user can switch from one gesture mode to another gesture mode while a stroke is being made. For example, zooming may be associated with spreading a pair of fingers and rotating may be associated with rotating the pair of fingers; therefore, the user can toggle between zooming and rotating by alternating the movement of their fingers between spreading and rotating. In yet another implementation, the number of gesture inputs can be changed while a stroke is being made (e.g., added or subtracted). For example, during zooming where

the fingers are spread apart, the user may further rotate their fingers to initiate both zooming and rotation. Furthermore during zooming and rotation, the user can stop spreading their fingers so that only rotation occurs. In other words, the gesture inputs can be continuously input, either simultaneously or consecutively.

In one particular embodiment, a single finger initiates tracking (or selection) and two or more fingers in close proximity to one another initiates scrolling or panning. Two fingers is generally preferred so as to provide easy toggling between one and two fingers, i.e., the user can switch between modes very easily by simply picking or placing an additional finger. This has the advantage of being more intuitive than other forms of mode toggling. During tracking, cursor movement is controlled by the user moving a single finger on the touch sensitive surface of a touch sensing device. The sensor arrangement of the touch sensing device interprets the finger motion and generates signals for producing corresponding movement of the cursor on the display. During scrolling, screen movement is controlled by the user moving dual fingers on the touch sensitive surface of the touch sensing device. When the combined fingers are moved in the vertical direction, the motion is interpreted as a vertical scroll event, and when the combined fingers are moved in the horizontal direction, the motion is interpreted as a horizontal scroll event. The same can be said for panning although panning can occur in all directions rather than just the horizontal and vertical directions.

The term "scrolling" as used herein generally pertains to moving displayed data or images (e.g., text or graphics) across a viewing area on a display screen so that a new set of data (e.g., line of text or graphics) is brought into view in the viewing area. In most cases, once the viewing area is full, each new set of data appears at the edge of the viewing area and all other sets of data move over one position. That is, the new set of data appears for each set of data that moves out of the viewing area. In essence, the scrolling function allows a user to view consecutive sets of data currently outside of the viewing area. The viewing area may be the entire viewing area of the display screen or it may only be a portion of the display screen (e.g., a window frame).

As mentioned above, scrolling may be implemented vertically (up or down) or horizontally (left or right). In the case of vertical scrolling, when a user scrolls down, each new set of data appears at the bottom of the viewing area and all other sets of data move up one position. If the viewing area is full, the top set of data moves out of the viewing area. Similarly, when a user scrolls up, each new set of data appears at the top of the viewing area and all other sets of data move down one position. If the viewing area is full, the bottom set of data moves out of the viewing area.

By way of example, the display screen, during operation, may display a list of media items (e.g., songs). A user is able to linearly scroll through the list of media items by moving his or her finger across a touch screen. As the finger moves across the touch screen, the displayed items from the list of media items are varied such that the user is able to effectively scroll through the list of media items. In most cases, the user is able to accelerate their traversal of the list of media items by moving his or her finger at greater speeds. Some embodiments, which may be related to the above example, are described in greater detail below. See for example Figs. 6, 23, 27.

Fig. 2 is a multipoint processing method 100, in accordance with one embodiment of the present invention. The multipoint processing method 100 may for example be performed in the system shown in Fig. 1. The multipoint processing method 100 generally begins at block 102 where images are read from a multipoint input device, and more particularly a multipoint touch screen. By way of example, the multipoint touch screen may generally correspond to the multipoint touch screen disclosed in copending U.S. Patent Application No.: 10/840,862, which is hereby incorporated herein by reference. Although the term "image" is used it should be noted that the data may come in other forms. In most cases, the image read from the touch screen provides magnitude (Z) as a function of position (x and y) for each sensing point or pixel of the touch screen. The magnitude may, for example, be reflect the capacitance measured at each point.

Following block 102, multipoint processing method 100 proceeds to block 104 where the image is converted into a collection or list of features. Each feature represents a distinct input such as a touch. In most cases, each feature includes its own unique identifier (ID), x coordinate, y coordinate, Z magnitude, angle θ, area A,

and the like. By way of example, Figs. 3A and 3B illustrate a particular image 120 in time. In image 120, there are two features 122 based on two distinct touches. The touches may for example be formed from a pair of fingers touching the touch screen. As shown, each feature 122 includes unique identifier (ID), x coordinate, y coordinate, Z magnitude, angle θ, and area A. More particularly, the first feature 122A is represented by ID_1, x_1, y_1, Z_1, θ_1, A_1 and the second feature 122B is represented by ID_2, x_2, y_2, Z_2, θ_2, A_2. This data may be outputted for example using a multitouch protocol.

The conversion from data or images to features may be accomplished using methods described in copending U.S. Patent Application No.: 10/840,862 which is hereby incorporated herein by reference. As disclosed therein, the raw data is received. The raw data is typically in a digitized form, and includes values for each node of the touch screen. The values may be between 0 and 256 where 0 equates to no touch pressure and 256 equates to full touch pressure. Thereafter, the raw data is filtered to reduce noise. Once filtered, gradient data, which indicates the topology of each group of connected points, is generated. Thereafter, the boundaries for touch regions are calculated based on the gradient data, i.e., a determination is made as to which points are grouped together to form each touch region. By way of example, a watershed algorithm may be used. Once the boundaries are determined, the data for each of the touch regions are calculated (e.g., x, y, Z, θ, A).

Following block 104, multipoint processing method 100 proceeds to block 106 where feature classification and groupings are performed. During classification, the identity of each of the features is determined. For example, the features may be classified as a particular finger, thumb, palm or other object. Once classified, the features may be grouped. The manner in which the groups are formed can widely varied. In most cases, the features are grouped based on some criteria (e.g., they carry a similar attribute). For example, the two features shown in Figs. 3A and 3B may be grouped together because each of these features is located in proximity to each other or because they are from the same hand. The grouping may include some level of filtering to filter out features that are not part of the touch event. In filtering, one or more features may be rejected because they either meet some predefined criteria or because they do not meet some criteria. By way of example, one of the

features may be classified as a thumb located at the edge of a tablet PC. Because the thumb is being used to hold the device rather than being used to perform a task, the feature generated therefrom is rejected, i.e., is not considered part of the touch event being processed.

Following block 106, the multipoint processing method 100 proceeds to block 108 where key parameters for the feature groups are calculated. The key parameters may include distance between features, x/y centroid of all features, feature rotation, total pressure of the group (e.g., pressure at centroid), and the like. As shown in Fig. 4, the calculation may include finding the centroid C, drawing a virtual line 130 to each feature from the centroid C, defining the distance D for each virtual line (D_1 and D_2), and then averaging the distances D_1 and D_2. Once the parameters are calculated, the parameter values are reported. The parameter values are typically reported with a group identifier (GID) and number of features within each group (in this case three). In most cases, both initial and current parameter values are reported. The initial parameter values may be based on set down, i.e., when the user sets their fingers on the touch screen, and the current values may be based on any point within a stroke occurring after set down. As should be appreciated, blocks 102-108 are repetitively performed during a user stroke thereby generating a plurality of sequentially configured signals. The initial and current parameters can be compared in later steps to perform actions in the system.

Following block 108, the process flow proceeds to block 110 where the group is or associated to a user interface (UI) element. UI elements are buttons boxes, lists, sliders, wheels, knobs, etc. Each UI element represents a component or control of the user interface. The application behind the UI element(s) has access to the parameter data calculated in block 108. In one implementation, the application ranks the relevance of the touch data to the UI element corresponding there to. The ranking may be based on some predetermine criteria. The ranking may include producing a figure of merit, and whichever UI element has the highest figure of merit, giving it sole access to the group. There may even be some degree of historesis as well (once one of the UI elements claims control of that group, the group sticks with the UI element until another UI element has a much higher ranking). By way of example,

the ranking may include determining proximity of the centroid (or features) to the GUI object associated with the UI element.

Following block 110, the multipoint processing method 100 proceeds to blocks 112 and 114. The blocks 112 and 114 can be performed approximately at the same time. From the user perspective, in one embodiment, the blocks 112 and 114 appear to be performed concurrently. In block 112, one or more actions are performed based on differences between initial and current parameter values as well as the UI element to which they are associated. In block 114, user feedback pertaining to the one ore more action being performed is provided. By way of example, user feedback may include display, audio, tactile feedback and/or the like.

Fig. 5 is a parameter calculation method 150, in accordance with one embodiment of the present invention. The parameter calculation method 150 may, for example, correspond to block 108 shown in Fig. 2. The parameter calculation method 150 generally begins at block 152 where a group of features is received. Following block 152, the parameter calculation method 150 proceeds to block 154 where a determination is made as to whether or not the number of features in the group of features has changed. For example, the number of features may have changed due to the user picking up or placing an additional finger. Different fingers may be needed to perform different controls (e.g., tracking, gesturing). If the number of features has changed, the parameter calculation method 150 proceeds to block 156 where the initial parameter values are calculated. If the number stays the same, the parameter calculation method 150 proceeds to block 158 where the current parameter values are calculated. Thereafter, the parameter calculation method 150 proceeds to block 150 where the initial and current parameter values are reported. By way of example, the initial parameter values may contain the average initial distance between points (or Distance (AVG) initial) and the current parameter values may contain the average current distance between points (or Distance (AVG) current). These may be compared in subsequent steps in order to control various aspects of a computer system.

The above methods and techniques can be used to implement any number of GUI interface objects and actions. For example, gestures can be created to detect and

effect a user command to resize a window, scroll a display, rotate an object, zoom in or out of a displayed view, delete or insert text or other objects, etc. Gestures can also be used to invoke and manipulate virtual control interfaces, such as volume knobs, switches, sliders, handles, knobs, doors, and other widgets that may be created to facilitate human interaction with the computing system.

To cite an example using the above methodologies, and referring to Figs. 6A-6H, a rotate gesture for controlling a virtual volume knob 170 on a GUI interface 172 of a display 174 of a tablet PC 175 will be described. In order to actuate the knob 170, the user places their fingers 176 on a multipoint touch screen 178. The virtual control knob may already be displayed, or the particular number, orientation or profile of the fingers at set down, or the movement of the fingers immediately thereafter, or some combination of these and other characteristics of the user's interaction may invoke the virtual control knob to be displayed. In either case, the computing system associates a finger group to the virtual control knob and makes a determination that the user intends to use the virtual volume knob. This association may also be based in part on the mode or current state of the computing device at the time of the input. For example, the same gesture may be interpreted alternatively as a volume know gesture if a song is currently playing on the computing device, or as a rotate command if an object editing application is being executed. Other user feedback may be provided, including for example audible or tactile feedback.

Once knob 170 is displayed as shown in Fig. 6A, the user's fingers 176 can be positioned around the knob 170 similar to if it were an actual knob or dial, and thereafter can be rotated around the knob 170 in order to simulate turning the knob 170. Again, audible feedback in the form of a clicking sound or tactile feedback in the form of vibration, for example, may be provided as the knob 170 is "rotated." The user may also use their other hand to hold the tablet PC 175.

As shown in Fig. 6B, the multipoint touch screen 178 detects at least a pair of images. In particular, a first image 180 is created at set down, and at least one other image 182 is created when the fingers 176 are rotated. Although only two images are shown, in most cases there would be many more images that incrementally occur between these two images. Each image represents a profile of the fingers in contact

with the touch screen at a particular instant in time. These images can also be referred to as touch images. It will be understood that the term "image" does not mean that the profile is displayed on the screen 178 (but rather imaged by the touch sensing device). It should also be noted that although the term "image" is used, the data may be in other forms representative of the touch plane at various times.

As shown in Fig. 6C, each of the images 180 and 182 is converted to a collection of features 184. Each feature 184 is associated with a particular touch as for example from the tips each of the fingers 176 surrounding the knob 170 as well as the thumb of the other hand 177 used to hold the tablet PC 175.

As shown in Fig. 6D, the features 184 are classified, i.e., each finger/thumb is identified, and grouped for each of the images 180 and 182. In this particular case, the features 184A associated with the knob 170 are grouped together to form group 188 and the feature 184B associated with the thumb is filtered out. In alternative arrangements, the thumb feature 184B may be treated as a separate feature by itself (or in another group), for example, to alter the input or operational mode of the system or to implement another gesture, for example, a slider gesture associated with an equalizer slider displayed on the screen in the area of the thumb (or other finger).

As shown in Fig. 6E, the key parameters of the feature group 188 are calculated for each image 180 and 182. The key parameters associated with the first image 180 represent the initial state and the key parameters of the second image 182 represent the current state.

Also as shown in Fig. 6E, the knob 170 is the UI element associated with the feature group 188 because of its proximity to the knob 170. Thereafter, as shown in Fig. 6F, the key parameter values of the feature group 188 from each image 180 and 182 are compared to determine the rotation vector, i.e., the group of features rotated five (5) degrees clockwise from the initial to current state. In Fig. 6F, the initial feature group (image 180) is shown in dashed lines while the current feature group (image 182) is shown in solid lines.

As shown in Fig. 6G, based on the rotation vector the speaker 192 of the tablet PC 175 increases (or decreases) its output in accordance with the amount of rotation of the fingers 176, i.e., increase the volume by 5% based on rotation of 5 degrees. The display 174 of the tablet PC can also adjust the rotation of the knob 170 in accordance with the amount of rotation of the fingers 176, i.e., the position of the knob 170 rotates five (5) degrees. In most cases, the rotation of the knob occurs simultaneously with the rotation of the fingers, i.e., for every degree of finger rotation the knob rotates a degree. In essence, the virtual control knob follows the gesture occurring on the screen. Still further, an audio unit 194 of the tablet PC may provide a clicking sound for each unit of rotation, e.g., provide five clicks based on rotation of five degrees. Sill yet further, a haptics unit 196 of the tablet PC 175 may provide a certain amount of vibration or other tactile feedback for each click thereby simulating an actual knob.

It should be noted that additional gestures can be performed simultaneously with the virtual control knob gesture. For example, more than one virtual control knob can be controlled at the same time using both hands, i.e., one hand for each virtual control knob. Alternatively or additionally, one or more slider bars can be controlled at the same time as the virtual control knob, i.e., one hand operates the virtual control knob, while at least one finger and maybe more than one finger of the opposite hand operates at least one slider and maybe more than one slider bar, e.g., slider bar for each finger.

It should also be noted that although the embodiment is described using a virtual control knob, in another embodiment, the UI element can be a virtual scroll wheel. As an example, the virtual scroll wheel can mimic an actual scroll wheel such as those described in U.S. Patent Publication Nos: 2003/0076303A1, 2003/0076301A1, 2003/0095096A1, which are all herein incorporated by reference. For example, when the user places their finger on the surface of the virtual scroll wheel and makes a swirling, rotational or tangential gesture motion, a scrolling action can be performed with respect to a list of items displayed in a window.

Fig. 7 is a diagram of a touch-based method 200 in accordance with one embodiment of the present invention. The method generally begins at block 202

where a user input that occurs over a multipoint sensing device is detected. The user input includes one or more touch inputs, with each touch input having a unique identifier. Following block 202, the touch-based method 200 proceeds to block 204 where the user input is classified as a tracking or selection input when the user input includes a single unique identifier (one touch input), or is classified as a gesture input when the user input includes at least two unique identifiers (more than one touch input). If the user input is classified as a tracking input, the touch-based method 200 proceeds to block 206 where tracking is performed corresponding to the user input. If the user input is classified as a gesture input, the touch-based method 200 proceeds to block 208 where one or more gesture control actions are performed corresponding the user input. The gesture control actions are based at least in part on changes that occur with or between the at least two unique identifiers.

Fig. 8 is a diagram of a touch-based method 250 in accordance with one embodiment of the present invention. The touch-based method 250 generally begins at block 252 where an initial image is captured during an input stroke on a touch sensitive surface. Following block 252, the touch-based method 250 proceeds to block 254 where the touch mode is determined based on the initial image. For example, if the initial image includes a single unique identifier then the touch mode may correspond to a tracking or selection mode. On the other hand, if the image includes more than one unique identifier, then the touch mode may correspond to a gesture mode. Following block 254, the touch-based method 250 proceeds to block 256 where a next image is captured during the input stroke on the touch sensitive surface. Images are typically captured sequentially during the stroke and thus the there may be a plurality of images associated with the stroke. Following block 256, touch-based method 250 proceeds to block 258 where a determination is made as to whether the touch mode changed between capture of the initial image and capture of the next image. If the touch mode changed, the touch-based method 250 proceeds to block 260 where the next image is set as the initial image and thereafter the touch mode is again determined at block 254 based on the new initial image. If the touch mode stayed the same, the touch-based method 250 proceeds to block 262 where the initial and next images are compared and one or more control signals are generated based on the comparison.

Fig. 9 is a diagram of a touch-based method 300 in accordance with one embodiment of the present invention. The touch-based method 300 begins at block 302 where a GUI object is output. For example, a processor may instruct a display to display a particular GUI object. Following block 302, the touch-based method 300 proceeds to block 304 where a gesture input is received over the GUI object. For instance, a user may set or move their fingers in a gestural way on the surface of the touch screen and while over the displayed GUI object. The gestural input may include one or more single gestures that occur consecutively or multiple gestures that occur simultaneously. Each of the gestures generally has a particular sequence, motion, or orientation associated therewith. For example, a gesture may include spreading fingers apart or closing fingers together, rotating the fingers, translating the fingers, and/or the like.

Following block 304 the touch-based method 300 proceeds to block 306 where the GUI object is modified based on and in unison with the gesture input. By modified, it is meant that the GUI object changes according to the particular gesture or gestures being performed. By in unison, it is meant that the changes occur approximately while the gesture or gestures are being performed. In most cases, there is a one to one relationship between the gesture(s) and the changes occurring at the GUI object and they occur substantially simultaneously. In essence, the GUI object follows the motion of the fingers. For example, spreading of the fingers may simultaneously enlarge the object, closing of the fingers may simultaneously reduce the GUI object, rotating the fingers may simultaneously rotate the object, translating the fingers may allow simultaneous panning or scrolling of the GUI object.

In one embodiment, block 306 may include determining which GUI object is associated with the gesture being performed, and thereafter locking the displayed object to the fingers disposed over it such that the GUI object changes in accordance with the gestural input. By locking or associating the fingers to the GUI object, the GUI object can continuously adjust itself in accordance to what the fingers are doing on the touch screen. Often the determination and locking occurs at set down, i.e., when the finger is positioned on the touch screen.

Fig. 10 is a diagram of a zoom gesture method 350, in accordance with one embodiment of the present invention. The zoom gesture may be performed on a multipoint touch screen. The zoom gesture method 350 generally begins at block 352 where the presence of at least a first finger and a second finger are detected on a touch sensitive surface at the same time. The presence of at least two fingers is configured to indicate that the touch is a gestural touch rather than a tracking touch based on one finger. In some cases, the presence of only two fingers indicates that the touch is a gestural touch. In other cases, any number of more than two fingers indicates that the touch is a gestural touch. In fact, the gestural touch may be configured to operate whether two, three, four or more fingers are touching, and even if the numbers change during the gesture, i.e., only need a minimum of two fingers at any time during the gesture.

Following block 352, the zoom gesture method 350 proceeds to block 354 where the distance between at least the two fingers is compared. The distance may be from finger to finger or from each finger to some other reference point as for example the centroid. If the distance between the two fingers increases (spread apart), a zoom-in signal is generated as shown in block 356. If the distance between two fingers decreases (close together), a zoom-out signal is generated as shown in block 358. In most cases, the set down of the fingers will associate or lock the fingers to a particular GUI object being displayed. For example, the touch sensitive surface can be a touch screen, and the GUI object can be displayed on the touch screen. This typically occurs when at least one of the fingers is positioned over the GUI object. As a result, when the fingers are moved apart, the zoom-in signal can be used to increase the size of the embedded features in the GUI object and when the fingers are pinched together, the zoom-out signal can be used to decrease the size of embedded features in the object. The zooming typically occurs within a predefined boundary such as the periphery of the display, the periphery of a window, the edge of the GUI object, and/or the like. The embedded features may be formed on a plurality of layers, each of which represents a different level of zoom. In most cases, the amount of zooming varies according to the distance between the two objects. Furthermore, the zooming typically can occur substantially simultaneously with the motion of the objects. For instance, as the fingers spread apart or closes together, the object zooms in or zooms out at the same time. Although this methodology is directed at zooming, it should be

noted that it may also be used for enlarging or reducing. The zoom gesture method 350 may be particularly useful in graphical programs such as publishing, photo, and drawing programs. Moreover, zooming may be used to control a peripheral device such as a camera, i.e., when the finger is spread apart, the camera zooms out and when the fingers are closed the camera zooms in.

Figs. 11A-11J illustrate a zooming sequence using the method described above. Fig. 11A illustrates a display presenting a GUI object 364 in the form of a map of North America with embedded levels which can be zoomed. In some cases, as shown, the GUI object is positioned inside a window that forms a boundary of the GUI object 364. Fig. 11B illustrates a user positioning their fingers 366 over a region of North America 368, particularly the United States 370 and more particularly California 372. In order to zoom in on California 372, the user starts to spread their fingers 366 apart as shown in Fig. 11C. As the fingers 366 spread apart further (distance increases), the map zooms in further on Northern California 374, then to a particular region of Northern California 374, then to the Bay area 376, then to the peninsula 378 (e.g., the area between San Francisco and San Jose Area), and then to the city of San Carlos 380 located between San Francisco and San Jose as illustrated in Figs. 11D-11H. In order to zoom out of San Carlos 380 and back to North America 368, the fingers 366 are closed back together following the sequence described above, but in reverse.

Fig. 12 is a diagram of a pan method 400, in accordance with one embodiment of the present invention. The pan gesture may be performed on a multipoint touch screen. The pan method 400 generally begins at block 402 where the presence of at least a first object and a second object are detected on a touch sensitive surface at the same time. The presence of at least two fingers is configured to indicate that the touch is a gestural touch rather than a tracking touch based on one finger. In some cases, the presence of only two fingers indicates that the touch is a gestural touch. In other cases, any number of more than two fingers indicates that the touch is a gestural touch. In fact, the gestural touch may be configured to operate whether two, three, four or more fingers are touching, and even if the numbers change during the gesture, i.e., only need a minimum of two fingers. Following block 402, the pan method 400 proceeds to block 404 where the position of the two objects when the objects are

moved together across the touch screen is monitored. Following block 404, the pan method 400 proceeds to block 406 were a pan signal is generated when the position of the two objects changes relative to an initial position. In most cases, the set down of the fingers will associate or lock the fingers to a particular GUI object displayed on the touch screen. Typically, when at least one of the fingers is positioned over the image on the GUI object. As a result, when the fingers are moved together across the touch screen, the pan signal can be used to translate the image in the direction of the fingers. In most cases, the amount of panning varies according to the distance the two objects move. Furthermore, the panning typically can occur substantially simultaneously with the motion of the objects. For instance, as the fingers move, the object moves with the fingers at the same time.

Figs. 13A-13D illustrate a panning sequence based on the pan method 400 described above. Using the map of Fig. 11, Fig. 13A illustrates a user positioning their fingers 366 over the map. Upon set down, the fingers 366 are locked to the map. As shown in Fig. 13B, when the fingers 366 are moved vertically up, the entire map 364 is moved up thereby causing previously seen portions of map 364 to be placed outside the viewing area and unseen portions of the map 364 to be placed inside the viewing area. As shown in Fig. 13C, when the fingers 366 are moved horizontally sideways, the entire map 364 is moved sideways thereby causing previously seen portions of map 364 to be placed outside the vowing area and unseen portions of the map to be placed inside the viewing area. As shown in Fig. 13D, when the fingers 366 are moved diagonally, the entire map 364 is moved diagonally thereby causing previously seen portions of map 364 to be placed outside the viewing area and unseen portions of the map to be placed inside the viewing area. As should be appreciated, the motion of the map 364 follows the motion of the fingers 366. This process is similar to sliding a piece of paper along a table. The pressure the fingers exert on the paper locks the paper to the fingers and when the fingers are slid across the table, the piece of paper moves with them.

Fig. 14 is a diagram of a rotate method 450, in accordance with one embodiment of the present invention. The rotate gesture may be performed on a multipoint touch screen. The rotate method 450 generally begins at block 452 where the presence of a first object and a second object are detected at the same time. The

presence of at least two fingers is configured to indicate that the touch is a gestural touch rather than a tracking touch based on one finger. In some cases, the presence of only two fingers indicates that the touch is a gestural touch. In other cases, any number of more than two fingers indicates that the touch is a gestural touch. In fact, the gestural touch may be configured to operate whether two, three, four or more fingers are touching, and even if the numbers change during the gesture, i.e., only need a minimum of two fingers.

Following block 452, the rotate method 450 proceeds to block 454 where the angle of each of the finger is set. The angles are typically determined relative to a reference point. Following block 454, rotate method 450 proceeds to block 456 where a rotate signal is generated when the angle of at least one of the objects changes relative to the reference point. In most cases, the set down of the fingers will associate or lock the fingers to a particular GUI object displayed on the touch screen. Typically, when at least one of the fingers is positioned over the image on the GUI object, the GUI object will be associated with or locked to the fingers. As a result, when the fingers are rotated, the rotate signal can be used to rotate the object in the direction of finger rotation (e.g., clockwise, counterclockwise). In most cases, the amount of object rotation varies according to the amount of finger rotation, i.e., if the fingers move 5 degrees then so will the object. Furthermore, the rotation typically can occur substantially simultaneously with the motion of the fingers. For instance, as the fingers rotate, the object rotates with the fingers at the same time.

Figs. 15A-15C illustrate a rotating sequence based on the method described above. Using the map of Fig. 11, Fig. 15A illustrates a user positioning their fingers 366 over the map 364. Upon set down, the fingers 366 are locked to the map 364. As shown in Fig. 15B, when the fingers 366 are rotated in a clockwise direction, the entire map 364 is rotated in the clockwise direction in accordance with the rotating fingers 366. As shown in Fig. 15C, when the fingers 366 are rotated in a counterclockwise direction, the entire map 364 is rotated in the counter clockwise direction in accordance with the rotating fingers 366.

It should be noted that the methods described in Figs. 10-15 can be implemented during the same gestural stroke. That is, zooming, rotating and panning

can all be performed during the gestural stroke, which may include spreading, rotating and sliding fingers. For example, upon set down with at least two fingers, the displayed object (map) is associated or locked to the two fingers. In order to zoom, the user can spread or close their fingers. In order to rotate, the user can rotate their fingers. In order to pan, the user can slid their fingers. Each of these actions can occur simultaneously in a continuous motion. For example, the user can spread and close their fingers while rotating and sliding them across the touch screen. Alternatively, the user can segment each of these motions without having to reset the gestural stroke. For example, the user can first spread their fingers, then rotate their fingers, then close their fingers, then slide their fingers and so on.

Fig. 16 is a diagram of a GUI operational method 500, in accordance with one embodiment of the present invention. The GUI operational method 500 is configured for initiating floating controls in a GUI. The GUI operational method 500 generally begins at block 502 where the presence of an object such as a finger or thumb is detected. This may for example be accomplished using a touch screen. Following block 502, the GUI operational method 500 proceeds to block 504 where the object is recognized (the identity of the object is found). The object may be recognized among a plurality of objects. For example, see block 104 of Fig. 2 above.

Following block 504, the GUI operational method 500 proceeds to block 506 where an image in the vicinity of the object is generated. The image is typically based on the recognized object . The image may include windows, fields, dialog boxes, menus, icons, buttons, cursors, scroll bars, etc. In some cases, the user can select and activate the image (or features embedded therein) in order to initiate functions and tasks. By way of example, the image may be a user interface element or a group of user interface elements (e.g., one or more buttons that open, close, minimize, or maximize a window). The image may also be one or more icons that launch a particular program or files that open when selected. The image may additionally correspond to non interactive text and graphics. In most cases, the image is displayed as long as the object is detected or it may be displayed for some preset amount of time, i.e., after a period of time it times out and is removed.

In one particular embodiment, the image includes one or more control options that can be selected by the user. The control options may include one or more control buttons for implementing various tasks. For example, the control option box may include music listening control buttons as for example, play, pause, seek and menu.

Figs. 17A-17E illustrate a floating control sequence using the method described above. As shown in Fig. 17A, a user 510 is using a tablet PC 512 and therefore is holding the tablet PC 512 with one hand 514 while navigating (e.g., tracking, gesturing) with the other hand 516. As shown in Fig. 17B, which is a close up of the user holding the tablet PC 512, a portion of the thumb of the holding hand 514 is positioned over the touch screen 520. As shown in Fig. 17C, the tablet PC 512 recognizes the thumb and displays a control box 522 adjacent the thumb. The control box 522 includes various buttons 524, which can be selected by the user's thumb to initiate tasks in the tablet PC 512. As shown in Fig. 17D, while holding the tablet PC 512, the thumb is extended over one of the buttons 524 and subsequently tapped thereby selecting the task associated with the button 524. By way of example, the task may be associated with launching a program or gaining access to a network or changing the mode of operation of the device. The control box 522 and buttons 524 may be used to change the input mode of the touch screen 520 so that, for example, the identical gesture made with the fingers of the user's other hand may have multiple meanings depending on which of buttons 524 is selected. As shown in Fig. 17E, when the thumb is moved away from the touch screen 520, the control box 522 may time out and disappear. Alternatively, the control box may be closed using conventional close icons or buttons.

Fig. 18 is a diagram of a GUI operational method 550, in accordance with one embodiment of the present invention. The GUI operational method 550 is configured for initiating zooming targets. The GUI operational method 550 generally begins at block 552 where a control box GUI element is displayed. The control box contains one or more control buttons, which are somewhat close together, and which can be used to perform actions. The control box may, for example, include control buttons such as maximize, minimize, close, and the like. Following block 552, the GUI operational method 550 proceeds to block 554 where the control box is enlarged, or at least one of the control buttons is enlarged for a period of time when the presence of

an object over the control box or one of the control buttons is detected. In the case where the control box is enlarged each of the control buttons is enlarged thereby making selection thereof much easier. In the case where only the control button is enlarged, the user would decide whether this is the correct button and if so select the enlarged control button, or restart the process so that the appropriate control button is presented. In most cases, the size of the control buttons corresponds to the size of the finger so that they may be easily selected by the object. Following block 554, the GUI operational method 550 proceeds to block 556 where a control signal associated with the selected control button is generated when the presence of the object over one of the enlarged control buttons is detected.

Figs. 19A-19D illustrate a zooming target sequence using the GUI operational method 550 described above. As shown in Fig. 19A, a user 510 places their finger 576 over a control box 578. Because the buttons 580 of the control box 578 included therein are smaller than the finger 576 and located close together, it is difficult for the user 510 to make a selection directly without possibly pressing an undesirable button 580, e.g., a button adjacent the desired button. By way of example, the finger 576 may cover two or more of the buttons 580. As shown in Fig. 19B, at least a portion of the control box 578 is enlarged including the buttons 580 included therein when the user places their thumb over the control box. As shown in Fig. 19C, once the control box has reached its enlarged state, the user can select one of the enlarged buttons, which is now closer to the size of the thumb. By way of example, the user may tap on the desired control button. As shown in Fig. 19D, the control box reduces to its initial size after the button is selected or after a predetermined time period in which no selection was made (e.g., times out) or when the user moves their finger away from the control box.

Fig. 20 is a diagram of a GUI operational method 600, in accordance with one embodiment of the present invention. The GUI operational method 600 is configured for initiating a page turn. The GUI operational method 600 generally begins at block 602 where a page from a multitude of pages is displayed in a GUI. By way of example, the pages may be associated with an electronic book. Following block 602, the GUI operational method 600 proceeds to block 604 where the presence of an object (or objects) in a predetermined region over the page is detected. The

predetermined area may, for example, correspond to the area where the page number is displayed. Following block 604, the GUI operational method 600 proceeds to block 606 where a page turn signal is generated when the object (or objects) is translated in the predetermined region. The translation is configured to simulate a finger turning the page in an actual paper bound book. The direction of the translation indicates whether to go to the next page or previous page in the list of pages. For example, if the finger is swiped right to left, then a page back signal is generated, and if the finger is swiped left to right, then a page up signal is generated. This GUI operational method 600 may be enhanced several ways. For instance, if multiple fingers are swiped, then this may create a paging signal greater than one page. For example, a two finger swipe equals two page turns, three finger swipe equals three page turns, etc. Or a two finger swipe equals ten page turns, three finger swipe equals 50 page turns, etc.

Figs. 21A-21E illustrate a page turning sequence using the GUI operational method 600 described above. As shown in Fig. 21A, which is a close up of a user 510 holding the tablet PC 512, the user swipes their finger over the page number in a direction to the left of the page 630. As shown in Fig. 21B, the tablet PC 512 recognizes the swipe and direction of the swipe in the area of the page number and therefore the tablet PC 512 displays the next page in a group of pages. This can be performed repeatedly to whisk through the group of pages. As shown in Fig. 21C, the user swipes their finger 576 over the page number in a direction to the right of the page 630. As shown in Fig. 21D, the tablet PC 512 recognizes the swipe and direction of the swipe in the area of the page number and therefore the tablet PC 512 displays the previous page in a group of pages. This can be performed repeatedly to whisk through the group of pages.

Fig. 22 is a diagram of a GUI operational method 650, in accordance with one embodiment of the present invention. The GUI operational method 650 is configured for initiating inertia typically during a scrolling or panning operation. Inertia is generally defined as the tendency of a body at rest to remain at rest or of a body in motion to stay in motion in a straight line unless disturbed by an external force. In this particular embodiment, the GUI or some portion thereof is associated with inertial properties, which is its resistance to rate of change in motion. For a GUI with

high inertia characteristics, the acceleration of the GUI will be small for a given input. On the other hand, if the GUI has low inertia characteristics, the acceleration will be large for a given input.

The GUI operational method 650 generally begins at block 652 where a graphical image is displayed on a GUI. Following block 652, the GUI operational method 650 proceeds to block 654 where a scrolling or panning stroke on a touch sensitive surface is detected. By way of example, the stroke may be a linear or rotational stroke. During a linear stroke, the direction of scrolling or panning typically follows the direction of the stroke. During a rotational stroke (see Fig. 6), the rotational stroke is typically converted to a linear input where clockwise motion may correspond to vertical up and counterclockwise motion may correspond to vertical down. Following block 654 the process flow proceeds to block 656 where the speed and direction of the scrolling or panning stroke is determined. Following block 656, the GUI operational method 650 proceeds to block 658 where the image is moved in accordance with the speed and direction of the scrolling or panning stroke as well as the associated inertial characteristics. Following block 658, the GUI operational method 650 proceeds to block 660 where the motion of the image continues even when the panning or scrolling stroke is no longer detected. For example, when the user picks up their finger from the touch sensitive surface, the scrolling or panning function continues as if the scrolling or panning stroke was still being made. In some cases, the motion of the image continues infinitely until some braking (stopping or slowing) control is performed. This particular methodology simulates zero gravity. In other cases, the motion of the image is slowed in accordance with the associated inertia GUI operational method 650. Metaphorically speaking, the image may correspond to a piece of paper moving over a desktop. In order to move the piece of paper, the user exerts a force on the paper in the desired direction. When the user lifts their finger off the paper, the paper will continue to slid along the desktop in the desired direction for some period of time. The amount it slides after lifting the finger generally depends on, among other things, its mass, the force applied by the finger, the friction force found between the paper and the desktop, etc. As should be appreciated, traditionally when scrolling and panning are implemented, the scrolling or panning stops when the fingers are picked up. In

contrast, using the above mentioned methodology, the scrolling or panning continues to move when the fingers are picked up.

The GUI operational method 650 may additionally include blocks A and B. In block A, an object such as a finger is detected on the touch sensitive surface when the image is moving without the assistance of the object (block 660). In block B, the motion of the image is stopped when the object is detected, i.e., the new touch serves as a braking means. Using the metaphor above, while the piece of paper is sliding across the desktop, the user presses their finger on the paper thereby stopping its motion.

Figs. 23A-23D illustrate an inertia sequence using the method described above. Fig. 23A illustrates a display presenting a GUI 678 including a window 679 having a list 680 of media items 681. The window 679 and list 680 may for example correspond to a control window and music list found in iTunes™ manufactured by Apple Computer, Inc of Cupertino, CA. As shown in Fig. 23B, when the user slides their finger or fingers 576 over the touch screen 520, vertical scrolling, which moves media items up or down through the window, is implemented. The direction of scrolling may follow the same direction as finger movement (as shown), or it may go in the reverse direction. In one particular embodiment, a single finger is used for selecting the media items from the list, and two fingers are used to scroll through the list.

Scrolling generally pertains to moving displayed data or images (e.g., media items 681) across a viewing area on a display screen so that a new set of data (e.g., media items 681) is brought into view in the viewing area. In most cases, once the viewing area is full, each new set of data appears at the edge of the viewing area and all other sets of data move over one position. That is, the new set of data appears for each set of data that moves out of the viewing area. In essence, these functions allow a user to view consecutive sets of data currently outside of the viewing area. In most cases, the user is able to accelerate their traversal through the data sets by moving his or her finger at greater speeds. Examples of scrolling through lists can be found in

U.S. Patent Publication Nos.: 2003/0076303A1, 2003/0076301A1, 2003/0095096A1, which are herein incorporated by reference.

As shown in Fig. 23C, the displayed data continues to move even when the finger is removed from the touch screen. The continuous motion is based at least in part on the previous motion. For example the scrolling may be continued in the same direction and speed. In some cases, the scrolling slow down over time, i.e., the speed of the traversal through the media items gets slower and slower until the scrolling eventually stops thereby leaving a static list. By way of example, each new media item brought into the viewing area may incrementally decrease the speed. Alternatively or additionally, as shown in Fig. 23D, the displayed data stops moving when the finger 576 is placed back on the touch screen 520. That is, the placement of the finger back on the touch screen can implement braking, which stops or slows down the continuous acting motion. Although this sequence is directed at vertical scrolling it should be noted that this is not a limitation and that horizontal scrolling as well as panning may be performed using the methods described above.

Fig. 24 is a diagram of a GUI operational method 700, in accordance with one embodiment of the present invention. The method 700 is configured for simulating a keyboard. The method generally begins at block 702 where a keyboard is presented on the display. Following block 702, the process flow proceeds to block 704 where the presence of a first object over a first key and a second object over a second key at the same time is detected on a touch screen. The touch screen is positioned over or in front of the display. By way of example, the display may be an LCD and the touch screen may be a multipoint touch screen. Following block 704, the process flow proceeds to block 706 where one or more simultaneous control signals are generated when the first object is detected over the first key and when the second object is detected over the second key at the same time.

In one embodiment, only a single control signal is generated when the first object is detected over the first key and when the second object is detected over the second key at the same time. By way of example, the first key may be a shift key and the second key may be a symbol key (e.g., letters, numbers). In this manner, the keyboard acts like a traditional keyboard, i.e., the user is allowed to select multiple

keys at the same time in order to change the symbol, i.e., lower/upper case. The keys may also correspond to the control key, alt key, escape key, function key, and the like.

In another embodiment, a control signal is generated for each actuated key (key touch) that occurs at the same time. For example, groups of characters can be typed at the same time. In some cases, the application running behind the keyboard may be configured to determine the order of the characters based on some predetermined criteria. For example, although the characters may be jumbled, the application can determine that the correct order of characters based on spelling, usage, context, and the like.

Although only two keys are described, it should be noted that two keys is not a limitation and that more than two keys may be actuated simultaneously to produce one or more control signals. For example, control-alt-delete functionality may be implemented or larger groups of characters can be typed at the same time.

Figs. 25A-25D illustrates a keyboard sequence using the method described above. Fig. 25A illustrates a display presenting a GUI object 730 in the form of a keyboard. As shown in Fig. 25B, a user positions their fingers 576 over the multipoint touch screen 520 over the keyboard 730 to enter data into a word processing program. By way of example, the user may place one of their fingers 576A on the Q key in order to produce a lower case "q" in the word processing program. As shown in Fig. 25C, when the user decides that a letter should be in upper case, the user places one finger 576B on the shift key and another finger 576A on the desired letter (as indicated by the arrows). As shown in Fig. 25D, in order to continue typing in lower case, the user simply removes their finger 576B from the shift key and places their finger 576A over a desired letter (as indicated by the arrow).

Fig. 26 is a diagram of a GUI operational method 750, in accordance with one embodiment of the present invention. The method 750 is configured for simulating a scroll wheel such as those described in U.S. Patent Publication Nos: 2003/0076303A1, 2003/0076301A1, 2003/0095096A1, all of which are herein incorporated by reference. The method generally begins at block 752 where a virtual

scroll wheel is presented on the display. In some cases, the virtual scroll wheel may include a virtual button at its center. The virtual scroll wheel is configured to implement scrolling as for example through a list and the button is configured to implement selections as for example items stored in the list. Following block 752, the method proceeds to block 754 where the presence of at least a first finger and more particularly, first and second fingers (to distinguish between tracking and gesturing) over the virtual scroll wheel is detected on a touch screen. The touch screen is positioned over or in front of the display. By way of example, the display may be an LCD and the touch screen may be a multipoint touch screen. Following block 754, the method proceeds to block 756 where the initial position of the fingers on the virtual scroll wheel is set. By way of example, the angle of the fingers relative to a reference point may be determined (e.g., 12 o clock, 6 o clock, etc.). Following block 756, the method 750 proceeds to block 758 where a rotate signal is generated when the angle of the fingers change relative to the reference point. In most cases, the set down of the fingers associate, link or lock the fingers (or finger) to the virtual scroll wheel when the fingers are positioned over the virtual scroll wheel. As a result, when the fingers are rotated, the rotate signal can be used to rotate the virtual scroll wheel in the direction of finger rotation (e.g., clockwise, counterclockwise). In most cases, the amount of wheel rotation varies according to the amount of finger rotation, i.e., if the fingers move 5 degrees then so will the wheel. Furthermore, the rotation typically occurs substantially simultaneously with the motion of the fingers. For instance, as the fingers rotate, the scroll wheel rotates with the fingers at the same time.

In some cases, the principals of inertia as described above can be applied to the virtual scroll wheel. In cases such as these, the virtual scroll wheel continues to rotate when the fingers (or one of the fingers) are lifted off of the virtual scroll wheel and slowly comes to a stop via virtual friction. Alternatively or additionally, the continuous rotation can be stopped by placing the fingers (or the removed finger) back on the scroll wheel thereby braking the rotation of the virtual scroll wheel.

Figs. 27A-27D illustrates a scroll wheel sequence using the method described above. Fig. 27A illustrates a display presenting a scroll wheel. The scroll wheel may be displayed automatically as part of a program or it may be displayed when a particular gesture is performed. By way of example, during the operation of a music

program (such as iTunes manufactured by Apple Computer Inc., of Cupertino, CA), the virtual scroll wheel may appear on the GUI of the music program when two fingers are placed on the touch screen rather than one finger which is typically used for tracking in the music program. In some cases, the virtual scroll wheel only appears when two fingers are placed on a predetermined area of the GUI. As shown in Fig. 27B, a user positions their fingers over the multipoint touch screen 520 over the scroll wheel. At some point, the fingers are locked to the scroll wheel. This can occur at set down for example. As shown in Fig. 27C, when the fingers are rotated in a clockwise direction, the scroll wheel is rotated in the clockwise direction in accordance with the rotating fingers. As shown in Fig. 27D, when the fingers are rotated in a counterclockwise direction, the virtual scroll wheel is rotated in the counter clockwise direction in accordance with the rotating fingers. Alternatively, rotation of the virtual scroll wheel may also be rotated with linear motion of the fingers in a tangential manner.

It should be noted that although a surface scroll wheel is shown, the principals thereof can be applied to more conventional scroll wheels which are virtually based. For example, scroll wheels, whose axis is parallel to the display screen and which appear to protrude through the display screen as shown in Fig. 28. In this particular implementation, however, linear motion of the fingers are used to rotate the virtual scroll wheel.

The various aspects, embodiments, implementations or features of the invention can be used separately or in any combination.

The invention is preferably implemented by hardware, software or a combination of hardware and software. The software can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer readable medium include read-only memory, random-access memory, CD-ROMs, DVDs, magnetic tape, optical data storage devices, and carrier waves. The computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

While this invention has been described in terms of several preferred embodiments, there are alterations, permutations, and equivalents, which fall within the scope of this invention. For example, although the invention has been primarily directed at touchscreens, it should be noted that in some cases touch pads may also be used in place of touchscreens. Other types of touch sensing devices may also be utilized. It should also be noted that there are many alternative ways of implementing the methods and apparatuses of the present invention. It is therefore intended that the following appended claims be interpreted as including all such alterations, permutations, and equivalents as fall within the true spirit and scope of the present invention.

What is claimed is:

1. A computer implemented method for processing touch inputs, said method comprising:

reading data from a touch sensitive device, the data pertaining to touch input with respect to the touch sensitive device, and the touch sensitive device having a multipoint capability; and

identifying at least one multipoint gesture based on the data from the touch sensitive device.

2. A computer implemented method as recited in claim 1 wherein said method further comprises:

performing a computing operation associated with the at least one gesture.

3. A computer implemented method as recited in claim 1 wherein said method further comprises:

associating a user interface element to the at least one gesture.

4. A computer implemented method as recited in claim 3 wherein said method further comprises:

displaying the user interface element on a display.

5. A computer implemented method as recited in claim 1 wherein said method further comprises:

displaying the user interface element on a display prior to said reading; and

subsequently altering the user interface element being displayed based on the at least one gesture.

6. A computer implemented method as recited in claim 1-5 wherein said identifying identifies at least two multipoint gestures based on the data from the touch sensitive device.

7. A computer implemented method as recited in claim 6 wherein the at least two gestures being identified are concurrently performed on the touch sensitive device.

8. A computer implemented method as recited in claim 6 wherein the at least two gestures being identified are contiguously performed on the touch sensitive device.

9. A gestural method, comprising:

detecting multiple touches at different points on a touch sensitive surface at the same time; and

segregating the multiple touches into at least two separate gestural inputs occurring simultaneously, each gestural input having a different function.

10. The gestural method as recited in claim 9 wherein touch sensitive surface is associated with a touch screen that overlays a display, and wherein the gestural inputs are selected from zooming, panning, and rotating.

11. A gestural method, comprising:

concurrently detecting a plurality of gestures that are concurrently performed with reference to a touch sensing device;

producing different commands for each of the gestures that have been detected.

12. The method as recited in claim 11 wherein the plurality of gestures are implemented with the same group of touches.

13. The method as recited in claim 11 wherein the plurality of gestures are implemented with different groups of touches.

14. The method as recited in claim 11-13 wherein the gestures include rotate gestures, panning gestures, or zooming gestures.

15 . A gestural method, comprising:

displaying a graphical image on a display screen;

detecting a plurality of touches at the same time on a touch sensitive device; and

linking the detected multiple touches to the graphical image presented on the display screen.

16. The method as recited in claim 15 wherein the graphical image is a user interface element.

17. The method as recited in claim 16 wherein the user interface element is displayed when a particular multitouch configuration is detected.

18. The method as recited in claim 17 wherein the touch sensitive device is a touch screen disposed over the display screen, and wherein the user interface element is displayed in proximity to the multiple touches.

19. The method as recited in claim 18 wherein the user interface element is displayed underneath the multiple touches.

20. The method as recited in claim 16-19 wherein the multiple touches are detected over the displayed user interface element.

21. The method as recited in claim 16-19 wherein the multiple touches are associated with a single user interface element.

22. The method as recited in claim 16-19 wherein a first portion of the multiple touches are associated with a first user interface element and a second portion of the multiple touches are associated with a second user interface element that is different than the first user interface element.

23. The method as recited in claim 15-22 wherein after linking the detected multiple touches to the graphical image, the graphical image changes based on the motion of the linked multiple touches.

24. The method as recited in claim 23 wherein the graphical image is changed in unison with the motion of the linked multiple touches such that the changes in the graphical image continuously follows the motion of the linked multiple touches.

25. The method as recited in claim 23 wherein the size of the graphical image changes when at least one of the touches in the linked multiple touches is translated over the touch sensitive surface.

26. The method as recited in claim 23 wherein the size of features embedded in the graphical image changes when at least one of the touches in the linked multiple touches is translated over the touch sensitive surface.

27. The method as recited in claim 23 wherein the orientation of the graphical image changes when at least one of the touches in the linked multiple touches is rotated over the touch sensitive surface.

28. The method as recited in claim 23 wherein the position of the graphical image changes when the linked multiple touches are translated together over the touch sensitive surface.

29. A method of invoking a user interface element on a display via a multipoint touch sensitive device of a computing system, said method comprising:

detecting and analyzing the simultaneous presence of two or more objects on contact with said touch sensitive device;

based at least in part on said analyzing, selecting a user interface tool, from a plurality of available tools, to display on a display for interaction by a user of said computing system; and

controlling the interface tool based at least in part on the further movement of said objects in relation to said touch sensitive device.

30. The method as recited in claim 29 wherein said selecting is also based in part on the current mode of the computing device at the time of the simultaneous presence of the two or more objects.

31. The method as recited in claim 29 wherein said touch sensitive device is a touch screen disposed over the display and wherein said tool is displayed at a location on the display proximate to the presence of said two or more objects on said touchscreen.

32. A touch-based method, comprising

detecting a user input that occurs over a multipoint sensing device, the user input including one or more inputs, each input having a unique identifier;

during the user input, classifying the user input as a tracking or selecting input when the user input includes one unique identifier or a gesture input when the user input includes at least two unique identifiers;

performing tracking or selecting during the user input when the user input is classified as a tracking or selecting input;

performing one or more control actions during the user input when the user input is classified as a gesturing input, the control actions being based at least in part on changes that occur between the at least two unique identifiers.

33. The method as recited in claim 32 wherein scrolling or panning is performed when the at least two unique identifiers move together in substantially the same direction.

34. The method as recited in claim 32 wherein zooming is performed when the at least two unique identifiers linearly move away or towards one another.

35. The method as recited in claim 32 wherein rotation is performed when the at least two unique identifiers rotate relative to each other or relative to a known point.

36. The method as recited in claim 32 wherein multiple control actions are performed simultaneously during the same user input.

37. The method as recited in claim 32 wherein the user input is a continuous stroke, the stroke maintaining continuous contact on the multipoint sensing device.

38. A touch-based method, comprising:

outputting a GUI on a display;

detecting a user input on a touch sensitive device;

analyzing the user input for characteristics indicative of tracking, selecting or a gesturing;

categorizing the user input as a tracking, selecting or gesturing input;

performing tracking or selecting in the GUI when the user input is categorized as a tracking or selecting input;

performing control actions in the GUI when the user input is categorized as a gesturing input, the actions being based on the particular gesturing input .

39. A touch-based method, comprising:

capturing an initial touch image;

determining the touch mode based on the touch image;

capturing the next touch image;

determining if the touch mode changed between the initial and next touch images;

if the touch mode changed, setting the next touch image as the initial touch image and determining the touch mode based on the new initial touch image; and

if the touch mode stayed the same, comparing the touch images and performing a control function based on the comparison.

40. The method as recited in claim 39 wherein the control function is selected from tracking, panning, zooming, rotating, scrolling, or enlarging.

41. A computer implemented method for processing touch inputs, said method comprising:

reading data from a touch sensitive device, the data pertaining to touch input with respect to the touch sensitive device, and the touch sensitive device having a multipoint capability;

converting the data to a collection of features;

classifying the features;

grouping the features into one or more feature groups;

calculating key parameters of the feature groups; and

associating the feature groups to user interface elements on a display.

42. The computer implemented method as recited in 41 wherein said method further comprises:

recognizing when at least one of the feature groups indicates performance of a gesture relative to its associated user interface element.

43. The computer implemented method as recited in 41 wherein said method further comprises:

providing user feedback when at least one of the feature groups indicates performance of a gesture relative to its associated user interface element.

44. The computer implemented method as recited in 41 wherein said method further comprises:

implementing an action when at least one of the feature groups indicates performance of a gesture relative to its associated user interface element.

45. The computer implemented method as recited in 44, wherein said method further comprises:

providing user feedback in conjunction with the action.

46. The method as recited in claim 41-45 wherein the step of associating comprises:

receiving group of features;

determining if there is a change in number of features;

if there is a change, calculating initial parameter values;

if there is no change, calculating current parameter values; and

reporting both the initial and current parameter values.

47. A computer implemented method, comprising:

outputting a graphical image;

receiving a multitouch gesture input over the graphical image; and

changing the graphical image based on and in unison with multitouch gesture input.

48. The method as recited in claim 47 further comprising:

receiving a second multitouch gesture input over the graphical image; and

changing the graphical image based on and in unison with the second multitouch gesture.

49. The method as recited in claim 47 further comprising:

outputting a second graphical image:

receiving a second multitouch gesture input over the second graphical image; and

changing the second graphical image based on and in unison with the second multitouch gesture.

50. A touch based method, comprising:

receiving a gestural input over a first region;

generating a first command when the gestural input is received over the first region;

receiving the same gestural input over a second region; and

generating a second command when the same gestural input is received over the second region, the second command being different than the first command.

51. A method for recognizing multiple gesture inputs, the method comprising:

receiving a multitouch gestural stroke on a touch sensitive surface, the multitouch gestural stroke maintaining continuous contact on the touch sensitive surface;

recognizing a first gesture input during the multitouch gestural stroke; and

recognizing a second gesture input during the multitouch gestural stroke.

52. The method as recited in claim51 further including recognizing a third gesture input during the multitouch gestural stroke

53. A computer implemented method, comprising:

detecting a plurality of touches on a touch sensing device;

forming one or more touch groups with the plurality of touches;

monitoring the movement of and within each of the touch groups; and

generating control signals when the touches within the touch groups are moved or when the touch groups are moved in their entirety.

54. A method for recognizing a zoom gesture made on a multipoint touch sensitive device computing system, comprising:

detecting the relative locations of a first object and a second object at the same time;

detecting a change in the relative locations of said first and second object;

generating a zoom signal in response to said detected change.

55. The method as recited in claim 54 wherein said zoom signal is a zoom out signal.

56. The method as recited in claim 54 wherein said zoom signal is a zoom in signal.

57. The method as recited in claim 54 further comprising:

associating the first and second objects to an image on a GUI interface;

58. The method as recited in claim 57 further comprising zooming out the image when a zoom out signal is generated.

59. The method as recited in claim 57 further comprising zooming in the image when a zoom in signal is generated.

60. The method as recited in claim 54-59 further comprising zooming the image when a zoom signal is generated, and wherein the zooming occurs substantially simultaneously with the change in relative locations of the objects.

61. The method as recited in claim 60 wherein the amount of zooming varies according to the distance between the two objects.

62. A method for recognizing a pan gesture made on a multipoint touch sensitive device, comprising:

detecting the presence of at least a first object and a second object at the same time;

monitoring the position of the said at least first and second objects when the objects are moved together across the touch sensitive device; and

generating a pan signal when the position of the said at least first and second objects changes relative to an initial position.

63. The method as recited in claim 62 further comprising:

associating said at least first and second objects to an image on a GUI interface;

panning the image when a pan signal is generated; and

wherein the panning occurs substantially simultaneously with the motion of the objects.

64. A method for recognizing a rotate gesture made on a multipoint touch sensitive device, comprising:

detecting the presence of at least a first object and a second object at the same time;

detecting a rotation of said at least first and second objects; and

generating a rotate signal in response to said detected rotation of said at least first and second objects.

65. The method as recited in claim 64 further comprising:

associating said at least first and second objects to an image on a GUI interface;

rotating the image when a rotate signal is generated; and

wherein the rotating occurs substantially simultaneously with the motion of the objects.

66. A computer implemented method for initiating zooming targets via a touch screen, the method comprising:

displaying an image on a GUI;

enlarging the image for a period of time when the presence of an object is detected over the image.

67. The method as recited in claim 66 wherein the image is a user interface element.

68. The method as recited in claim 67 wherein the user interface element is a control box containing one or more control buttons, and wherein said enlarging includes enlarging the control box and each of the control buttons.

69. The method as recited in claim 68 wherein the size of the control buttons correspond to the size of the object or larger so that the control buttons can be easily selected by the object.

70. The method as recited in claim 69 further comprising:

in the enlarged state, generating a control signal associated with the control button when the presence of the object is detected over one of the control buttons.

71. The method as recited in claim 66 wherein the object is a finger.

72. The method as recited in claim 66-71 further comprising:

implementing a gesture input when the presence of one or more objects are detected over portions of the GUI other than the image.

73. A computer implemented method of initiating a page turn via a touch sensitive device, the method comprising:

displaying a page from a multitude of pages in a GUI presented on a display;

detecting the presence of an object on the touch sensitive device; and

generating a page turn signal when the object is translated horizontally on the touch sensitive device.

74. The computer implemented method as recited in claim 73 wherein the translation simulates a finger turning the page in a paper bound book.

75. The computer implemented method as recited in claim 73 wherein the translation pertains to a page turn gesture by a user.

76. The computer implemented method as recited in claim 73-75 wherein said method further comprises:

displaying a next page in response to the page turn signal.

77. A computer implemented method of initiating inertia, the method comprising:

displaying an image on a GUI;

detecting a stroke on a touch sensitive surface;

noting the speed and direction of the stroke;

moving the image or features embedded in the image in accordance with the speed and direction of the stroke; and

slowing the motion of the image or features embedded in the image in accordance with inertia principals when the stroke is no longer detected.

78. The method as recited in claim 77 further comprising:

detecting an object on the touch sensitive surface when image or features embedded in the image is slowing down because of inertia;

stopping the motion of the image or features embedded in the image when another object is detected, the another object serving as a braking means to the moving image or features embedded in the image

79. A method of simulating a keyboard, comprising:

providing a display and a touch screen positioned over the display;

displaying a keyboard on the display, the keyboard including at least a first and a second key;

detecting the presence of a first object over the first key and a second object over the second key at the same time; and

generating a single control function in response to the detection of said first object over the first key and said second object over said second key.

80. The method as recited in claim 79 wherein the first and second objects are portions of one or more hands.

81. The method as recited in claim 79 wherein the first key is a modifying key that modifies the second key.

82. The method as recited in claim 81 wherein the first key is a shift key, control key or alt key.

82. The method as recited in claims 9, wherein the touch sensitive surface is part of a touch sensitive device, and wherein the gestural inputs are selected from zooming, panning and rotating.

83. The method as recited in claims 1, 11, 15, 29, 32, 38, 41, 51, 53, 54, 62, 64, 73, 77, wherein the touch sensitive device is a touch screen.

84. The method as recited in claims 1, 11, 15, 29, 32, 38, 41, 51, 53, 54, 62, 64, 73, 77, wherein the touch sensitive device is a touch pad.

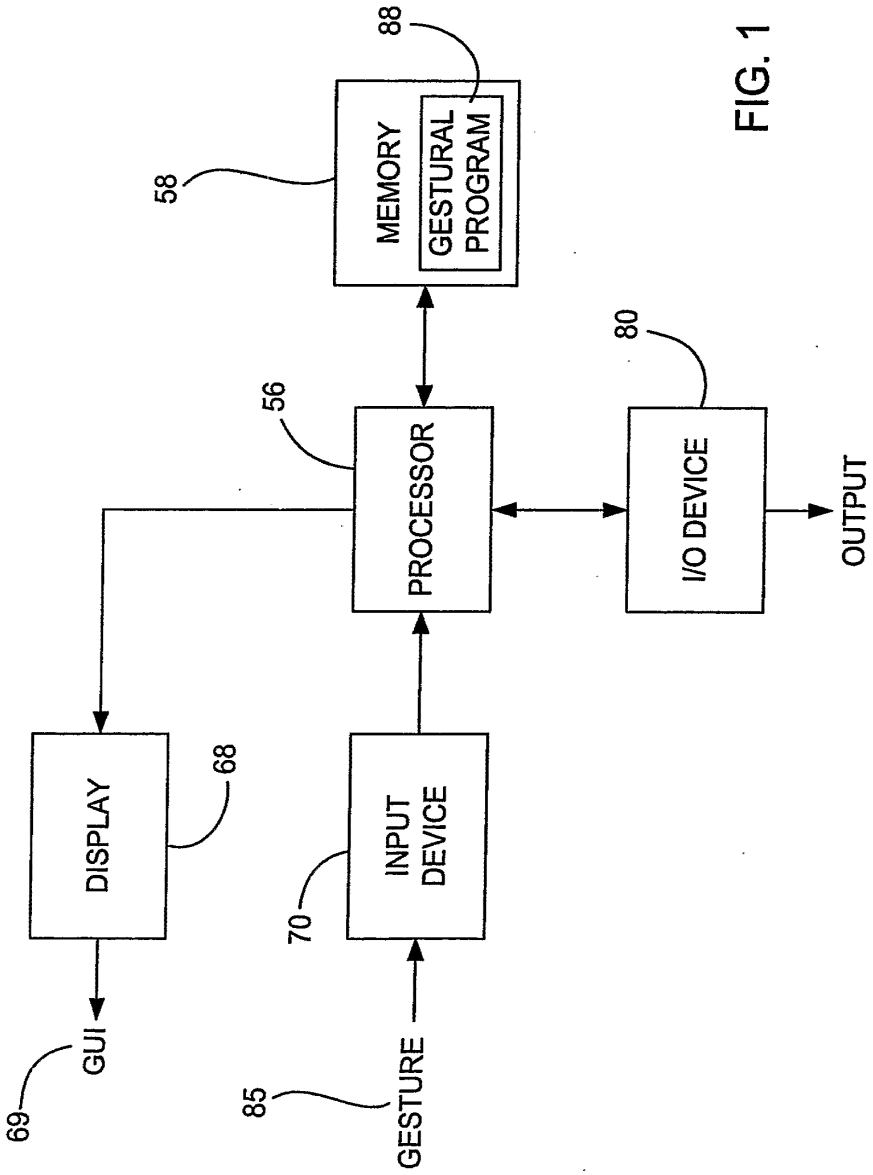

88
MEMORY
GESTURAL PROGRAM
58
56
PROCESSOR
80
I/O DEVICE
OUTPUT
DISPLAY
68
INPUT DEVICE
70
GUI
69
GESTURE
85

FIG. 1

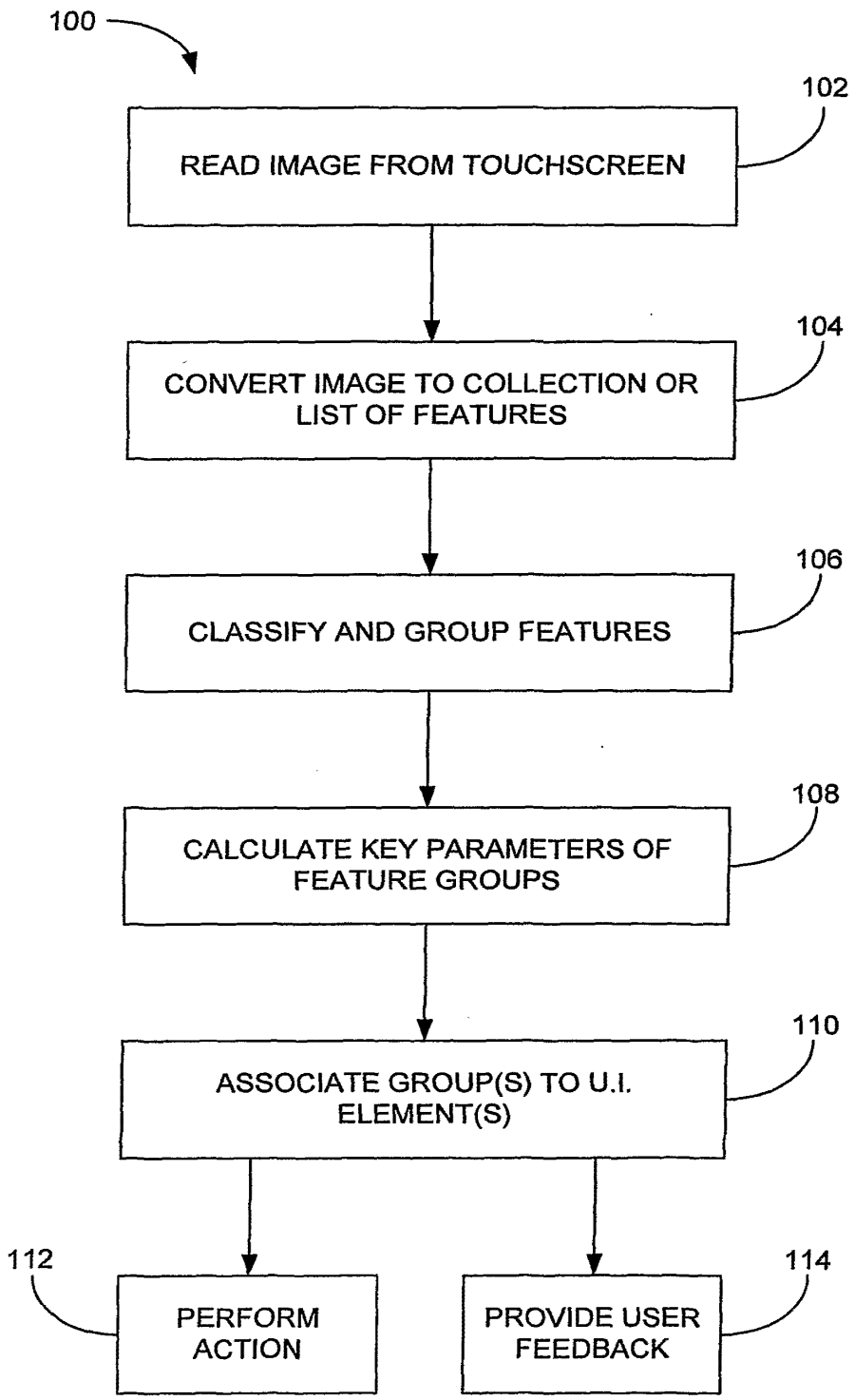

100
102
READ IMAGE FROM TOUCHSCREEN
104
CONVERT IMAGE TO COLLECTION OR LIST OF FEATURES
106
CLASSIFY AND GROUP FEATURES
108
CALCULATE KEY PARAMETERS OF FEATURE GROUPS
110
ASSOCIATE GROUP(S) TO U.I. ELEMENT(S)
112
PERFORM ACTION
114
PROVIDE USER FEEDBACK

FIG. 2

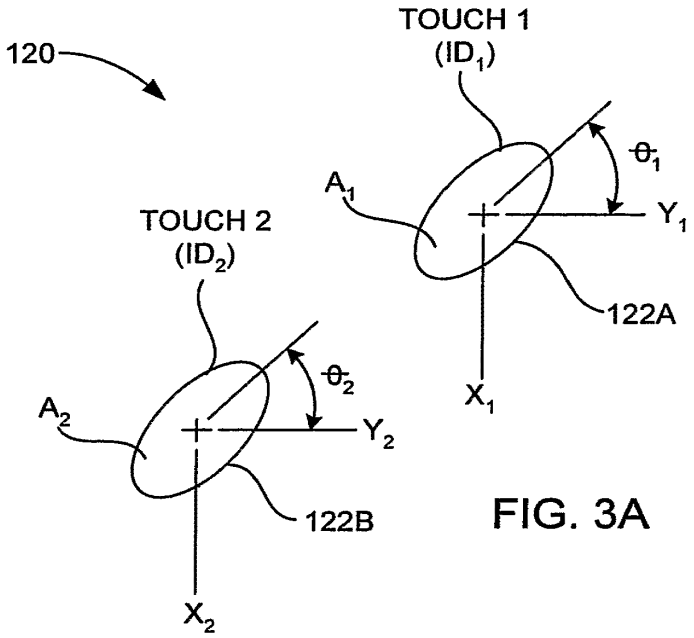

120
TOUCH 1
(ID1)
θ1
A1
Y1
122A
X1
TOUCH 2
(ID2)
θ2
A2
Y2
122B
X2

FIG. 3A

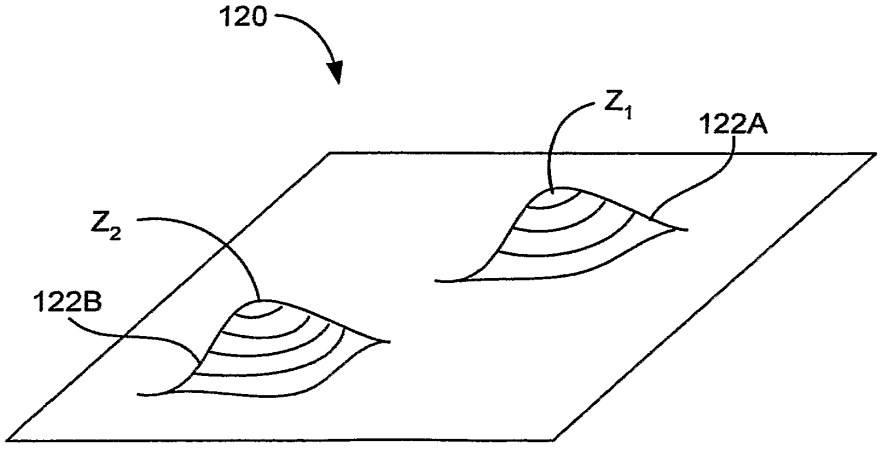

120
Z1
122A
Z2
122B

FIG. 3B

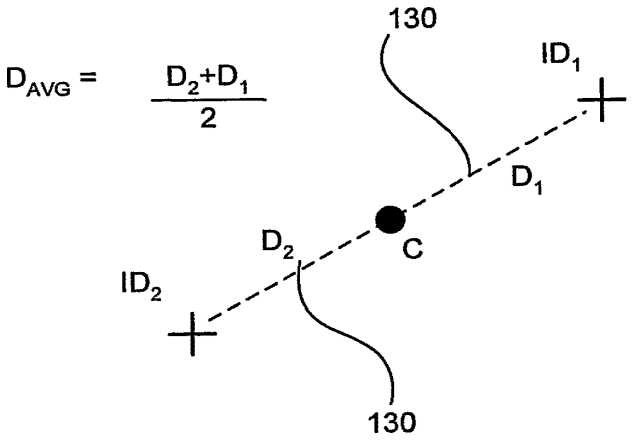


FIG. 4

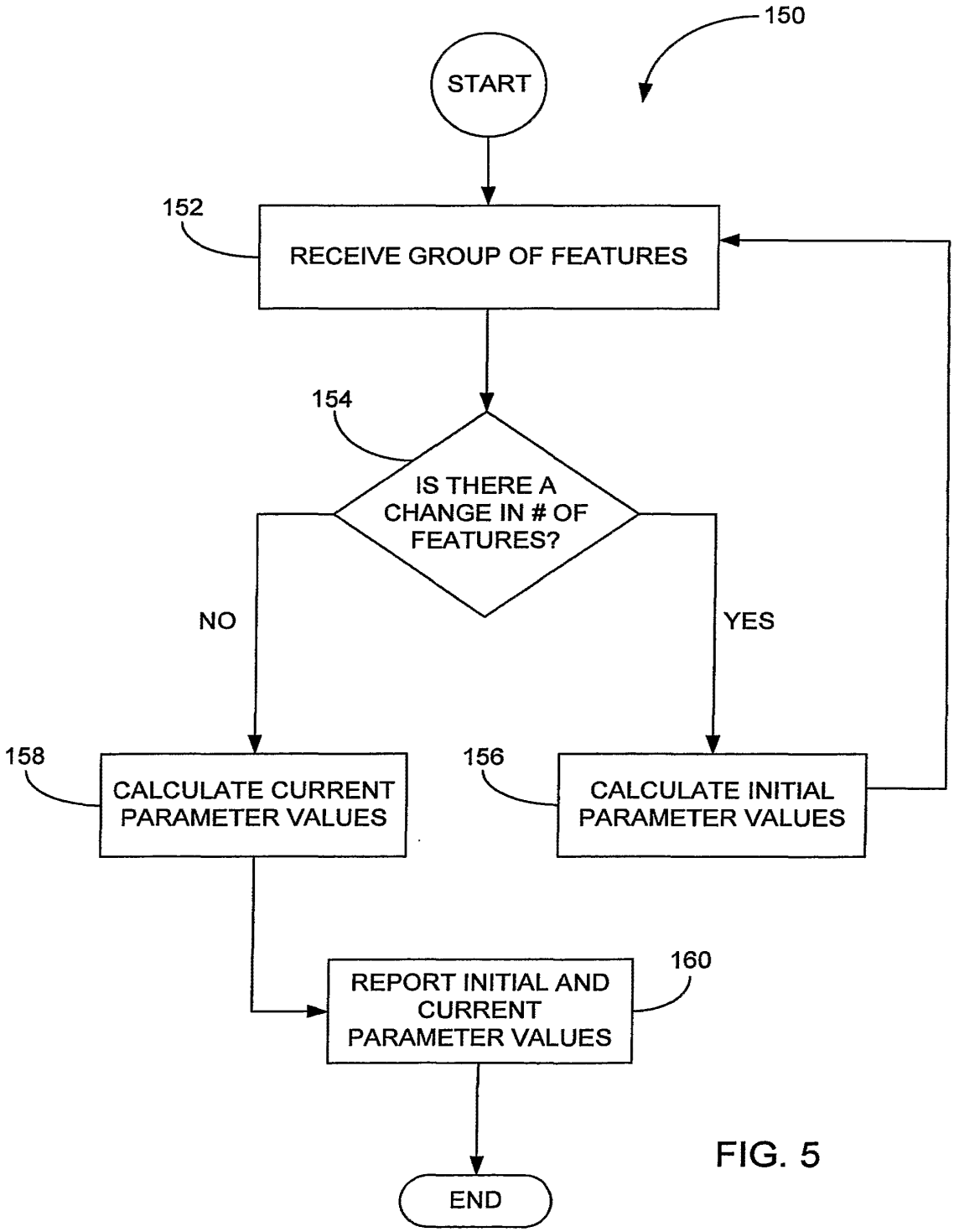

150
START
152
RECEIVE GROUP OF FEATURES
154
IS THERE A CHANGE IN # OF FEATURES?
NO
YES
158
CALCULATE CURRENT PARAMETER VALUES
156
CALCULATE INITIAL PARAMETER VALUES
160
REPORT INITIAL AND CURRENT PARAMETER VALUES
END

FIG. 5

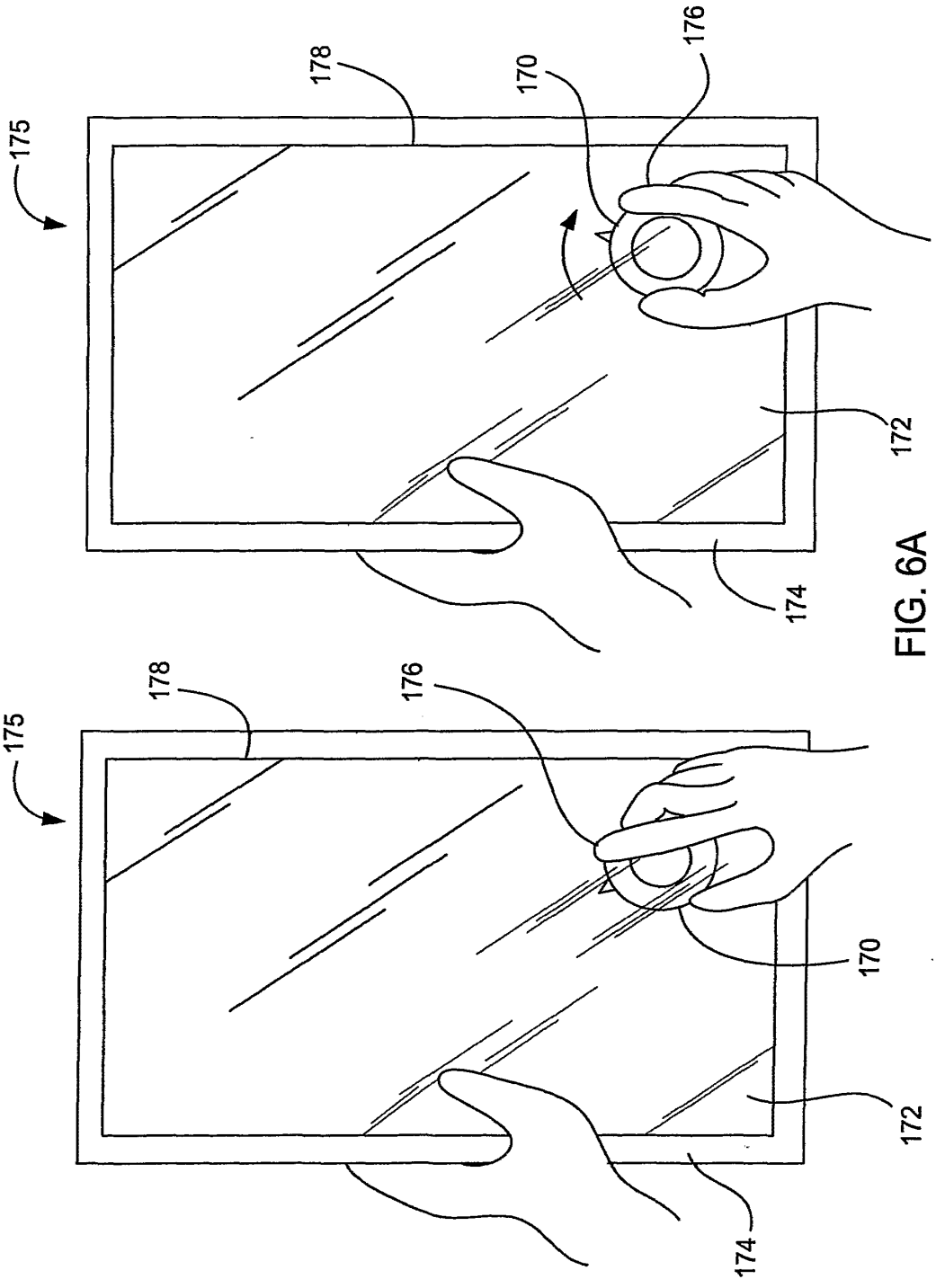


FIG. 6A

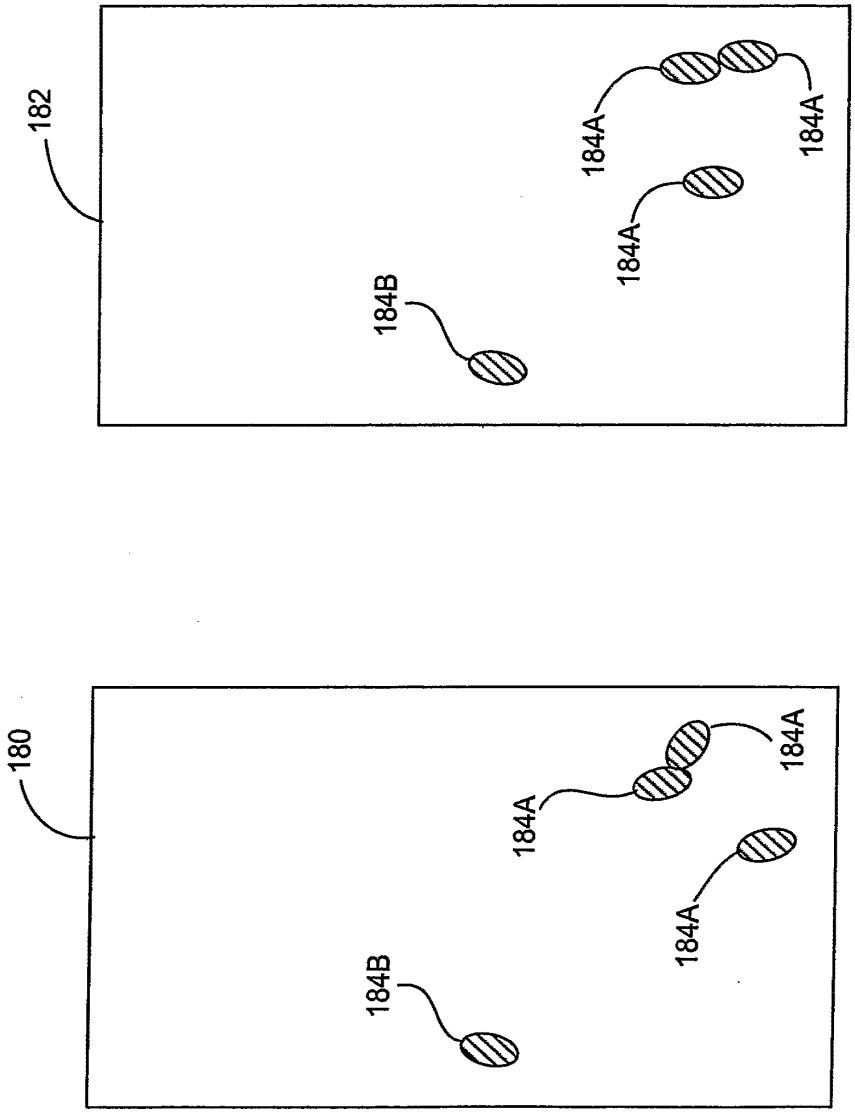


FIG. 6B

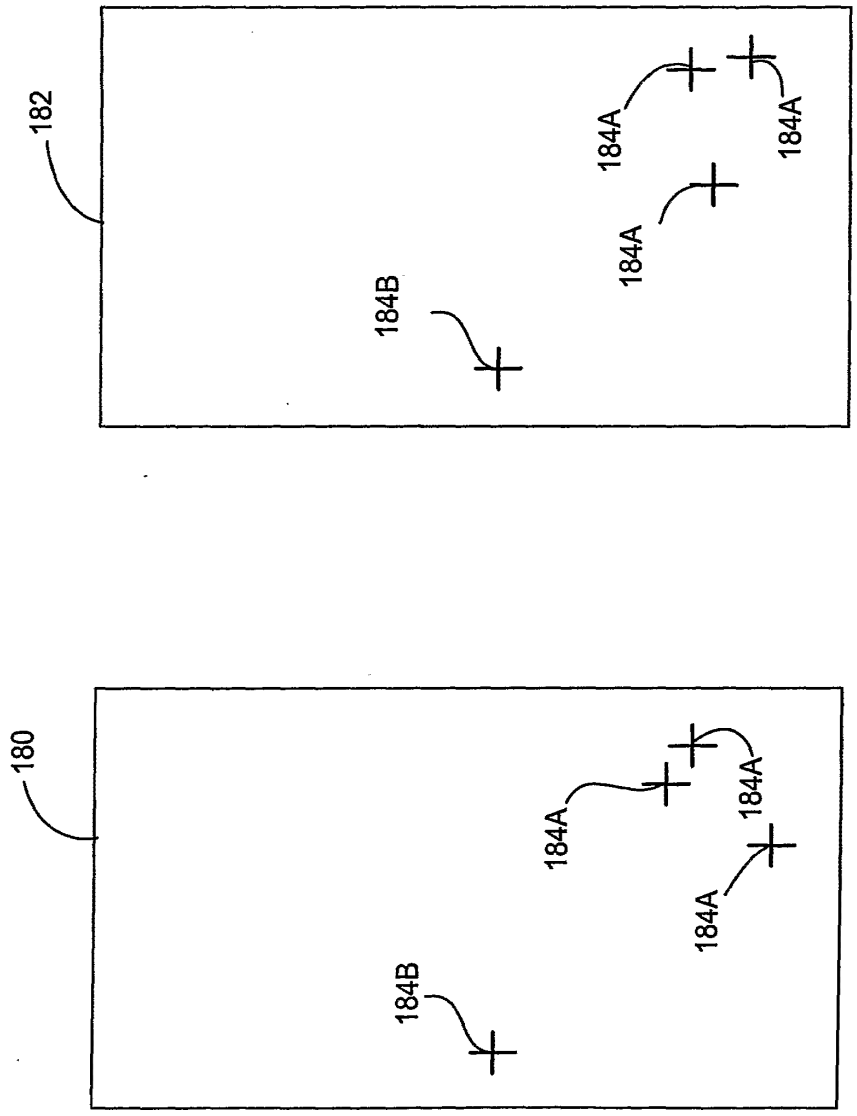


FIG. 6C

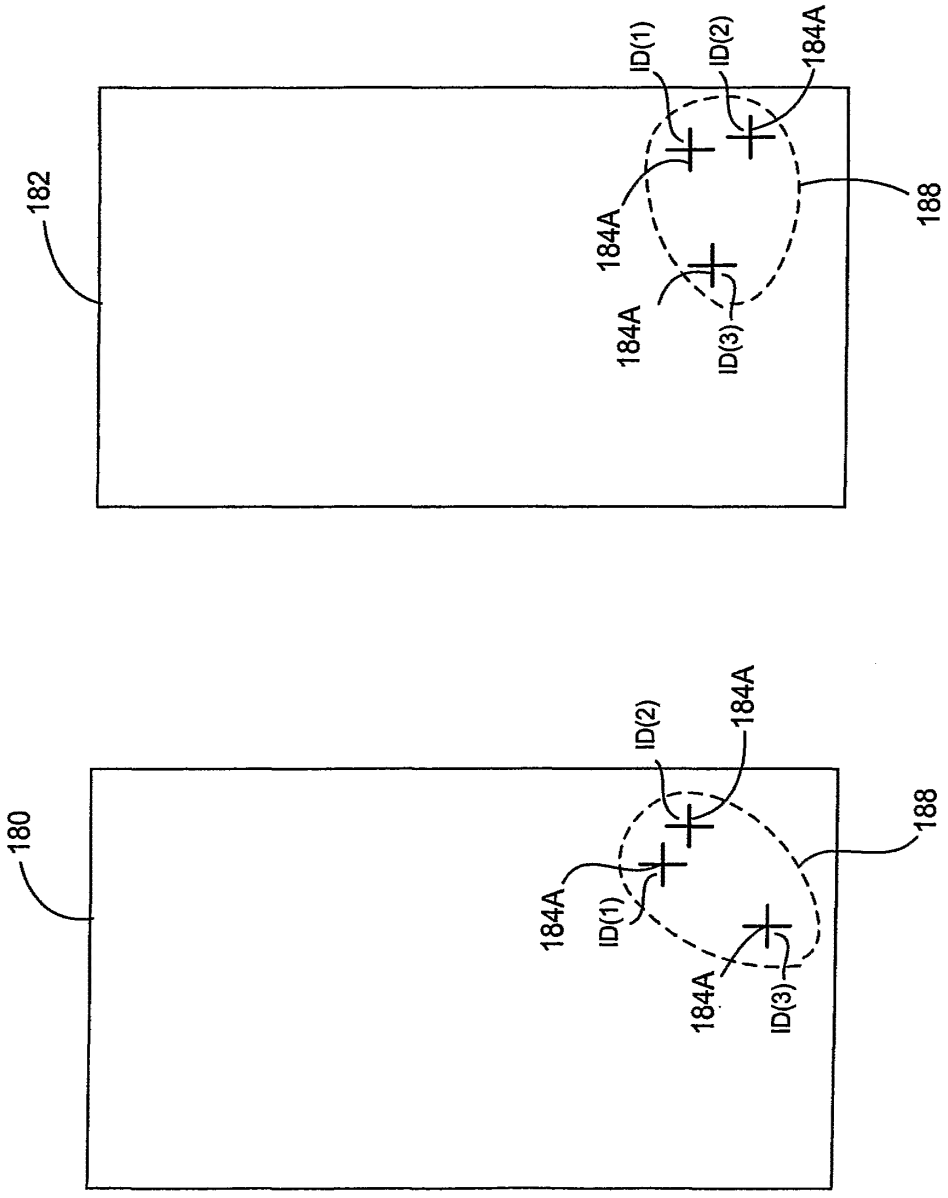

182
ID(1)
ID(2)
184A
184A
188
184A
ID(3)
180
ID(2)
184A
188
184A
ID(1)
184A
ID(3)

FIG. 6D

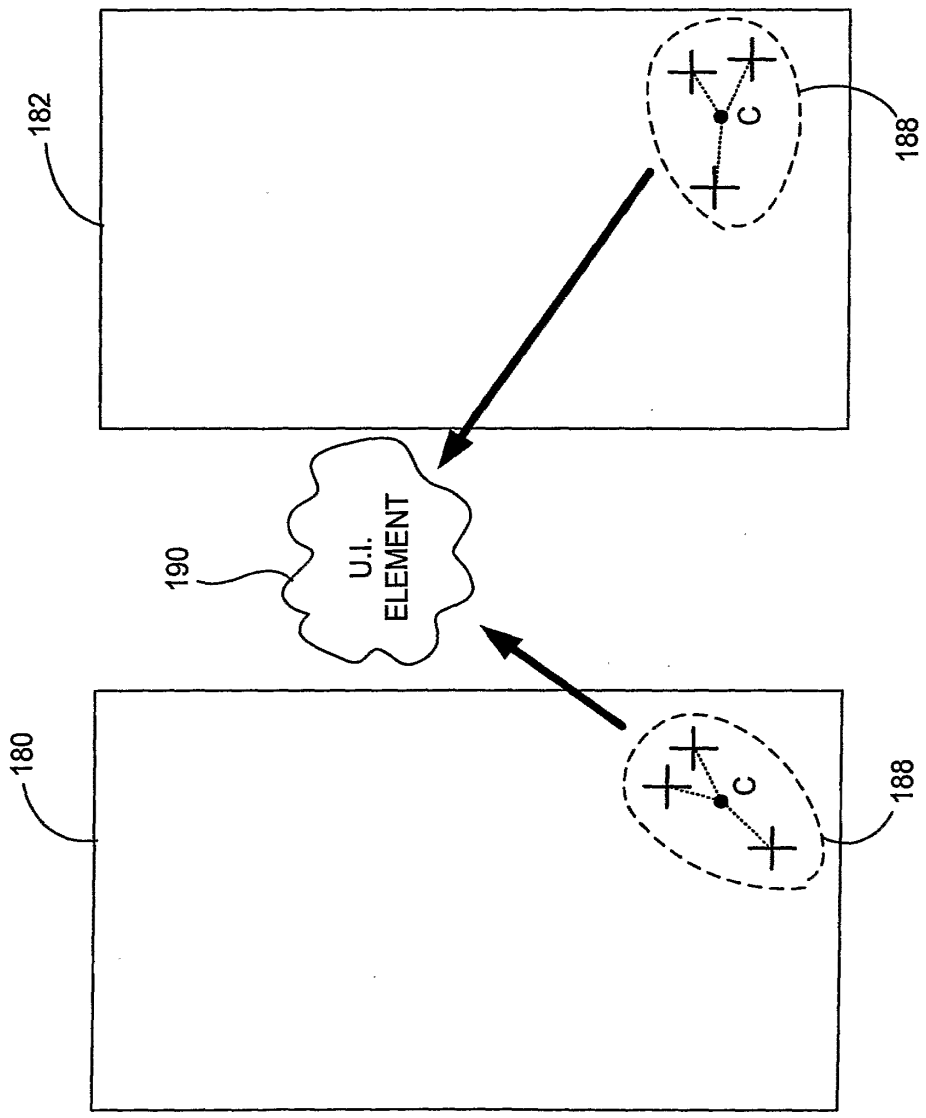


FIG. 6E

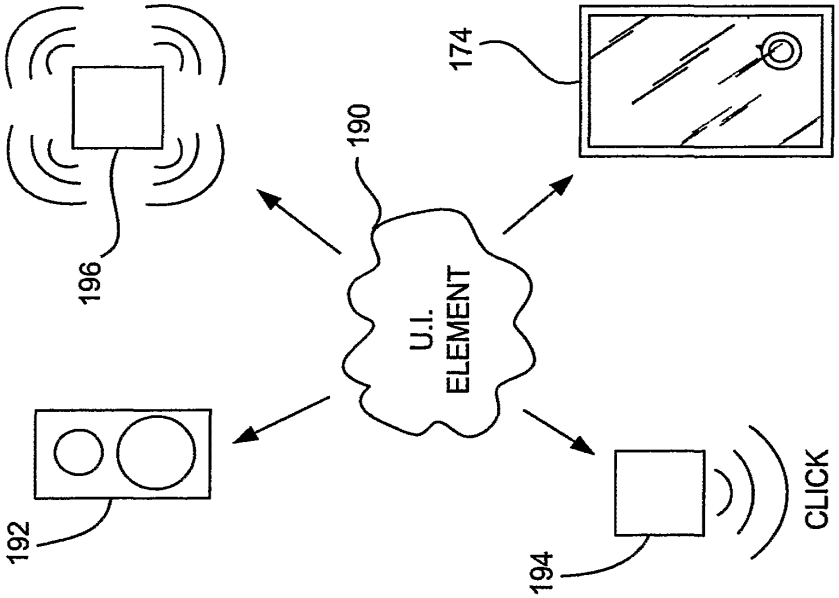


FIG. 6G

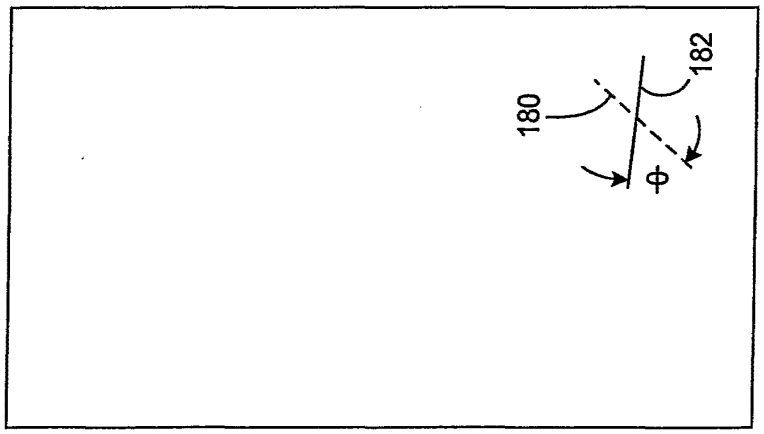


FIG. 6F

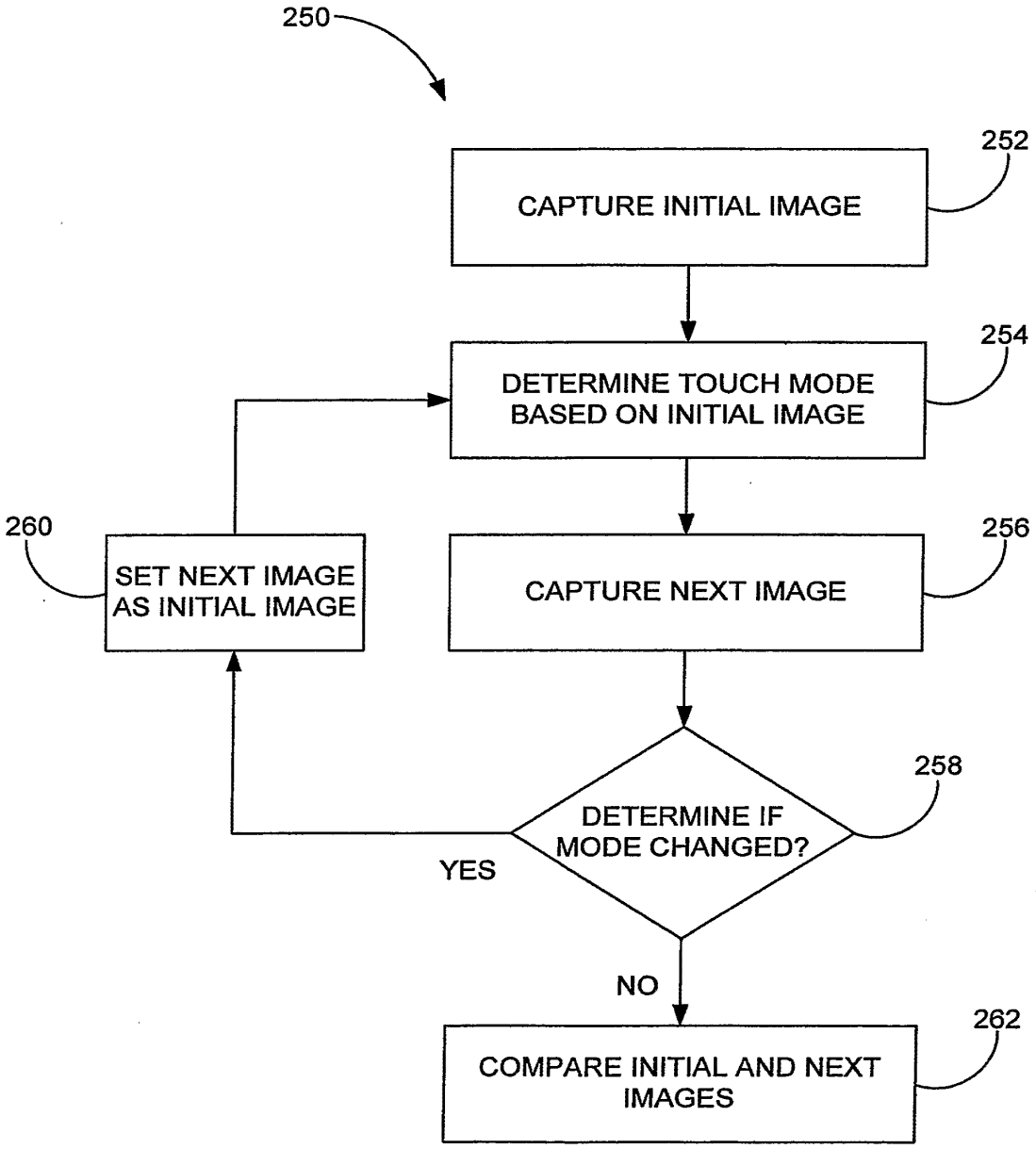

250
252
CAPTURE INITIAL IMAGE
254
DETERMINE TOUCH MODE BASED ON INITIAL IMAGE
256
CAPTURE NEXT IMAGE
258
DETERMINE IF MODE CHANGED?
YES
NO
260
SET NEXT IMAGE AS INITIAL IMAGE
262
COMPARE INITIAL AND NEXT IMAGES

FIG. 8

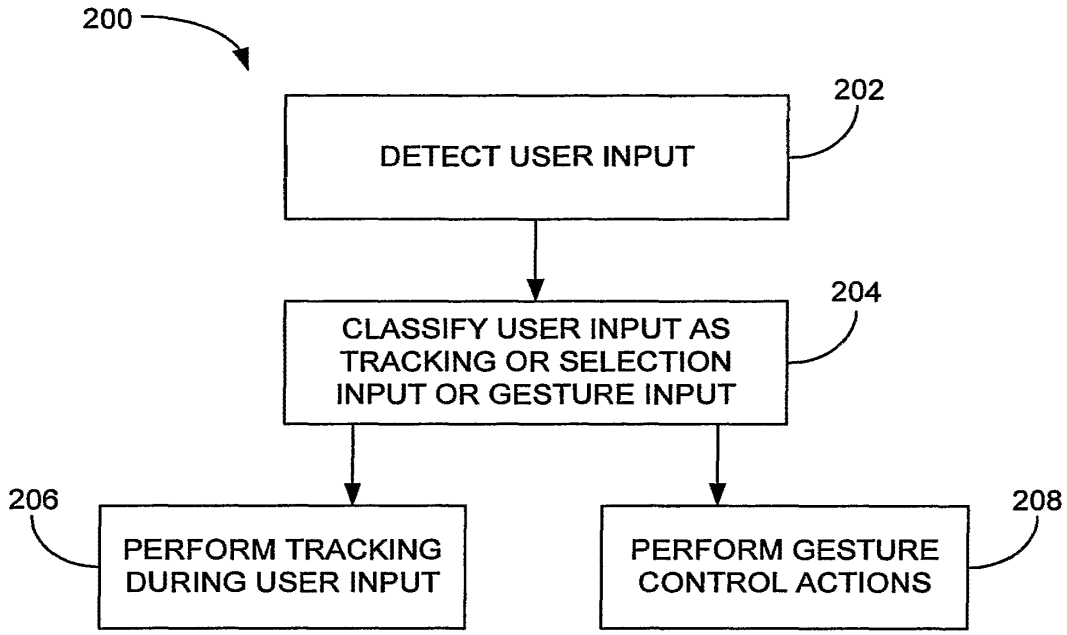

200
DETECT USER INPUT
202
CLASSIFY USER INPUT AS TRACKING OR SELECTION INPUT OR GESTURE INPUT
204
206
PERFORM TRACKING DURING USER INPUT
208
PERFORM GESTURE CONTROL ACTIONS

FIG. 7

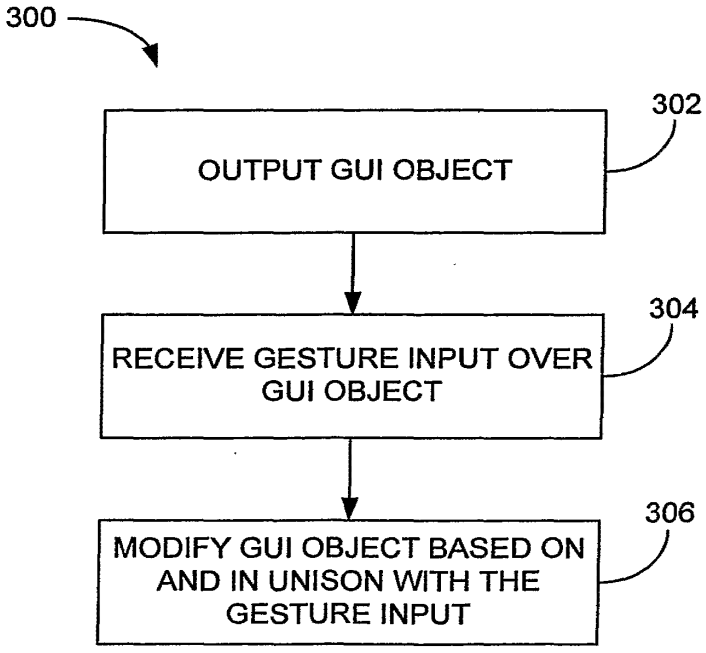

300
OUTPUT GUI OBJECT
302
RECEIVE GESTURE INPUT OVER GUI OBJECT
304
MODIFY GUI OBJECT BASED ON AND IN UNISON WITH THE GESTURE INPUT
306

FIG. 9

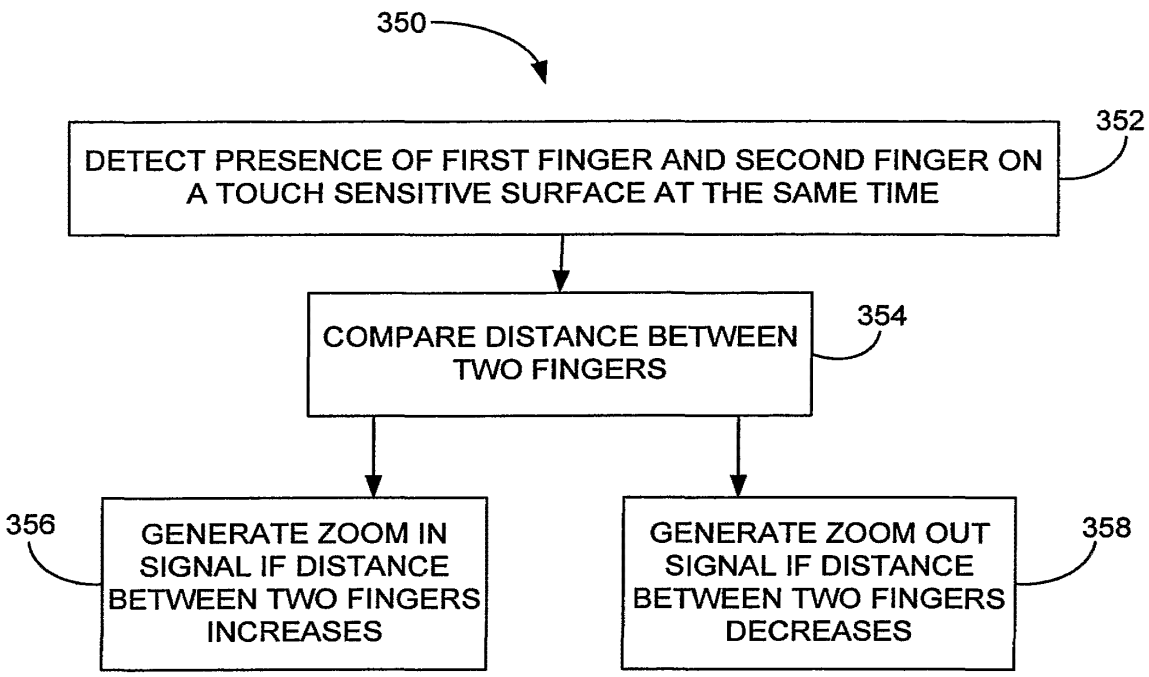

350
DETECT PRESENCE OF FIRST FINGER AND SECOND FINGER ON A TOUCH SENSITIVE SURFACE AT THE SAME TIME
352
COMPARE DISTANCE BETWEEN TWO FINGERS
354
GENERATE ZOOM IN SIGNAL IF DISTANCE BETWEEN TWO FINGERS INCREASES
356
GENERATE ZOOM OUT SIGNAL IF DISTANCE BETWEEN TWO FINGERS DECREASES
358

FIG. 10

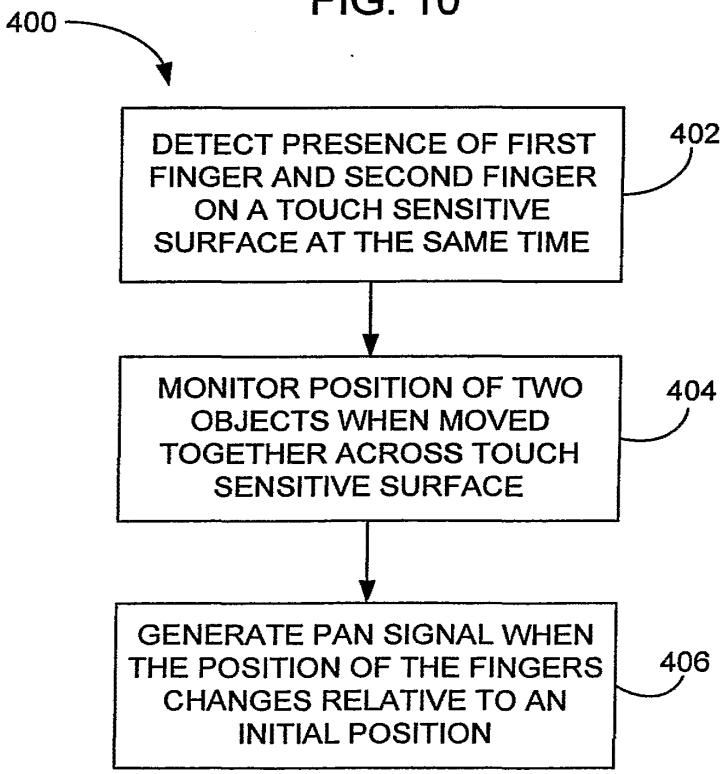

400
DETECT PRESENCE OF FIRST FINGER AND SECOND FINGER ON A TOUCH SENSITIVE SURFACE AT THE SAME TIME
402
MONITOR POSITION OF TWO OBJECTS WHEN MOVED TOGETHER ACROSS TOUCH SENSITIVE SURFACE
404
GENERATE PAN SIGNAL WHEN THE POSITION OF THE FINGERS CHANGES RELATIVE TO AN INITIAL POSITION
406

FIG. 12

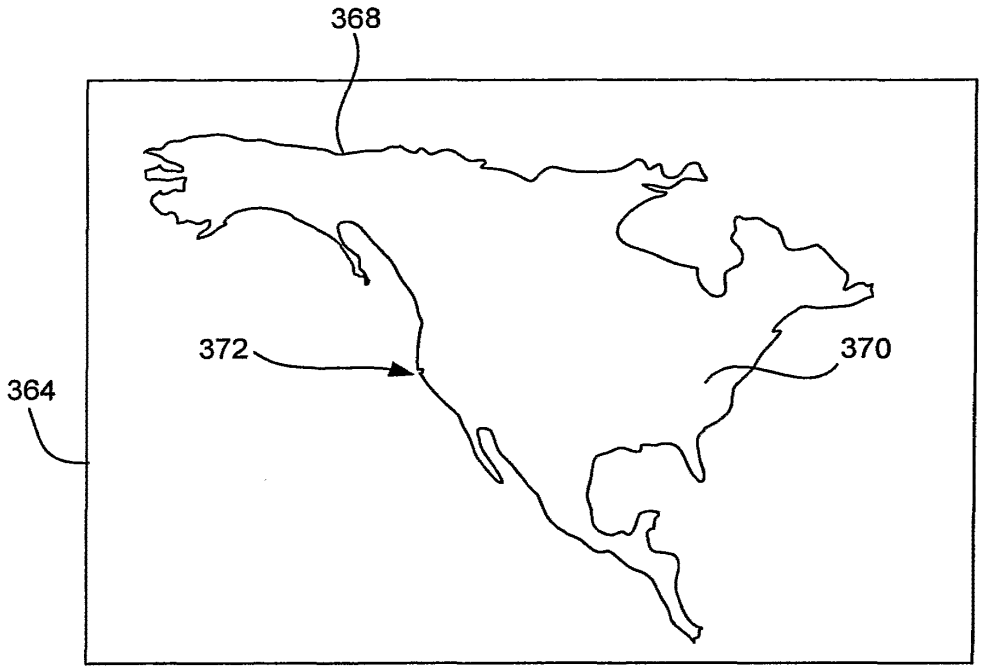


FIG. 11A

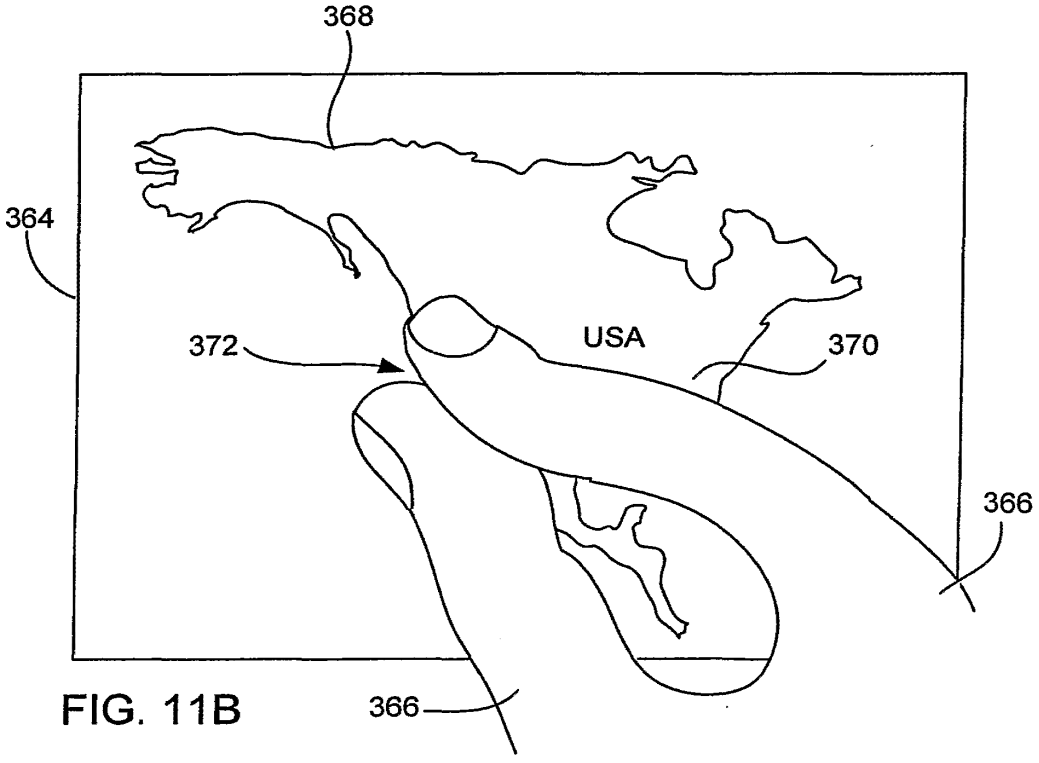


FIG. 11B

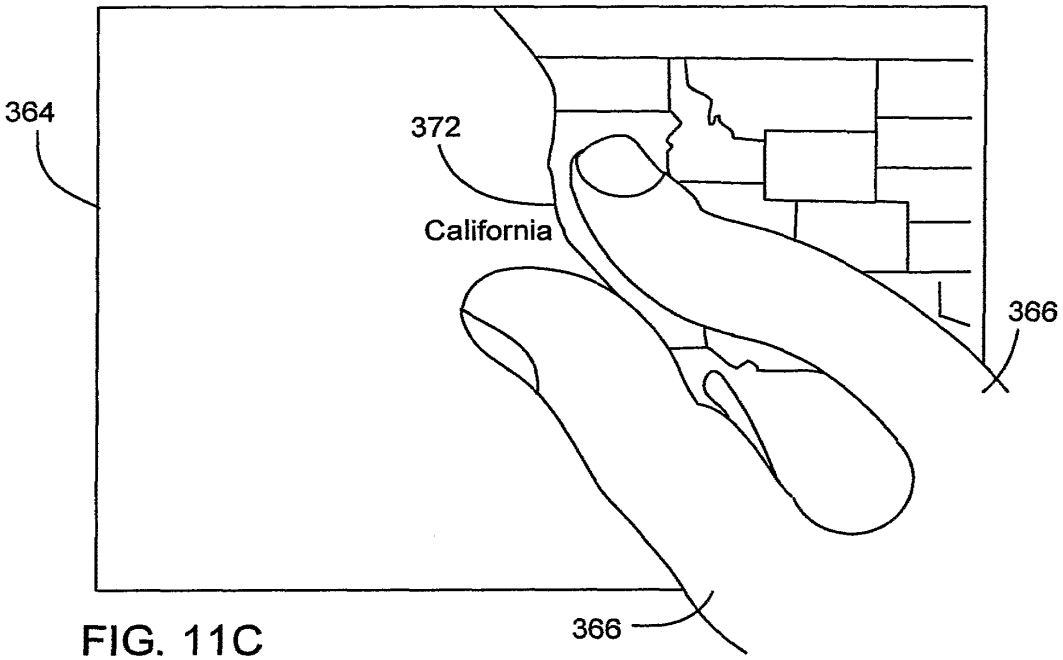


FIG. 11C

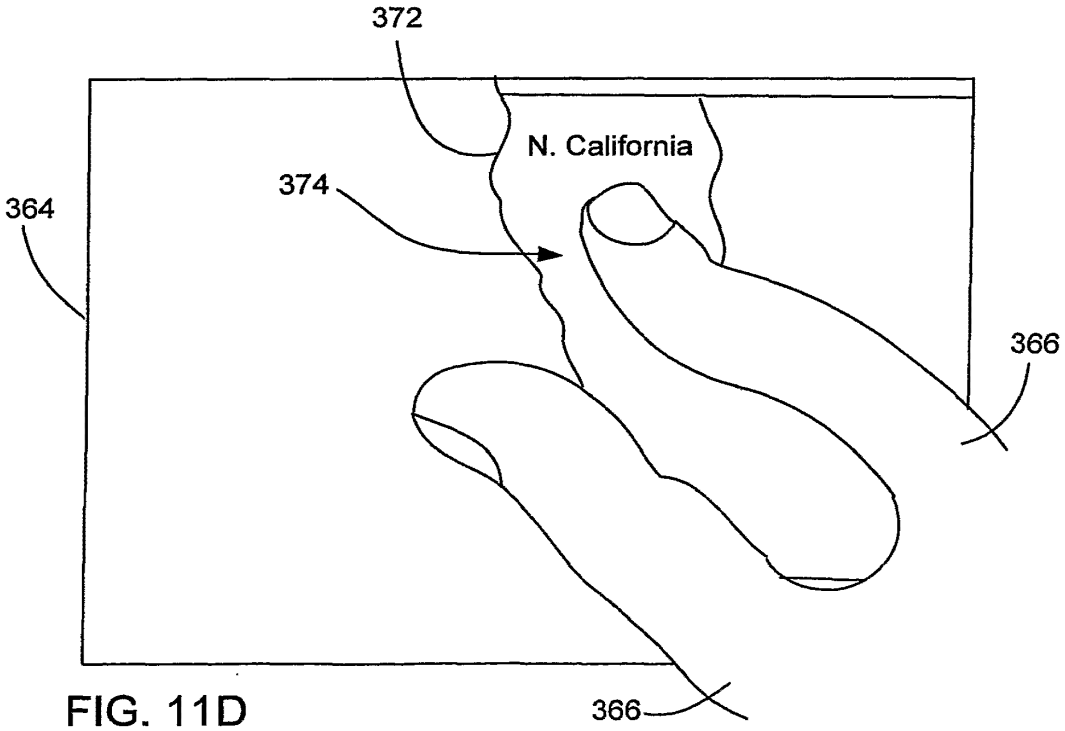


FIG. 11D

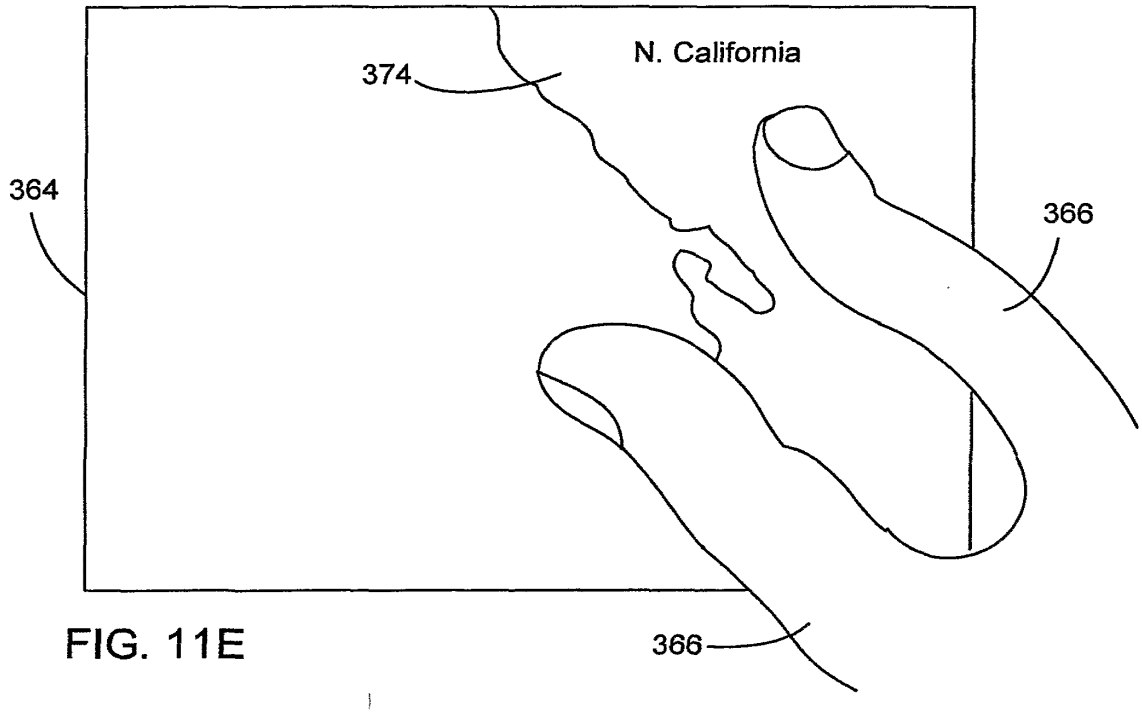


FIG. 11E

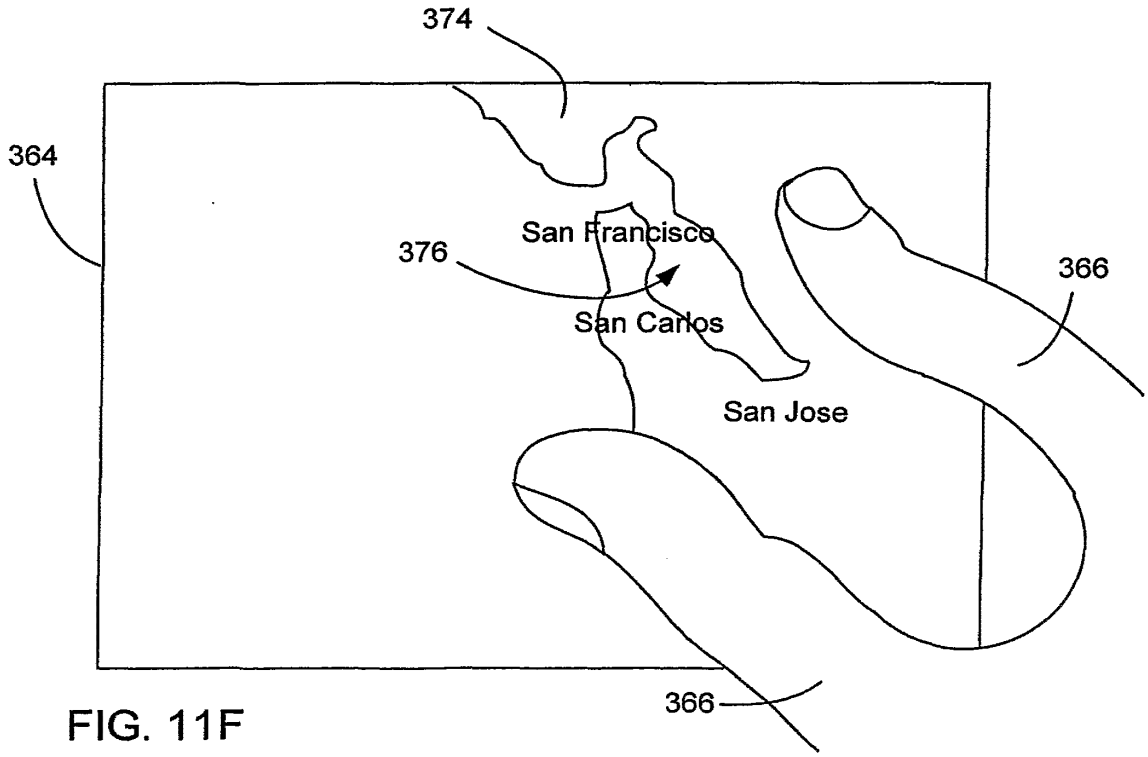


FIG. 11F

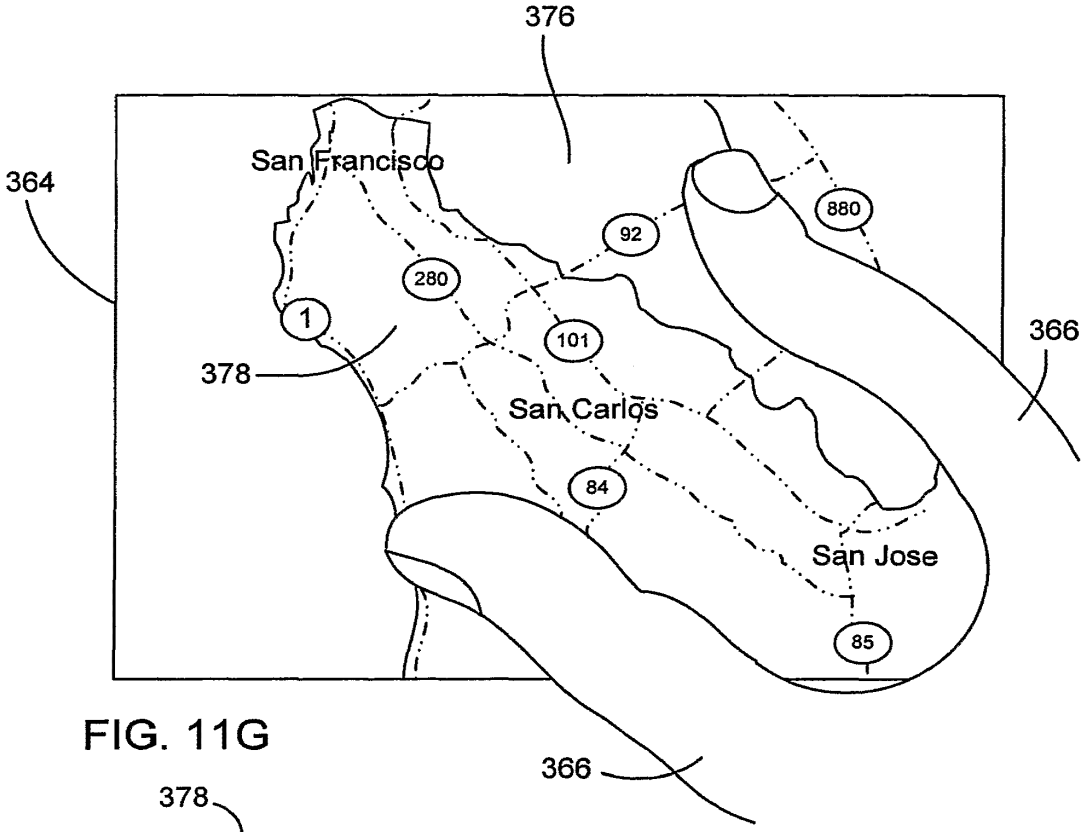


FIG. 11G

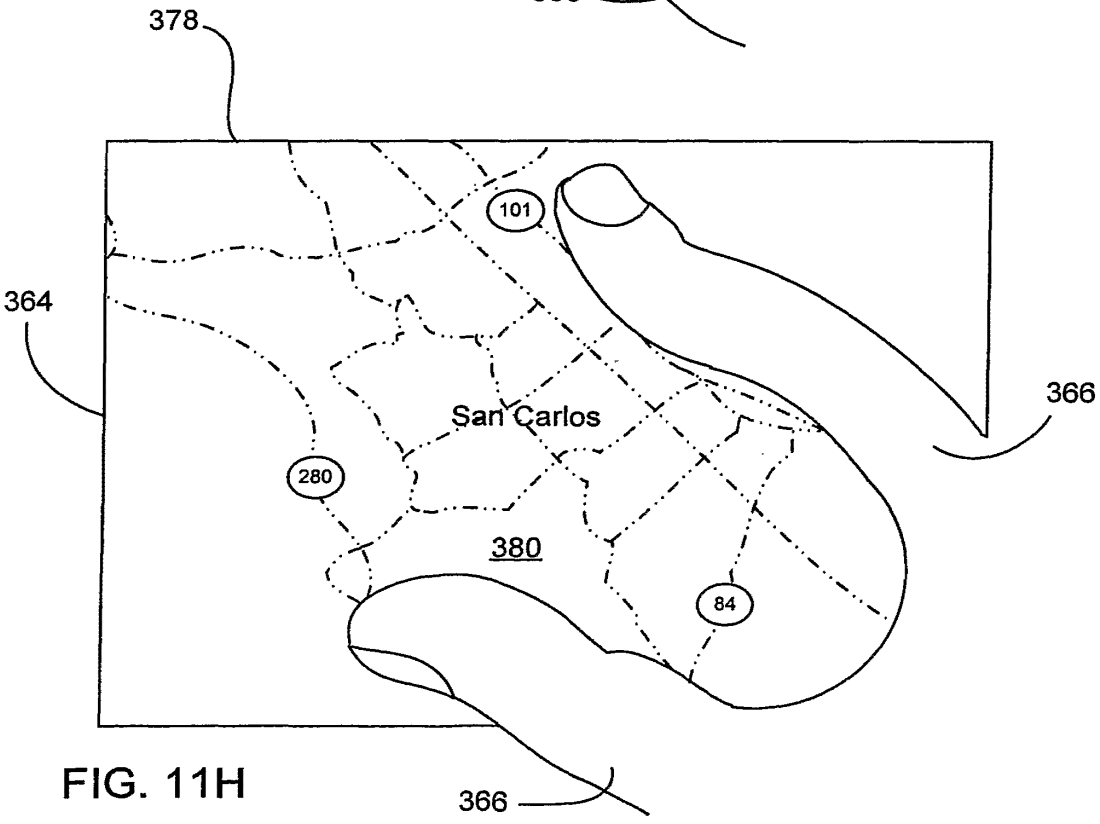


FIG. 11H

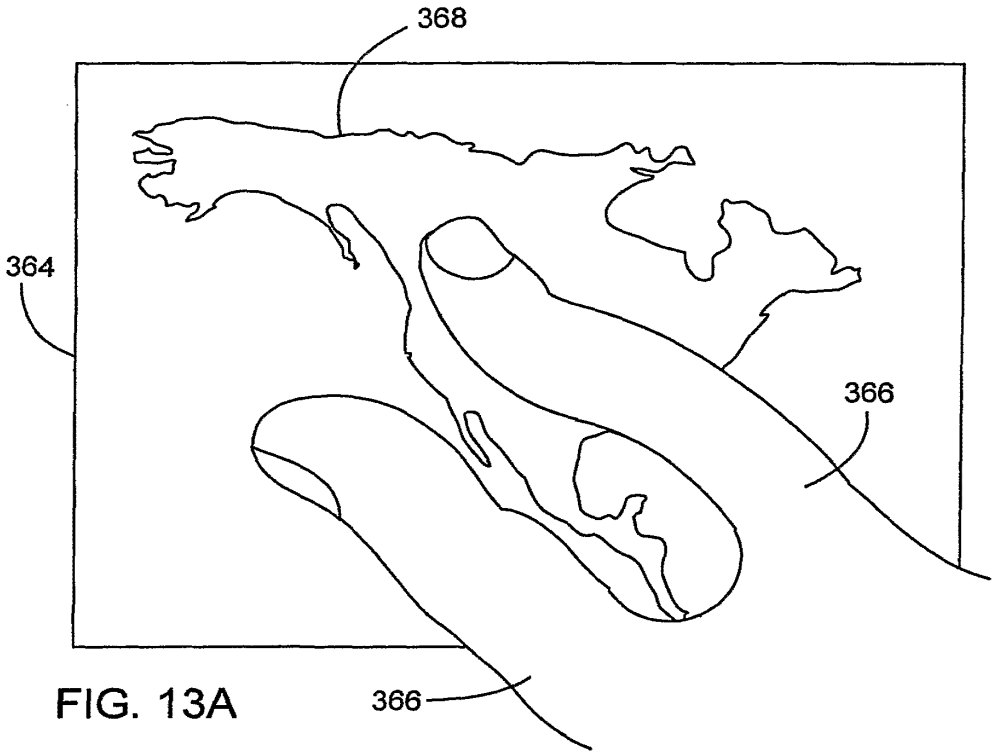


FIG. 13A

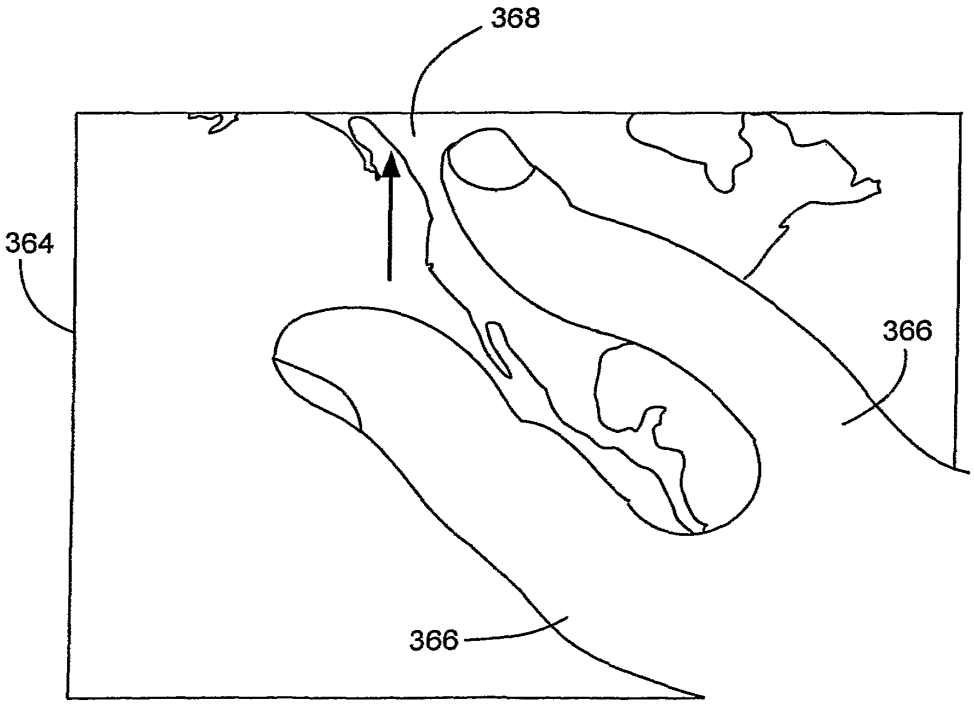


FIG. 13B

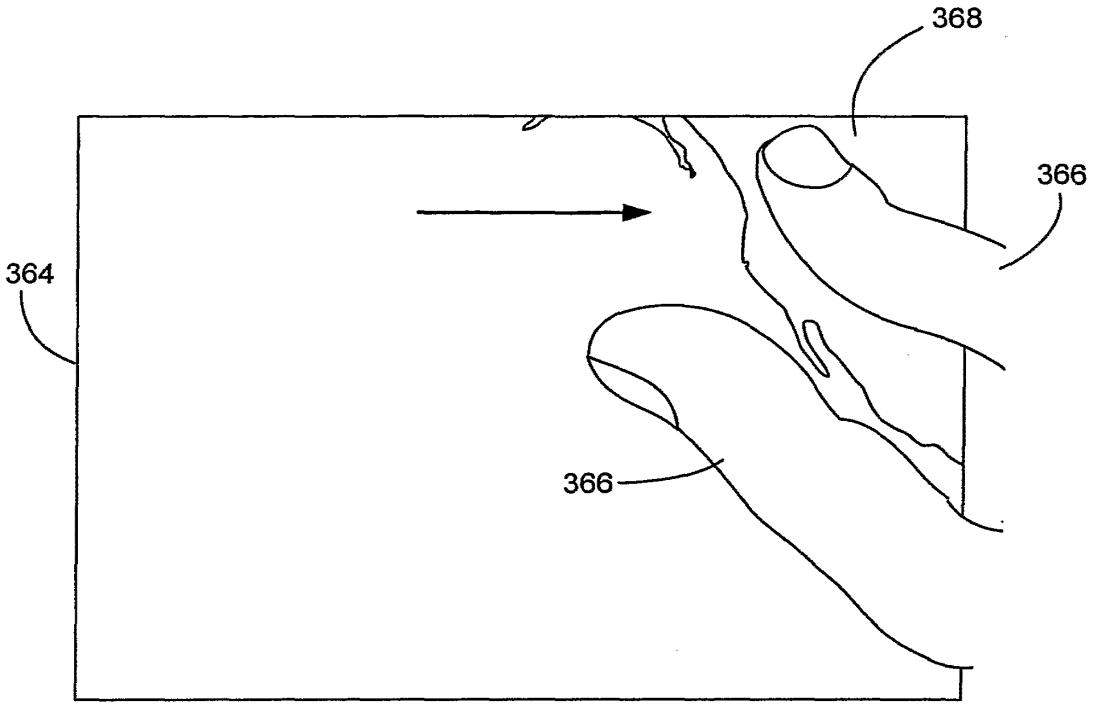


FIG. 13C

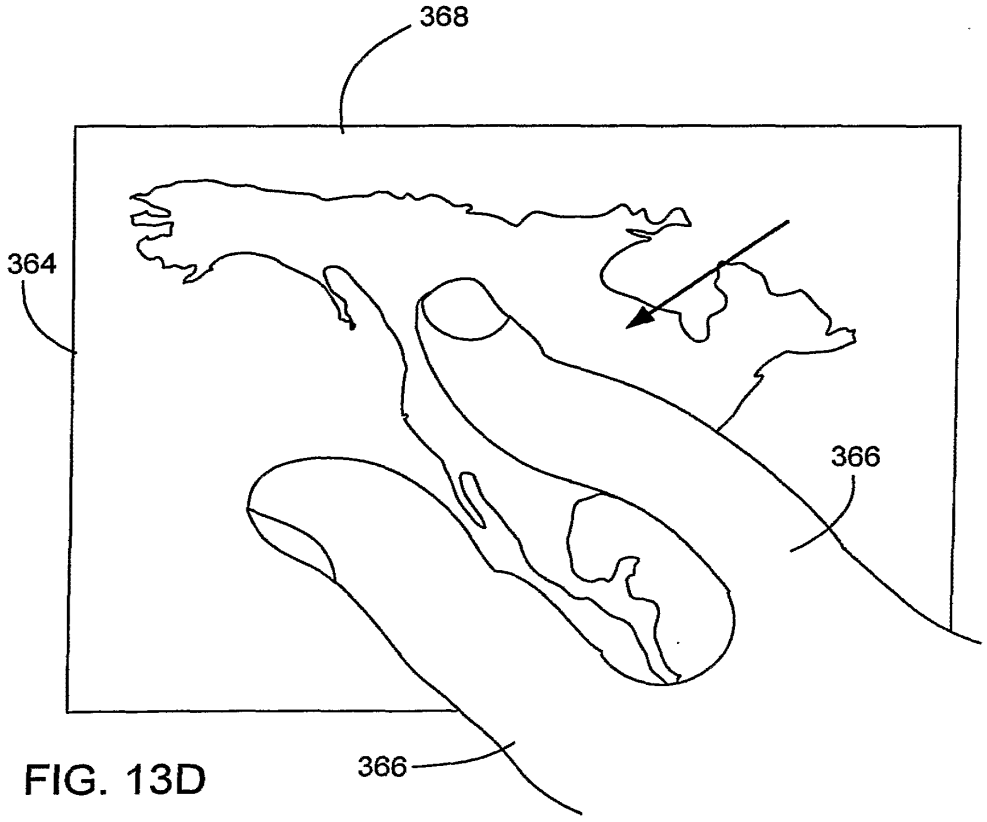


FIG. 13D

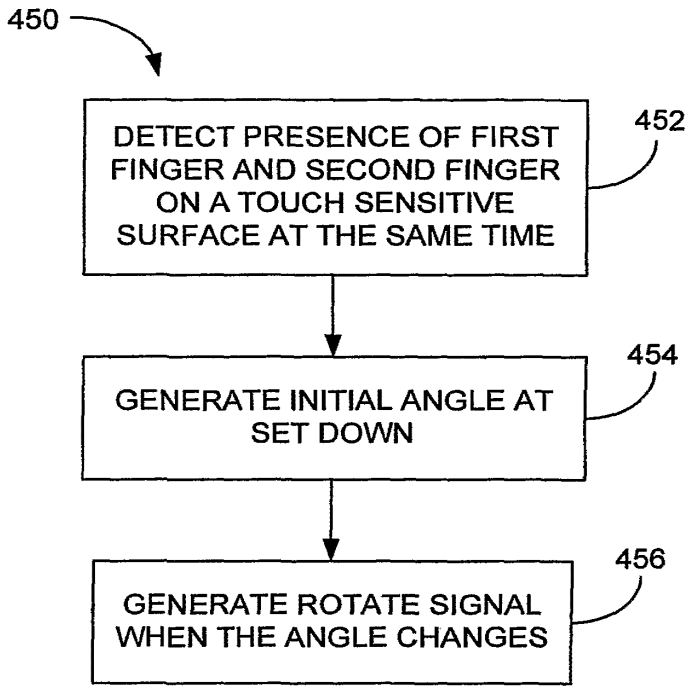

450
DETECT PRESENCE OF FIRST FINGER AND SECOND FINGER ON A TOUCH SENSITIVE SURFACE AT THE SAME TIME
452
GENERATE INITIAL ANGLE AT SET DOWN
454
GENERATE ROTATE SIGNAL WHEN THE ANGLE CHANGES
456

FIG. 14

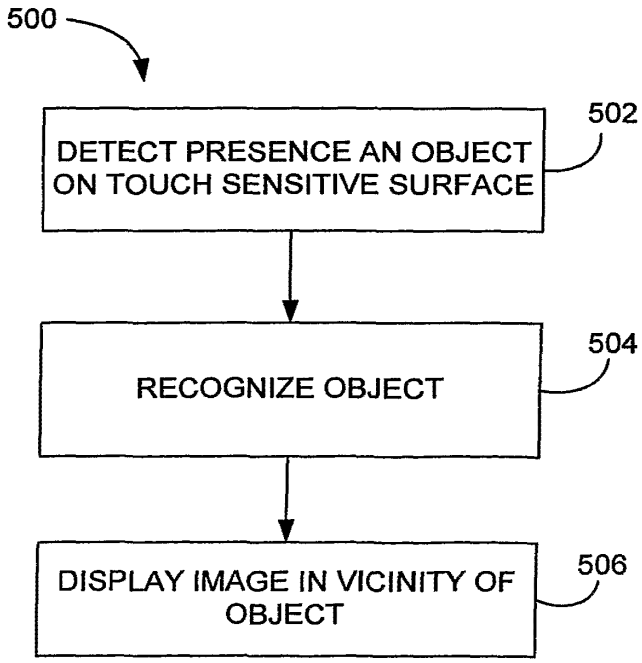

500
DETECT PRESENCE AN OBJECT ON TOUCH SENSITIVE SURFACE
502
RECOGNIZE OBJECT
504
DISPLAY IMAGE IN VICINITY OF OBJECT
506

FIG. 16

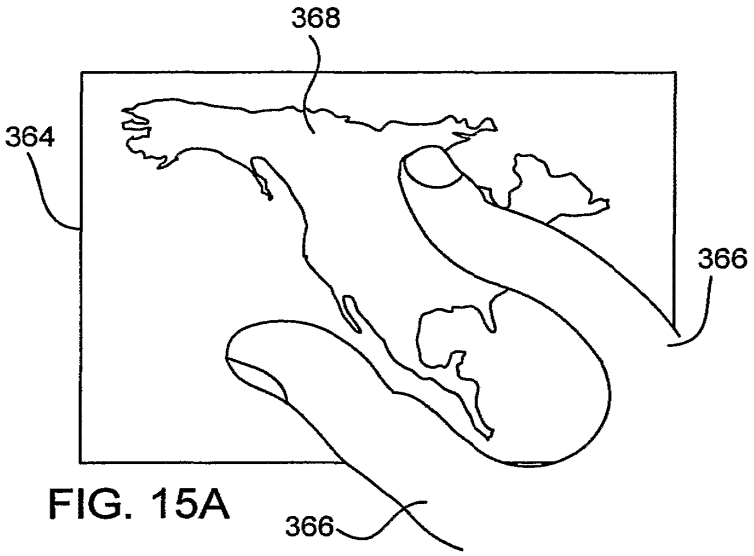


FIG. 15A

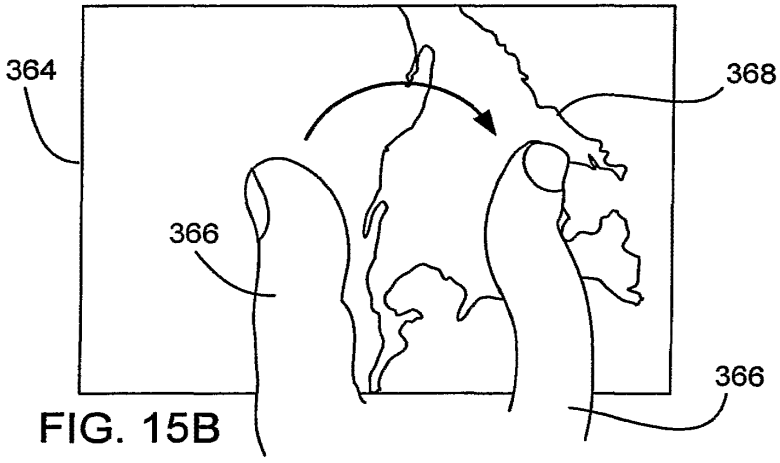


FIG. 15B

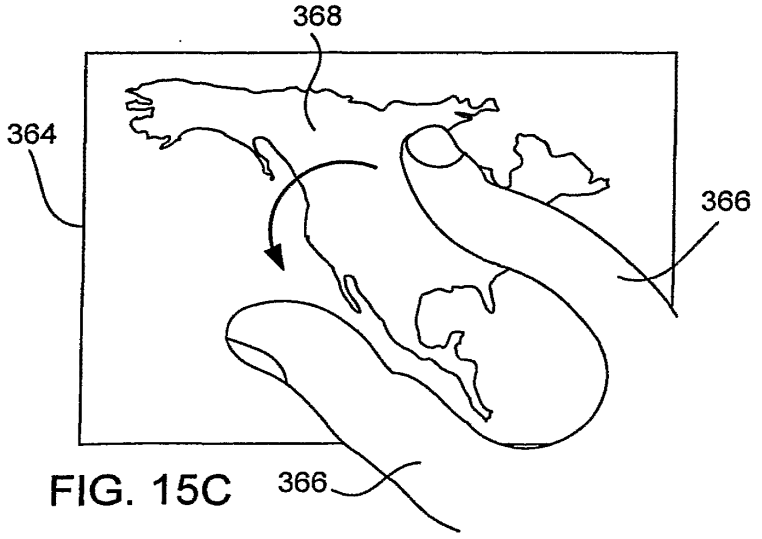


FIG. 15C

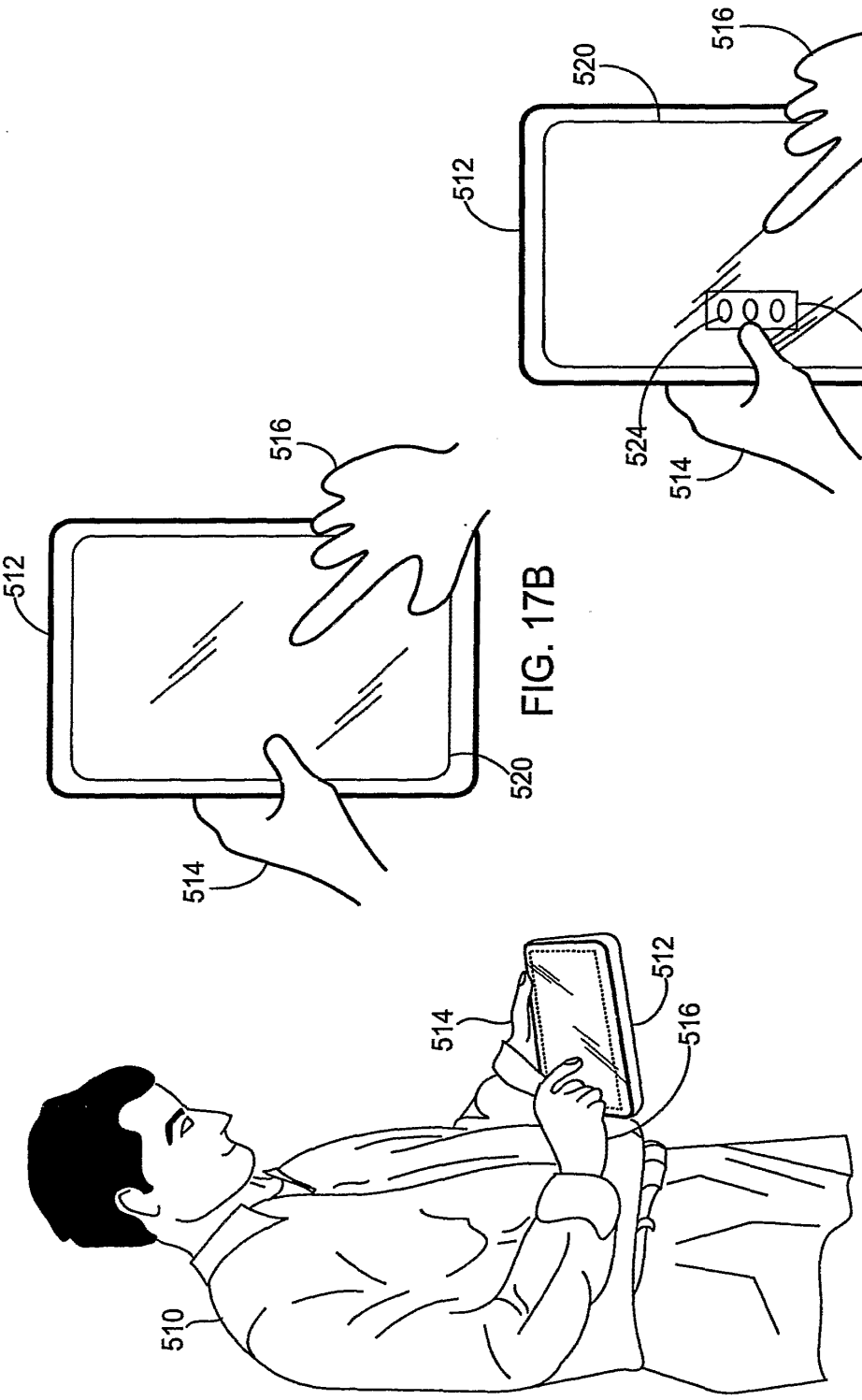


FIG. 17A

FIG. 17B

FIG. 17C

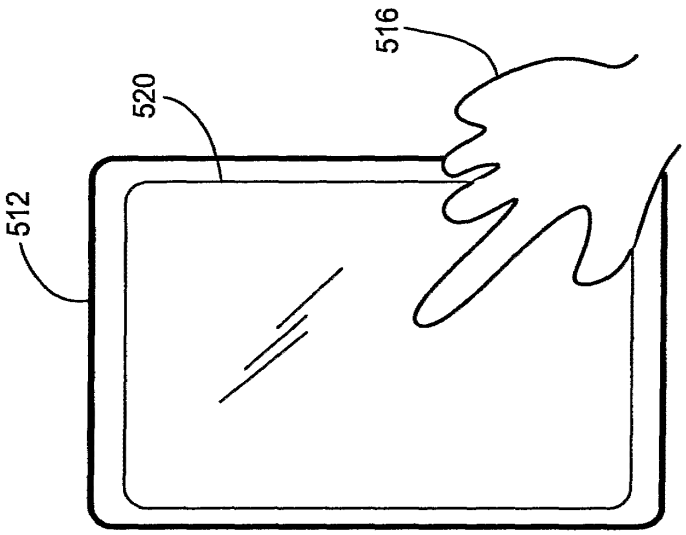


FIG. 17E

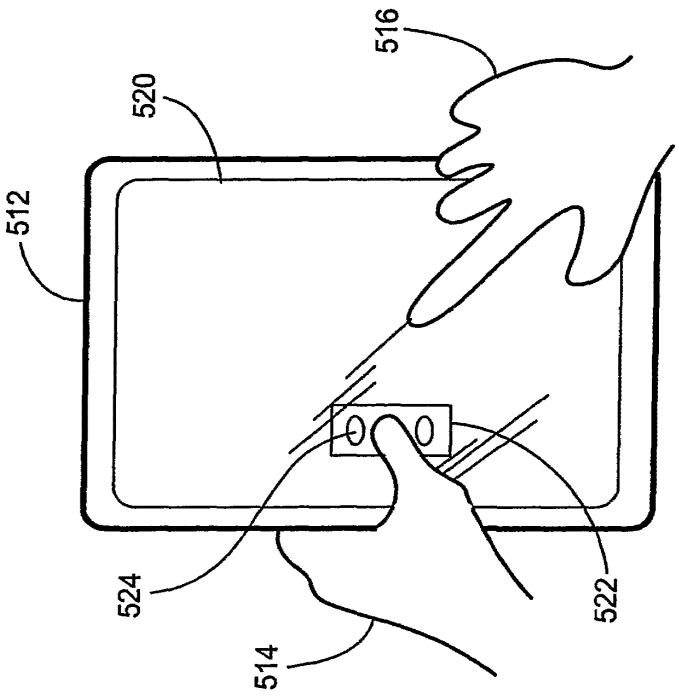


FIG. 17D

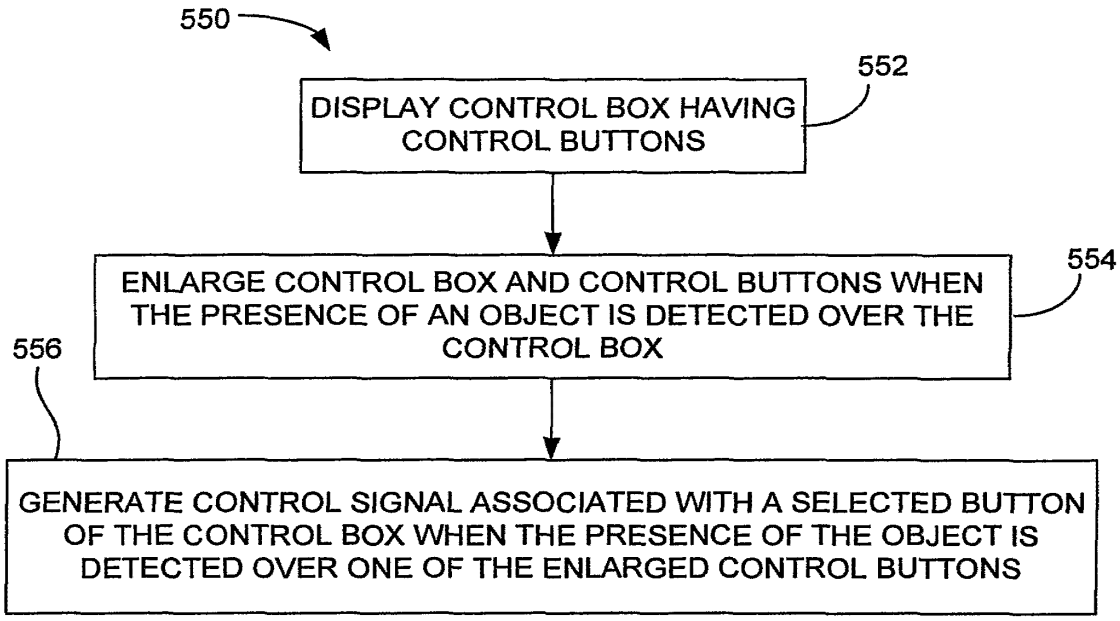

550
552
DISPLAY CONTROL BOX HAVING CONTROL BUTTONS
554
ENLARGE CONTROL BOX AND CONTROL BUTTONS WHEN THE PRESENCE OF AN OBJECT IS DETECTED OVER THE CONTROL BOX
556
GENERATE CONTROL SIGNAL ASSOCIATED WITH A SELECTED BUTTON OF THE CONTROL BOX WHEN THE PRESENCE OF THE OBJECT IS DETECTED OVER ONE OF THE ENLARGED CONTROL BUTTONS

FIG. 18

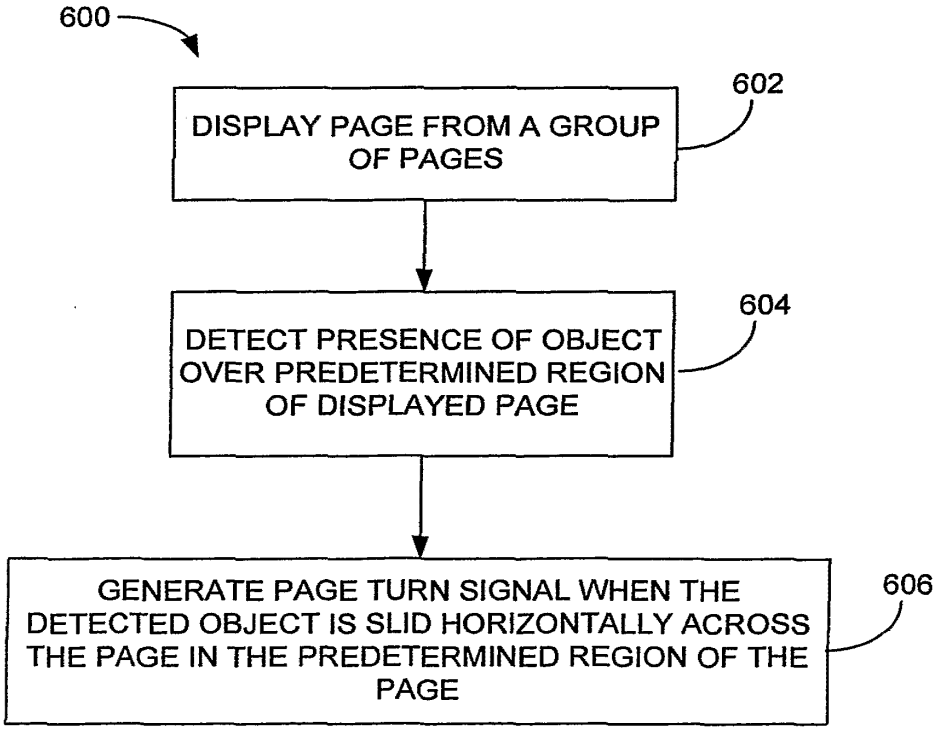

600
602
DISPLAY PAGE FROM A GROUP OF PAGES
604
DETECT PRESENCE OF OBJECT OVER PREDETERMINED REGION OF DISPLAYED PAGE
606
GENERATE PAGE TURN SIGNAL WHEN THE DETECTED OBJECT IS SLID HORIZONTALLY ACROSS THE PAGE IN THE PREDETERMINED REGION OF THE PAGE

FIG. 20

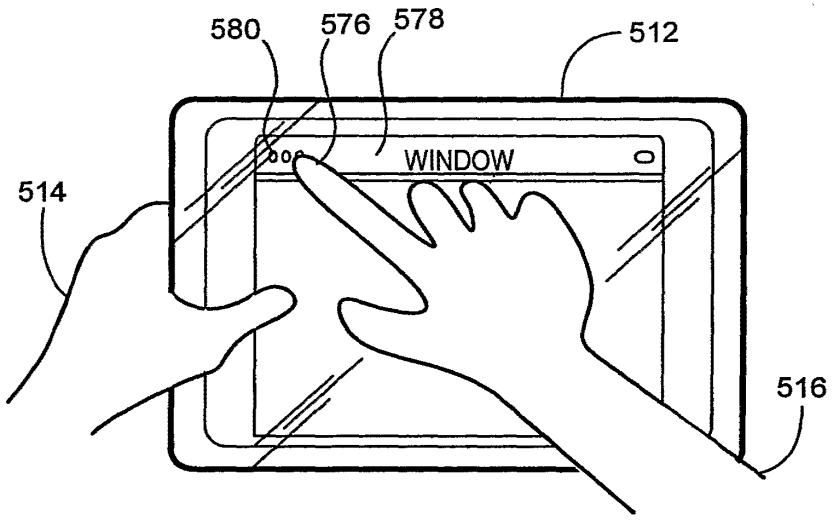


FIG. 19A

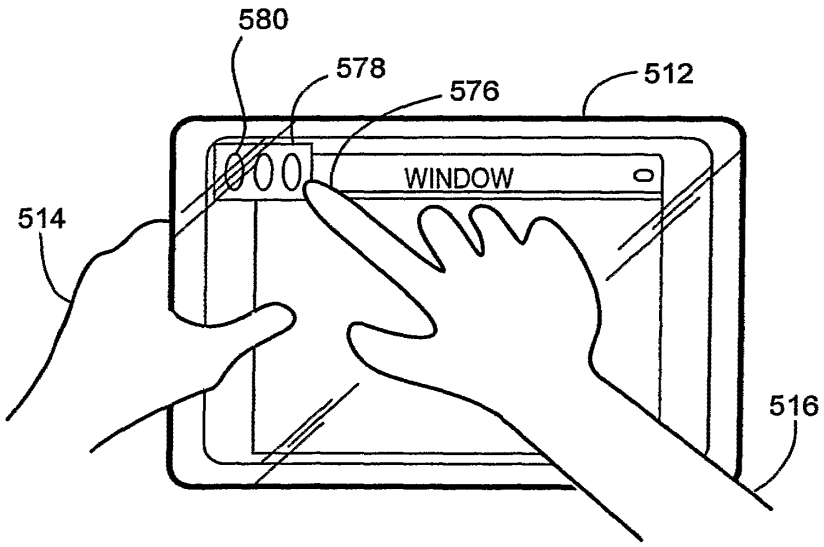


FIG. 19B

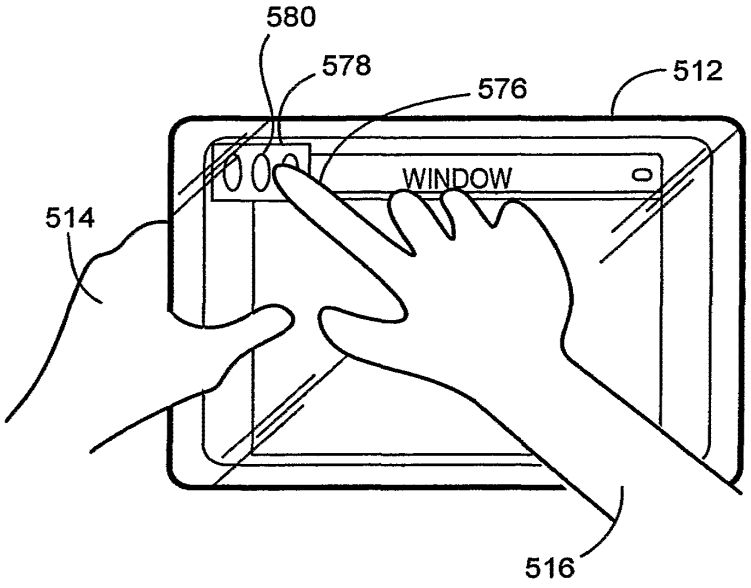


FIG. 19C

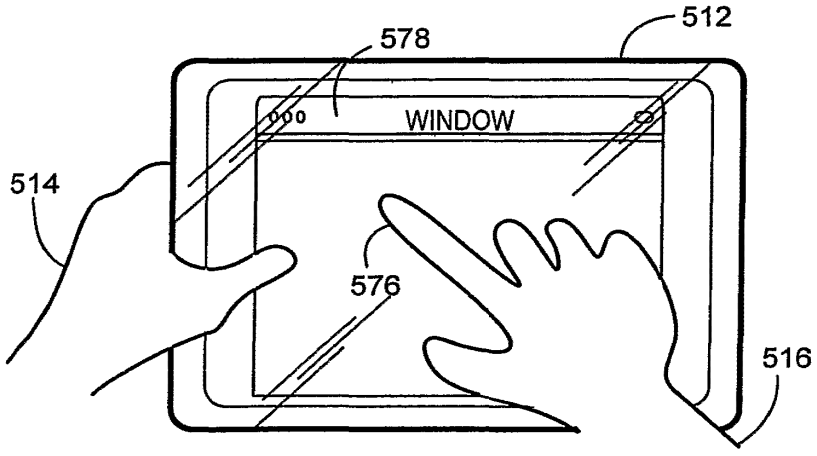


FIG. 19D

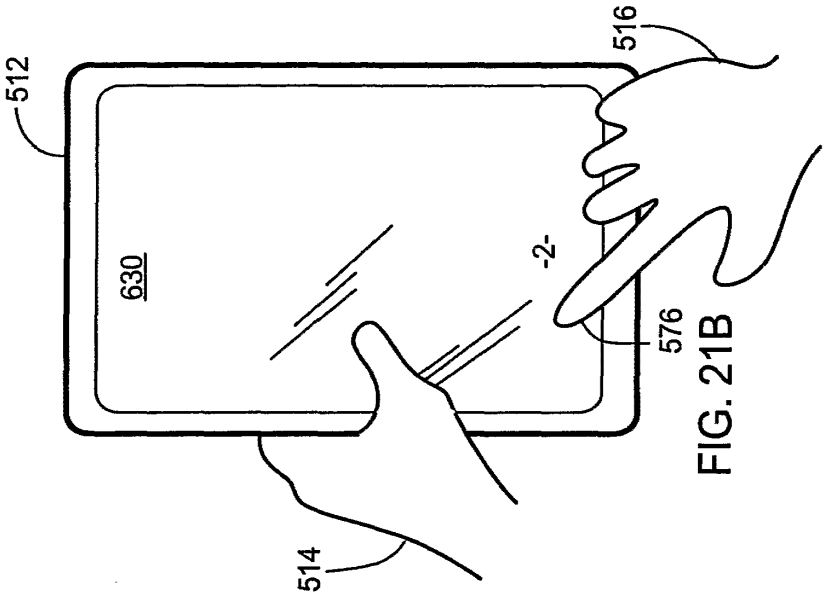


FIG. 21B

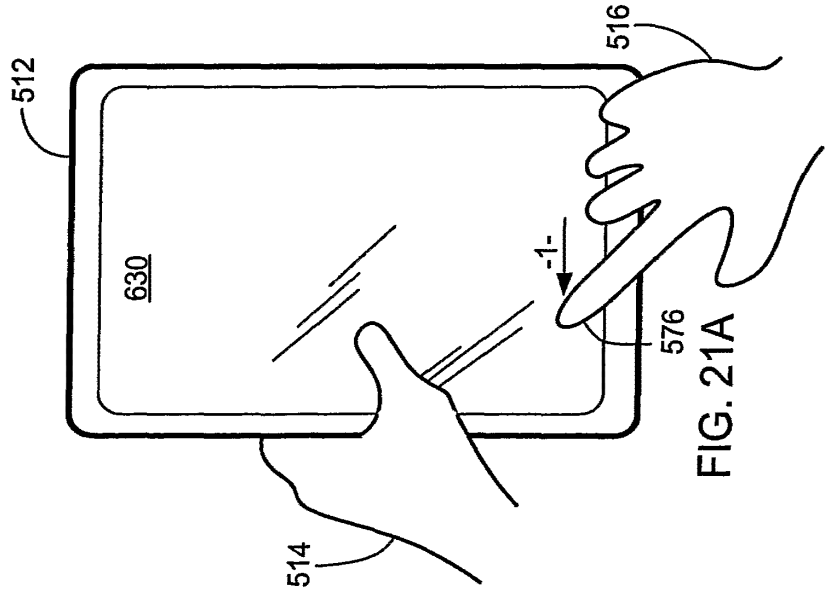


FIG. 21A

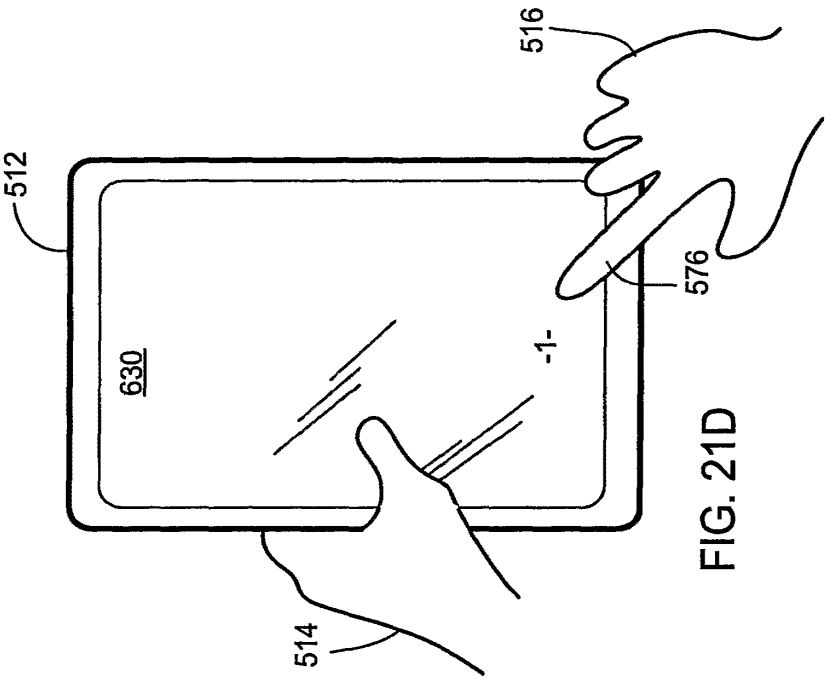


FIG. 21D

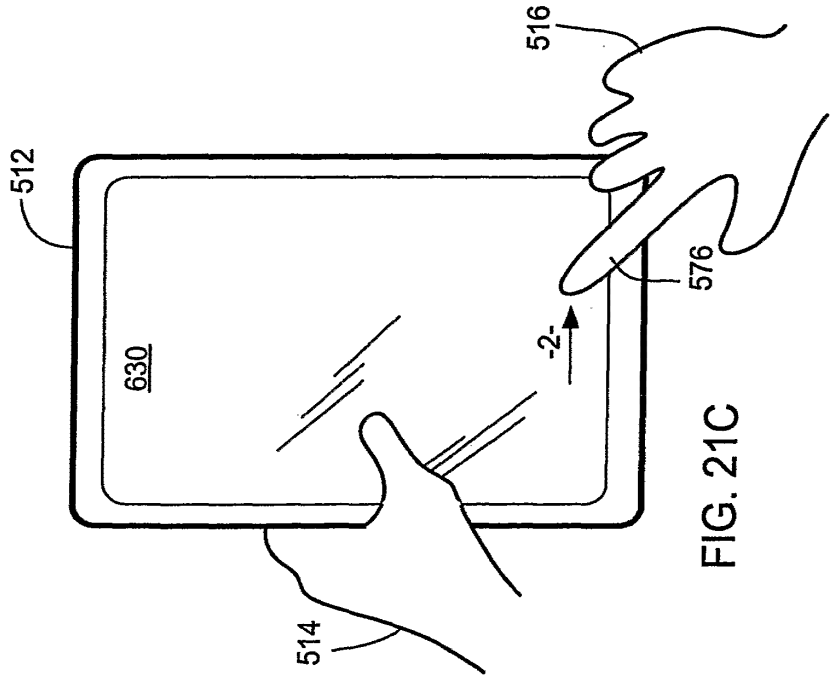


FIG. 21C

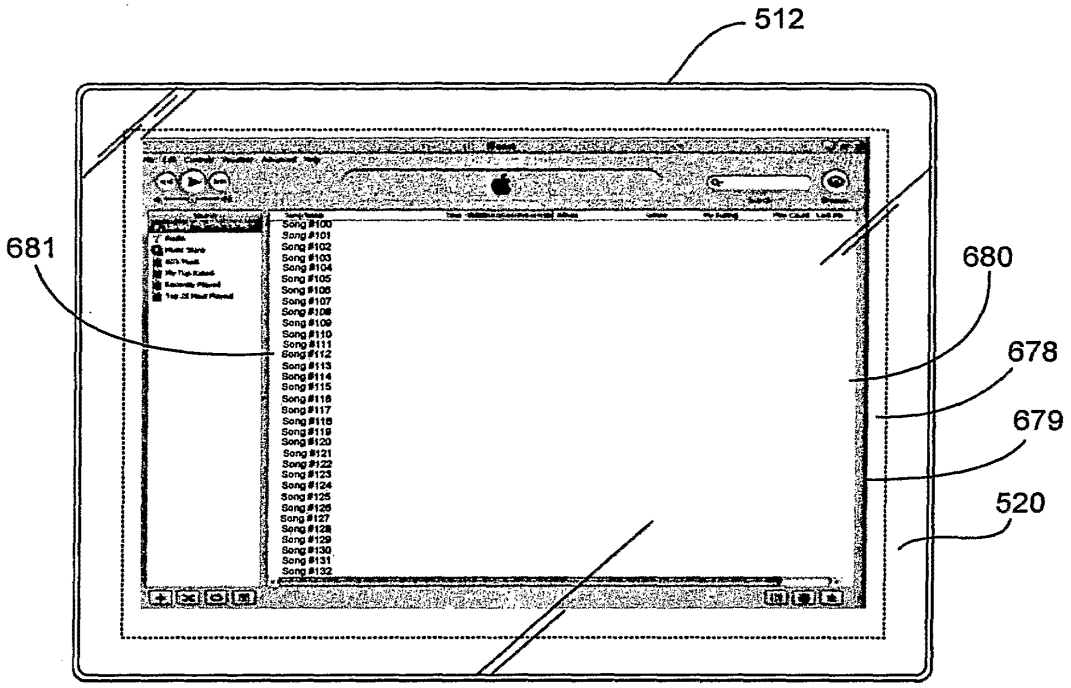


FIG. 23A

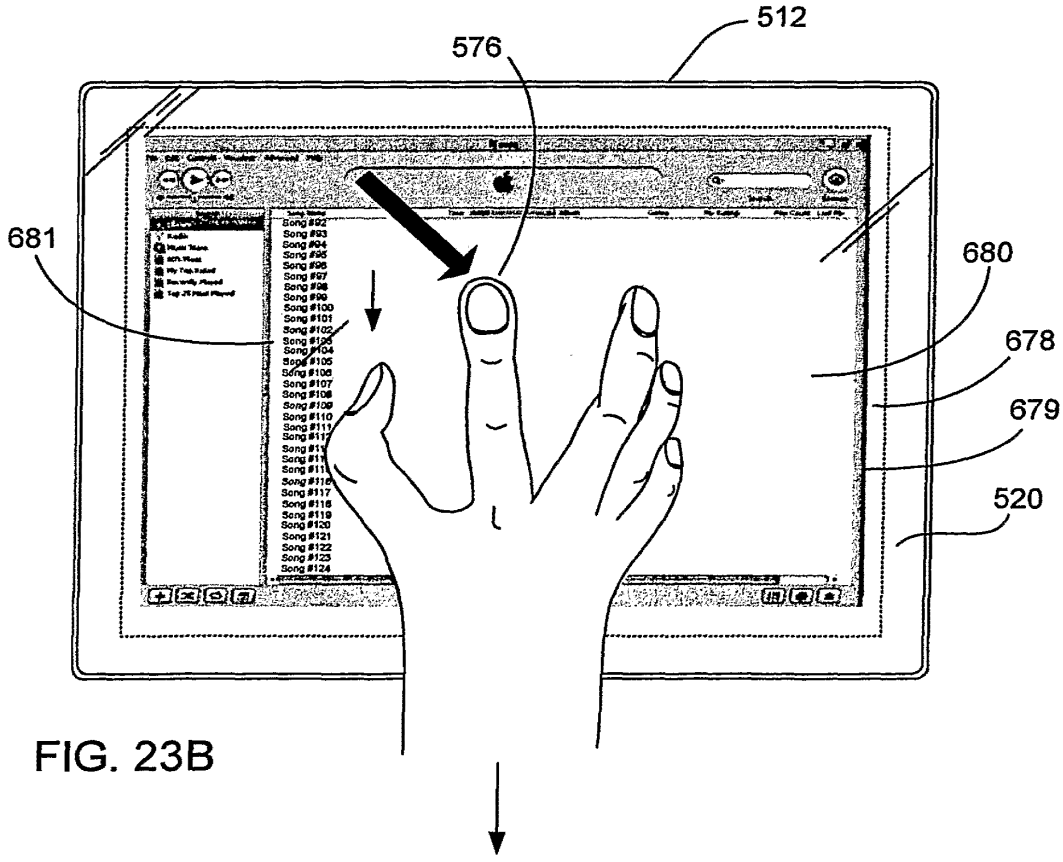


FIG. 23B

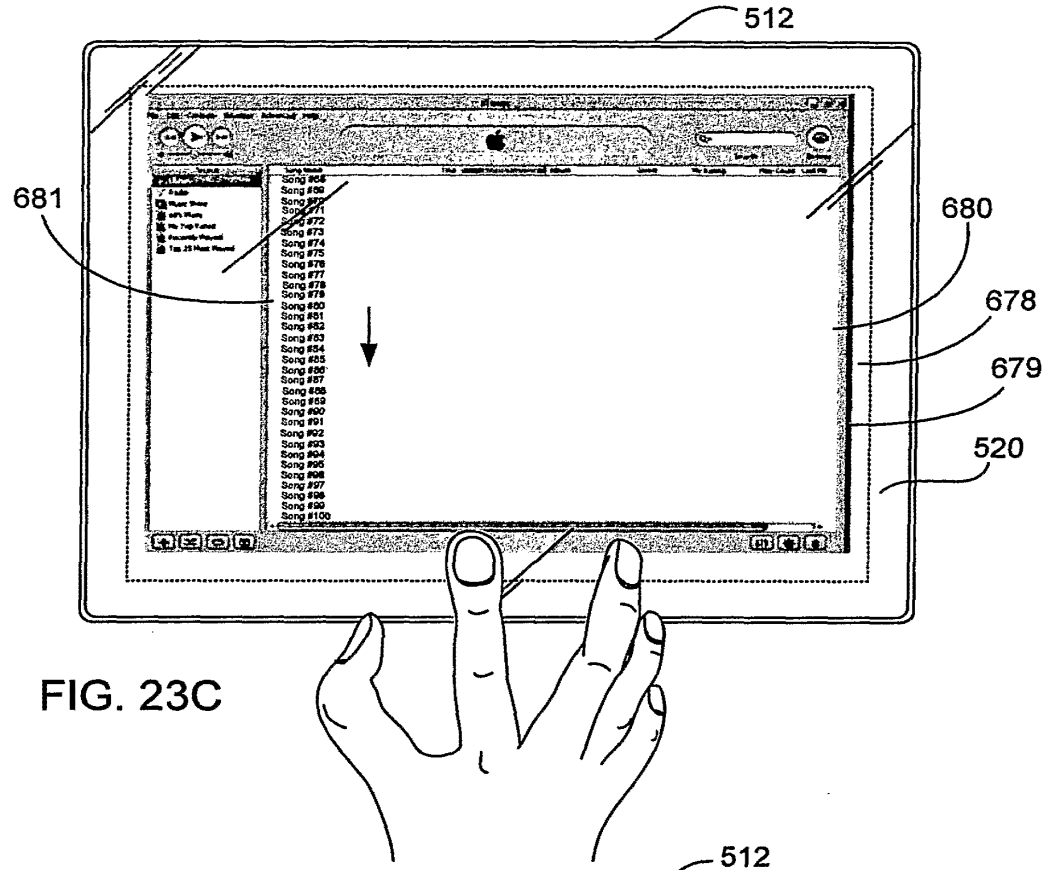


FIG. 23C

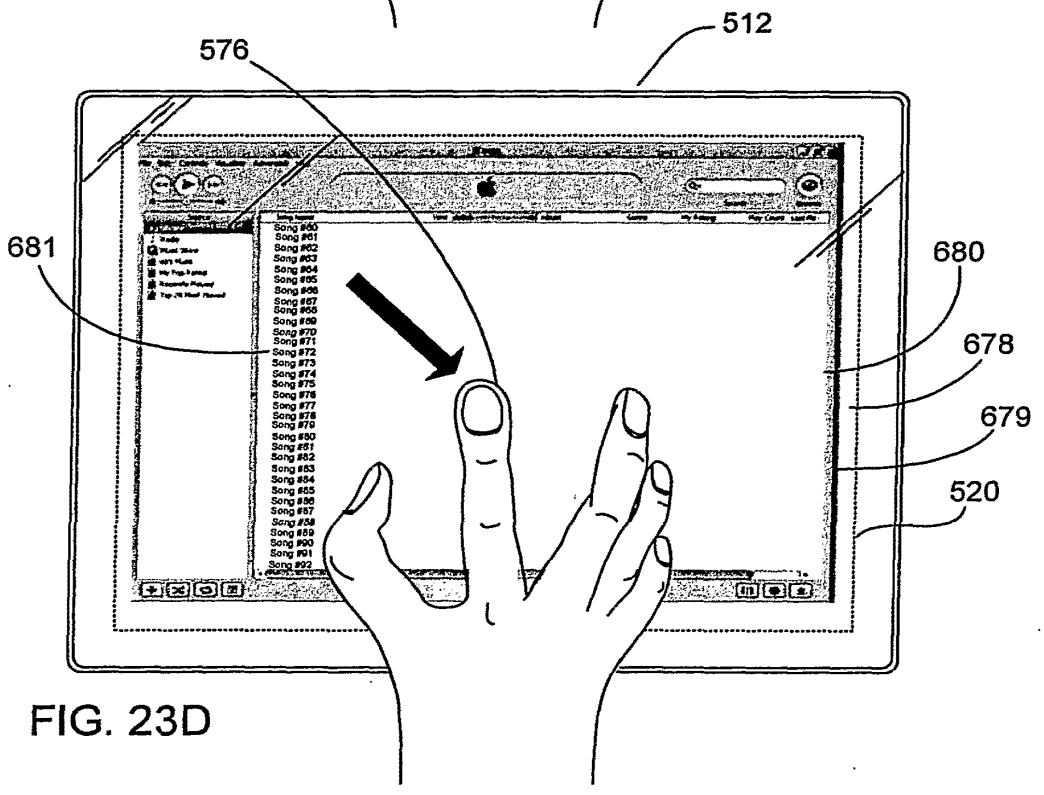


FIG. 23D

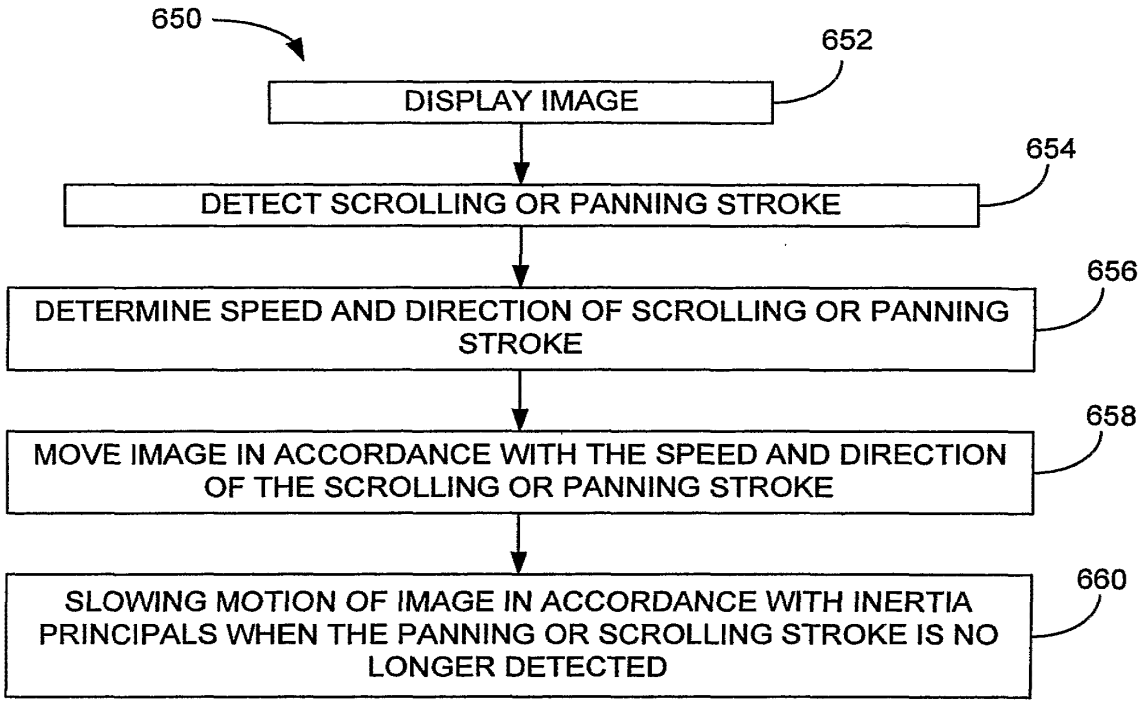

650
652
DISPLAY IMAGE
654
DETECT SCROLLING OR PANNING STROKE
656
DETERMINE SPEED AND DIRECTION OF SCROLLING OR PANNING STROKE
658
MOVE IMAGE IN ACCORDANCE WITH THE SPEED AND DIRECTION OF THE SCROLLING OR PANNING STROKE
660
SLOWING MOTION OF IMAGE IN ACCORDANCE WITH INERTIA PRINCIPALS WHEN THE PANNING OR SCROLLING STROKE IS NO LONGER DETECTED

FIG. 22

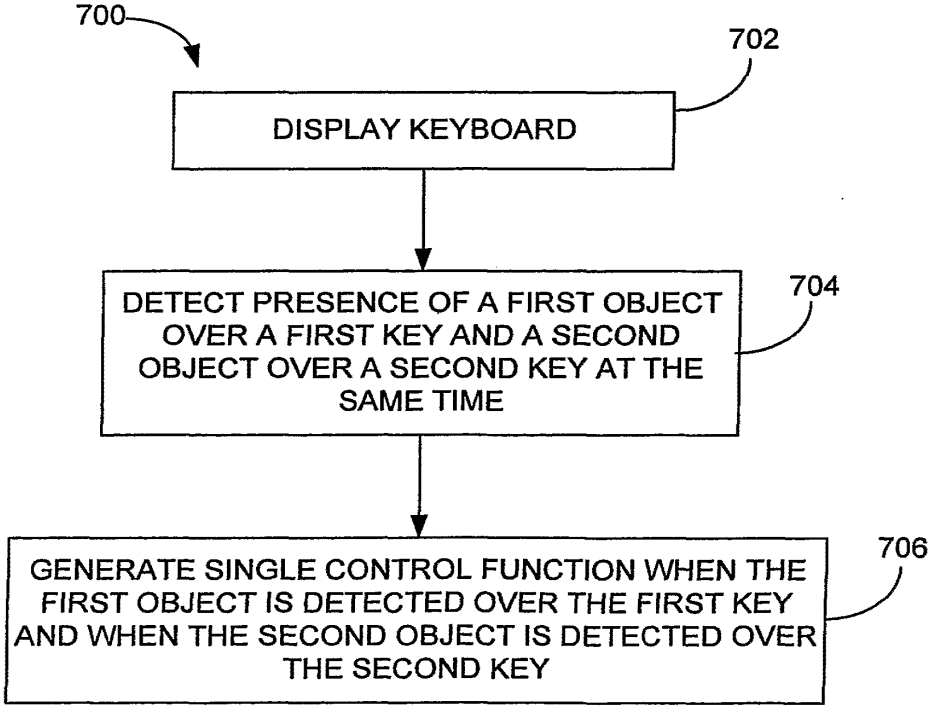

700
702
DISPLAY KEYBOARD
704
DETECT PRESENCE OF A FIRST OBJECT OVER A FIRST KEY AND A SECOND OBJECT OVER A SECOND KEY AT THE SAME TIME
706
GENERATE SINGLE CONTROL FUNCTION WHEN THE FIRST OBJECT IS DETECTED OVER THE FIRST KEY AND WHEN THE SECOND OBJECT IS DETECTED OVER THE SECOND KEY

FIG. 24

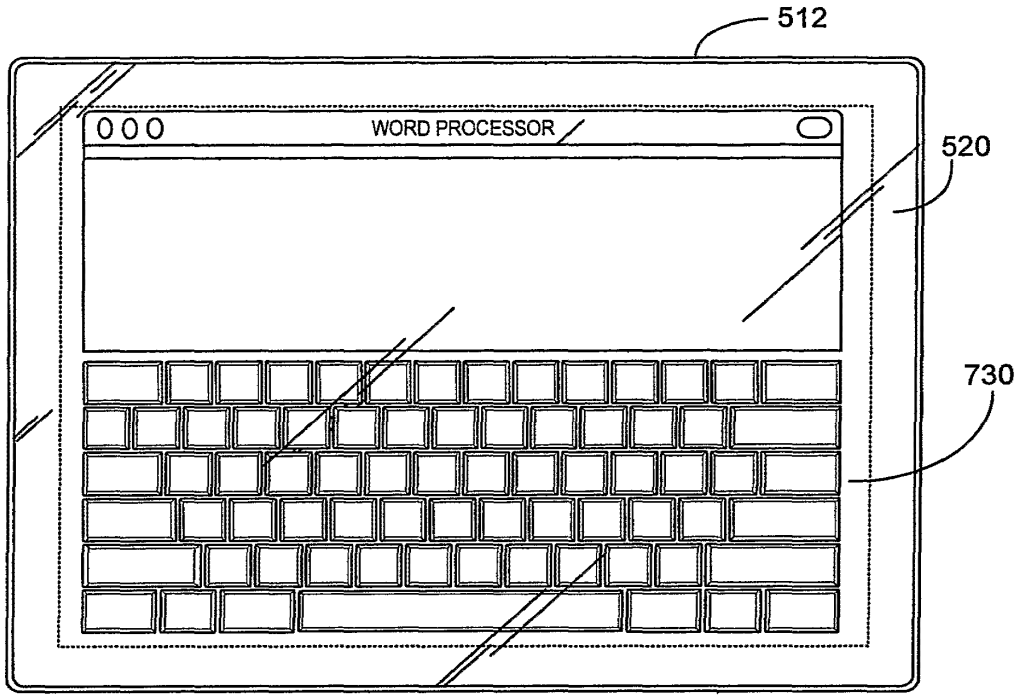


FIG. 25A

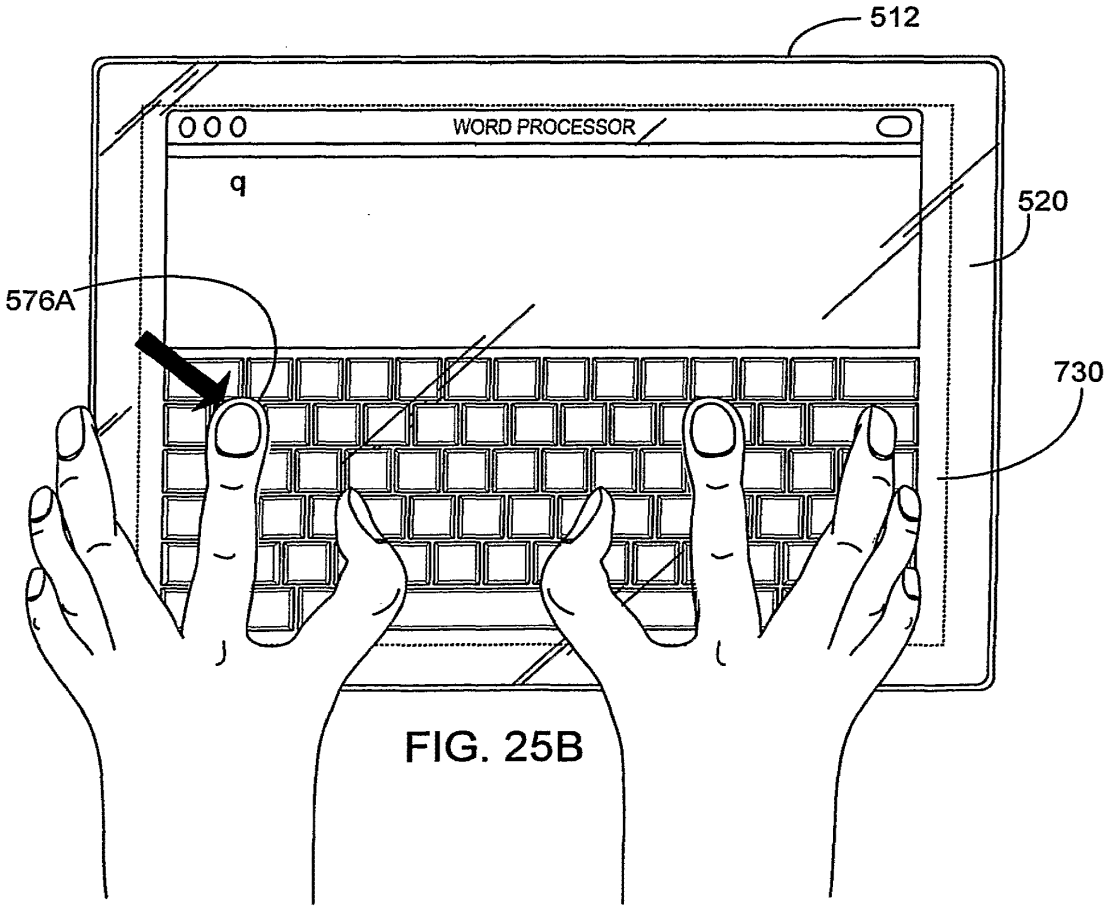


FIG. 25B

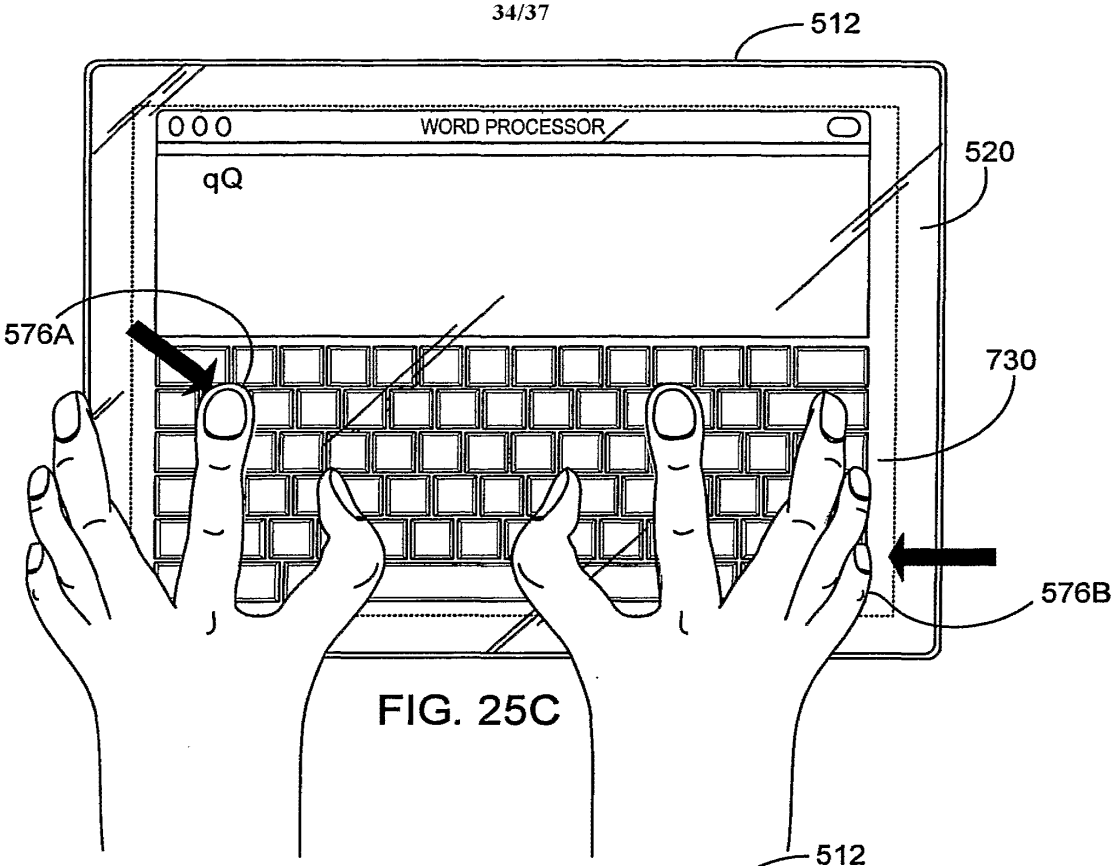


FIG. 25C

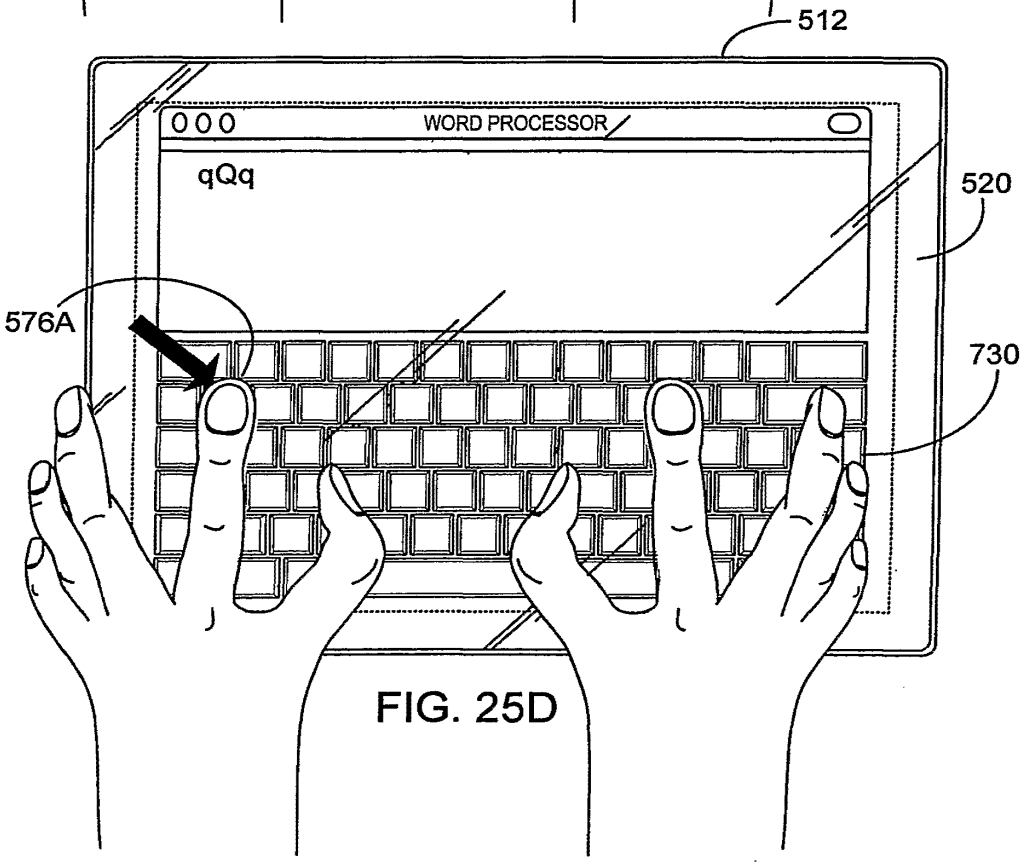


FIG. 25D

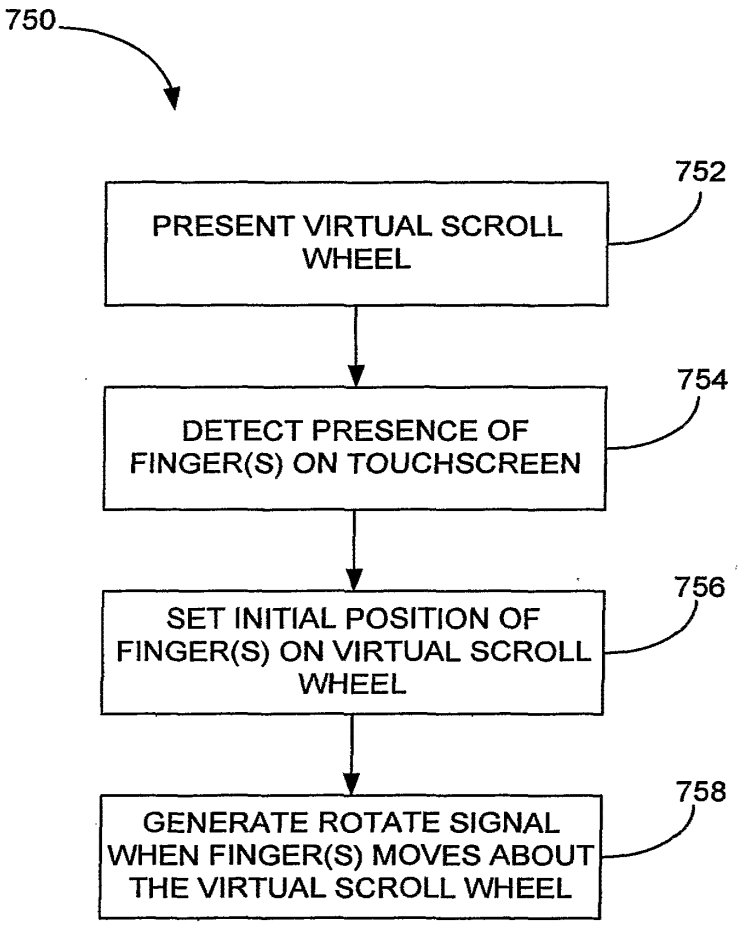

750
752
PRESENT VIRTUAL SCROLL WHEEL
754
DETECT PRESENCE OF FINGER(S) ON TOUCHSCREEN
756
SET INITIAL POSITION OF FINGER(S) ON VIRTUAL SCROLL WHEEL
758
GENERATE ROTATE SIGNAL WHEN FINGER(S) MOVES ABOUT THE VIRTUAL SCROLL WHEEL

FIG. 26

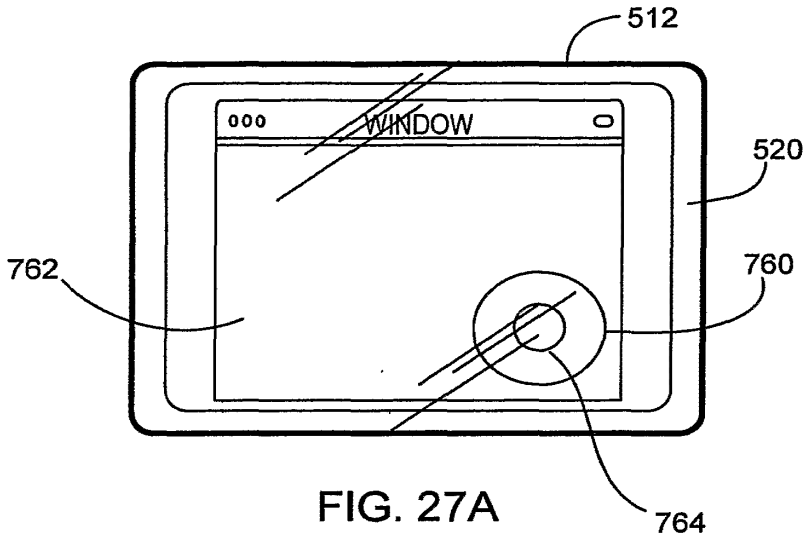


FIG. 27A

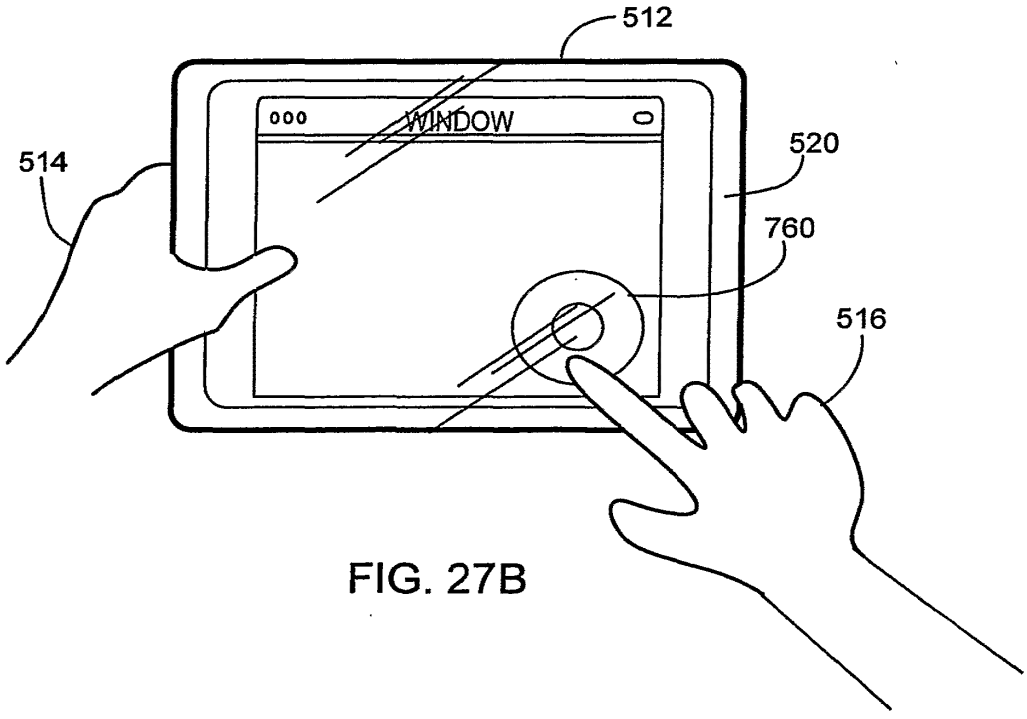


FIG. 27B

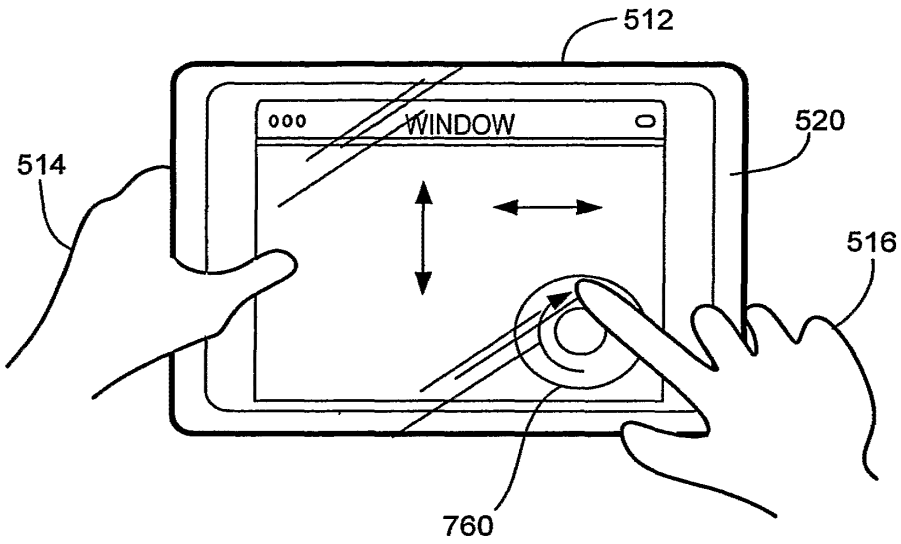


FIG. 27C

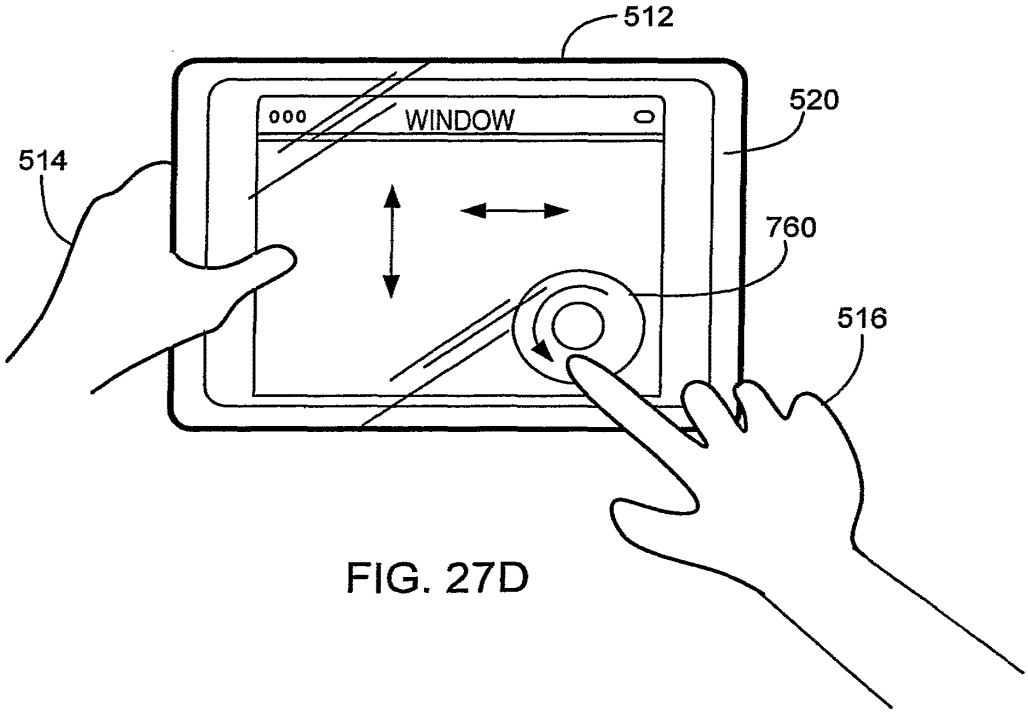


FIG. 27D

Espacenet

Bibliographic data: JP2008508600 (A) — 2008-03-21

GESTURES FOR TOUCH SENSITIVE INPUT DEVICES

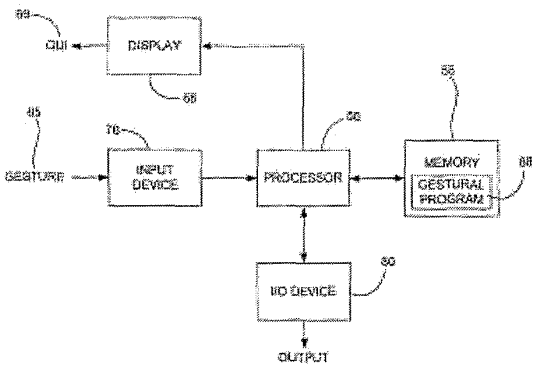
Inventor(s):

Applicant(s):

Classification:	**- international:**	***G06F3/041; G06F3/048***
	- European:	G06F3/048; G06F3/0488; G06F3/0488G
Application number:	JP20070523644 20050719	
Priority number (s):	US20040903964 20040730; US20040592483P 20040730; US20050038590 20050118; WO2005US25641 20050719	
Also published as:	JP4763695 (B2) WO2006020305 (A2) WO2006020305 (A3) KR20120014067 (A) KR20090050109 (A) more	

Abstract not available for JP2008508600 (A)
Abstract of corresponding document: WO2006020305 (A2)

Methods and systems for processing touch inputs are disclosed. The invention in one respect includes reading data from a multipoint sensing device such as a multipoint touch screen where the data pertains to touch input with respect to the multipoint sensing device, and identifying at least one multipoint gesture based on the data from the multipoint sensing device.



Last updated: 24.09.2012 Worldwide Database 5.7.42; 93p

Espacenet

Bibliographic data: JP2004171157 (A) — 2004-06-17

TACTICAL INTERFACE DEVICE

Inventor(s): TAKEUCHI SHIN; TSUKAMOTO KAZUYUKI; SAKAMAKI KATSUMI ± (TAKEUCHI SHIN, ; TSUKAMOTO KAZUYUKI, ; SAKAMAKI KATSUMI)

Applicant(s): FUJI XEROX CO LTD ± (FUJI XEROX CO LTD)

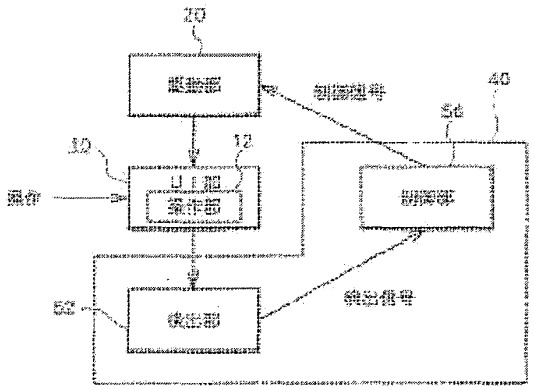
Classification: - international: ***G06F11/00; G06F3/00; G06F3/01; G06F3/033; G06F3/038; G09G5/00;*** (IPC1-7): G06F3/033
- European: G06F3/01F; G06F3/0338

Application number: JP20020334324 20021118

Priority number (s): JP20020334324 20021118

Also published as: JP4314810 (B2) US2004095369 (A1) US7215320 (B2) KR20040044075 (A) CN1501217 (A) more

Abstract of JP2004171157 (A)



PROBLEM TO BE SOLVED: To provide an operating feel associated with a variety of operations by a touch to a single operating part. SOLUTION: This tactical interface device has a detecting part 52 which detects the state of an operating part 12 operated by an operator and the position of the operating part 12 and outputs the detected state and the like in signals; a drive part 20 which provides a driving force by means of electromagnetism to the operating part 12 in order to impart reaction to the operator; and a control part 56 which controls the drive of the drive part 20 in accordance with the signals outputted from the detecting part 52 based on interface definition information by which specification information for the operating part 12 to operate as an interface device is defined. The control part 56 provides the operator with an operating feel which is generated when the operating part 12 working as the interface device is operated by imparting the reaction corresponding to the operation by the operator. ; COPYRIGHT: (C) 2004,JPO

Last updated: 24.09.2012 Worldwide Database 5.7.42; 93p

Espacenet

Bibliographic data: JP2005071157 (A) — 2005-03-17

POINTING DEVICE

Inventor(s): TADA YUKIO ± (TADA YUKIO)

Applicant(s): YAMAHA CORP ± (YAMAHA CORP)

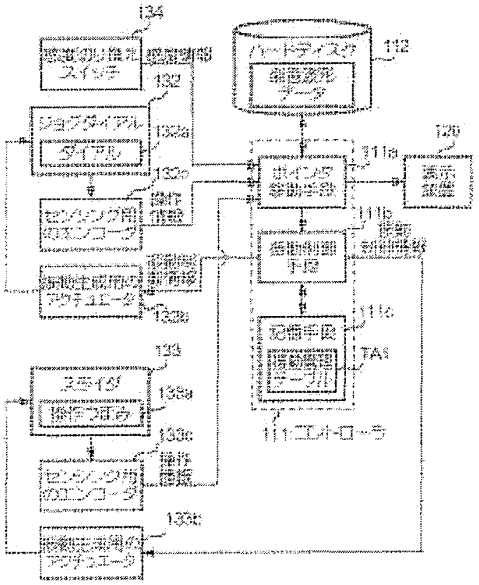
Classification: - international: ***G06F3/00; G06F3/01; G06F3/033; G06F3/048; G09G5/00;*** (IPC1-7): G06F3/00; G06F3/033
- European: G06F3/01F; G06F3/0362

Application number: JP20030301521 20030826

Priority number (s): JP20030301521 20030826

Also published as: JP4713070 (B2) US2005231466 (A1)

Abstract of JP2005071157 (A)



PROBLEM TO BE SOLVED: To provide a
pointing device capable of considerably
reducing loads upon the eye by pointing operation. ; SOLUTION: A sensing encoder 132c mounted on a jog dial 132 and the like detects the rotation direction, the amount of rotation and the like of a dial 132a, and supplies a controller 111 with the detection result as operation information. When a pointer moving means 111a receives the operation information, it determines the position of a pointer P on the basis of the operation information, and sends a movement instruction to a display unit 120. At the same time, the pointer moving means 111a reads the value of data indicated by the pointer after movement from a hard disk 112, and supplies a vibration control means 111b with this value. The vibration control means 111b controls vibration generated from an actuator 132b for vibration generation in accordance with the value of the data received from the pointer moving means 111a. ; COPYRIGHT: (C)2005,JPO&NCIPI

Last updated: 24.09.2012 Worldwide Database 5.7.42; 93p

Espacenet

Bibliographic data: JP2003029914 (A) — 2003-01-31

MULTIFUNCTIONAL INPUT DEVICE

Inventor(s): NONAKA AIJI ± (NONAKA AIJI)

Applicant(s): ALPS ELECTRIC CO LTD ± (ALPS ELECTRIC CO LTD)

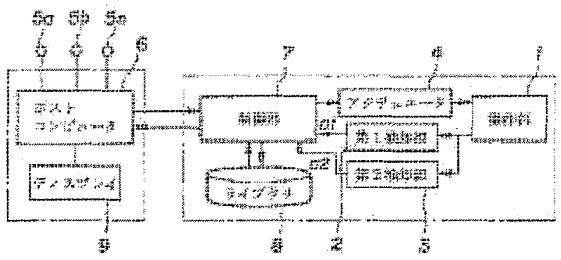
Classification: - international: ***G06F3/00; G06F3/01; G06F3/023; G06F3/038;*** (IPC1-7): G06F3/023; G06F3/033
- European: G06F3/01F

Application number: JP20010217020 20010717

Priority number (s): JP20010217020 20010717

Also published as: JP3958944 (B2) EP1278152 (A2) EP1278152 (A3) EP1278152 (B1) US2003018835 (A1) more

Abstract of JP2003029914 (A)



PROBLEM TO BE SOLVED: To provide a
multifunctional input device capable of
reducing the burdens of a host computer and easily adjusting the various kinds of the functions of a plurality of electrical apparatuses at a high speed. SOLUTION: The multifunctional input device is composed of an operation part 1, a first detection part 2 and a second detection part 3 detecting the operation state of the operation part 1, an actuator 4 imparting external force to the operation part 1, a control part 7 transferring signals with the host computer 6 centrally controlling a plurality of the electrical apparatuses 5a-5n and controlling the drive of the actuator 4 on the basis of a command from the host computer 6,; and a function/touch library 8 storing data for driving the actuator 4 corresponding to a first detection signal a1 and a second detection signal a2 outputted from the first detection part 2 and the second detection part 3 and the data for operating the electrical apparatuses 5a-5n through the host computer 6.

Last updated: 24.09.2012 Worldwide Database 5.7.42; 93p

Electronic Patent Application Fee Transmittal

Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Michael T. Morlock/Renee Prevette
Attorney Docket Number:	IMM253

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**

Electronic Acknowledgement Receipt	
EFS ID:	14093809
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Renee Prevette
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	29-OCT-2012
Filing Date:	27-DEC-2007
Time Stamp:	10:43:27
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	8949
Deposit Account	201430
Authorized User	KILPATRICK TOWNSEND & STOCKTON, LLP
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)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	IDSTransmittal.pdf	37730 bc1f6a1609d5885460533ef9810ad7bacf62cf3f	no	1
Warnings:					
Information:					
2	Transmittal Letter	IDSLetter.pdf	213536 62618f0133c9a3e4e1ddadbec2b73a27d3a1ddf5	no	5
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	PTOSB08.pdf	65323 a26924a27e96f6475155fb28c0ded32407b7ffef	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Foreign Reference	WO2006020305.pdf	3592231 5fbf98b22f30d4af1e64ac638eed0469aba3a3f8	no	87
Warnings:					
Information:					
5	Foreign Reference	JP2008508600.pdf	65392 953272408d746655f97230d84b60c4d46d84f6a7	no	1
Warnings:					
Information:					
6	Foreign Reference	JP2004171157.pdf	93534 b500c872ecd0b9db857119b537c5c4e018ed3156	no	2
Warnings:					
Information:					
7	Foreign Reference	JP2005071157.pdf	101261 35d7a68b65432b0933c26f110ec8c9e384755d7e	no	2
Warnings:					
Information:					
8	Foreign Reference	JP2003029914.pdf	89376 ee83e598ee3fa45d74839488e5d03e5b8b9ab505	no	2
Warnings:					
Information:					

9	Non Patent Literature	JPOA08-28-2012.pdf	58776 8ae702bdff477354d75b5ed7b890d5bcab730ce7	no	2
Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	29919 81d524766510eeaf08025f01bd012b6d608d1b55	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	4347078		

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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Conf No.: 2809
Michael D. Levin	)	
	)	Art Unit: 2629
Serial No. 11/965,046	)	
	)	Examiner: **Zubajlo, Jennifer L.**
Filed: December 27, 2007	)	
	)	

For: VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK

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

TRANSMITTAL

Sir:

Transmitted herewith are the following documents for filing in the above-identified application:

1. Information Disclosure Statement Letter;
2. Information Disclosure Statement by Applicant (Form PTO/SB/08);
3. Five (5) Foreign Patent References;
4. One (1) Non-Patent Literature Reference; and
5. EFS Web Payment in the amount of $180.00.

The Commissioner is hereby authorized to charge any deficiency to Deposit Account Number 20-1430.

Respectfully submitted,

Date: 10/25/2012

Michael T. Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing
I hereby certify that this correspondence is being electronically filed with The United States Patent Office via EFS-Web on October 29, 2012.

Renée S. Prevette

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Michael D. Levin	)	
	)	Conf. No.: 2809
Serial No. 11/965,046	)	
	)	Art Unit: 2629
Filed: December 27, 2007	)	
	)	Examiner: Zubajlo, Jennifer L.
For: **VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK**	)	
	)	
	)	
	)	
	)	
Attorney Ref. IMM253 (51851-339922)	)	

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Pursuant to 37 C.F.R. §§ 1.97 and 1.98, applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I.. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the PTO/SB/08 forms attached hereto.

II. COPIES (check at least one box)

a. ☐ This application was filed before June 30, 2003. Accordingly, submitted herewith is a legible copy of (i) each U.S. and foreign patent; (ii) each publication or that portion which caused it to be listed; and (iii) all other information or that portion which caused it to be listed.

b. ☒ This application was filed on or after June 30, 2003. Accordingly, copies of cited U.S. patents and patent application publications therefore are not included. Copies of foreign patent documents and non-patent literature are included.

c. ☐ Some or all of the documents listed on the PTO/SB/08 forms are not enclosed because they were cited in the International Search Report and copies should already be in the PTO file. If copies are needed, please contact the undersigned.

III. CONCISE EXPLANATION OF THE RELEVANCE
(check at least one box)

a. ☒ **DOCUMENTS IN THE ENGLISH LANGUAGE**
The patents, publications, or other information listed on the attached PTO/SB/08 forms are in the English language and therefore, do not require a statement of relevancy.

b. ☒ **DOCUMENTS NOT IN THE ENGLISH LANGUAGE**

A concise explanation of the relevance of all patents, publications, or other information listed that is not in the English language is as follows:

JP 2008-508600 – English language abstract provided
JP 2004-171157 – English language abstract provided
JP 2005-071157 – English language abstract provided
JP 2003-029914 – English language abstract provided

c. ☐ **ENGLISH LANGUAGE SEARCH REPORT**
An English language version of the search report or action that indicates the degree of relevance found by the foreign office is attached, thereby satisfying the requirement for a concise explanation. See MPEP 609(III)(A)(3).

d. ☐ **OTHER**
The following additional information is provided for the Examiner's consideration.

FEES

IV. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(b):
(check one box)

a. ☐ within three months of the filing date of a national application (37 C.F.R. § 1.97(b)(1)). No fee or statement is required. *(This section is not to be used with RCE's.)*

b. ☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application (37 C.F.R. § 1.97(b)(2)). No fee or statement is required.

c. ☐ before the mailing of a first Office action after the filing of or concurrently with a Request for Continued Examination under § 1.114 (37 C.F.R. § 1.97(b)(4)). No fee or statement is required.

d. ☐ before the mailing date of a first Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or statement is required.

In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) below, or, if no statement has been made, charge our deposit account in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

V. ☒ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(c):
(check one box)

before the mailing date of a Final Office Action under 37 C.F.R. § 1.113 (See 37 C.F.R. § 1.97(c)(1)) or before the mailing date of a Notice of Allowance under 37 C.F.R. § 1.311 (See 37 C.F.R. § 1.97(c)(2)).

a. ☒ No statement; therefore, a fee in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

b. ☐ See the statement below. No fee is required.

VI. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(d)
after the period specified in 37 C.F.R. 1.97(c) but before payment of the issue fee; see statement and payment of fees below.

VII. STATEMENT UNDER 37 C.F.R. § 1.97(e) (check only one box)
The undersigned hereby states that

a. ☐ each item of information contained in the IDS was first cited in any communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS;

b. ☐ no item of information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

c. ☐ Some of the items of information were cited in a communication from a foreign Patent Office. As to this information, the undersigned states that each item of information contained in the IDS was first cited in a communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS. As to the remaining information, the undersigned hereby states that no item of this remaining information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application and, to the best of my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

VIII. ☒ PATENT TERM ADJUSTMENT

Each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.704(d).

IX. PAYMENT OF FEES (check one box)

☒ Payment by credit card Form PTO-2038 in the amount of $180 required by 37 C.F.R. § 1.17(p) is enclosed for the above-identified fee.

☐ Please charge Deposit Account No. 20-1430 in the amount required by 37 C.F.R. § 1.17(p) for the above-indicated fee. A triplicate copy of this paper is attached.

☐ No fee is required.

If the Examiner has any questions concerning this IDS, he/she is requested to contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 20-1430.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 20-1430 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17.

Respectfully submitted,

Date: 10/25/2012

By: _____
Michael T. Morlock (Reg. No. 62,245)

Attachment(s):
- ☒ PTO/SB/08
- ☒ Documents
- ☒ Fee
- ☐ Other

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 11/06/2012

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2695	

MAIL DATE	DELIVERY MODE
11/06/2012	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.

ADVISORY ACTION

Response to Arguments

1. Applicant's arguments filed 10/22/12 have been fully considered but they are not persuasive.

Applicant argues that “Tuomo does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent," as recited by claim 1. In fact, Tuomo only mentions vibrotactile effects briefly in paragraph [0053] and claim 22. And Tuomo does not describe any types of vibrotactile effects. Furthermore, Tuomo does not even use the word detent.” Examiner disagrees.

Detents are defined as a device used to mechanically resist or arrest the rotation of a wheel, axle, or spindle; as click-stops, used to divide a rotation into discrete increments. Therefore, even though Tuomo Nyyssonen does not use the word “detent”, he teaches virtual knobs which are obviously divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents. For example, when a virtual knob is used to control volume, volume would be divided into discrete increments such as 0, 1, 2, 3, …. Etc for volume levels for lowest to highest values. Further, these virtual knobs are combined with vibro-tactile feedback in response to user inputs which teaches the detent profile comprising haptic data associated with a virtual detent.

Therefore, the combination of Grant and Tuomo Nyyssonen teach "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad; receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent ....".

Conclusion

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Patent No. US 7,720,552 and Pub. No.: US 2006/0187216 both teach virtual knobs used with touch devices that could replace the Nyyssonen reference for a 103 rejection.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JENNIFER ZUBAJLO whose telephone number is (571)270-1551. The examiner can normally be reached on Monday-Friday, 10 am - 7 pm, EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amare Mengistu can be reached on (571) 272-7674. 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.

/Jennifer Zubajlo/
Examiner, Art Unit 2695
11/2/12

/Amare Mengistu/
Supervisory Patent Examiner, Art Unit 2695

Advisory Action **Before the Filing of an Appeal Brief**	**Application No.** *11/965,046*	**Applicant(s)** LEVIN, MICHAEL D.
	Examiner JENNIFER ZUBAJLO	**Art Unit** 2695

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

THE REPLY FILED 22 October 2012 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☒ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
9. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
10. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

11. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.
12. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
13. ☐ Other: _____.

STATUS OF CLAIMS

14. The status of the claim(s) is (or will be) as follows:
    Claim(s) allowed: .
    Claim(s) objected to: .
    Claim(s) rejected: 1-7 and 9-20.
    Claim(s) withdrawn from consideration: .

	/Jennifer Zubajlo/ Examiner, Art Unit 2695

Continuation of 11. does NOT place the application in condition for allowance because: same reasons as set forth in previous office action and also see attached response to arguments.

Ok to enter.
/JZ/
11/2/12

Attorney Docket IMM253 (51851/339922)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629
Confirmation No.	:	2809

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

AMENDMENT AND RESPONSE TO FINAL OFFICE ACTION

Sir:

The following Amendment and Remarks are submitted in response to the Office Action mailed August 21, 2012.

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

Remarks begin on page 7 of this paper.

PTO/SB/31 (09-12)
Approved for use through 01/31/2013. OMB 0651-0031
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NOTICE OF APPEAL FROM THE EXAMINER TO THE PATENT TRIAL AND APPEAL BOARD

Docket Number (Optional): IMM253 (51851/339922)

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on _____

Signature _____

Typed or printed name _____

In re Application of: Michael D. Levin

Application Number	Filed
11/965,046	December 27, 2007

For: Virtual Detents Through Vibrotactile Feedback

Art Unit	Examiner
2695	Zubajlo, Jennifer L.

Applicant hereby **appeals** to the Patent Trial and Appeal Board from the last decision of the examiner.

The fee for this Notice of Appeal is (37 CFR 41.20(b)(1)) $ 630.00

☐ Applicant claims small entity status. See 37 CFR 1.27. Therefore, the fee shown above is reduced by half, and the resulting fee is: $ _____

☐ 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 No. 20-1430 .

☐ A petition for an extension of time under 37 CFR 1.136(a) (PTO/SB/22) is 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.

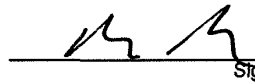
I am the

☐ 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 62,245.

☐ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34. _____



Signature

Michael Morlock

Typed or printed name

336/607-7300

Telephone number

11/19/2012

Date

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 41.31. 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, 1.14 and 41.6. 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.

Electronic Patent Application Fee Transmittal

Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Michael T. Morlock/Laura Smith
Attorney Docket Number:	IMM253

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:				
Notice of appeal	1401	1	630	630
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
			Total in USD ($)	**630**

Electronic Acknowledgement Receipt	
EFS ID:	14259526
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Laura Smith
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	19-NOV-2012
Filing Date:	27-DEC-2007
Time Stamp:	11:24:49
Application Type:	Utility under 35 USC 111(a)

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RAM confirmation Number	10883
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Transmittal Letter	Transmittal339922.pdf	35205 f58d7972786d8b87b1ca128b6f29da86ee3162c3	no	1
Warnings:					
Information:					
2	Notice of Appeal Filed	NoticeofAppeal339922.pdf	78897 cd8365d04a830db44425dd22ea457e20ed5a26bf	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	29755 de32369995164fed6e612220006154daf38445be	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	143857		

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.

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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Conf No.: 2809
Michael D. Levin	)	
	)	Art Unit: 2695
Serial No. 11/965,046	)	
	)	Examiner: **Zubajlo, Jennifer L.**
Filed: December 27, 2007	)	
	)	

For: VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK

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

TRANSMITTAL

Sir:

Transmitted herewith are the following documents for filing in the above-identified application:

1. Transmittal;
2. Notice of Appeal; and
3. EFS-Web Payment in the amount of $630.00.

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 20-1430.

Respectfully submitted,

Date: 11/19/2012

Michael T. Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing
I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web on November 19, 2012.

Laura J. Smith

US2000 12635331 1

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2695
Examiner Name	Zubajlo, Jennifer L.
Attorney Docket Number	IMM253 (51851/339922)

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	6,128,006	10-03-2000	Rosenbourg et al.	
	2.	6,686,911	02-03-2004	Levin et al.	
	3.	2005/151720	07-14-2005	Cruz-Hernandez et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	4.	WO 97/25657	07-17-1997	Lex Computer & Management		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
	5.	Supplementary European Search Report dated December 12, 2012 for corresponding European Patent Application No. 07863260.1.	

Examiner Signature		Date Considered	

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G05B 13/00	A1	(11) International Publication Number: WO 97/25657
		(43) International Publication Date: 17 July 1997 (17.07.97)

(21) International Application Number: PCT/US96/20687

(22) International Filing Date: 19 December 1996 (19.12.96)

(30) Priority Data:
08/585,198 11 January 1996 (11.01.96) US

(71) Applicant: LEX COMPUTER AND MANAGEMENT CORPORATION [US/US]; One Elm Street, Keene, NH 03431 (US).

(72) Inventors: SCHULER, Chester, L.; 57 Atkinson Lane, Sudbury, MA 01776 (US). HABERMAN, Seth, M.; Apartment 6A, One West 85th Street, New York, NY 10024 (US).

(74) Agents: MICHAELIS, Brian et al.; Dike, Bronstein, Roberts & Cushman, 130 Water Street, Boston, MA 02109 (US).

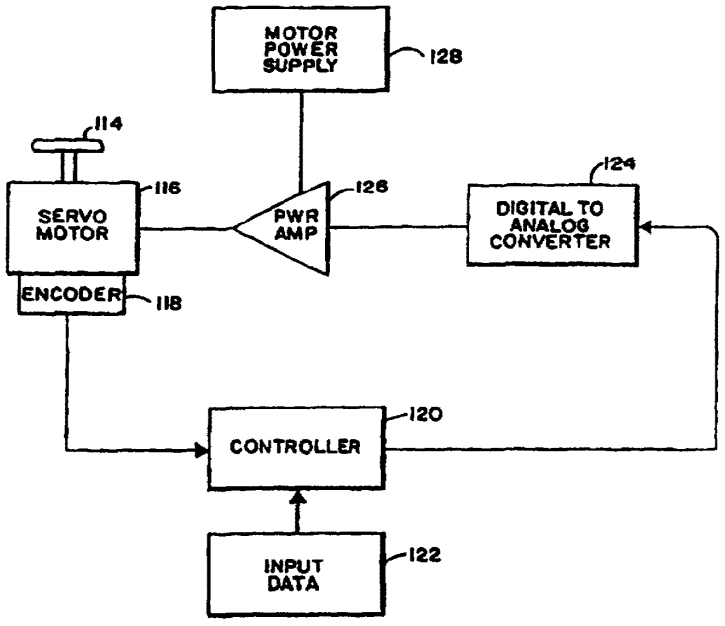
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: METHOD AND APPARATUS FOR TACTILELY RESPONSIVE USER INTERFACE

(57) Abstract

A method and apparatus implementing a user interface device, such as a mouse or trackball, having electronically controllable tactile responsiveness which is flexibly programmable. The interface device includes at least two sets of wheels that move as the interface device is actuated. A servo motor (116) is attached to each of the at least two sets of wheels. A position encoder (118) is associated with each servo motor (116) and outputs position information to a controller (120).



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METHOD AND APPARATUS FOR TACTILELY RESPONSIVE USER INTERFACE

FIELD OF THE INVENTION

The present invention relates to user interface devices and in particular to devices providing tactile responsiveness and having programmable force-position profiles defining tactile responsiveness in manipulating a cursor on a screen display.

BACKGROUND OF THE INVENTION

In numerous contexts humans perform tasks by interacting with machines via actuators having knobs, dials or linear actuators. Such human interaction in many instances becomes conditioned upon the responsiveness of the actuator. The human operator interacts in accordance with tactile feedback perceived through contact with the actuator knobs, dials or handles.

For example, in video or film editing using systems as described in U.S. Patent Nos. 4,937,685 and 4,964,004 which are

incorporated herein by reference, an editor edits video image information at a console having a plurality of "control wheels" (i.e. large dials or knobs). The film or video editor controls operation of a composition system from an operator's console, as illustrated in Fig. 1, using two sets of controls, one for each hand, to control the editing process. Each control set includes a plurality of finger switches or pushbuttons 110 clustered proximate to a large rotatable control wheel 112, facilitating tactile operation with minimal hand movement. As the editor is focussing on at least one video monitor, viewing frames of visual source material during the editing function, it is generally the case that the operator will acquire a feel for the various controls and become acclimated to their functionality through tactile feedback therefrom, rather than having to look at the control wheel(s) for visual feedback. Accordingly, more efficient human interaction with, and sensitivity to the composition system is achieved.

The control wheels 112 exhibit tactile responsiveness, such as detents or clicks, as they are rotated. Typically, a full rotation of the wheel 112 is correlated to a unit of time, such as one second, of viewing the visual source material being edited. A corresponding number of "frames" of visual source material will be viewed during such a time period, depending on the medium or type of source material being edited. It is most desirable that the number of frames of source material be correlated to the tactile responsiveness, i.e. number of clicks, of the wheel 112 during rotation. For instance, film editing involves standardized source

material of which twenty-four (24) frames are provided per second. Thus, it is most desirable that in a full rotation of the wheel 112 (presenting one second of source material), the wheel respond with twenty-four (24) clicks, each click corresponding to one frame of the visual source material.

While film editing involves source material having twenty-four (24) frames per second, other video medium standards require different frame rates. The frame rate, or number of frames per second according to the National Television System Committee (NTSC) is thirty (30) frames per second, a standard promulgated for television video in the United States. Standards such as PAL and SECAM provide for a standard frame rate of twenty-five (25) frames per second in England and France respectively. New standards for high definition television specify a frame rate of thirty (30) or sixty (60) frames per second.

Differing frame rate standards relating to visual source material and the nature of mechanical detents in actuators, presents the problem that multiple actuators are required to facilitate correlation between actuator tactile responsiveness and the various visual source material standards. As illustrated in Fig. 1a, actuators known in the art for providing tactile responsiveness typically incorporate a mechanical detent mechanism. A fixed number of clicks is provided by a spring loaded friction mechanism 111 coacting with a sprocket 113 having a fixed number of cogs or detents corresponding to the desired number of clicks per revolution. Therefore, an actuator having twenty-four fixed

detents is required and dedicated for a film editing context, a thirty detent actuator is required for a NTSC video editing system, a twenty five detent actuator is required in the PAL or CCAM video editing context, etc. The plurality of actuators required limits the flexibility of visual source material composition systems and significantly increases the complexity, cost and hardware requirements of a flexible system.

In addition to the lack of flexibility of use of fixed mechanical detent actuators, such actuators disadvantageously become worn and suffer tactile responsiveness degradation over time. Other mechanically/spring loaded linear or rotary actuators suffer similar deficiencies.

Likewise, other types of actuators or user interface devices are known for permitting users to interact with electronic devices, such as personal computers. Such user interface devices, like a trackball or mouse as disclosed in U.S. Patent No. 4,868,549 ("the '549 patent"), may include tactile responsiveness in the form of resistance to movement of the device as the device is actuated and the cursor moves across predetermined areas of the display screen.

In the '549 patent a mouse is disclosed which has an electromagnetic means, in the form of an electromagnet in conjunction with a magnetic surface or an electromagnetic brake, which provides resistance to the movement of a "spherical ball pickup". Feedback or tactile responsiveness is achieved in one embodiment by controlling the degree of sliding friction between a magnetic portion of the mouse and a magnetic pad surface on which

the mouse must be actuated. Disadvantageously, the magnetic pad surface is a requirement in such an embodiment, and the friction forces between the pad and the mouse may be affected in ways that may not be predictable and might be detrimental to the tactile responsiveness.

In another embodiment in the '549 patent, an electromagnetic brake is included and resistance is provided by the brake directly to the spherical ball or tracking element. The braking mechanism is totally self-contained within the mouse eliminating the need for a magnetic pad surface. However, while the electromagnetic brake provides a stopping mechanism, it cannot provide a continuous torque to the tracking element, i.e. no torque is applied when the tracking element is stopped. Such a mechanism cannot be used to change tactile responsiveness, e.g. to decrease resistance, as a function of characteristics of a particular screen display. The resistance provided is only opposed to motion and cannot aid motion by actively driving the ball to facilitate ease of motion in certain display areas or to keep the cursor off of the boundary of a restricted display area.

SUMMARY OF THE INVENTION

The present invention provides an actuator having electronically controllable tactile responsiveness which is flexibly programmable to facilitate provision in a single actuator of torque-position characteristics, such as a selectable number of detents per actuation through its full operative path. In an

illustrative case of a rotary actuator the present invention facilitates provision in a single actuator, of torque versus angular position characteristics, such as a selectable number of detents per revolution.

According to the invention, an actuator is in communication with a servo motor having a position encoder which outputs position information to a controller that has access to torque-position relation information. The output of the controller is a digital torque signal, in accordance with the torque-position relation information, which is converted to an analog current signal applied to the servo motor to generate torque in the servo motor. The torque, presenting a tactile response to a human interacting with the actuator, is sensed as a detent or a plurality of detents.

In further accord with the invention, the controller is a microprocessor which receives position information, from the encoder, through a counter as a position count. Torque-position relation information is stored in microprocessor accessible firmware as a table containing a series of particular torque values corresponding to a series of particular position values. The torque values, output as digital signals and converted by a digital to analog converter, can be modified in accordance with a plurality of stored torque versus position tables to facilitate flexible programming of various torque profiles.

Features of the invention include the capacity to store and modify torque profiles and to select one of a predetermined set of torque profiles to provide an actuator with a desired tactile

responsiveness. The torque profiles, stored for example, in electrically erasable programmable read only memory can be changed via a computer in communication with the microprocessor. Upon system power down and subsequent power up, a previously entered torque profile can be present as a default profile.

In a further embodiment of the invention, a user interface device, such as a trackball or mouse, is provided and implemented with programmable tactile responsiveness. In a mouse or trackball embodiment, the device includes an interface mechanism comprised of at least two sets of wheels that move as a spherical ball or tracking element is actuated by a user. The wheels are aligned on mutually orthogonal axes and each of at least two sets of wheels has a servo motor attached thereto and a position encoder associated with each servo motor. Position information from the position encoder is received by a controller that has access to tactile force information, i.e. torque-display position information.

The torque-display position information relates a position or coordinate of a display entity or cursor on a display screen of an electronic device to a force or torque applied to the user interface device, effecting tactile responsiveness of the user interface device as a function of the display screen on which the display entity or cursor is manipulated. The controller, having received the display entity or cursor position information from the position encoders, generates an output which is a digital signal in accordance with the force-display position relation information.

The force can be positive or negative, to assist or resist motion. In a disclosed embodiment, a digital torque signal output in accordance with torque-display position information is converted via a digital to analog converter, to an analog current signal which is applied to servo motors to generate torque in the servo motors. The torque generated in the servo motors is translated to the tracking element or ball of the user interface device and perceived by the user as tactile responsiveness that is a function of the position of the cursor on the screen display.

Features of the invention include the capability to effect tactile screen boundaries, and "walls" and "troughs" which correspond to button bar functions or icon placement on a drag-down menu, by increasing and decreasing resistance to further manipulation of the interface device by the user, or by aiding motion of the device. "Bumps" and other textures can be implemented on the screen display and tactilely perceived as the cursor is moved. Cell boundaries can be defined by hard stops or "hills" which a cursor will roll off to limit access to screen areas or otherwise provide an indication of cursor position without requiring the user to look at the screen. Different tactile response profiles can be stored to correspond to different screen displays and user applications. Physically impaired people can interface to computer applications without the need for sight or fine motor skills.

DESCRIPTION OF THE DRAWING

These and other features and advantages of the present invention will become more apparent in view of the following detailed description in conjunction with the accompanying drawing, of which:

Fig. 1 is an illustration of an operator's console for editing visual source material in a composition system;

Fig. 1a is a partially broken-away view of an actuator according to the prior art having mechanical detents;

Fig. 2 is a block diagram of a system for providing programmable tactile feedback in an actuator;

Fig. 3 is a block diagram of a system for providing programmable tactile feedback in an actuator, wherein the controller comprises a counter, microprocessor and accessible firmware;

Fig. 3a is an illustrative diagram of an actuator and associated function keys for controlling multiple functions and providing multiple tactile responses in accordance with the selected function;

Fig. 4 is a block diagram of a system for providing programmable tactile feedback in an actuator, wherein the system further includes a tachometer sensing motor actuation to generate a corresponding actuation in an associated actuator;

Fig. 5A is a view of a prior art mechanical means for introducing resistance in an exercise machine;

Fig. 5B is a block diagram illustrating implementation of a

torque controller according to the invention implemented in an exercise machine;

Fig. 6 is a block diagram of a joystick implementation of an actuator with electronically controllable tactile responsiveness; and

Fig. 7 is a perspective view, partially broken away, of a trackball implementation of a user interface device according to the invention;

Fig. 8A and 8B are front and side views, respectively, of a wheel assembly implemented in the trackball of FIG. 1;

Fig. 9 is a plan view of the wheel assembly of Figs. 8A and 8B attached to a motor and encoder assembly;

Fig. 10 is a diagrammatic representation of a pair of wheel sets having motors and encoders associated therewith, and contacting the tracking element;

Fig. 10A is a diagrammatic representation of a wheel set disposed for a third axis (z-axis) responsiveness;

Fig. 11 is a diagrammatic representation of a user interface device according to the invention configured to interface to a personal computer;

Fig. 12 is a block diagram of a system according to the invention; and

Figs. 13A-13D show a user interface screen and profiles for tactile responsiveness implemented to effect characteristics of the screen.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

Referring now to Fig. 2, an actuator, such as a rotary actuator having a control knob 114 is attached via a shaft to a servo motor 116. In this illustrative embodiment wherein the actuator is for use in a film/video editing context, the servo motor is a PMI 12FVS motor. In the present application, as discussed in greater detail hereinafter, the servo motor is not used as a motor per se, but rather as a torque controller. The motor never runs at a significant amount of its rated revolutions per minute, but operates normally in this application in a stalled or semi-stalled state. The preferred motor 116 has an installed encoder 118. The encoder 118 is a PMI M23, 300 segment modular encoder having an index and providing 300 cycles per revolution, which results in 1200 waveform edges from index to index. Note that in this illustrative embodiment it is important that the encoder be selected to provide a number of edges which is divisible by factors of two, three, five and eight. Thus, position information can be electronically divided to provide an integer number of clicks in selectable modes of 24, 25 and 30 positions per revolution (corresponding to the film/video editing standards of 24, 25 and 30 frames per second or revolution, as discussed hereinbefore).

The position information received from the encoder 118 is processed by a controller 120 so that it represents a positional count. The controller 120 accesses stored input data 122 in the form of torque-position relation information which correlates a

received position count with a related torque value. As noted hereinbefore, the position count, which is a function of encoder output information, can be derived by electronically dividing position information provided by the encoder waveform, as desired into a selected number of positions or position values. The input data 122 accessed by the controller 120 will have stored torque values associated with the selected position values as provided in accordance with the desired torque profile. The controller 120 outputs the torque value as a digital signal which is converted by a latchable digital to analog converter 124 to an analog voltage. As a voltage applied to the motor would result in a proportional motor speed, the analog voltage is related to motor torque by generating a proportional motor current using a power amplifier 126 in conjunction with a motor power supply 128. The torque related current is applied to the motor 116 to present the desired torque which imparts the desired tactile responsiveness to the control knob 114.

In an embodiment illustrated in Fig. 3, the controller 120 comprises a counter 130 which receives the servo motor position information from the encoder 118. A microprocessor 132, such as a Motorola 6809, receives a position count from the counter 130 providing an indication of servo motor position relative to the index. The count provided by the counter will increment or decrement depending on the direction of the change of position of the servo motor. The microprocessor accesses electrically erasable programmable read only memory 134 (EEPROM) which is programmed with

one or more tables of torque-position relation information. Each table defines a particular torque profile specifying a torque value corresponding to a particular position count (i.e. knob/servo motor position).

A main application CPU 136 runs an application which requires and defines particular torque profiles for the actuator 114. The main application CPU may run an application which defines the functionality of a control wheel and related function buttons as illustrated in Fig. 3a. In this illustrative embodiment the control wheel has an outer dial 140 which according to the application performs a first function having a fixed number of positions, such as selecting one of a plurality of switch settings. The application can assign a second function to the same outer dial 140 and provide a profile assigning an alternative responsiveness to the outer dial actuator, such as assigning a lever control function having electronically defined stop positions, when a shift key 142 is depressed. An inner control knob 144 similarly can be assigned a first function and corresponding torque profile (such as a free running non-detent scan function), by the application running on the main application CPU, and a second (or other) function and corresponding torque profile (such as a 30 detent per rotation edit mode, as discussed hereinbefore), which is invoked such as by depressing an alt key 146.

The main application CPU 136, upon application initialization, down loads the desired torque profiles to the microprocessor

accessible EEPROM, via an RS-232 serial, or other communication port. The desired torque profiles reside in EEPROM and are selectable via the microprocessor for providing the desired torque at the appropriate actuator position(s) in accordance with the requirements of the main application. A desired torque profile can be selected by a user operating the control knob 144 or outer dial 140 actuators, alone or with other control functions such as the alt or shift keys, to be responsive in accordance with the first or second function. A change in actuator function, and a corresponding change in actuator responsiveness (i.e. torque profile) can be effected via selected key strokes, such as a shift key or function key implementation discussed.

The EEPROM resident tables will not change until a new set of profiles is programmed, i.e down loaded, into the microprocessor accessible memory. Thus, when the system is powered down and subsequently powered up, the previously selected torque profile is resident and available as a default mode for the respective actuators.

As illustrated in Fig. 4, the selectable torque profiles and tactile responsiveness of the actuator according to the invention can be implemented so that a second actuator 150 is responsive to a first actuator 114', operating substantially as discussed hereinbefore. In certain operations it is desirable to have two actuators working in conjunction according to a common torque profile. In such a case, the servo motor of one actuator can be used to actually drive a second motor, in addition to its function

as a torque controller.

For instance, it is desirable when editing film, to turn the first actuator 114' to add one or more frames to one end of the composition material while removing one or the same number of frames from an opposite end of the composition material controlled by the second actuator 150. In such a case, rather than trying to turn the respective control knobs exactly the same amount, it would be best to have the second actuator 150 respond according to the first actuator 114' and its associated torque profile.

As the first actuator 114' is manually rotated N clicks as sensed according to its torque profile implemented as discussed hereinbefore with respect to Fig. 3, the encoder 118' and a tachometer 152 associated with the first actuator 114' indicate the direction and speed, respectively, of the first actuator 114' to the microprocessor 132'. The direction and position of the first actuator 114' is received from the encoder 118' through the counter 130'. The rate of change of position, i.e. velocity, is indicated by the tachometer 152 as an analog signal, which must be converted by an analog to digital converter 154 for processing digitally by the microprocessor 132'. The microprocessor 132', in accordance with the count received from the first actuator 114' and a velocity profile, generates a digital signal which is delivered to the second actuator digital to analog converter 156 and converted to an analog signal, increasing power to a second actuator servo motor 158. The power increase to the second actuator servo motor 158 results in an actuation of the second

motor in a direction according to the direction sensed, and according to an operation directed by the microprocessor. The microprocessor monitors a second actuator encoder 160 to read a complementary count from the second actuator 150 being driven, and monitors a second actuator tachometer 160 to sense a velocity comparable to that of the first actuator being manually actuated. When the comparisons indicate that the second actuator is actuated in accordance with the manual actuation of the first actuator, the operation is complete.

While the implementation of a driven actuator describes a tachometer for determining velocity of the actuators, it will be appreciated that velocity can be derived by the microprocessor using a mathematical operation which takes the first derivative of the rate of change of position information, eliminating the need for a tachometer. Further, although a motor power supply is indicated in Fig. 4 for each servo motor, it can be appreciated that a single power supply can be used for both motors.

Although the invention is described herein in the context of an actuator in a film/video editing context, one of ordinary skill in the art will appreciate that selectably programmable tactile responsiveness according to the invention can be provided in many contexts in which mode selection of tactile responsiveness is desirable.

While the actuator having electronically controllable tactile responsiveness is described herein as providing a selectable number of detents or clicks per rotation of a control wheel, it can be

appreciated that other torque profiles, such as progressively increasing torque in one direction or another or increasing torque to a point of a pseudo hard stop, can be achieved according to the invention by introducing a torque profile which results in an appropriate current applied to the servo motor.

Further, although programmable tactile responsiveness is described in the context of a rotary actuator application, it will be appreciated that selectable tactile responsiveness can be implemented according to the invention in other applications and actuator contexts, such as in linear actuator contexts.

Referring now to Fig. 5A and 5B, it will be appreciated by those of ordinary skill in the art in view of the foregoing, that the electronically controllable tactile responsiveness according to the invention can be implemented in actuators other than knob type actuators and in contexts other than video or film editing contexts. Various exercise machines have mechanisms for providing resistance, such as the mechanism illustrated in Fig. 5A. The linear motion of an exerciser pulling alternately on the handles 300, 302 of Fig. 5B is translated and imparts a rotary motion to a take-up spool 304 (Fig. 5A and 5B). In known exercise machines, resistance is introduced at the take-up spool by tightening a mechanical/spring mechanism 306 (Fig. 5A) which increases the work required to impart linear motion to the handles 300, 302. The system according to the invention and described hereinbefore can be implemented in such a context by introducing a bidirectional servo-motor 308 (Fig. 5B) which is adapted to receive bidirectional

torque versus position information in the form of current profiles resulting in resistance similar to that introduced by the mechanical means of 306 of Fig. 5A. The current provided by the torque controller 310 is a function of torque adjust profiles 312 which are selectable/programmable and stored in a manner as discussed hereinbefore.

Similarly, referring now to Fig. 6, programmable tactile responsiveness can be implemented in an actuator such as a joystick actuator 400. In such a context, torque profiles are stored in tables within a torque controller 402 in the form of at least two tables for containing profiles to control motors in at least two axes. A first servo motor 403 is attached to a sphere 404 to which a joystick 406 is fixed. The first motor 403 is fixed to the sphere 404 to which the joystick is fixed and controls the tactile responsiveness of the joystick 406 as it is linearly actuated in directions indicated by the arrow A-B. The linear motion of the joystick in the direction A-B is translated into a rotary motion by a shaft 408 forming an axis about which the joystick 406 rotates in a limited manner. The torque controller 402 contains at least one profile table that determines the current provided to the first servo motor 403 and ultimately determines the particular responsiveness of joystick 406 as it is actuated in directions A-B.

A second servo motor 410 is mounted to a fixed frame or surface 412 and controls responsiveness of the joystick 406 as it is actuated in the direction indicated by arrow C-D. An assembly comprised of the sphere 404, joystick 406 and first motor 403 is

capable of limited rotation about an axis formed by a shaft 414 which is connected at a first end to the second motor 410 and at a second end to a bearing 416. As the joystick 406 is actuated in the direction C-D, the sphere 404, and first motor 403 to which the joystick 406 is attached is actuated having a responsiveness as determined by at least a second profile table stored in the torque controller 402.

Although the illustrative embodiments of the exercise implementation and joystick implementation describe controlled tactile responsiveness in a single axis and double axis context respectively, it will be appreciated by those of ordinary skill in the art that tactile responsiveness can be implemented in a plurality of axes greater than 2.

Furthermore, it will be appreciated by those of ordinary skill in the art that various mechanisms, such as the spool of the exerciser implementation, are useful for translating torque into linear force and/or linear force into rotational torque, and that the tables discussed hereinbefore while containing torque versus position profiles can be programmed to comprise force versus linear position profiles.

Referring now to Figs. 7-9, a user interface device can be implemented according to the invention, to include tactile responsiveness as a function of the position of a display entity, e.g. cursor, on a screen display. In this illustrative embodiment a trackball 500 is implemented including a plurality of sets of drive wheels 502 which contact a tracking member or ball 504. As

will be understood by those of ordinary skill in the art, manipulation of the tracking member or ball 504 effects manipulation or movement of a cursor on a screen display (not shown in Figs. 7-9). The details of construction and manufacture of a trackball and/or mouse implementation will be understood by those of ordinary skill in the art, and therefore will not be presented here other than to present significant components and their interrelationships.

In this illustrative embodiment, the tracking member or ball is interconnected in the user interface device by an interconnection mechanism comprised of sets of drive wheels. Each of the sets of drive wheels 502, best illustrated in Figs. 8A and 8B, is comprised of a hub 506 about which at least one frame structure 508 is configured. The frame(s) 508 have a plurality of frame portions each extending longitudinally through a respective one of a plurality of barrel-shaped gripping members 510. Preferably, the outside radius of a large portion of the gripping members 510 is equal to the outside radius of the drive wheels 502. Two drive wheels are used, offset slightly, to make the contact with the ball 504 smooth so as to avoid a "bumpy" feeling as the ball 504 is actuated and in turn actuates the wheels 502. The gripping members are each rotatable around the frame portion that extends through and supports it. The gripping members 510 are made of a polymeric material suitable for establishing gripping contact with the ball 504. In this illustrative embodiment, as illustrated in Fig. 8A, two frames 508 are configured about the hub 506. The

gripping members 510 are offset or staggered in order to compensate for gaps between gripping members on a respective frame, to maintain a gripping member in contact with the ball 504 at all times.

Each pair of frames 508 attached to a common hub 506 and with associated gripping members 510, constitutes a wheel set that is attachable, as illustrated in Fig. 9, to a servo motor 512 and encoder 514 to form a drive/position assembly 516. In this illustrative embodiment the drive/position assembly servo motor is used actively as a motor. The servo motor may be a Pittman Model No. 8322 (manufactured by Pittman, Harleysville, PA), which optionally comes with an integrated optical encoder which fulfills the encoder requirement. At least one drive/position assembly 516 is configured to apply torque and sense position along a respective one of mutually orthogonally disposed axes, e.g. an x-axis corresponding to cursor movement across a display screen, a y-axis orthogonally disposed with respect to the x-axis and corresponding to cursor movement up and down on a screen, and a z-axis orthogonally disposed with respect to the x and y axes and corresponding to cursor movement in and out of a screen in a three dimensional configuration. In some instances, as described hereinafter, a wheel set is attached to a motor without an encoder, or just a bearing 518 to implement a complementary slave assembly 520 when it may not be desirable to include additional servo motors and/or encoders. The referenced servo motor, without an encoder, may be employed passively as a bearing.

To implement a two dimensional user interface device, e.g. trackball or mouse, the tracking element or ball 504 is configured to have at least two drive/position assemblies 516 positioned with the gripping members 510 in contact with the ball. As illustrated in Fig. 10, a first drive/position assembly 516 is positioned with the gripping members of its wheel set in contact with the ball, and includes a servo motor and encoder. A first complementary slave assembly 520 is positioned opposed to the first drive/position assembly 516 and has gripping members of its wheel set engaging the side of the ball 504 opposite the first drive/position assembly 516.

A second drive/position assembly 516' is positioned on an axis orthogonal with respect to the first drive/position assembly 516 and has a servo motor and encoder attached thereto. A second complementary slave assembly 520' is positioned opposed to the second drive/position assembly 516' and has gripping members of its wheel set engaging the side of the ball 504 opposite the second drive/position assembly 516'. In the illustrative two dimensional implementation, the complementary slave assemblies include motors that are slaved to the motors of the drive/position assemblies. Such slaved motors produce a complementary torque to assist the drive/position assemblies in applying a more balanced torque to the ball. It will be appreciated that a less expensive device can be implemented according to the invention by merely having the wheel sets opposed to the drive/position assemblies configured with a bearing to passively engage the ball.

As illustrated in Fig. 10A, in implementing a three dimensional user interface device according to the invention, a drive/position assembly 516'' is positioned along a circumference of the ball 504 such that the orientation of the wheel set is orthogonally disposed with respect to the orientation of the wheel sets of the x and y axis assemblies (in Fig. 10A for simplicity only one wheel set 516 is shown exemplifying the orientation of the x and y axis assemblies). The z-axis drive/position assembly 516'' is preferably configured with a complementary slave assembly 520'' disposed along an axis that is perpendicular to an axis along which the drive/position assembly 516'' is disposed. Although the functionality of a two dimensional implementation is described hereinafter for ease of explanation, it will be appreciated that a z-axis drive/position assembly and complementary slave assembly can readily be implemented in a user interface device that is responsive in three dimensions.

Referring now to Figs. 11 and 12, the drive/position assemblies 516 and complementary slave assemblies 520 are configured with the ball 504 (not shown in Figs. 11 and 12), as a user interface device 500 in a system that includes an electronic device or computer system 528 with a screen 530 on which a cursor is positioned on a screen display or graphical user interface, as known in the art. The computer to which the user interface device 500 is connected has an operating system and is capable of running various application programs which result in various screen displays on which the cursor is manipulated using the user

interface device 500.

The user interface device 500 includes at least a first and second drive/position assembly 516, 516' each with a servo motor 534 and encoder 536 and associated first and second complementary slave assemblies 520, 520' for respectively sensing y-axis and x-axis ball movement to be translated into a cursor position on the display. In this illustrative embodiment, each of the servo motors in the drive/position assemblies is connected in series with its respective complementary slave assembly motor which results in the motor pairs seeing the same current. In the present application each servo motor 534 is not used as a motor per se, but rather as a torque controller. The motor never runs at a significant amount of its rated revolutions per minute, but operates normally in this application in a stalled or semi-stalled state. The preferred motor, as discussed hereinabove, has an installed encoder 536. The encoder 536 is matched to the motor and the motor application as appreciated by one of ordinary skill in the art.

The computer or electronic device 528, as known in the art, is configured to accept an interface board 532 which includes the mechanisms required to electronically interface the user interface device 500 to the computer system 528 and display 530. The interface board 532 is typically configured to reside in an I/O slot of the computer 528 and includes a microprocessor 538 which communicates with the computer 528 via a serial communication channel 540. In the embodiment illustrated in Fig. 11, the interface board 532 comprises a counter 542 associated with each

encoder 536. Each counter 542 receives servo motor position information from the encoder 118. The microprocessor 538, such as a Motorola 6809, receives a position count from each counter 542 providing an indication of position of each servo motor relative to an index. The count provided by the counter will be incremented or decremented depending on the direction of the change of position of the servo motor relative to the index, which is indicative of a change in position of the ball and the cursor on the screen display.

The microprocessor 538 accesses torque profile information from a storage mechanism as a function of the coordinate position indicated via the encoders, i.e. x-axis position and y-axis position. The storage mechanism can be internal to the microprocessor and/or external in the form of additional torque profile storage 545 (such as EEPROM, ROM, disk, CDROM etc). The torque profile information provides an indication of a torque or force to be applied by/to the motor. The torque is a function of the position of the cursor on the screen and a function of the particular screen display on which the cursor is being manipulated.

As in the embodiments described hereinbefore, the torque value, in this case a value for each motor or axis, is output from the storage mechanism as a digital signal which is converted by a latchable digital to analog converter (D/A) 544 to an analog voltage. As a voltage applied to the motor would result in a proportional motor speed, the analog voltage is related to motor torque by generating a proportional motor current using a power

driver or amplifier 546 (for each motor). The torque related current is applied to the motor(s) 516, 516', 520, 520', to present the desired torque which imparts the desired tactile responsiveness to the ball 504.

The computer 528 runs an application, or several applications, which requires and defines particular torque profiles for the user interface device 500. Each screen display of an application running on the computer has torque profile information associated with that particular screen display to effect a corresponding particular tactile responsiveness for that screen display. The torque profile information which is being processed is stored in the microprocessor. Additional torque profile information which is not immediately required for a running screen display can be stored in external memory associated with the microprocessor 545. The torque profile information represents a spatial array that indicates the relationship of motor currents or torques as a function of position parameters for each axis present in the embodiment. In this illustrative embodiment the array must contain torque information for x and y axis motor pairs as a function of the x and y coordinate position of the cursor on the particular screen display(s).

Preferably, a large volume of torque profile information defining the tactile responsiveness of numerous screen displays of an application software package or an operating system is stored in a database associated with a particular application or applications that run on the computer. As illustrated in Fig. 12, the computer

typically runs an operating system or main application 550 which is stored on some external storage medium such as a disk or CD ROM and paged or transferred to the computer's main memory as the application code is running.

A database of torque profiles 552, as part of an application running under the operating system or with the application 550, defines the tactile responsiveness of the user interface device based on the screen displays of the application(s). The torque profile information 552 is accessible to the application(s) or operating system(s) via the application's application program interface (API), as known in the art. The torque profiles relate the tactile responsiveness of the user interface device 500 to the graphical user interface(s) or screen display(s) of the application 550, as respective torque profiles are downloaded or made available to the microprocessor 538 on the interface board 532 to generate the appropriate digital signals in response to the position information received from the encoders, as discussed hereinbefore.

A user interface device driver 554 facilitates communication between the microprocessor 538 on the interface board 532 for the user interface device 500, and the host computer 528. The microprocessor computes coordinates for a change of cursor position by processing the information received from the encoders and information known about the original position of the cursor as provided by the host computer over the serial channel 540. The driver communicates the information related to cursor position to and from the host computer which effects actual positioning of the

cursor. In the present embodiment, the driver 554 is generic to the user interface device 500 and is modified slightly from a mouse or trackball I/O device driver as known in the art, in that the driver 554, through an interface to the torque profile information 552 and application software 550 coordinates the downloading of appropriate torque profile information to the microprocessor based on indications from the application 550 as to the appropriate torque profile.

Based on the application being run on the host 528, the driver 554 running on the host communicates relevant torque profile information to the microprocessor 538. The driver also communicates information to the microprocessor regarding the present position of the cursor on the display screen of the host 528. In response to the coordinate information of the cursor on the display screen, the microprocessor 538 generates digital information corresponding to the appropriate torque relative to the position of the cursor on the screen, in accordance with the relevant torque-position profile for that screen display. The D/A 544 for each axis receives the digital torque information and produces the appropriate analog signal to the power driver(s) 546 which generate a current to apply the positive or negative torque to the motors resulting in the applicable tactile responsiveness of the ball 504.

When the trackball or mouse is moved to effect a movement of the cursor on the display screen 530, each encoder 536 sends position information to the microprocessor 538. Position

information in this illustrative embodiment includes an indication of the direction and number of steps the encoder is changed in response to actuation of the associated wheel set in contact with the manually manipulated ball 504. The microprocessor 538 receives the magnitude and direction information and tracks the position in the spatial array of relevant torque profile information to determine the appropriate torque corresponding to the position information received. The microprocessor 538 communicates the position information to the user interface device driver which effects a change in the position of the cursor by communicating with the computer as is appreciated by those of skill in the art. The microprocessor 538 also conveys torque information to the servo motors, via the D/As and power drivers as described, to effect appropriate tactile responsiveness based on cursor position within the screen display of the particular application and torque-position information.

The torque-position information stored and made accessible to the microprocessor for implementing tactile responsiveness of the user interface device according to the invention can be used to implement various tactile responses as a function of position of the cursor on the screen display. Boundaries for cursor containment and restricted display areas can be implemented by effecting stops using maximized motor torque. Among other responsiveness, tactile "hills" and "troughs" can be implemented to define tactile contours of a graphical user interface such as illustrated in Figs. 13A-13D. In this particular example of an

application, a graphical user interface includes a header showing a command options banner as it appears on the display screen (Figs. 13a and 13B).

The command options banner is a button bar on which a cursor is positioned by a user using a user interface device to point and click to effect certain functionality. The various commands, i.e. "File," Options," "Window," "Help" can be delineated by tactile boundaries according to the invention, so that the proper positioning of the cursor within an appropriate area to click and invoke the command can be easily done and can be tactilely perceptible. With or without fine motor skills or vision, the user actuates the user interface device according to the invention and feels the position of the cursor on the screen display. Tactile boundaries are programmed, as discussed hereinbefore and as illustrated in Figs 13C and 13D, so that higher resistance is perceived at the boundaries with little or no resistance felt when the cursor is properly positioned.

Moving the cursor vertically on the screen toward the button bar the user will perceive neutral or no resistance in the unrestricted area 560. A sharp increase in torque will be felt as the lower boundary 562 of the button bar is encountered. When the cursor is actuated to a position between the lower boundary and an upper boundary, i.e. in a trough 564, no resistance is perceived. As the upper boundary 566 is approached the torque increases and as the absolute boundary of the screen is encountered increased torque effects a perceptible stop 568. It should be noted that positive

and negative torques can be generated according to the invention so that the user interface device includes a tendency to urge the cursor into a position centered within the boundaries.

Likewise, when the user interface device is actuated to move the cursor horizontally along the button bar, as illustrated in Fig. 13D, boundaries are established that urge the cursor into the proper position to activate the desired menu selection.

It should be appreciated that in addition to boundaries formed by hills and troughs and walls, the tactile responsiveness of the user interface device according to the invention can be used to implement "texturing" that is tactilely perceptible. Slight increases in torque can be programmed at selected distances with lesser torque therebetween such that a feeling of bumpiness can be implemented as the cursor is actuated across a screen display. Elasticity, in the form of increasing torque to a point of reverse torque, can be implemented to simulate perceived stretching or resiliency. Furthermore, given the active nature of the torque assistance capability of the motor(s) in the user interface device according to the invention, motion assistance can be effected to make the device roll off of a bump or hill without manual assistance (such an application is especially useful where a user may not have fine motor skills).

The EEPROM resident tables or arrays of torque profile information will not change until a new set of profiles is programmed, i.e down loaded, into the microprocessor accessible memory. Thus, when the system is powered down and subsequently

powered up, the previously selected torque profile is resident and available as a default mode for the respective actuators, unless a particular default state is desired and provided.

Although the invention is described hereinbefore with a singular screen display, it will be appreciated by those of ordinary skill in the art that the torque position information can be structured in a manner such that screens can be nested, and their corresponding profiles nested so that invoking a new screen from a present screen invokes a corresponding new set of torque position information.

It should be appreciated that although tables or arrays of torque profile information are discussed in the illustrative embodiment herein for relating cursor screen position with tactile responsiveness of the user interface device, torque values may be calculated "on the fly" for particular screen displays rather than storing values associated with particular positions. Additionally, rather than having the user interface device providing information regarding position and changes thereof, torque values may be associated with particular cursor locations on a particular screen display such that the screen generates the position information which is processed according to the invention to provide resultant tactile responsiveness.

In the embodiment where a slave motor is connected in series, the slave motor will see the same current as the motor with which it is connected in series. In such a master/slave motor pair, the motors should be virtually identical motors to effect smoothness of

rotation of the ball or tracking element. However, in order to minimize cost of a system according to the invention, it will be appreciated that it may be preferable to exclude the slave motor in favor of a passive bearing.

The description of the invention hereinbefore relates to a trackball, but it will be appreciated that tactile responsiveness according to the invention can be implemented in various other user interface devices, including a mouse, joysticks and other devices requiring actuation and benefitting from the tactile responsiveness as a function of position. Further, while "a cursor" is manipulated in the embodiment described herein, that term is used generically to describe something manipulated in a user interface of an electronic device, and it should be appreciated that any of various symbols and interface or display resident entities can be manipulated with tactile responsiveness, such as cursors, icons, windows, menus, or the like.

While various embodiments of the invention illustrated herein describe a main CPU to execute an application program requiring and defining torque profiles for an actuator, and a separate 6809 microprocessor implementing firmware specifying torque-position relationships, one of ordinary skill in the art will appreciate that torque-position relationships can be implemented in the application CPU without the microprocessor or via numerous other microcontrollers. Further, while it is described that the torque profiles are in EEPROM accessible to the microprocessor it will be appreciated that the torque profiles can be stored in

microprocessor resident or other storage means, such as ROM, RAM, PALs and the like, and accessed accordingly to implement the desired tactile responsiveness in an actuator.

Although the invention has been shown and described with respect to exemplary embodiments thereof, various other changes, additions and omissions in the form and detail thereof may be made therein without departing from the spirit and scope of the invention.

CLAIMS

What is claimed is:

1. A user interface device to manipulate a position of a cursor on a screen display in an electronic apparatus, comprising:

a tracking element actuatable to track the position of said cursor on said screen display;

at least one motor interconnected to said tracking element and having a position encoder connected thereto, each said position encoder generating a motor position signal indicative of the position of a respective motor;

a controller receiving cursor position information from said electronic apparatus and motor position information from a respective encoder;

a store of force-position information accessible to said controller, said controller accessing said store of force-position information in response to at least one of said cursor position information and said motor position signal to generate, using said at least one motor, a positive or negative force in said tracking element as a function of a position of said cursor on said screen display.

2. The user interface device of claim 1 wherein said tracking element is a sphere interfaced to said at least one motor by at least two sets of wheels contacting said sphere and said at least two sets of wheels are aligned on mutually orthogonal axes.

3. The user interface device of claim 2 wherein each of said at least two sets of wheels comprises a hub about which a pair of frames is disposed and each of said pair of frames includes gripping members staggered in a manner so that there is always a gripping member in contact with said sphere.

4. The user interface device of claim 1 wherein said at least one motor comprises a plurality of motors and each of said plurality of motors has an associated complementary motor connected in series.

5. The user interface device of claim 1 wherein said at least one motor comprises a plurality of motors and each of said plurality of motors has an associated complementary bearing.

6. The user interface device of claim 1 wherein said at least one motor comprises a plurality of motors each interconnected to said tracking element by at least one set of wheels aligned on mutually orthogonal axes and configured to sense or impart motion of the tracking element on a respective axis.

7. The user interface device of claim 6 wherein said plurality of motors each interconnected to said tracking element by at least one set of wheels aligned on mutually orthogonal axes are configured to sense or impart motion of the tracking element on mutually orthogonally disposed x and y-axes.

8. The user interface device of claim 7 further including at least one set of wheels configured to sense or impart motion of the tracking element on a z-axis orthogonally disposed with respect to said x and y-axes.

9. A method of generating tactile responsiveness in a user interface device having a tracking element manipulating a position of a displayed element on a display screen of an electronic device, said method comprising the steps of:

positioning a plurality of drive/position assemblies along mutually orthogonal axes with respect to said tracking element, each of said plurality of drive/position assemblies including a motor and an associated encoder to drive and sense position of said tracking element;

interfacing said user interface device to said display screen via a controller that receives information from said associated encoder of each of said plurality of drive/position assemblies and from said electronic device to track movement of said tracking element and the position on said display screen of said displayed element;

storing force-position relation information, accessible to said controller, as a function of the position on the display screen of the displayed element; and

accessing said force-position information via said controller and generating a signal to each of said plurality of drive/position assemblies to effect a positive or negative force to respectively

assist or resist motion of said tracking element depending upon the position of said displayed element on said display screen.

10. The method of claim 9 wherein said step of positioning a plurality of drive/position assemblies further includes positioning a corresponding plurality of complementary slave assemblies along corresponding mutually orthogonal axes, each of said complementary slave assemblies being electrically connected in series with a respective one of said plurality of drive/position assemblies.

11. The method of claim 9 wherein the step of interfacing said user interface device to said display screen via said controller includes interconnecting said electronic device to said controller to send and receive information about the position of the displayed element on said display screen between said electronic device and said controller, and interconnecting said plurality of drive/position assemblies to said controller to send said signal to each of said plurality of drive/position assemblies to effect said positive or negative force to respectively assist or resist motion of said tracking element depending upon the position of said displayed element on said display screen.

12. A user interface device having tactile feedback capabilities, comprising:

an actuatable member for imparting a tactile feedback to a user of said user interface device;

a motor interconnected to said actuatable member;

a position encoder in communication with said motor, said position encoder providing position information of said motor;

a controller receiving said position information from at least said position encoder;

a store of force-position relation information accessible to said controller, said controller outputting at least one force value corresponding to said position information in accordance with said store of force-position relation information; and

a drive signal source generating a drive signal to said motor in accordance with said at least one force value, said drive signal causing a force in said motor to provide said tactile feedback to said actuatable member to assist or resist motion of said actuatable member.

13. The user interface device of claim 12 further including a counter receiving said position information of said motor and providing a count to said controller, said controller outputting a force value corresponding to said position information in accordance with said store of force-position relation information.

14. The user interface device of claim 13 wherein said force value is a digital force value and further including a digital to analog converter receiving said digital force value and converting said digital force value to an analog force signal.

15. The user interface device of claim 14 further including a power amplifier receiving said analog force signal and generating said drive signal to said motor in accordance with said at least one force value, said drive signal being proportional to said analog force signal.

16. The actuator of claim 12 wherein said controller is a microprocessor receiving said position information on at least one port thereof.

17. The actuator of claim 16 wherein said microprocessor includes resident erasable programmable read only memory which is used for said store of force-position relation information.

18. The actuator of claim 12 wherein said drive signal source is a current source including a power amplifier and said drive signal is a current provided by said power amplifier.

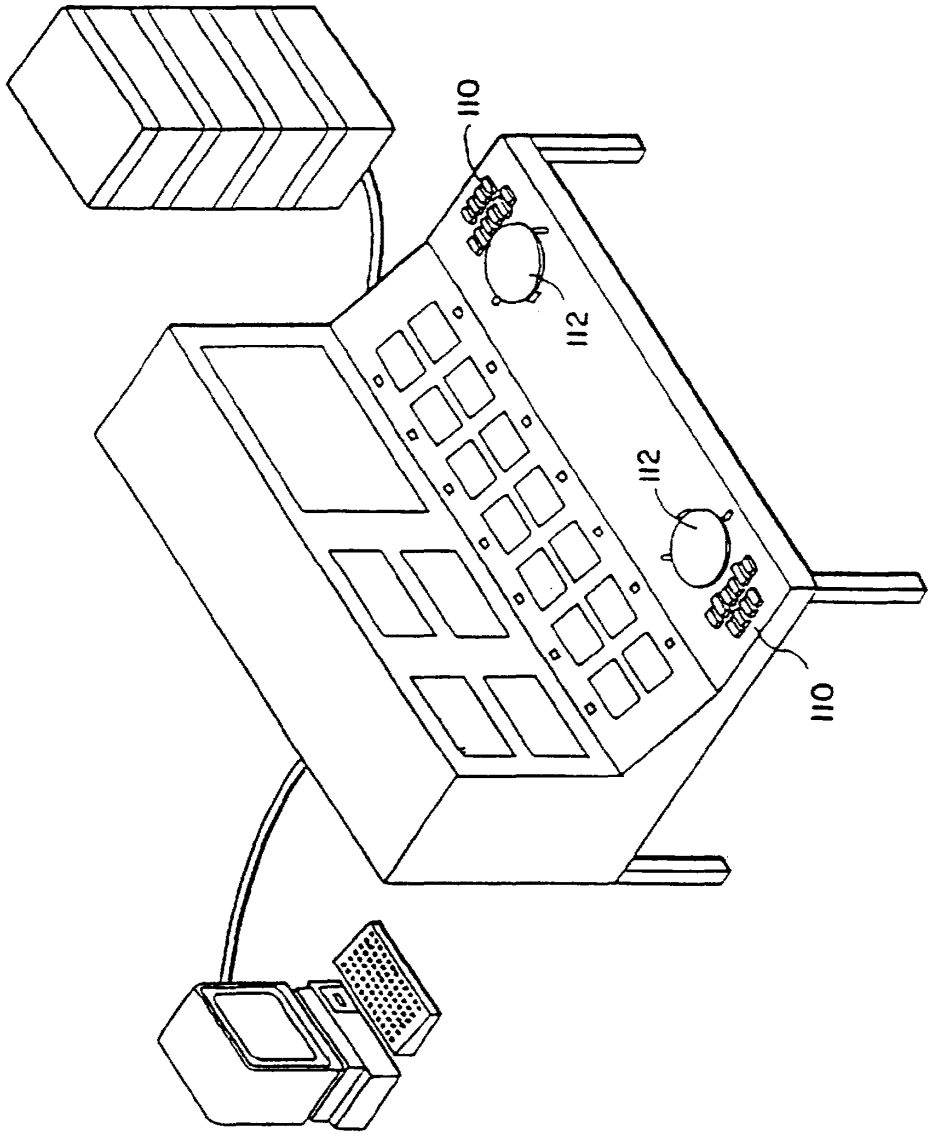


FIG. 1

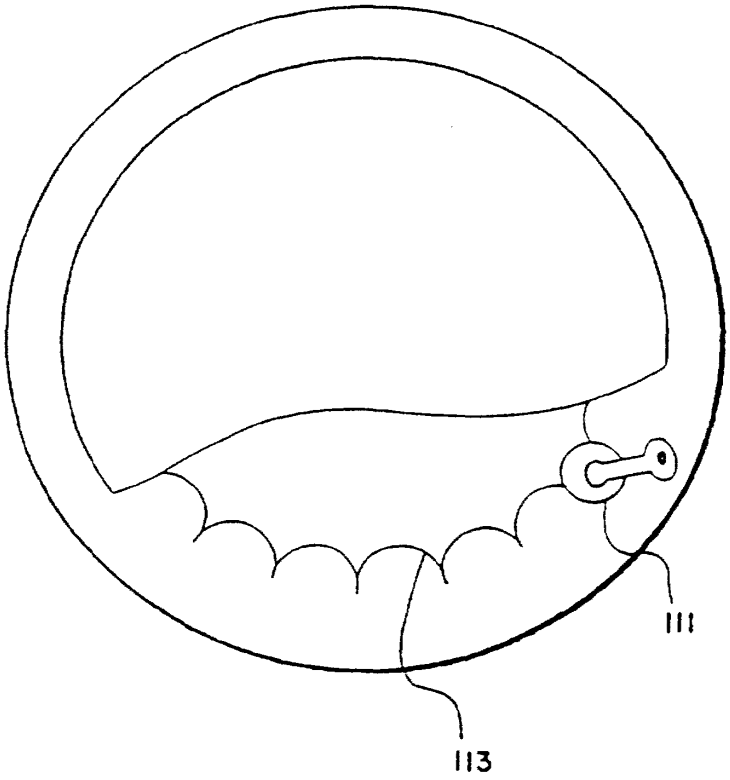


FIG. 1a
(PRIOR ART)

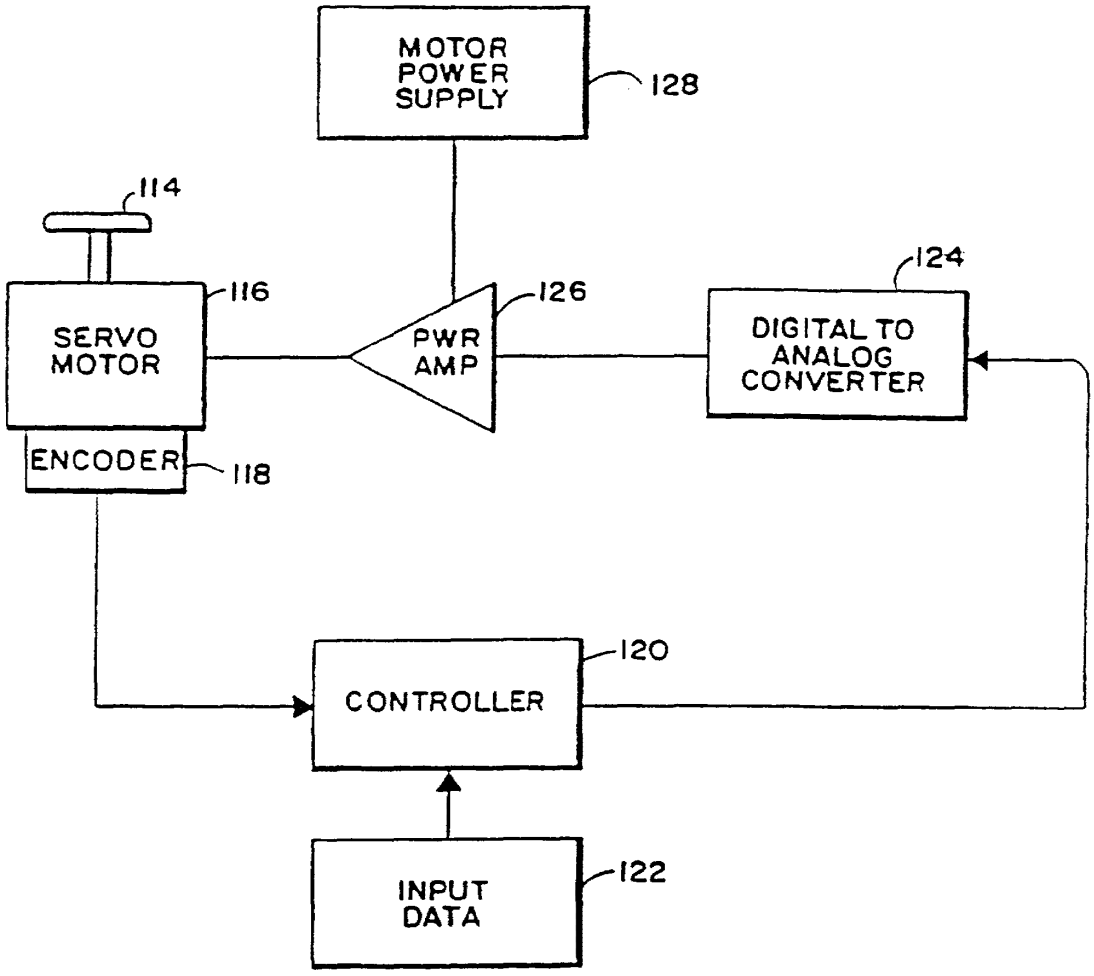

MOTOR POWER SUPPLY
128
114
SERVO MOTOR
116
PWR AMP
126
DIGITAL TO ANALOG CONVERTER
124
ENCODER
118
CONTROLLER
120
INPUT DATA
122

FIG. 2

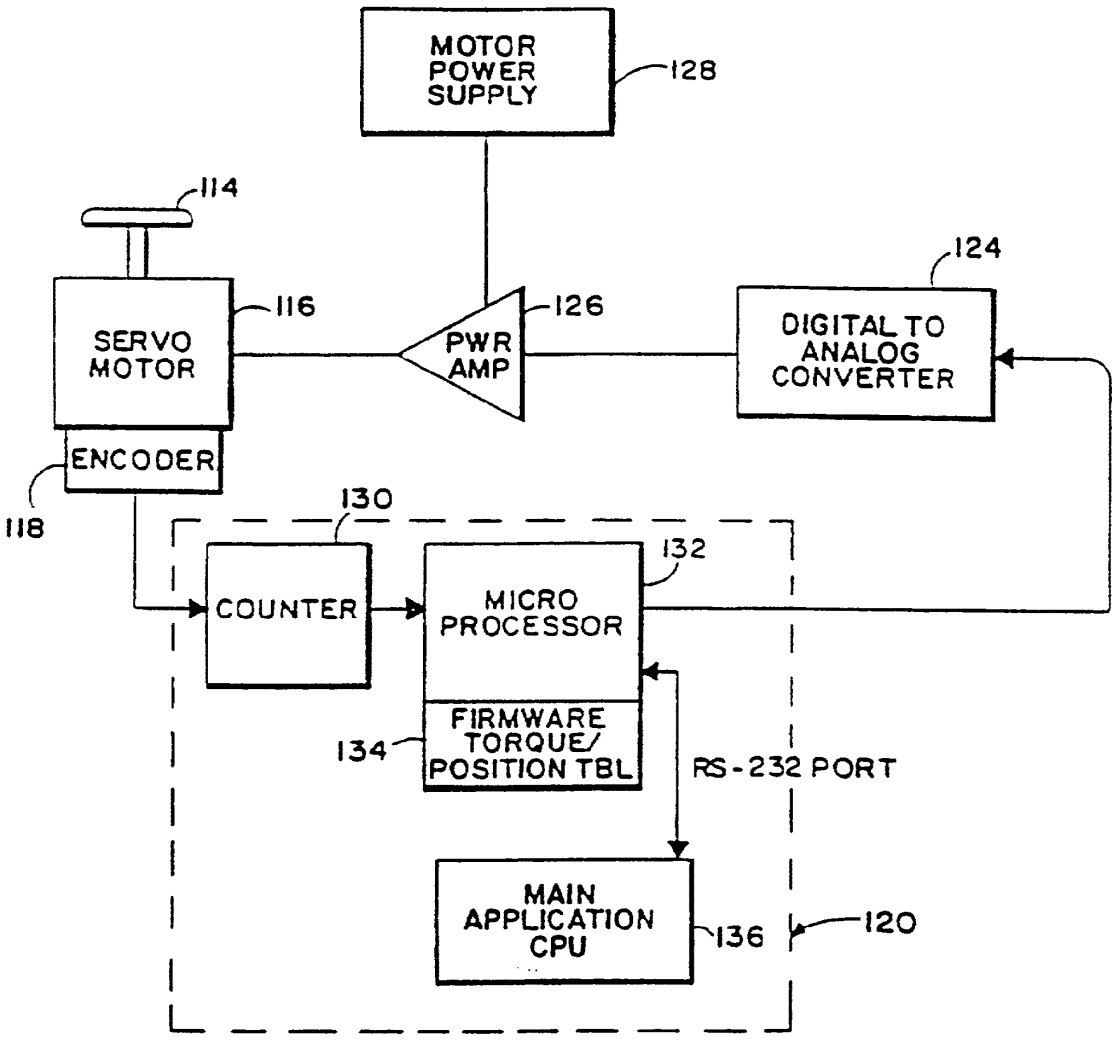

MOTOR POWER SUPPLY
128
114
SERVO MOTOR
116
PWR AMP
126
DIGITAL TO ANALOG CONVERTER
124
ENCODER
118
130
COUNTER
MICRO PROCESSOR
132
FIRMWARE TORQUE/ POSITION TBL
134
RS-232 PORT
MAIN APPLICATION CPU
136
120

FIG. 3

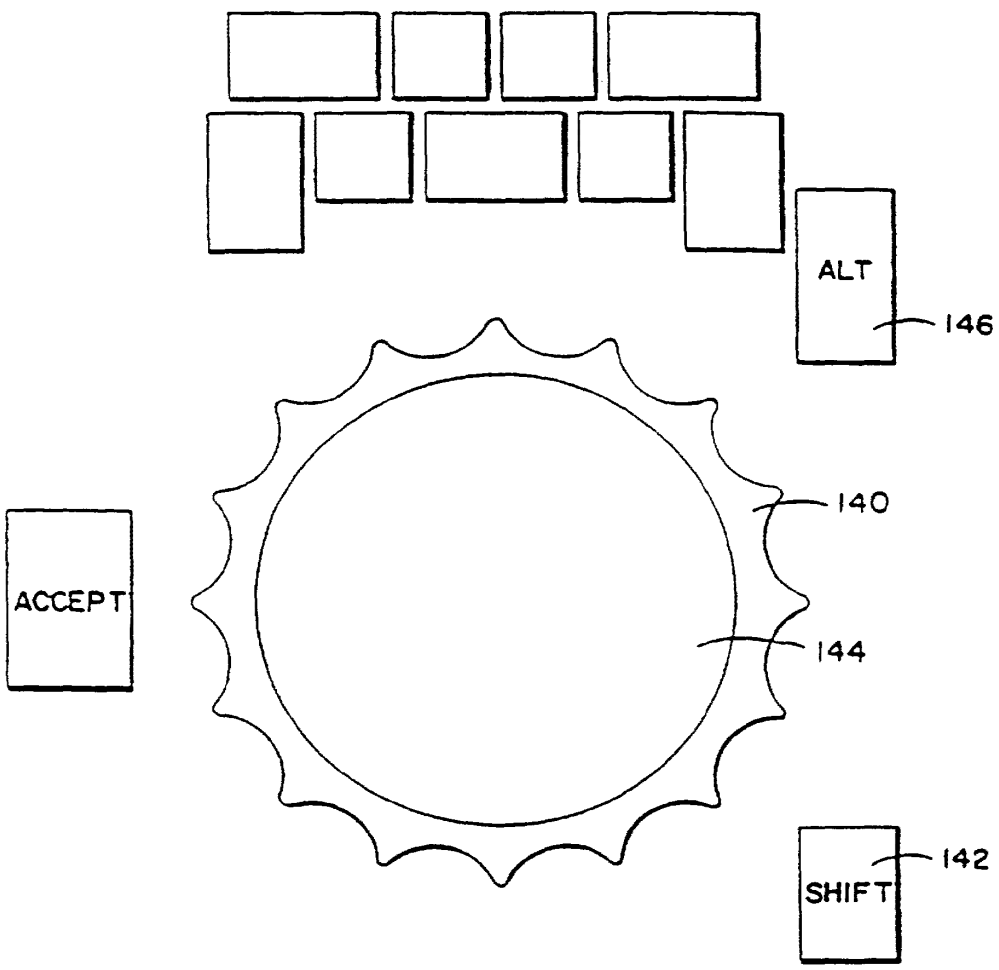


FIG. 3a

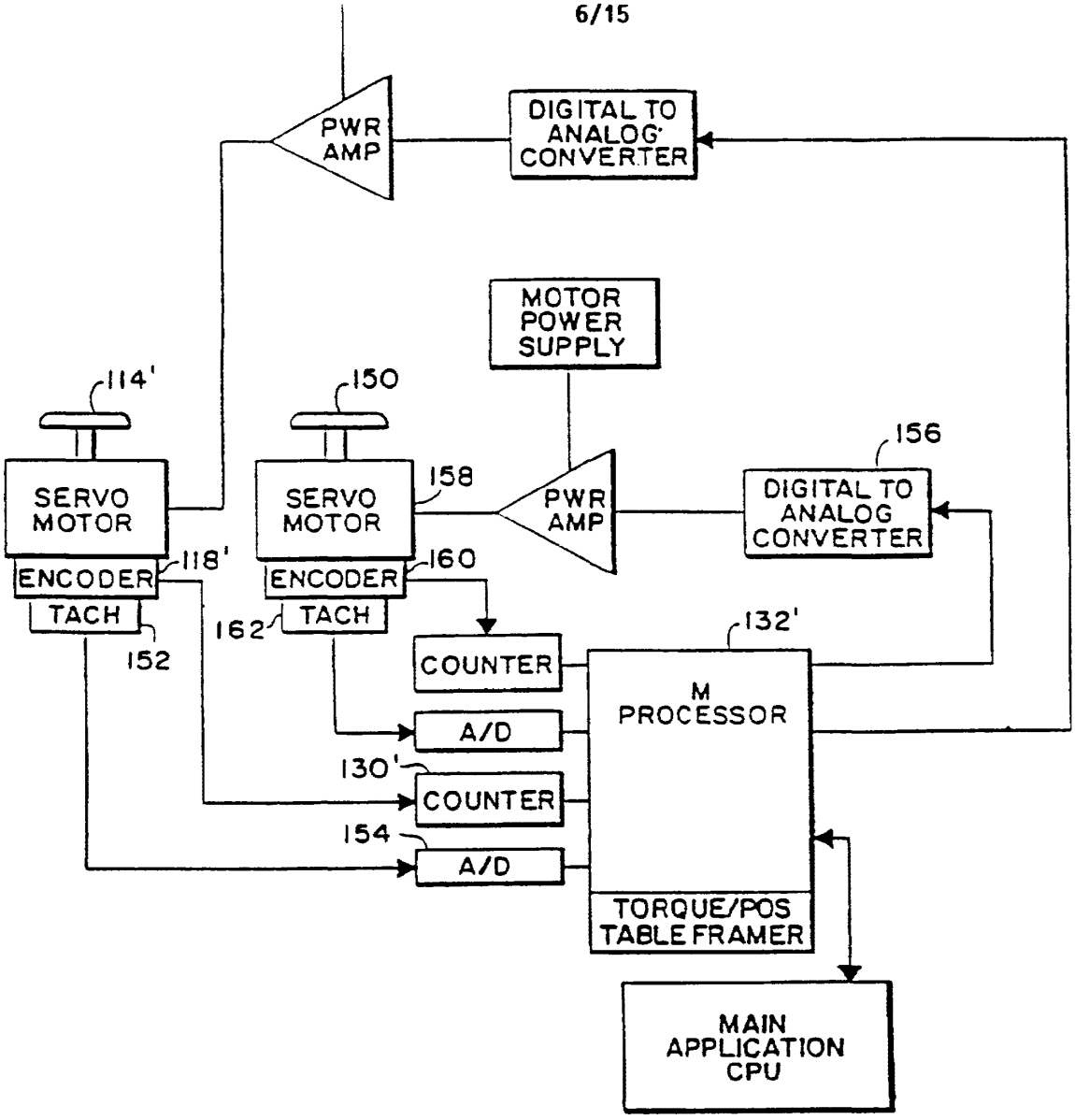

PWR AMP
DIGITAL TO ANALOG CONVERTER
MOTOR POWER SUPPLY
114'
150
156
SERVO MOTOR
158
SERVO MOTOR
PWR AMP
DIGITAL TO ANALOG CONVERTER
ENCODER
118'
ENCODER
160
TACH
152
162
TACH
132'
COUNTER
M PROCESSOR
A/D
130'
COUNTER
154
A/D
TORQUE/POS TABLE FRAMER
MAIN APPLICATION CPU

FIG. 4

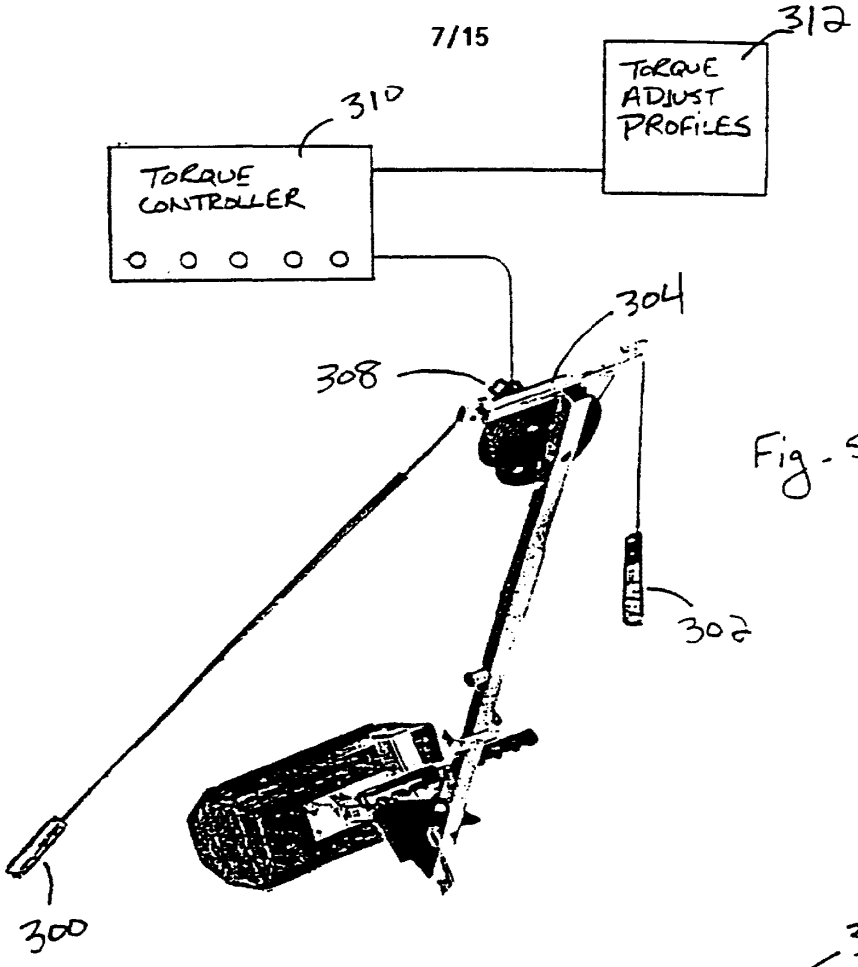
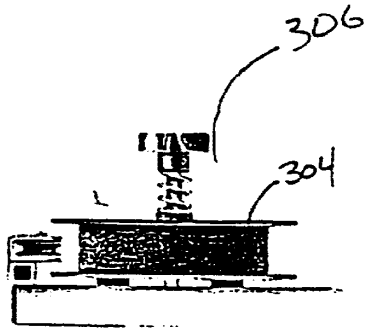


Fig. 5B



PRIOR ART

Fig. 5A

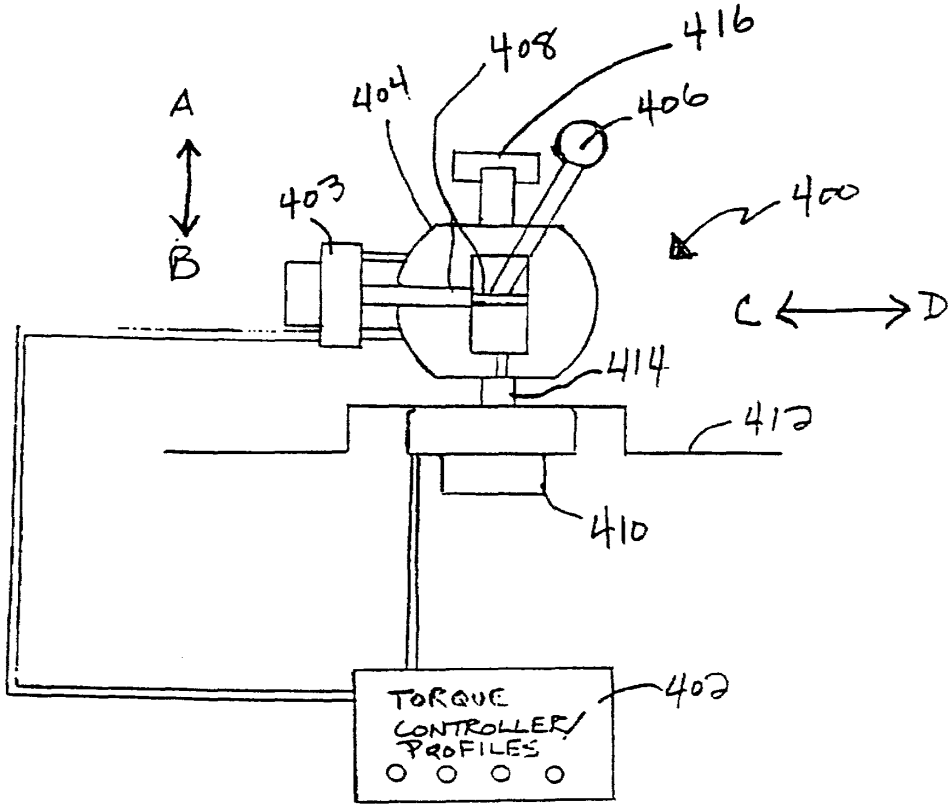

A
B
C
D
400
402
403
404
406
408
410
412
414
416
TORQUE
CONTROLLER/
PROFILES

Fig. 6

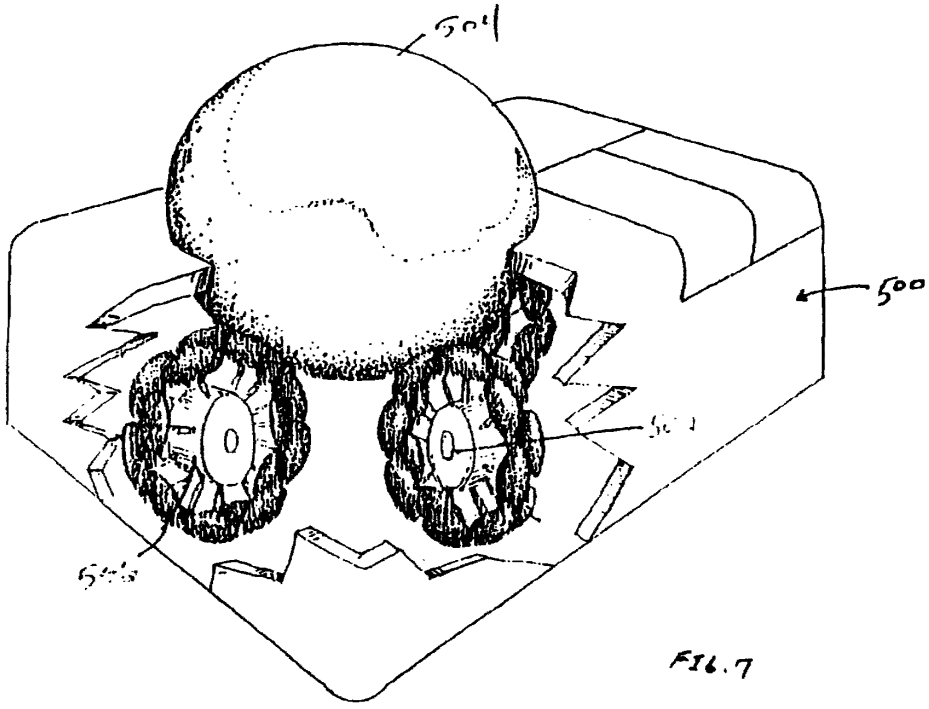


FIG. 7

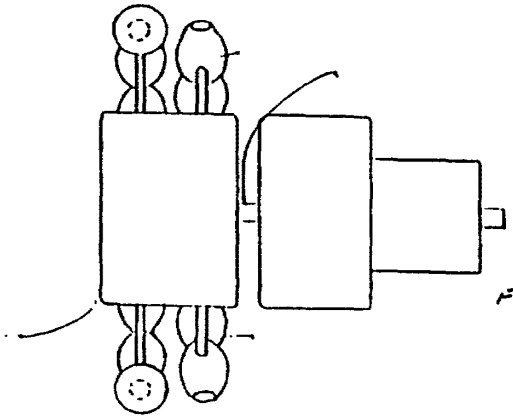


FIG. 9

Montage Electronic ickball Patent Application 11/16/94

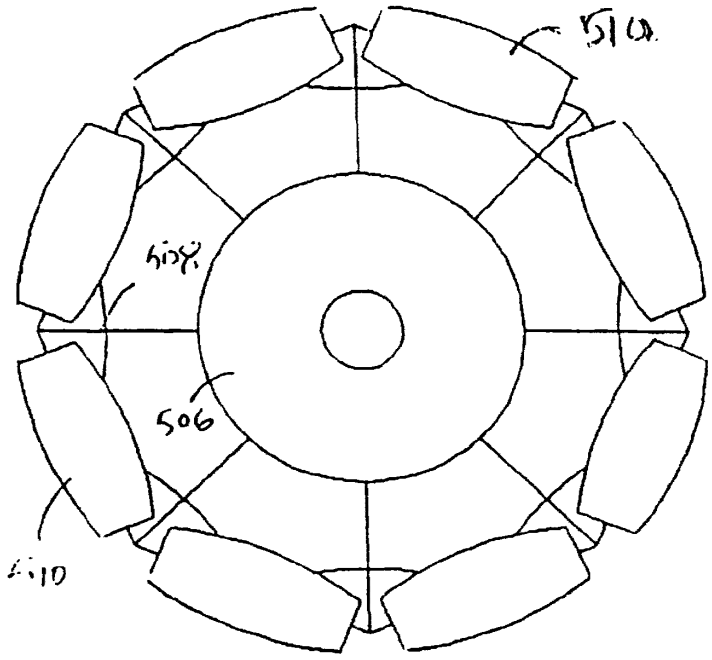


Fig. 8B

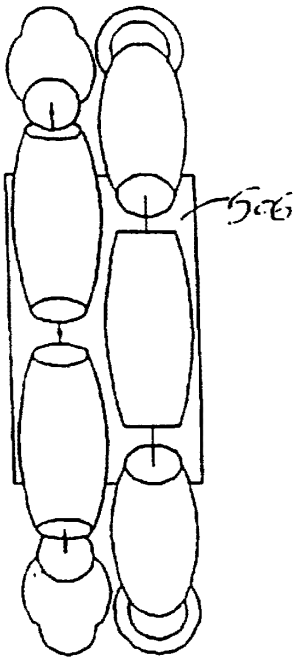
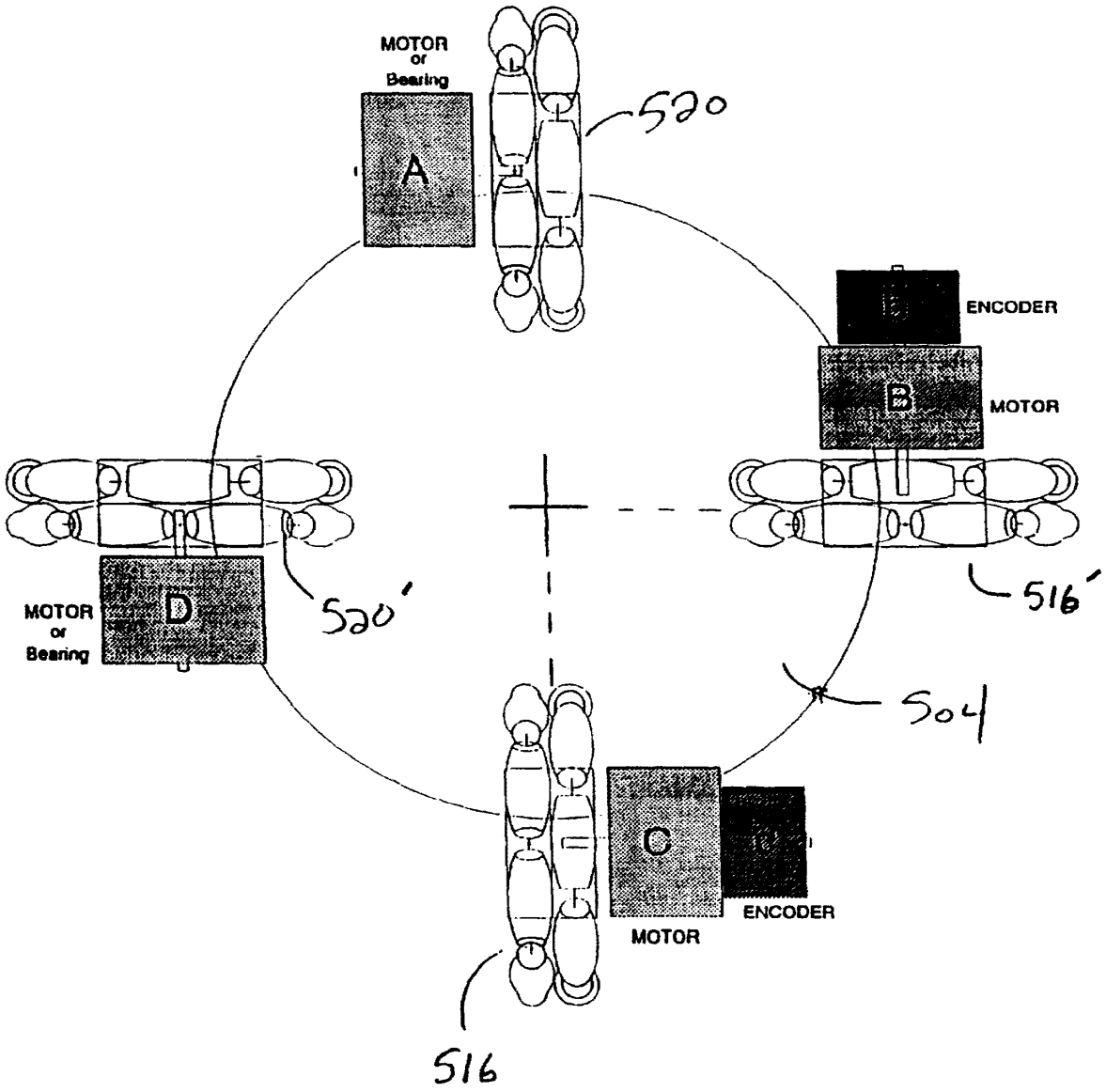


Fig. 8A


MOTOR
or
Bearing
A
520
ENCODER
B
MOTOR
MOTOR
or
Bearing
D
520'
516'
504
C
ENCODER
MOTOR
516

BOTTOM VIEW

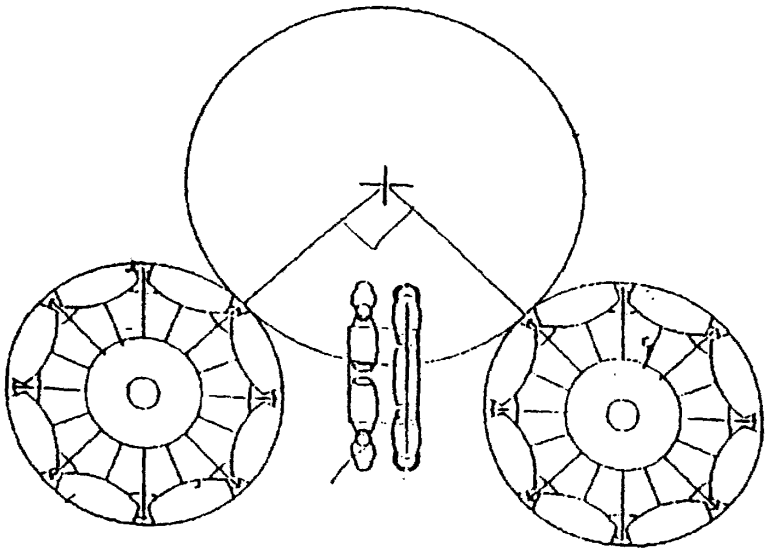


FIG.
10A

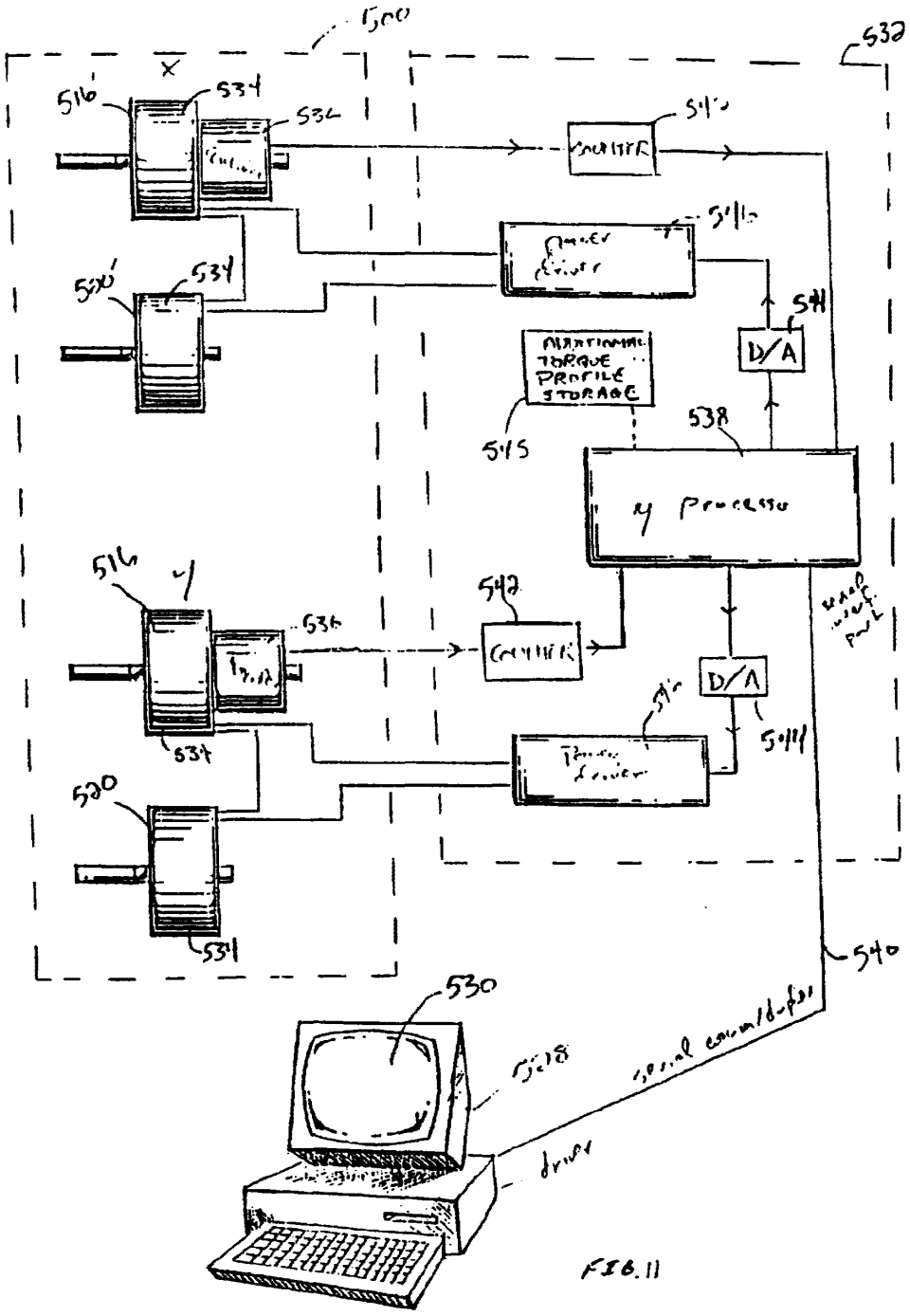

500
532
516
534
536
514
516'
534
520'
D/A
511
TORQUE PROFILE STORAGE
515
538
Processor
516
534
542
D/A
511'
534
520
531
540
530
518
driver

FIG. 11

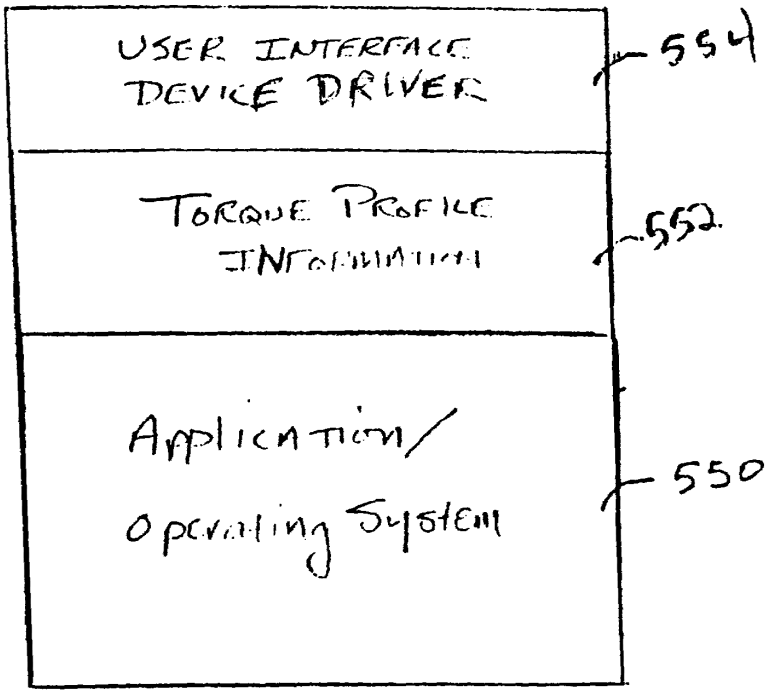

USER INTERFACE DEVICE DRIVER
554
TORQUE PROFILE INFORMATION
552
Application/ Operating System
550

Fig. 12

Here is a windows h er showing the command options banner appears on the screen.

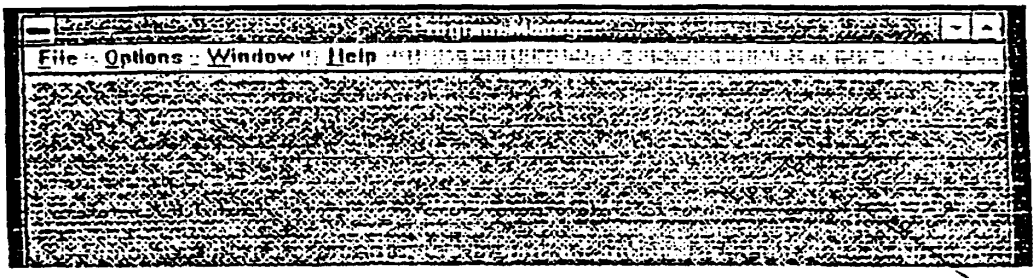
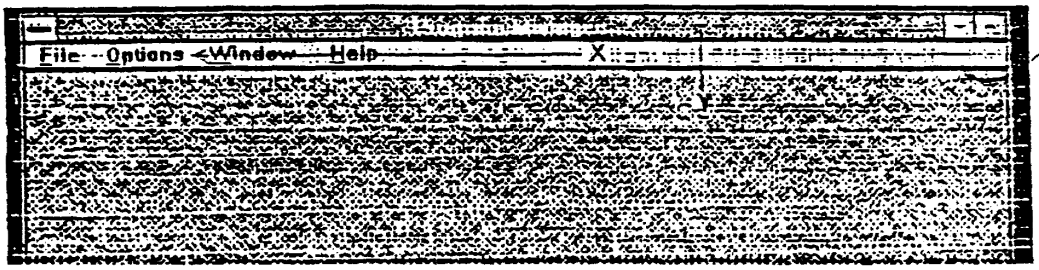


Fig. 13A

Dark lines have been added to define a torque trough arrows indicate motion in X & Y axes. 560



562

Fig. 13B

Curves below show torque profile for X & Y axes movements indicated above.

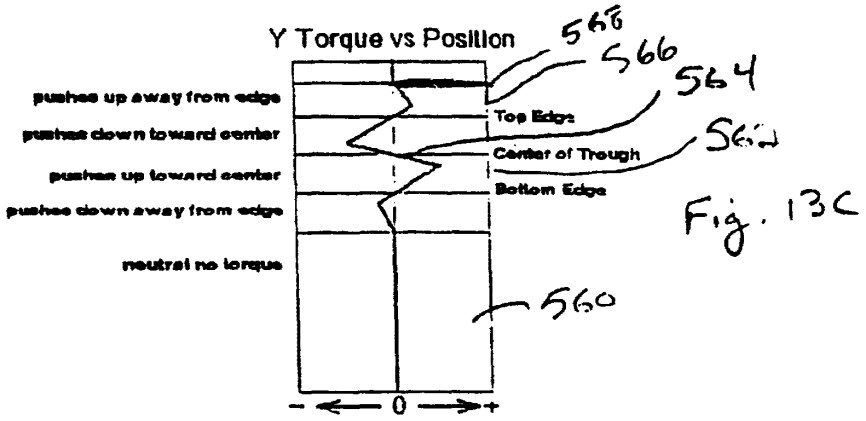


Fig. 13C

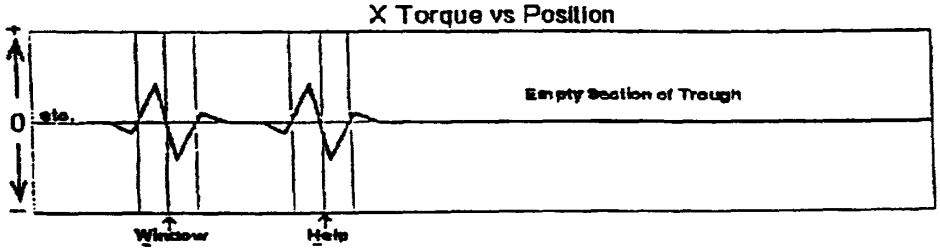


Fig. 13D

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/20687

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :G05B 13/00
US CL : 364/188; 318/561,601,652
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)

U.S. : 364/188-190; 318/560,561,637-638,569,600-601,615-616,646,652,687; 360/13,14.1,14.2,14.3,72.2,33.1; 340/726,723,792;

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 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.
A, P	US, A, 5,491,477 (CLARK ET AL.) 13 February 1996, col. 4. lines 44-63 and fig. 3.	1-18
A, E	US, A 5,559,412 (SCHULER) 24 September 1996, col. 2, line 40 - col. 3, line 11.	1-18
Y	US, A 5,220,260 (SCHULER) 15 June 1993, col 2, lines 30-61.	1-18
A	US, A, 4,939,594 (MOXON ET AL.) 03 July 1990, col. 2, lines 5-69.	1-18
A	US, A, 4,979,050 (WESTLAND ET AL.) 18 December 1990, col. 2, lines 15-69.	1-18

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"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
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"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
"E"	earlier document published on or after the international filing date	"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
"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)	"&"	document member of the same patent family
"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		

Date of the actual completion of the international search 29 MARCH 1997	Date of mailing of the international search report 14 APR 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer Reba Elmore Telephone No. (703) 305-3800

Form PCT/ISA/210 (second sheet)(July 1992)*

Electronic Patent Application Fee Transmittal

Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Michael T. Morlock/Renee Prevette
Attorney Docket Number:	IMM253

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**

Electronic Acknowledgement Receipt	
EFS ID:	14874413
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Renee Prevette
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	05-FEB-2013
Filing Date:	27-DEC-2007
Time Stamp:	09:45:00
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	8943
Deposit Account	201430
Authorized User	KILPATRICK TOWNSEND & STOCKTON, LLP
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)	

File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1	Transmittal Letter	IDSLetter.pdf	205251 75a79d9f0ca1b3e384cdc89a6c69d53d92bda0a5	no	5
Warnings:					
Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	PTOSB08.pdf	62231 498f871639e1c9e71e9173970a63aedbaa0380cc	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	WO97-25657.pdf	1946942 851ae81592d9819ed5e171be9b5235efabf6cd0b	no	58
Warnings:					
Information:					
4	Non Patent Literature	IMM253EPSupplSearchReport12-18-12.pdf	5759128 fd9fbc997db76e98b88e5e40caaf0bcb07831062	no	7
Warnings:					
Information:					
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		Total Files Size (in bytes):	8003470		

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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.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Michael D. Levin	)	
	)	Conf. No.: 2809
Serial No. 11/965,046	)	
	)	Art Unit: 2695
Filed: December 27, 2007	)	
	)	Examiner: Zubajlo, Jennifer L.
For: **VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK**	)	
	)	
	)	
Attorney Ref. IMM253 (51851-339922)	)	

INFORMATION DISCLOSURE STATEMENT

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

Sir:

Pursuant to 37 C.F.R. §§ 1.97 and 1.98, applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I.. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the PTO/SB/08 forms attached hereto.

II. COPIES (check at least one box)

a. ☐ This application was filed before June 30, 2003. Accordingly, submitted herewith is a legible copy of (i) each U.S. and foreign patent; (ii) each publication or that portion which caused it to be listed; and (iii) all other information or that portion which caused it to be listed.

b. ☒ This application was filed on or after June 30, 2003. Accordingly, copies of cited U.S. patents and patent application publications therefore are not included. Copies of foreign patent documents and non-patent literature are included.

c. ☐ Some or all of the documents listed on the PTO/SB/08 forms are not enclosed because they were cited in the International Search Report and copies should already be in the PTO file. If copies are needed, please contact the undersigned.

III. CONCISE EXPLANATION OF THE RELEVANCE
(check at least one box)

a. ☒ **DOCUMENTS IN THE ENGLISH LANGUAGE**
The patents, publications, or other information listed on the attached PTO/SB/08 forms are in the English language and therefore, do not require a statement of relevancy.

b. ☐ **DOCUMENTS NOT IN THE ENGLISH LANGUAGE**

A concise explanation of the relevance of all patents, publications, or other information listed that is not in the English language is as follows:

c. ☐ **ENGLISH LANGUAGE SEARCH REPORT**
An English language version of the search report or action that indicates the degree of relevance found by the foreign office is attached, thereby satisfying the requirement for a concise explanation. See MPEP 609(III)(A)(3).

d. ☐ **OTHER**
The following additional information is provided for the Examiner's consideration.

FEES

IV. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(b):
(check one box)

a. ☐ within three months of the filing date of a national application (37 C.F.R. § 1.97(b)(1)). No fee or statement is required. *(This section is not to be used with RCE's.)*

b. ☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application (37 C.F.R. § 1.97(b)(2)). No fee or statement is required.

c. ☐ before the mailing of a first Office action after the filing of or concurrently with a Request for Continued Examination under § 1.114 (37 C.F.R. § 1.97(b)(4)). No fee or statement is required.

d. ☐ before the mailing date of a first Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or statement is required.

In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) below, or, if no statement has been made, charge our deposit account in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

V. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(c):
(check one box)

before the mailing date of a Final Office Action under 37 C.F.R. § 1.113 (See 37 C.F.R. § 1.97(c)(1)) or before the mailing date of a Notice of Allowance under 37 C.F.R. § 1.311 (See 37 C.F.R. § 1.97(c)(2)).

a. ☐ No statement; therefore, a fee in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

b. ☐ See the statement below. No fee is required.

VI. ☒ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(d)
after the period specified in 37 C.F.R. 1.97(c) but before payment of the issue fee; see statement and payment of fees below.

VII. STATEMENT UNDER 37 C.F.R. § 1.97(e) (check only one box)
The undersigned hereby states that

a. ☒ each item of information contained in the IDS was first cited in any communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS;

b. ☐ no item of information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of IDS was known to any individual designated

in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

c. ☐ Some of the items of information were cited in a communication from a foreign Patent Office. As to this information, the undersigned states that each item of information contained in the IDS was first cited in a communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS. As to the remaining information, the undersigned hereby states that no item of this remaining information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application and, to the best of my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

VIII. ☐ PATENT TERM ADJUSTMENT

Each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.704(d).

IX. PAYMENT OF FEES (check one box)

☒ Payment by credit card Form PTO-2038 in the amount of $180 required by 37 C.F.R. § 1.17(p) is enclosed for the above-identified fee.

☐ Please charge Deposit Account No. 20-1430 in the amount required by 37 C.F.R. § 1.17(p) for the above-indicated fee. A triplicate copy of this paper is attached.

☐ No fee is required.

If the Examiner has any questions concerning this IDS, he/she is requested to contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 20-1430.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 20-1430 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17.

Respectfully submitted,

Date: 2/5/2013

By: _____
Michael T. Morlock (Reg. No. 62,245)

Attachment(s):
- ☒ PTO/SB/08
- ☒ Documents
- ☒ Fee
- ☐ Other

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629
Confirmation No.	:	2809

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPEAL BRIEF

Sir:

This is an Appeal Brief filed under 37 C.F.R. § 41.37 in connection with the final rejection of claims 1-7 and 9-20 in the Final Office Action mailed August 21, 2012 (hereinafter the "Office Action"). Each of the topics required by 37 C.F.R. § 41.37 is presented herewith and labeled appropriately.

Real Party in Interest

The real party in interest in the present application is the assignee, Immersion Corporation, 30 Rio Robles, San Jose, CA 95134 (hereinafter "Appellant").

Related Appeals and Interferences

Appellant and the Appellant's legal representative know of no appeals or interferences that will directly affect, will be directly affected by, or have a bearing on the Board's decision in this appeal.

Status of Claims

Claims 1-7 and 9-20 stand rejected and are the substance of this appeal. Claim 8 was previously cancelled during prosecution. The rejection of claims 1-7 and 9-20 is appealed.

Status of Amendments

Appellant has not sought to amend the claims after the mailing of the Final Office Action.

Summary of the Claimed Subject Matter

The following summary is intended to provide examples of embodiments disclosed within the present specification and is not intended to limit the full scope of the disclosure within the specification or to otherwise replace or modify the disclosure of the present application. Discussion below of step numberings or orderings, such as by use of the words "first," "next," or "last" is only for the convenience of discussing each of the claim elements; no ordering of steps or processing should be inferred from such numberings or orderings.

The present invention generally relates to systems, methods, and related logic for virtual detents through vibrotactile feedback. For example, the specification discloses that "[o]ne embodiment of the invention is a method comprising the steps of receiving an input signal that comprises information associated with the manipulation of an input device, and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect comprising a virtual detent to the input device. In another embodiment, a computer-readable medium (such as, for example, random access memory or a computer disk) comprises code for carrying out such a method."[1] The specification further discloses that "in some embodiments the actuator 108 may be configured to provide the perception of a detent (i.e. a virtual detent) without the traditional means necessary for a mechanical detent. For example, the actuator 108 may be used in place of various mechanical components which traditionally provided tactile feedback, such as springs, brakes or cams. In some embodiments, the vibrotactile feedback may comprise a click effect replicating a mechanical click. In other embodiments, the vibrotactile feedback may not comprise a click effect, but some other effect, such as a spring effect or a barrier effect."[2]

[1] Specification as filed at paragraph [0006].
[2] *Id.* at [0033].

The present invention recites five independent claims, claims 1, 9, 10, 14, and 15. Claim 1 is a method claim. The first element of claim 1 is "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad." Support for this limitation may be found throughout the specification. For example, the specification discloses "[s]ystems of the invention comprise an input device 102 and a sensor 104. The input device 102 shown in Figure 1 is configured to provide an input signal to the processor when the input device 102 is manipulated. In other embodiments, sensor 104 can generate an input signal when the sensor 104 detects manipulation of the input device 102."[3] The specification further discloses that "the input device 102 can be, for example, a mechanical input device. Examples of mechanical input devices include a rotary knob coupled to an encoder."[4] The specification further discloses that "[i]n other embodiments, the input device may comprise a different device, such as a touch pad."[5]

The next element of claim 1 recites "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent." Support for this limitation is found throughout the specification. For example, the specification discloses, "[t]he processor 106 may generate a signal by accessing a detent profile stored in a memory (not shown in Figure 1). In one embodiment, the processor 106 may access a specific detent profile based at least in part on the input signal. In certain embodiments, the processor 106 may determine which of a plurality of simulated mechanical detents to generate. For example, the processor 106 may analyze the input signal and determine that a hard stop is appropriate. Further, the processor 106 may then access the hard stop virtual detent profile in a memory, and generate a detent signal based on the hard stop virtual detent profile."[6] Furthermore, the specification discloses "Figures 9A, 9B, 9C, 9D, 9E, 9F, 9G, and 9H are eight illustrations of virtual detent profiles in various embodiments of the present invention. In Figures 9A-9H, the rotary knob 202 is shown on the right along with a representation of the virtual detent profile on

[3] *Id.* at [0016].
[4] *Id.* at [0017].
[5] *Id.* at [0052].
[6] *Id.* at [0026].

the left corresponding with the rotary knob. The virtual detent profiles illustrated in Figures 9A-9H are exemplary embodiments of the invention."[7]

The next element of claim 1 recites "generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent." Support for this limitation is found throughout the specification. For example, the specification discloses, "in some embodiments the actuator 108 may be configured to provide the perception of a detent (i.e. a virtual detent) without the traditional means necessary for a mechanical detent. For example, the actuator 108 may be used in place of various mechanical components which traditionally provided tactile feedback, such as springs, brakes or cams. In some embodiments, the vibrotactile feedback may comprise a click effect replicating a mechanical click. In other embodiments, the vibrotactile feedback may not comprise a click effect, but some other effect, such as a spring effect or a barrier effect."[8] The specification further discloses that "The actuator 108 can be any of a variety of different types of force producing devices, including an eccentric rotating mass (ERM) actuator, a multifunctional (MFT) actuator, a linear mass actuator, an electro-magnetic actuator, a motor, a voice coil, a pneumatic or hydraulic actuator, an electro-active polymer, or any other suitable actuator. In one embodiment, actuator 108 may comprise a plurality of actuators of the same or different design."[9]

Claim 9 recites a method. The first element of claim 9 is "detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad." Support for this limitation may be found throughout the specification. For example, the specification discloses "[s]ystems of the invention comprise an input device 102 and a sensor 104. The input device 102 shown in Figure 1 is configured to provide an input signal to the processor when the input device 102 is manipulated. In other embodiments, sensor 104 can generate an input signal when the sensor 104 detects manipulation of the input device 102."[10] The specification further discloses that "the input device 102 can be, for example, a mechanical input device. Examples of mechanical input devices include a rotary knob coupled to

[7] *Id.* at [0096].
[8] *Id.* at [0033].
[9] *Id.* at [0037].
[10] *Id.* at [0016].

an encoder."[11] The specification further discloses that "[i]n other embodiments, the input device may comprise a different device, such as a touch pad."[12]

The next element of claim 9 is "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent." Support for this limitation may be found throughout the specification. For example, the specification discloses, "[t]he processor 106 may generate a signal by accessing a detent profile stored in a memory (not shown in Figure 1). In one embodiment, the processor 106 may access a specific detent profile based at least in part on the input signal. In certain embodiments, the processor 106 may determine which of a plurality of simulated mechanical detents to generate. For example, the processor 106 may analyze the input signal and determine that a hard stop is appropriate. Further, the processor 106 may then access the hard stop virtual detent profile in a memory, and generate a detent signal based on the hard stop virtual detent profile."[13] Furthermore, the specification discloses "Figures 9A, 9B, 9C, 9D, 9E, 9F, 9G, and 9H are eight illustrations of virtual detent profiles in various embodiments of the present invention. In Figures 9A-9H, the rotary knob 202 is shown on the right along with a representation of the virtual detent profile on the left corresponding with the rotary knob. The virtual detent profiles illustrated in Figures 9A-9H are exemplary embodiments of the invention."[14]

The next element of claim 9 is "generating a detent signal based at least in part on the detent profile and the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal." Support for this limitation may be found throughout the specification. For example, the specification discloses, "in some embodiments the actuator 108 may be configured to provide the perception of a detent (i.e. a virtual detent) without the traditional means necessary for a mechanical detent. For example, the actuator 108 may be used in place of various mechanical components which traditionally provided tactile feedback, such as springs, brakes or cams. In some embodiments, the vibrotactile feedback may comprise a click effect replicating a mechanical click. In other embodiments, the vibrotactile feedback may not comprise a click effect, but some other effect,

[11] *Id.* at [0017].
[12] *Id.* at [0052].
[13] *Id.* at [0026].
[14] *Id.* at [0096].

such as a spring effect or a barrier effect."[15] The specification further discloses that "The actuator 108 can be any of a variety of different types of force producing devices, including an eccentric rotating mass (ERM) actuator, a multifunctional (MFT) actuator, a linear mass actuator, an electro-magnetic actuator, a motor, a voice coil, a pneumatic or hydraulic actuator, an electro-active polymer, or any other suitable actuator. In one embodiment, actuator 108 may comprise a plurality of actuators of the same or different design."[16]

Claim 10 recites "A non-transitory computer-readable medium on which is encoded program code." Support may be found throughout the specification. For example, the specification describes "[e]mbodiments of computer-readable media may comprise, but are not limited to, an electronic, optical, magnetic, or other storage or transmission device capable of providing a processor with computer-readable instructions. Other examples of media comprise, but are not limited to, a floppy disk, CD-ROM, magnetic disk, memory chip, ROM, RAM, ASIC, configured processor, all optical media, all magnetic tape or other magnetic media, or any other medium from which a computer processor can read."[17]

The first element of claim 10 is "program code for receiving an input signal comprising information associated with the manipulation of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad." Support for this limitation may be found throughout the specification. For example, the specification discloses "[s]ystems of the invention comprise an input device 102 and a sensor 104. The input device 102 shown in Figure 1 is configured to provide an input signal to the processor when the input device 102 is manipulated. In other embodiments, sensor 104 can generate an input signal when the sensor 104 detects manipulation of the input device 102."[18] The specification further discloses that "the input device 102 can be, for example, a mechanical input device. Examples of mechanical input devices include a rotary knob coupled to an encoder."[19] The specification further discloses that "[i]n other embodiments, the input device may comprise a different device, such as a touch pad."[20]

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[15] *Id.* at [0033].
[16] *Id.* at [0037].
[17] *Id.* at [0030].
[18] *Id.* at [0016].
[19] *Id.* at [0017].
[20] *Id.* at [0052].

The next element of claim 10 is "program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent." Support for this limitation may be found throughout the specification. For example, the specification discloses, "[t]he processor 106 may generate a signal by accessing a detent profile stored in a memory (not shown in Figure 1). In one embodiment, the processor 106 may access a specific detent profile based at least in part on the input signal. In certain embodiments, the processor 106 may determine which of a plurality of simulated mechanical detents to generate. For example, the processor 106 may analyze the input signal and determine that a hard stop is appropriate. Further, the processor 106 may then access the hard stop virtual detent profile in a memory, and generate a detent signal based on the hard stop virtual detent profile."[21] Furthermore, the specification discloses "Figures 9A, 9B, 9C, 9D, 9E, 9F, 9G, and 9H are eight illustrations of virtual detent profiles in various embodiments of the present invention. In Figures 9A-9H, the rotary knob 202 is shown on the right along with a representation of the virtual detent profile on the left corresponding with the rotary knob. The virtual detent profiles illustrated in Figures 9A-9H are exemplary embodiments of the invention."[22]

The next element of claim 10 is "program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent." Support for this limitation may be found throughout the specification. For example, the specification discloses, "in some embodiments the actuator 108 may be configured to provide the perception of a detent (i.e. a virtual detent) without the traditional means necessary for a mechanical detent. For example, the actuator 108 may be used in place of various mechanical components which traditionally provided tactile feedback, such as springs, brakes or cams. In some embodiments, the vibrotactile feedback may comprise a click effect replicating a mechanical click. In other embodiments, the vibrotactile feedback may not comprise a click effect, but some other effect, such as a spring effect or a barrier effect."[23] The specification further discloses that "The actuator 108 can be any of a variety of different types of force producing devices, including an eccentric rotating mass (ERM) actuator, a multifunctional (MFT) actuator, a linear mass actuator, an electro-magnetic actuator, a motor, a voice coil, a pneumatic or hydraulic actuator, an electro-active polymer, or any other suitable actuator. In one

[21] *Id.* at [0026].
[22] *Id.* at [0096].
[23] *Id.* at [0033].

embodiment, actuator 108 may comprise a plurality of actuators of the same or different design."[24]

Claim 14 recites "A non-transitory computer-readable medium on which is encoded program code." Support may be found throughout the specification. For example, the specification describes "[e]mbodiments of computer-readable media may comprise, but are not limited to, an electronic, optical, magnetic, or other storage or transmission device capable of providing a processor with computer-readable instructions. Other examples of media comprise, but are not limited to, a floppy disk, CD-ROM, magnetic disk, memory chip, ROM, RAM, ASIC, configured processor, all optical media, all magnetic tape or other magnetic media, or any other medium from which a computer processor can read."[25]

The first element of claim 14 is "program code for detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad." Support for this limitation may be found throughout the specification. For example, the specification discloses "[s]ystems of the invention comprise an input device 102 and a sensor 104. The input device 102 shown in Figure 1 is configured to provide an input signal to the processor when the input device 102 is manipulated. In other embodiments, sensor 104 can generate an input signal when the sensor 104 detects manipulation of the input device 102."[26] The specification further discloses that "the input device 102 can be, for example, a mechanical input device. Examples of mechanical input devices include a rotary knob coupled to an encoder."[27] The specification further discloses that "[i]n other embodiments, the input device may comprise a different device, such as a touch pad."[28]

The next element of claim 14 is "program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent." Support for this limitation may be found throughout the specification. For example, the specification discloses, "[t]he processor 106 may generate a signal by accessing a detent profile stored in a memory (not shown in Figure 1). In one embodiment, the processor 106 may access a specific detent profile based at least in part on the input signal. In certain embodiments, the

[24] *Id.* at [0037].
[25] *Id.* at [0030].
[26] *Id.* at [0016].
[27] *Id.* at [0017].
[28] *Id.* at [0052].

processor 106 may determine which of a plurality of simulated mechanical detents to generate. For example, the processor 106 may analyze the input signal and determine that a hard stop is appropriate. Further, the processor 106 may then access the hard stop virtual detent profile in a memory, and generate a detent signal based on the hard stop virtual detent profile."[29] Furthermore, the specification discloses "Figures 9A, 9B, 9C, 9D, 9E, 9F, 9G, and 9H are eight illustrations of virtual detent profiles in various embodiments of the present invention. In Figures 9A-9H, the rotary knob 202 is shown on the right along with a representation of the virtual detent profile on the left corresponding with the rotary knob. The virtual detent profiles illustrated in Figures 9A-9H are exemplary embodiments of the invention."[30]

The next element of claim 14 is "program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal." Support for this limitation may be found throughout the specification. For example, the specification discloses, "in some embodiments the actuator 108 may be configured to provide the perception of a detent (i.e. a virtual detent) without the traditional means necessary for a mechanical detent. For example, the actuator 108 may be used in place of various mechanical components which traditionally provided tactile feedback, such as springs, brakes or cams. In some embodiments, the vibrotactile feedback may comprise a click effect replicating a mechanical click. In other embodiments, the vibrotactile feedback may not comprise a click effect, but some other effect, such as a spring effect or a barrier effect."[31] The specification further discloses that "The actuator 108 can be any of a variety of different types of force producing devices, including an eccentric rotating mass (ERM) actuator, a multifunctional (MFT) actuator, a linear mass actuator, an electro-magnetic actuator, a motor, a voice coil, a pneumatic or hydraulic actuator, an electro-active polymer, or any other suitable actuator. In one embodiment, actuator 108 may comprise a plurality of actuators of the same or different design."[32]

Claim 15 recites a system. The first element of claim 15 is "an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad." Support

[29] *Id.* at [0026].
[30] *Id.* at [0096].
[31] *Id.* at [0033].
[32] *Id.* at [0037].

for this limitation may be found throughout the specification. Support for this limitation may be found throughout the specification. For example, the specification discloses "[s]ystems of the invention comprise an input device 102 and a sensor 104. The input device 102 shown in Figure 1 is configured to provide an input signal to the processor when the input device 102 is manipulated. In other embodiments, sensor 104 can generate an input signal when the sensor 104 detects manipulation of the input device 102."[33] The specification further discloses that "the input device 102 can be, for example, a mechanical input device. Examples of mechanical input devices include a rotary knob coupled to an encoder."[34] The specification further discloses that "[i]n other embodiments, the input device may comprise a different device, such as a touch pad."[35]

The next element of claim 15 is "a processor in communication with the input device, the processor configured to receive an input signal and a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent, the processor further configured to generate a detent signal." Support for this limitation may be found throughout the specification. For example, the specification discloses, "[t]he processor 106 may generate a signal by accessing a detent profile stored in a memory (not shown in Figure 1). In one embodiment, the processor 106 may access a specific detent profile based at least in part on the input signal. In certain embodiments, the processor 106 may determine which of a plurality of simulated mechanical detents to generate. For example, the processor 106 may analyze the input signal and determine that a hard stop is appropriate. Further, the processor 106 may then access the hard stop virtual detent profile in a memory, and generate a detent signal based on the hard stop virtual detent profile."[36] Furthermore, the specification discloses "Figures 9A, 9B, 9C, 9D, 9E, 9F, 9G, and 9H are eight illustrations of virtual detent profiles in various embodiments of the present invention. In Figures 9A-9H, the rotary knob 202 is shown on the right along with a representation of the virtual detent profile on the left corresponding with the rotary knob. The virtual detent profiles illustrated in Figures 9A-9H are exemplary embodiments of the invention."[37]

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[33] *Id.* at [0016].
[34] *Id.* at [0017].
[35] *Id.* at [0052].
[36] *Id.* at [0026].
[37] *Id.* at [0096].

The next element of claim 15 is "at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent." Support for this limitation may be found throughout the specification. For example, the specification discloses, "in some embodiments the actuator 108 may be configured to provide the perception of a detent (i.e. a virtual detent) without the traditional means necessary for a mechanical detent. For example, the actuator 108 may be used in place of various mechanical components which traditionally provided tactile feedback, such as springs, brakes or cams. In some embodiments, the vibrotactile feedback may comprise a click effect replicating a mechanical click. In other embodiments, the vibrotactile feedback may not comprise a click effect, but some other effect, such as a spring effect or a barrier effect."[38] The specification further discloses that "The actuator 108 can be any of a variety of different types of force producing devices, including an eccentric rotating mass (ERM) actuator, a multifunctional (MFT) actuator, a linear mass actuator, an electro-magnetic actuator, a motor, a voice coil, a pneumatic or hydraulic actuator, an electro-active polymer, or any other suitable actuator. In one embodiment, actuator 108 may comprise a plurality of actuators of the same or different design."[39]

Grounds of Rejection to be Reviewed on Appeal

There is one issue presented for appeal:

(1) Did the Examiner err in rejecting claims 1-7 and 9-20 as obvious under 35 U.S.C. § 103 in view of the combination of U.S. Pub. No. 2006/0119573 to Grant (hereinafter "Grant") in combination with U.S. Pub. No. 2006/0119573 to Tuomo Nyyssonen (hereinafter "Tuomo").

Argument

Issue 1: Whether the Examiner erred in rejecting claims 1-7 and 9-20 as obvious under 35 U.S.C. § 103(a) over Grant and Tuomo.

The Office Action rejects claim 1 under 35 U.S.C. § 103(a) over Grant in combination with Tuomo. Appellant respectfully asserts that the Office Action has failed to establish *prima*

[38] *Id.* at [0033].
[39] *Id.* at [0037].

facie obviousness. To establish *prima facie* obviousness of a claimed invention under 35 U.S.C. § 103, the Office Action must show, either from the references themselves or in the knowledge generally available to one of ordinary skill in the art, that the cited references disclose or suggest each claimed element and that it would have been obvious under *Graham v. John Deere Co.* to modify the references or to combine teachings in the references to arrive at the claimed invention. *See* MPEP §§ 2141 and 2143; *Graham v. John Deere Co.*, 383 U.S. 1 (1966); *KSR Int'l Co. v. Teleflex, Inc.*, 82 U.S.P.Q.2d at 1395-96.

Neither Grant nor Tuomo disclose or suggest "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad; receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent . . . ." As the Office Action states, "Grant does not specifically teach the vibrotactile effect comprising a virtual detent." Office Action, p. 2. Appellant previously argued that Tuomo does not cure Grant's deficiency. In response, in the Advisory Action mailed November 6, 2012 ("Advisory Action") the Examiner states:

> Detents are defined as a device used to mechanically resist or arrest the rotation of a wheel, axle, or spindle; as click-stops, used to divide a rotation into discrete increments. Therefore, even though Tuomo Nyyssonen does not use the word "detent", he teaches virtual knobs which are obviously divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents. For example, when a virtual knob is used to control volume, volume would be divided into discrete increments such as 0, 1, 2, 3, ... Etc for volume levels for lowest to highest values. Further, these virtual knobs are combined with vibro-tactile feedback in response to user inputs which teaches the detent profile comprising haptic data associated with a virtual detent.
>
> Advisory Action, p. 2.

Appellant respectfully notes that the Office Action provides no citation to Tuomo, or any other reference, for the statement "virtual knobs which are obviously divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents." Advisory Action, p. 2. Appellant respectfully disagrees, and notes that Tuomo does not disclose or suggest that a virtual knob is, or must be, divided into discrete increments. In fact, Tuomo does not even use the word "increment."

Furthermore, Appellant notes that even if a knob was divided into a "discrete increment," as the Office Action suggests, this still does not disclose the limitation of "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1.

Appellant further notes that in the rejection, the Office Action cites Tuomo paragraphs [0053], [0057], and claims 1 and 22. Office Action, p. 3. With regard to these paragraphs, Appellant respectfully notes that paragraph [0053] recites only "[f]urther, embodiments are envisioned in which the construction can be combined with vibro-tactual and/or audio feedback in response to VI inputs." Tuomo paragraph [0053]. Appellant respectfully notes that this paragraph does not mention detents. Rather, it merely suggests using a vibrotactile feedback response, without providing any embodiment that implements vibrotactile feedback or a description of the type of vibrotactile feedback. Accordingly, this paragraph does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1.

With regard to paragraph [0057], Appellant respectfully notes that this paragraph discloses a knob for controlling audio components, for example, volume, bass, or treble. *See* Tuomo paragraph [0057]. But paragraph [0057] does not disclose using detents with this knob. With regard to claim 1, Appellant respectfully notes that this claim does not disclose or suggest a haptic effect, much less "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1. Finally, with regard to claim 22, Appellant respectfully notes that this claim recites only "wherein the special set of user inputs are combined with a vibro-tactile and/or audio response." Tuomo claim 22. As discussed above with regard to paragraph [0053], this does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1.

Thus, the Office Action has failed to establish *prima facie* obviousness with respect to claim 1, and Appellant respectfully requests the Board overturn the 35 U.S.C. § 103(a) rejection of claim 1. Appellant further requests the Board overturn the 35 U.S.C. § 103(a) rejections of claims 2-7, which depend from and further limit claim 1, and are thus allowable for at least the same reasons as claim 1.

Claim 9 recites limitations similar to claim 1. Thus, Appellant respectfully asserts that claim 9 is allowable for at least the same reasons as claim 1, and Appellant respectfully requests the Board overturn the 35 U.S.C. § 103(a) rejection of claim 9.

Claim 10 recites limitations similar to claim 1. Thus, Appellant respectfully asserts that claim 10 is allowable for at least the same reasons as claim 1, and Appellant respectfully requests the Board overturn the 35 U.S.C. § 103(a) rejection of claim 10. Appellant respectfully requests the Board overturn the 35 U.S.C. § 103(a) rejections of claims 11-13, which depend from and further limit claim 10, and are thus allowable for at least the same reasons as claim 10.

Claim 14 recites limitations similar to claim 1. Thus, Appellant respectfully asserts that claim 14 is allowable for at least the same reasons as claim 1, and Appellant respectfully requests the Board overturn the 35 U.S.C. § 103(a) rejection of claim 14.

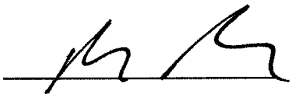
Claim 15 recites limitations similar to claim 1. Thus, Appellant respectfully asserts that claim 15 is allowable for at least the same reasons as claim 1, and Appellant respectfully requests the Board overturn the 35 U.S.C. § 103(a) rejection of claim 15. Appellant further requests the Board overturn of the 35 U.S.C. § 103(a) rejections of claims 16-20, which depend from and further limit claim 15, and are thus allowable for at least the same reasons as claim 15.

Conclusion

In view of the foregoing arguments, Appellant respectfully asserts that claims 1-7 and 9-20 are patentable over Grant in view of Tuomo. Appellant respectfully requests that the Board reverse each of the Examiner's bases for rejection.

Respectfully submitted,

Date: 2/5/2015



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Appendix A – Claims

1. A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

2. The method of claim 1, further comprising generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously.

3. The method of claim 1, wherein the vibrotactile signal is based at least in part on the input signal.

4. The method of claim 1, wherein the vibrotactile signal is further based in part on the status of the input device.

5. The method of claim 1, further comprising determining whether to generate a vibrotactile signal.

6. The method of claim 5, wherein determining whether to generate a vibrotactile signal is based at least in part on a status of the system to be manipulated.

7. The method of claim 1, further comprising determining one of a plurality of virtual detents to generate.

9. A method comprising:

detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a detent signal based at least in part on the detent profile and the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

10. A non-transitory computer-readable medium on which is encoded program code, the program code comprising:

program code for receiving an input signal comprising information associated with the manipulation of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the

detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

11. The computer-readable medium of claim 10, further comprising program code for generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal.

12. The computer-readable medium of claim 10, further comprising program code for determining whether to generate a detent signal.

13. The computer-readable medium of claim 10, further comprising program code for determining a virtual detent to generate.

14. A non-transitory computer-readable medium on which is encoded program code, the program code comprising:

program code for detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

program code for receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

program code for generating a detent signal based at least in part on the change in position, the detent signal configured to cause an actuator to produce a vibrotactile effect

to the input device, the vibrotactile effect comprising the virtual detent, the vibrotactile effect based at least in part on the detent signal.

15. A system comprising:

an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad;

a processor in communication with the input device, the processor configured to receive an input signal and a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent, the processor further configured to generate a detent signal; and

at least one actuator coupled to the input device, the at least one actuator configured to receive the detent signal and produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

16. The system of claim 15, wherein the processor is further configured to control a system based at least in part on a manipulation of the input device.

17. The system of claim 15, wherein the processor is further configured to determine whether to generate a detent signal.

18. The system of claim 15, wherein the at least one actuator is coupled to a housing of the input device.

19. The system of claim 15, wherein the input device comprises a sensor.

20. The method of claim 1, wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile.

Appendix B – Evidence

Appendix C – Related Proceedings

None.

Electronic Patent Application Fee Transmittal

Application Number:	11965046
Filing Date:	27-Dec-2007
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Filer:	Michael T. Morlock/Laura Smith
Attorney Docket Number:	IMM253

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:				
Filing a brief in support of an appeal	1402	1	630	630
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	150	150
Miscellaneous:				
		Total in USD ($)		**780**

Electronic Acknowledgement Receipt

EFS ID:	14874626
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Laura Smith
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	05-FEB-2013
Filing Date:	27-DEC-2007
Time Stamp:	10:11:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$780
RAM confirmation Number	9162
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Transmittal Letter	Transmittal339922.pdf	37397 a0c8ca624a4bd12cc06443afd27aa458a1d9514e	no	1
Warnings:					
Information:					
2	Extension of Time	ExtensionofTime339922.pdf	75459 f03bf959f6931d37e21224b49ea9d1b899d98992	no	1
Warnings:					
Information:					
3	Appeal Brief Filed	AppealBrief339922.pdf	1038137 c8e4805f232a71569ece1f3b6a928bdb0d1b12b6	no	21
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	31724 1d6472df325de366acd881bf741cf66aa23e315f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1182717		

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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Conf No.: 2809
Michael D. Levin	)	
	)	Art Unit: 2629
Serial No. 11/965,046	)	
	)	Examiner: **Zubajlo, Jennifer L.**
Filed: December 27, 2007	)	
	)	

For: VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK

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

TRANSMITTAL

Sir:

Transmitted herewith are the following documents for filing in the above-identified application:

1. Transmittal;
2. Petition for Extension of Time (1 month);
3. Appeal Brief; and
4. EFS-Web Payment in the amount of $780.00
   ($150.00 – Extension of Time; $630.00 – Appeal Brief)

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 20-1430.

Date: 2/5/2013

Respectfully submitted,

Michael T. Morlock
Reg. No. 62,245

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(336) 607-7300

Certificate of Electronic Filing
I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web on February 5, 2013.

Laura J. Smith

US2000 12674149 1

PTO/SB/22 (10-12)
Approved for use through 1/31/2013. 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)	Docket Number (Optional) 51851/339922 (IMM253)
Application Number 11/965,046	Filed December 27, 2007
For Virtual Detents Through Vibrotactile Feedback	
Art Unit 2629	Examiner Zubajlo, Jennifer L.

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))	$150	$75	$ 150.00
☐ Two months (37 CFR 1.17(a)(2))	$570	$285	$
☐ Three months (37 CFR 1.17(a)(3))	$1,290	$645	$
☐ Four months (37 CFR 1.17(a)(4))	$2,010	$1,005	$
☐ Five months (37 CFR 1.17(a)(5))	$2,730	$1,365	$

☐ 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 20-1430.

■ Payment made via EFS-Web.

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. 37 CFR 3.73(b) statement is enclosed (Form PTO/SB/96).

■ attorney or agent of record. Registration number 62,245.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

Signature	Date
	2/5/2013
Michael Morlock	336/607-7300
Typed or printed name	Telephone Number

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. 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: Mail Stop PCT, 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.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 06/11/2013

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2695	

MAIL DATE	DELIVERY MODE
06/11/2013	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.

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 11/965,046
Filing Date: December 27, 2007
Appellant(s): LEVIN, MICHAEL D.

Michael Morlock
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed February 5, 2013.

(1) Grounds of Rejection to be Reviewed on Appeal

Every ground of rejection set forth in the Office action dated August 21, 2012 from which the appeal is taken is being maintained by the examiner except for the grounds of rejection (if any) listed under the subheading “WITHDRAWN REJECTIONS.” New grounds of rejection (if any) are provided under the subheading “NEW GROUNDS OF REJECTION.”

The following ground(s) of rejection are applicable to the appealed claims.

Claims 1-7 and 9-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Danny A. Grant (Pub. No.: US 2006/0119573 A1) in view of Tuomo Nyyssonen (Pub. No.: US 2007/0222765).

As to claims 1, 10 and 15, Grant teaches a method (and system and corresponding program code, see [0006]) comprising: receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad (see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads), and generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device (see [0017]).

Grant does not specifically teach receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent.

Nyyssonen teaches receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; the vibrotactile effect comprising the virtual detent (see [0051], [0053], [0057], claims 1 & 22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Nyyssonen because adding virtual detents enables providing vibrotactile signals when useful in situations when

actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 9 and 14, Grant teaches a method (and corresponding program code, see [0006]) comprising: detecting a change in position of an input device configured to control one of a plurality of systems, wherein the input device comprises a touch-pad (detect incoming call, see [0016] and [0046] – "The housing 103 may be, for example, a housing of a cell phone, personal digital assistant or other electronic device" – note that it is well known in the art for cell phones and PDAs to comprise touch-pads); and generating a detent signal based at least in part on the change in position (generates driving signal, see [0016]), the detent signal configured to cause an actuator to produce a vibrotactile effect to the input device (see pare [0017]).

Grant does not specifically teach receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal.

Nyyssonen teaches receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; generating a detent signal based at least in part on the detent profile and the change in position, the vibrotactile effect comprising a virtual detent, the vibrotactile effect based at least in part on the detent signal (see [0051], [0053], [0057], claims 1 & 22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teachings of Grant with Nyyssonen because adding virtual detents enables providing vibrotactile signals when useful in situations when actual mechanical structure is not available, thereby increasing the functionality of Grant.

As to claims 2 and 11, Nyyssonen further teaches generating a system signal associated with a system to be manipulated, the system signal based at least in part on the input signal, and wherein generating a system signal and generating the vibrotactile signal occur substantially simultaneously (see [0053], [0057], claims 1 & 22).

As to claim 3, Nyyssonen further teaches wherein the vibrotactile signal is based at least in part on the input signal (see [0053], [0057]).

As to claim 4, Nyyssonen further teaches wherein the vibrotactile signal is further based in part on the status of the input device (see [0053], [0057]).

As to claims 5 and 12, Grant further teaches determining whether to generate a vibrotactile signal (see [0016]-[0017] and [0021]) and also see Nyyssonen (see [0053], [0057]).

As to claim 6, Grant further teaches wherein determining whether to generate a vibrotactile signal is based at least in part on a statue of the system to be manipulated (whether cell phone is receiving a call, see [0016]-[0017]) and see also Nyyssonen (see [0053], [0057]).

As to claim 7, Nyyssonen further teaches determining one of a plurality of virtual detents to generate (see [0053], [0057]).

As to claim 13, Nyyssonen further teaches determining a virtual detent to generate (see [0053], [0057]).

As to claim 16, Grant further teaches wherein the processor is further configured to control a system based at least in part on a manipulation of the input device (see [0016] and Fig 1) and see also Nyyssonen (see Abstract, [0053], [0057]).

As to claim 17, Nyyssonen further teaches wherein the processor is further configured to determine whether to generate a detent signal (see [0053], [0057]).

As to claim 18, Grant further discloses wherein the at least one actuator is coupled to a housing of the input device (see [0046] and Fig 1).

As per claim 19, Nyyssonen further discloses wherein the input device comprises a sensor (see Abstract).

As per claim 20, Nyyssonen further discloses wherein the detent profile comprises a first detent profile, and further comprising receiving a second detent profile (see [0053], [0057] – note that it would be obvious for different detents to be used with different functions).

(2) Response to Argument

Applicant argues that “Tuomo does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent," as recited by claim 1. In fact, Tuomo only mentions vibrotactile effects briefly in paragraph [0053] and claim 22. And Tuomo does not describe any types of vibrotactile effects. Furthermore, Tuomo does not even use the word detent.” Examiner disagrees.

Detents are defined as a device used to mechanically resist or arrest the rotation of a wheel, axle, or spindle; as click-stops, used to divide a rotation into discrete increments. It is well known for virtual knobs to be divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents

Therefore, even though Tuomo Nyyssonen does not use the word “detent”, he teaches virtual knobs which are obviously divided into discrete increments in order for

certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents. For example, when a virtual knob is used to control volume, it is well known for volume to be divided into discrete increments such as 0, 1, 2, 3, …. Etc for volume levels for lowest to highest values. Each movement of the virtual knob must be assigned a value which is an increment. Further, these virtual knobs are combined with vibro-tactile feedback in response to user inputs (i.e. virtual knob movement in discrete increments to control volume) which teaches the detent profile comprising haptic data associated with a virtual detent. Since these discrete increments are well known with volume control, they would be obviously used and with the vibro-tactile feedback associated with user input (i.e. virtual knob movement in discrete increments to control volume), detents (i.e. the feedback felt from the volume control). See paragraphs [0051], [0053], [0057], and claims 1 & 22 of Tuomo Nyyssonen.

Further support for the statement that it is well known for virtual knobs to be divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents can be found in column 4 line 19 – column 5 line 19 of previously cited reference Robert F. Lloyd (Patent No: US 7,720,552). Lloyd teaches virtual knobs with incremental adjustment.

Therefore, the combination of Grant and Tuomo Nyyssonen teach "receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-

pad; receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent ....".

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

/Jennifer Zubajlo/

Examiner, Art Unit 2695

Conferees:

/Amare Mengistu/

Supervisory Patent Examiner, Art Unit 2695

/Bipin Shalwala/

Supervisory Patent Examiner, Art Unit 2696

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 06/18/2013

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	PAPER NUMBER
2695	

MAIL DATE	DELIVERY MODE
06/18/2013	PAPER

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
11/965,046	27 December, 2007	LEVIN, MICHAEL D.	IMM253

	EXAMINER	
PATENT DEPARTMENT (51851) KILPATRICK TOWNSEND & STOCKTON LLP 1001 WEST FOURTH STREET WINSTON-SALEM, NC 27101	JENNIFER ZUBAJLO	
	ART UNIT	PAPER
	2695	20130611

DATE MAILED:

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Commissioner for Patents

IDS filed 10/29/12 and IDS filed 2/5/13 have been considered and are attached. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure: US 2006/038781 A1; WO 97/25657 A1; US 6,128,006 A; US 2005/151720 A1; US 6,686,911 B1; JP 2008-508600; JP 2004-171157; JP 2005-71157; and JP 2003-29914.

/Amare Mengistu/ Supervisory Patent Examiner, Art Unit 2695	/Jennifer Zubajlo/ Examiner, Art Unit 2695 6/11/13

PTO-90C (Rev.04-03)

Substitute for form 1449A/PTO

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/956,046
Filing Date	December 27, 20007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Zubajlo, Jennifer L.
Attorney Docket Number	IMM253 (51851/339922)

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
/J.Z./	1.	7,215,320 B2	05-08-2007	Takeuchi et al.	
/J.Z./	2.	2003/0018835 A1	01-23-2003	Nonaka	
/J.Z./	3.	2005/0231466 A1	10-20-2005	Tada	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
/J.Z./	4.	WO 2006/020305 A2	02-23-2006	Apple Computer, Inc.		
/J.Z./	5.	JP 2008-508600 B	03-21-2008			X
/J.Z./	6.	JP 2004-171157	06-17--2004	Fuji Xerox Co. Ltd.		
/J.Z./	7.	JP 2005-71157	03-17-2005	Yamaha Corp.		
/J.Z./	8.	JP 2003-29914	01-31-2003	Alps Electric Co. Ltd.		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
/J.Z./	9.	Translation of Notice of Reasons for Rejection mailed August 28, 2012 for corresponding Japanese Application No. 2009-544090.	

Examiner Signature	/Jennifer Zubajlo/	Date Considered	06/11/2013

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.Z./

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/965,046
Filing Date	December 27, 2007
First Named Inventor	Michael D. Levin
Art Unit	2695
Examiner Name	Zubajlo, Jennifer L.
Attorney Docket Number	IMM253 (51851/339922)

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
/J.Z./	1.	6,128,006	10-03-2000	Rosenbourg et al.	
/J.Z./	2.	6,686,911	02-03-2004	Levin et al.	
/J.Z./	3.	2005/151720	07-14-2005	Cruz-Hernandez et al.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
/J.Z./	4.	WO 97/25657	07-17-1997	Lex Computer & Management		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
/J.Z./	5.	Supplementary European Search Report dated December 12, 2012 for corresponding European Patent Application No. 07863260.1.	

Examiner Signature	/Jennifer Zubajlo/	Date Considered	06/11/2013

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.Z./

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 06/26/2013

PATENT DEPARTMENT (51851)
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EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2695	

MAIL DATE	DELIVERY MODE
06/26/2013	PAPER

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
11/965,046	27 December, 2007	LEVIN, MICHAEL D.	IMM253

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1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
RICHARD ELLIS	
ART UNIT	PAPER
OPIM	A-76554

DATE MAILED:

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Commissioner for Patents

Please see the enclosed notice relating to the examiner's answer recently mailed in this application.

PTO-90C (Rev.04-03)

Appeal Forwarding Fee Requirement

USPTO records show that an examiner's answer was recently mailed.

If the examiner's answer is in response to an appeal brief filed on or after March 19, 2013 and the appeal brief fee required by former 37 CFR 41.20(b)(2) was not filed before March 19, 2013, the appeal forwarding fee set forth in 37 CFR 41.20(b)(4) is required to avoid dismissal of the appeal. The appeal forwarding fee is required within the later of two months from the date of either the examiner's answer, or a decision refusing to grant a petition under 37 CFR 1.181 to designate a new ground of rejection in an examiner's answer. See 37 CFR 41.45.

If the examiner's answer is in response to an appeal brief filed before March 19, 2013 or the appeal brief fee required by former 37 CFR 41.20(b)(2) was filed before March 19, 2013, an appeal forwarding fee is not required.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	Michael D. Levin
Application No.	:	11/965,046
For	:	**Virtual Detents Through Vibrotactile Feedback**
Filed	:	December 27, 2007
Examiner	:	Jennifer L. Zubajlo
Art Unit	:	2629
Confirmation No.	:	2809

Mail Stop Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

REPLY BRIEF

Sir:

This is a Reply Brief filed under 37 C.F.R. § 41.41 in response to the Examiner's Answer mailed June 11, 2013 (the "Answer"). This Reply Brief is in connection with final rejection of claims 1-7 and 9-20 in the Final Office Action mailed August 21, 2012 (hereinafter the "Office Action").

In the present Reply Brief, Appellant addresses a portion of the issues raised in the Examiner's Answer. Appellant hereby incorporates Appellant's arguments as presented in Appellant's Appeal Brief filed February 5, 2013, and Appellant's failure to address any issue in this Reply Brief should not be taken as an indication that Appellant agrees with the Examiner. The Board should instead consider Appellant's arguments in the record as a whole.

Argument

In the Answer, the Examiner addresses Appellant's position by arguing (1) that it is well known to divide a knob into discrete increments and thus virtual detents are well known, and (2) citing the reference US 7,720,552 Lloyd ("Lloyd") as supporting the position that virtual detents are well known. With regard to both of these points, Appellant respectfully notes that the

relevant claim limitation is not "a virtual detent." Rather, the relevant claim limitation requires "receiving a detent profile associated with one of the systems, ***the detent profile comprising haptic data associated with a virtual detent***." This requires haptic data associated with a virtual detent. The existence of a virtual detent, by itself, does not disclose or suggest the claimed limitation.

With regard the Examiner's first point, "even though Tuomo Nyyssonen does not use the word 'detent', he teaches virtual knobs which are obviously divided into discrete increments in order for certain movements or actions to occur with a certain distance of movement and therefore by definition are the same as virtual detents." Answer, pp. 8-9. Appellant respectfully notes that it may be known to divide a volume knob into increments. However, even if a knob was divided into a "discrete increment," as the Answer suggests, this still does not disclose the limitation of "receiving a detent profile associated with one of the systems, ***the detent profile comprising haptic data*** associated with a virtual detent" as recited by claim 1.

Appellant further notes that the Answer states "Since these discrete increments are well known with volume control, they would be obviously used and with the vibro-tactile feedback associated with user input (i.e. virtual knob movement in discrete increments to control volume), detents (i.e. the feedback felt from the volume control). See paragraphs [0051], [0053], [0057], and claims 1 & 22 of Tuomo Nyyssonen." With regard to these paragraphs, Appellant respectfully notes that only one of these three paragraphs even mentions any type of haptic effect. This is paragraph [0053], which recites, ***in its entirety***, "Further, embodiments are envisioned in which the construction can be combined with vibro-tactual and/or audio feedback in response to VI inputs." Tuomo, paragraph [0053]. Appellant respectfully notes that this paragraph does not mention detents. Rather, it merely suggests using a vibrotactile feedback response, without providing any embodiment that implements vibrotactile feedback or a description of the type of vibrotactile feedback. Accordingly, this paragraph does not disclose or suggest "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" as recited by claim 1.

With regard to the Examiner's citation to Lloyd, as an initial matter, Appellant respectfully notes that the Examiner has not affirmatively recited Lloyd in a rejection of any claim. Rather, in the Office Action mailed February 28, 2012 Lloyd was listed in the Notice of References Cited, but without any analysis of Lloyd in the body of the Office Action.

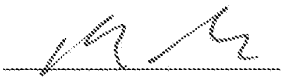
Appellant further notes that Lloyd does disclose the use of virtual detents. However, Lloyd does not disclose "receiving a detent profile associated with one of the systems, ***the detent profile comprising haptic data associated with a virtual detent***" as is required by claim 1. For example, Lloyd is in no way related to haptic effects. For example, Lloyd does not even use the words "haptic," "vibration," or "tactile." Thus, regardless of whether Lloyd discloses a virtual detent, it does not disclose "the detent profile comprising haptic data associated with a virtual detent" as is required by claim 1.

Conclusion

In view of the Appellant's arguments in the Appeal Brief and this Reply Brief, Appellant respectfully requests the Board reverse the Examiner's rejection of the pending claims.

Respectfully submitted,

Date: 8/17/2015



Michael T. Morlock
Reg. No. 62,245

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(336) 734-2756 (fax)

Electronic Acknowledgement Receipt

EFS ID:	16557894
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Toyce Southern
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	12-AUG-2013
Filing Date:	27-DEC-2007
Time Stamp:	10:11:05
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	Transmittal Letter	transmittal.pdf	37793 b72b744577afaf1df44d7a2c40538ad121333223	no	1

Warnings:	
Information:	

2	Reply Brief Filed	replybrief.pdf	1882025 db770e25331a570c7de8d245ff578d0db8839d98	no	3

Warnings:	
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Total Files Size (in bytes):	1919818

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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Conf No.: 2809
Michael D. Levin	)	
	)	Art Unit: 2695
Serial No. 11/965,046	)	
	)	Examiner: **Zubajlo, Jennifer L.**
Filed: December 27, 2007	)	
	)	

For: VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK

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

TRANSMITTAL

Commissioner:

Transmitted herewith are the following documents for filing in the above-identified application:

1. Transmittal; and
2. Reply Brief

The Commissioner is hereby authorized to charge any additional fees required by this action, or credit any overpayment, to Deposit Account Number 20-1430.

Date: 8/12/2013

Respectfully submitted,

Michael T. Morlock
Reg. No. 62,245

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Certificate of Electronic Filing
I hereby certify that this correspondence is being electronically filed with the United States Patent Office via EFS-Web on August 12, 2013.

Toyce E. Southern

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 08/23/2013

PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

EXAMINER	
ZUBAJLO, JENNIFER L	
ART UNIT	**PAPER NUMBER**
2695	

MAIL DATE	DELIVERY MODE
08/23/2013	PAPER

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PATENT DEPARTMENT (51851)
KILPATRICK TOWNSEND & STOCKTON LLP
1001 WEST FOURTH STREET
WINSTON-SALEM, NC 27101

Appeal No: 2013-010046
Application: 11/965,046
Appellant: Michael D. Levin

Patent Trial and Appeal Board Docketing Notice

Application 11/965,046 was received from the Technology Center at the Board on August 15, 2013 and has been assigned Appeal No: 2013-010046.

In all future communications regarding this appeal, please include both the application number and the appeal number.

The mailing address for the Board is:

PATENT TRIAL and APPEAL BOARD
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ALEXANDRIA, VIRGINIA 22313-1450

Telephone inquiries can be made by calling 571-272-9797 and referencing the appeal number listed above.

By order of the Patent Trial and Appeal Board.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1 of 1

Complete if Known	
Application Number	11/956,046
Filing Date	December 27, 20007
First Named Inventor	Michael D. Levin
Art Unit	2629
Examiner Name	Zubajlo, Jennifer L.
Attorney Docket Number	IMM253 (51851/339922)

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	1.	JP 2003-295959	10-17-2003	Alps Electric Co. Ltd.		X
	2.	JP 2004-094570	03-25-2004	Matsushita Electric Ind. Co. Ltd.		X
	3.	JP 2006-251845	09-21-2006	Alps Electric Co. Ltd.		X
	4.	JP 2008-016426	01-24-2008	Tokai Rika Co. Ltd.		X

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
	5.	Translation of Notice of Reasons for Rejection mailed June 18, 2013 for corresponding Japanese Application No. 2009-544090.	

Examiner Signature		Date Considered	

Espacenet

Bibliographic data: JP2003295959 (A) — 2003-10-17

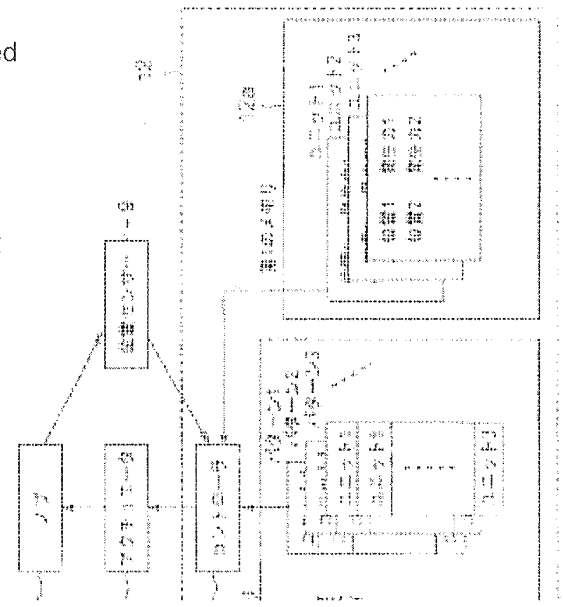
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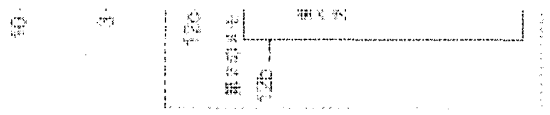
No documents available for this priority number.

Inventor(s):	NUMATA HIDETAKA; ONODERA MIKIO ± (NUMATA HIDETAKA, ; ONODERA MIKIO)
Applicant(s):	ALPS ELECTRIC CO LTD ± (ALPS ELECTRIC CO LTD)
Classification:	**- international:*G05G7/04; G06F3/00; G06F3/01;*** (IPC1-7): G05G7/04 **- cooperative: G06F3/016**
Application number:	JP20020097595 20020329
Priority number (s):	JP20020097595 20020329
Also published as:	JP4061105 (B2) EP1349050 (A2) EP1349050 (A3) US2003184518 (A1) US7187359 (B2)

Abstract of JP2003295959 (A)

PROBLEM TO BE SOLVED: To provide a haptic force feedback device that is reduced in the quantity of memory (ROM capacity) even if the kinds of force patterns are increased. ; SOLUTION: The device is provided with an operation part 10, an actuator 3 for feeding back haptic force to the operation part 10, and a control part 12 for controlling the actuator 3. The control part 12 stores a plurality of unit force patterns of which force patterns are different, and combines the unit force patterns to form composite force patterns. Also, the actuator 3 is controlled by the composite force patterns to feed back the haptic force to the operation part 10. ; COPYRIGHT: (C)2004,JPO





Last updated: 13.03.2013 Worldwide
Database 5.8.11.1; 92p

PRIOR ART REFERENCE

(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
特開2003－295959
（P2003－295959A）
(43)公開日　平成15年10月17日(2003.10.17)

(51)Int.Cl.[7]	識別記号	ＦＩ	ﾃｰﾏｺｰﾄﾞ(参考)
Ｇ０５Ｇ　7/04		Ｇ０５Ｇ　7/04	Ｚ　３Ｊ０７０

審査請求　未請求　請求項の数５　ＯＬ　（全 7 頁）

(21)出願番号　特願2002－97595(P2002－97595)

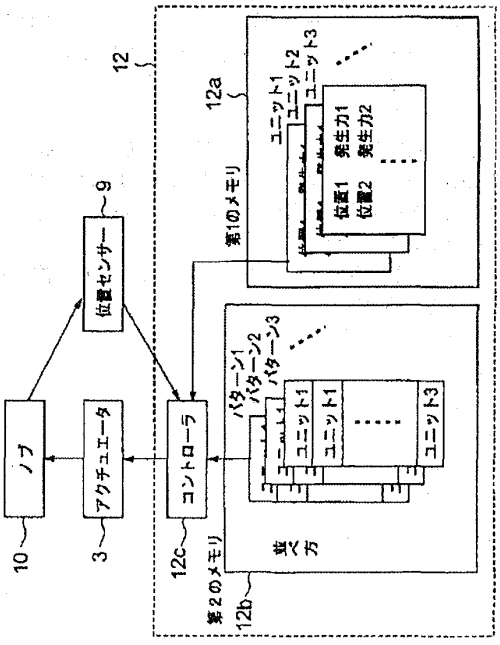
(22)出願日　平成14年３月29日(2002.3.29)

(71)出願人　000010098
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(54)【発明の名称】　力覚付与装置

(57)【要約】
【課題】　フォースパターンの種類が増えても必要とするメモリ量（ＲＯＭ容量）が少ない力覚付与装置を提供する。
【解決手段】　操作部１０と、操作部１０に感触（力覚）を与えるアクチュエータ３と、このアクチュエータ３を制御する制御部１２とを備え、制御部１２は、フォースパターンの異なる複数のユニットフォースパターンを記憶して、このユニットフォースパターンを組み合わせて合成フォースパターンを形成すると共に、この合成フォースパターンによりアクチュエータ３を制御して、操作部１０に感触を与える。



PRIOR ART REFERENCE

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【特許請求の範囲】

【請求項１】 操作部と、操作部に感触を与えるアクチュエータと、このアクチュエータを制御する制御部とを備え、前記制御部は、フォースパターンの異なる複数のユニットフォースパターンを記憶して、このユニットフォースパターンを組み合わせて合成フォースパターンを形成すると共に、この合成フォースパターンにより前記アクチュエータを制御して、前記操作部に感触を与えることを特徴とする力覚付与装置。

【請求項２】 前記複数のユニットフォースパターンの内の一つは、所定の値から力が増加した後力が減少する山形状、または所定の値から力が減少した後力が増加する谷形状で、クリック感触を与えるものであることを特徴とする請求項１記載の力覚付与装置。

【請求項３】 前記複数のユニットフォースパターンの内の一つは、所定の値から力が増加する上昇する傾斜を有し、減速感触を与えるものであることを特徴とする請求項１または２記載の力覚付与装置。

【請求項４】 前記複数のユニットフォースパターンの内の一つは、所定の値から力が減少する下降する傾斜を有し、加速感触を与えるものであることを特徴とする請求項１から３のいずれかに記載の力覚付与装置。

【請求項５】 前記複数のユニットフォースパターンの内の一つは、所定の値で力が変化しない水平な直線状で、一定の力の感触を与えるものであることを特徴とする請求項１から４のいずれかに記載の力覚付与装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、力覚付与装置に関し、特に、操作部に与えられるフォースパターンを、ユニットフォースパターンを準備することにより、これらユニットフォースパターンを組み合わせて作成する力覚付与装置に関する。

【０００２】

【従来の技術】従来の力覚付与装置を図６、７に基づいて説明する。図６は従来の力覚付与装置のブロック図、図７は従来の力覚付与装置のフォースパターンの発生力のグラフをそれぞれ示す。

【０００３】操作部としてのノブ５１は、所定の機能を出力するために回転可能に設けられている。

【０００４】位置センサ５２は、回転型エンコーダなどであって、ノブ５１の回転軸（図示せず）に取り付けられ、ノブ５１の回転角度位置を検出するようになっている。

【０００５】アクチュエータ５４は、電磁コイルやモータなどノブ５１に発生力を与えるものである。

【０００６】制御部５３は、図６に示すように、コントローラ５３ａとメモリ（ＲＯＭ）５３ｂから構成され、メモリ５３ｂは、各回転角度位置に応じて、発生力をアクチュエータ５４よりノブ５１へ加える各種フォースパターンのテーブル（パターン１～パターンＮ）を備え、コントローラ５３ａは位置センサ５２からノブ５１の回転角度位置の信号を受け、指定されたテーブルに記憶された回転角度位置に応じた発生力の出力の指示をアクチュエータ５４に出している。各種フォースパターンの各テーブルには、フォースパターンの種類（パターン１～パターンＮ）によりノブ５１の回転角度位置（位置１～位置ｎ）に対応して発生力（発生力１～発生力ｎ）が記憶されている。

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【０００７】各テーブル（パターン１，パターン２，パターン３；図６参照）の発生力と回転角度の関係は、図７Ａ～Ｃのグラフに示すようになっている。図７Ａに示すパターン１のフォースパターンは、ノブ５１の１回転３６０度中、８０度、１２０度、１６０度、３６０度の各回転角度でグラフの線の傾きが変わりクリック感触を持つ。図７Ｂに示すパターン２のフォースパターンは、ノブ５１の１回転３６０度中、同じパターンを３回繰り返し、８０度、１２０度、２００度、２４０度、３２０度、３６０度の各回転角度でグラフの線の傾きが変わりクリック感触を持つ。図７Ｃに示すパターン３のフォースパターンは、ノブ５１の１回転３６０度中、同じパターンを９回繰り返し、４０度おきの各回転角度でグラフの線の傾きが変わりクリック感触を持つ。各フォースパターンは異なる波形になっているためそれぞれの１回転中のクリック感触は異なる。

【０００８】従来の力覚付与装置の動作を説明する。ノブ５１を回転させると、ノブ５１の回転軸に取り付けられている回転角度の位置センサ５２がノブ５１の回転角度を検出する。検出された回転角度の信号は制御部５３に送られ、回転角度の信号を受け取った制御部５３は、メモリ５３ｂに記憶されている回転角度位置に対応する発生力のテーブル（パターン１、パターン２、・・・・パターンＮ）の内から指定されたテーブルを読み出して、コントローラ５３ａが回転角度位置に対応する発生力を出力するようにアクチュエータ５４に指示を出す。アクチュエータ５４はコントローラ５３ａから指示された発生力をノブ５１に出力するように動作する。ノブ５１はアクチュエータ５４の発生力を受けて所定の操作感触を出力する。

【０００９】

【発明が解決しようとする課題】しかしながら、上記した従来の力覚付与装置においては、フォースパターンの種類が増えると、必要とするメモリ量が増加し、必要なメモリ量を準備するのが困難になるという問題があった。

【００１０】従って、本発明の目的は、フォースパターンの種類が増えても必要とするメモリ量が少ない力覚付与装置を提供することにある。

【００１１】

【課題を解決するための手段】本発明の力覚付与装置

は、操作部と、操作部に感触（力覚）を与えるアクチュエータと、このアクチュエータを制御する制御部とを備え、前記制御部は、フォースパターンの異なる複数のユニットフォースパターンを記憶して、このユニットフォースパターンを組み合わせて合成フォースパターンを形成すると共に、この合成フォースパターンにより前記アクチュエータを制御して、前記操作部に感触を与える。この構成により、ユニットフォースパターンを組み合わせるので、数の少ないユニットフォースパターンを記憶するメモリと、ユニットフォースパターンを組み合わせるときの並べ方を記憶するメモリがあればよいので、フォースパターンの種類が増えても全体として必要なメモリ量（ＲＯＭ容量）が少なくなる。

【００１２】また、前記複数のユニットフォースパターンの内の一つは、所定の値から力が増加した後力が減少する山形状、または所定の値から力が減少した後力が増加する谷形状で、クリック感触を与えるものである。この構成により、山形状または谷形状のユニットフォースパターンを選ぶだけでよいので、容易にクリック感触を作り出せる。

【００１３】また、前記複数のユニットフォースパターンの内の一つは、所定の値から力が増加する上昇する傾斜を有し、減速感触を与えるものである。この構成により、所定の値から力が増加する上昇する傾斜を有するユニットフォースパターンを選ぶだけでよいので、容易に減速感触を得ることができる。

【００１４】また、前記複数のユニットフォースパターンの内の一つは、所定の値から力が減少する下降する傾斜を有し、加速感触を与えるものである。この構成により、所定の値から力が減少する下降する傾斜を有するユニットフォースパターンを選ぶだけでよいので、容易に加速感触を得ることができる。

【００１５】また、前記複数のユニットフォースパターンの内の一つは、所定の値で力が変化しない水平な直線状で、一定の力の感触を与えるものである。この構成により、所定の値で力が変化しない水平な直線状のユニットフォースパターンを選ぶだけでよいので容易に一定の力の感触を得ることができる。

【００１６】

【発明の実施の形態】本発明の力覚付与装置の実施形態について図１～図５に基づいて説明する。図１は本発明の力覚付与装置の実施形態の部分断面図、図２は本発明の力覚付与装置の実施形態のブロック図、図３は本発明の力覚付与装置の実施形態で用いられる合成フォースパターンのグラフ、図４は本発明の力覚付与装置の実施形態で用いられるユニットフォースパターンのグラフ、図５は本発明の力覚付与装置の実施形態のユニットフォースパターンの並べ方を示す図をそれぞれ示す。

【００１７】基台１は、絶縁樹脂製で、中央に孔１ａを有する円環状をなしている。

【００１８】プリント配線板２は、力覚付与装置に必要な制御部１２などを構成する各種電気部品（図示せず）を搭載し、基台１の下面に取り付けられている。

【００１９】アクチュエータ３は電磁コイルであって、鉄心にコイルを巻回して円環状に配置したもので、中央に円形の孔３ａを有し、このアクチュエータ３は基台１の上に設置されている。

【００２０】駆動体４は、絶縁樹脂製で、軸部４ａ、円板部４ｂ、リング状部４ｃからなり、円板状の円板部４ｂの周縁からリング状部４ｃが上方へ環状に立ち上がっており、円板部４ｂの中央に軸部４ａが円板部４ｂに対して垂直に形成されている。軸部４ａはアクチュエータ３の円形の孔３ａに回転可能に嵌合している。

【００２１】アーマチュア５は、鉄板を有し、中央に円形の孔５ａを有する円板状の形状をなしている。アーマチュア５は、その一方の面が駆動体４の円板部４ｂの下面にアーマチュア戻しバネ６を介して取り付けられている。アーマチュア５の他方の面はアクチュエータ３の上面に空間を介して対向している。

【００２２】係合部材７は、絶縁樹脂製で、リング状の側壁７ａと底板部７ｂからなり、円板状の底板部７ｂの周縁からリング状の側壁７ａが立ち上がった開口のある器状をなしている。係合部材７の側壁７ａは、駆動体４のリング状部４ｃを外側から包むように嵌合し、係合部材７と駆動体４とは互いに結合している。

【００２３】操作軸８は、金属製で、係合部７の底板部７ｂの中央に垂直に取り付け固定されている。操作軸８には太径部８ａが形成されている。

【００２４】位置センサ９は、回転角度位置を検出する回転型エンコーダであって、円筒形をなし、回転体と固定体（図示せず）からなり、回転体は操作軸８に取り付け固定され、固定体には突起９ａが設けられている。

【００２５】操作部としてのノブ１０は、絶縁樹脂からなり、円筒状をなして、中心に軸孔（図示せず）を有している。ノブ１０の軸孔には、操作軸８の上端部が嵌合している。

【００２６】パネル板１１は、金属板よりなり、表面は塗装されており、孔１１ａを有している。パネル板１１の孔１１ａには操作軸８が挿通され、パネル板１１の表面には操作軸８の太径部８ａが当接している。位置センサ９の固定体の突起９ａは、パネル板１１の図示せぬ孔に嵌合され、位置センサ９の固定体はパネル板１１に固定されている。また、位置センサ９は、操作軸８の軸方向で、パネル板１１と係合部材７との間に挟まれて位置している。

【００２７】次に、本発明の実施形態の力覚付与装置の動作について説明する。ノブ１０を回転させて操作軸８を回転すると、係合部７を介して駆動体４が回転する。この時、操作軸８は位置センサ９の回転体を回転させ、回転体の回転角の信号をプリント配線板２に搭載された

制御部１２へ送る。制御部１２は第１のメモリ（ＲＯＭ）１２ａに記憶されたユニットフォースパターン（ユニット１、ユニット２、ユニット３、・・・）の中から異なるユニットフォースパターンを取り出し、第２のメモリ（ＲＯＭ）１２ｂからユニットフォースパターンの並べ方のパターン（パターン１、パターン２、パターン３、・・・）の中から指定された並べ方のパターンを選び、選んだ並べ方のパターンに従って、各ユニットフォースパターンを並べて合成フォースパターンを作成し、制御部１２のコントローラ１２ｃへ送る。

【００２８】コントローラ１２ｃは合成フォースパターンに応じた電流をアクチュエータ３に送るよう指示を出す。電流を受けたアクチュエータ３は、受けた電流に応じて対向するアーマチュア５を吸引する。アーマチュア５はアクチュエータ３から、アクチュエータ３に与えた電流に応じた吸引力を受けるが、この時アーマチュア戻しバネ６がその厚さ方向に伸びて、アーマチュア５はアクチュエータ３の上面に吸着される。この状態で、ノブ１０を回転させようとすると、アーマチュア５がアクチュエータ３に吸着されているので、吸引力に応じた摩擦力が生じて、ノブ１０を回転させようとする回転トルクが増加する。このようにして所定の合成フォースパターンに対応した摩擦力（発生力）により、ノブ１０に所定の回転トルクが得られるようになっている。

【００２９】アクチュエータ３への通電を止めると、アクチュエータ３がアーマチュア５を吸引する吸引力はなくなるので、アーマチュア戻しバネ６が縮んで、アーマチュア５はアクチュエータ３の上面から離れ、ノブ１０はアーマチュア５の摩擦力がない状態で回転する。

【００３０】次に、各種合成フォースパターンとこの合成フォースパターンをユニットフォースパターンから作成する方法について説明する。図３には各種合成フォースパターンが示されている。図３Ａの合成フォースパターンは、ノブ１０の回転角度をゼロから増加させていくと、ノブ１０の回転トルクを上げる力（発生力）がゼロから徐々に増加し、８０度回転したところで発生力の増加が止まり減少し始める。更にノブ１０を回転させると発生力は減少し続け、１２０度で発生力の減少は止まり増加し始め、更にノブ１０を回転させると１６０度で発生力の増加が止まり、発生力は一定の値になる。この場合、発生力が増加から減少に移る回転角度位置、減少から増加に移る回転角度位置、増加から一定値になる回転角度位置でそれぞれクリック感触が得られる。従って、この場合、１回転３６０度中、回転角度位置が８０度、１２０度、１６０度でそれぞれクリック感触が得られることになる。

【００３１】図３Ｂの合成フォースパターンは、ノブ１０に対する発生力が一定で、１回転３６０度に渡って回転トルクが一定の重さになる。

【００３２】図３Ｃの合成フォースパターンは、ノブ１０の回転角度をゼロから増加させていくと、ノブ１０に対する発生力が徐々に増加し、８０度回転したところで発生力の増加は止まり減少し始める。更にノブ１０を回転させると発生力は減少し続け、１２０度で減少は止まる。この場合の合成フォースパターンは、１回転３６０度の中で、１２０度までの発生力の増減を３回繰り返す。この場合も、発生力の増加から減少に移る回転角度位置、減少から増加に移る回転角度位置において、それぞれノブ１０にクリック感触を生ずる。従って、この場合、クリック感触が得られるのは、１回転３６０度中、８０度、１２０度、２００度、２４０度、３２０度、３６０度の回転角度位置で、合計６回ある。

【００３３】図３Ｄの合成フォースパターンは、ノブ１０の回転角度をゼロから増加させていくと、ノブ１０のに対する発生力が所定の値から徐々に増加し、４０度回転したところで発生力の増加が止まる。この場合の合成フォースパターンは、４０度までの発生力の変化状態を１回転３６０度中９回繰り返す。従って、この場合のクリック感触は１回転３６０度中、４０度間隔で９回現れる。

【００３４】図３Ｅの合成フォースパターンは、ノブの回転角度をゼロから増加させていくと、ノブ１０に対する発生力が所定の値から徐々に減少し、４０度回転したところで発生力の減少が止まる。この場合の合成フォースパターンは、４０度までの発生力の変化状態を１回転３６０度中９回繰り返す。従って、この場合のクリック感触も１回転３６０度中、４０度間隔で９回現れる。

【００３５】図３Ｆの合成フォースパターンは、ノブ１０の回転角度をゼロから増加させていくと、ノブ１０に対する発生力が所定の値からから徐々に増加し、４０度回転したところで発生力が減少し始める。更にノブ１０を回転させると発生力は減少し続け、８０度で発生力の減少は止まる。この場合の合成フォースパターンは、８０度までの発生力の変化状態を１回転３６０度中４回繰り返し、その後０度－４０度の発生力の変化が加わる。この場合は発生力の増減の変化が、１回転３６０度中９回現れる。従って、この場合のクリック感触も１回転３６０度中、４０度間隔で９回現れる。

【００３６】但し、図３Ｄ、図３Ｅ、図３Ｆの合成フォースパターンのクリック感触は、発生のタイミングは同じであるが、感触そのものはフォースパターンの形状が違うためそれぞれ異なる感触となる。従って、図３Ａで得られるクリック感触も合成フォースパターンの形状が違うため、図３Ｄ、図３Ｅ、図３Ｆで得られるクリック感触とは違った感触になる。また、図３Ａ、図３Ｃの８０度におけるクリック感触はフォースパターンの形状が同じであるため同じ感触になる。

【００３７】上記した各種合成フォースパターンを作成するユニットフォースパターンは図４Ａ～図４Ｄに示されている。図４Ａに示すユニット１のユニットフォース

パターンは、０度－８０度の範囲で発生力がゼロから徐々に増加し、その後８０度－１２０度の範囲で発生力が８０度の値から徐々に減少し１２０度において所定の値まで下がる。ユニット１のフォースパターンの場合、８０度において発生力が増加から減少に移るため、８０度においてノブ１０の操作感触はクリック感触となる。

【００３８】図４Ｂに示すユニット２のユニットフォースパターンは、０度－４０度の範囲で発生力が所定の値から増加する上昇する傾斜を有するグラフ形状である。ユニット２のユニットフォースパターンの場合、回転角度の増加に伴って発生力が増加するので、ノブ１０の操作感触は減速感触となる。

【００３９】図４Ｃに示すユニット３のユニットフォースパターンは、０度－４０度の範囲で発生力が所定の値から減少する下降する傾斜を有するグラフ形状である。ユニット３のユニットフォースパターンの場合、回転角度の増加に伴って発生力が減少するので、ノブ１０の操作感触は加速感触となる。

【００４０】図４Ｄに示すユニット４のユニットフォースパターンは、０度－４０度の範囲で発生力が所定の値から変化せず、水平な直線状のグラフ形状である。ユニット４のユニットフォースパターンの場合、発生力が一定で、ノブ１０の回転トルクは一定の重さになる。

【００４１】上記各ユニットフォースパターンは制御部１２の第１のメモリ１２ａに記憶されている。また、各ユニットフォースパターンの並べ方は第２のメモリ１２ｂに記憶されている。図５Ａ～Ｆには並べ方のパターンが９個示されている。合成フォースパターンの種類が多い場合、各ユニットフォースパターン（図４Ａ～Ｄ）を記憶するメモリ量と、ユニットフォースパターンの並べ方（図５Ａ～Ｆ）を記憶するメモリ量の和は、各合成フォースパターン（図３Ａ～Ｆ）をそれぞれ記憶するメモリ量の和より格段に少なくなる。

【００４２】図３Ａに示す合成フォースパターンをユニットフォースパターンを用いて作成する場合、ユニットフォースパターンとして、ユニット１，ユニット２，ユニット４を用い、図５Ａに示すように、ユニット１とユニット２を各１個並べた後にユニット４を５個並べる。

【００４３】図３Ｂに示す合成フォースパターンをユニットフォースパターンを用いて作成する場合、ユニットフォースパターンとして、ユニット４を用い、図５Ｂに示すように、ユニット４を９個並べる。

【００４４】図３Ｃに示す合成フォースパターンをユニットフォースパターンを用いて作成する場合、ユニットフォースパターンとして、ユニット１を用い、図５Ｃに示すように、ユニット１を３個並べる。

【００４５】図３Ｄに示す合成フォースパターンをユニットフォースパターンを用いて作成する場合、ユニットフォースパターンとして、ユニット２を用い、図５Ｄに示すように、ユニット２を９個並べる。

【００４６】図３Ｅに示す合成フォースパターンをユニットフォースパターンを用いて作成する場合、ユニットフォースパターンとして、ユニット３を用い、図５Ｅに示すように、ユニット３を９個並べる。

【００４７】図３Ｆに示す合成フォースパターンをユニットフォースパターンを用いて作成する場合、ユニットフォースパターンとして、ユニット２，ユニット３を用い、図５Ｆに示すように、ユニット２とユニット３を各１個並べた組を４組並べ、その後にユニット２を１個並べる。図３Ａ～Ｆに示す合成フォースパターンの図において、回転角度０度は現在のノブ１０の位置としてもよいし、所定のある回転位置としてもよい。以上のようにして、ユニットフォースパターンから合成フォースパターンを作成する。

【００４８】尚、上記した実施形態においては、位置センサが検出する量として１次元である回転角度を採用したが、本発明はこれに限定されることなく、位置センサが検出する量としては操作部の並進する移動量を採用してもよい。

【００４９】また、上記した実施形態の合成フォースパターンは、上記実施形態のユニットフォースパターンの組み合わせに限定されず、様々な組み合わせを取ることができる。

【００５０】また、上記実施形態において、クリック感触を発生するユニットフォースパターンとして山形状のユニットフォースパターンを説明したが、本発明はこれに限定されることなく、クリック感触を得るためには谷形状のユニットフォースパターンを採用してもよい。

【００５１】また、上記実施形態において、アクチュエータ３を電磁コイルとして説明したが、本発明はこれに限定されることなく、アクチュエータ３としてＤＣモータを使用してもよく、ＤＣモータはノブ１０の操作軸８に直接、またはギヤなどを介して間接的に取り付けられ、ノブ１０の回転方向と同一回転方向に回転力（発生力）を与えるか、またはノブ１０の回転方向と逆方向に回転力を与えるようにしてもよい。

【００５２】

【発明の効果】以上説明したように、本発明の力覚付与装置は、操作部と、操作部に感触を与えるアクチュエータと、このアクチュエータを制御する制御部とを備え、制御部は、フォースパターンの異なる複数のユニットフォースパターンを記憶して、このユニットフォースパターンを組み合わせて合成フォースパターンを形成すると共に、この合成フォースパターンによりアクチュエータを制御して、操作部に感触を与える。

【００５３】上記構成により、ユニットフォースパターンを組み合わせるので、数の少ないユニットフォースパターンを記憶するメモリと、ユニットフォースパターンを組み合わせるときの並べ方を記憶するメモリがあればよいので、フォースパターンの種類が増えても全体とし

て必要なメモリ量（ＲＯＭ容量）が少なくなる。

【図面の簡単な説明】

【図１】本発明の力覚付与装置の実施形態の部分断面図である。

【図２】本発明の力覚付与装置の実施形態のブロック図である。

【図３】本発明の力覚付与装置の実施形態で用いられる合成フォースパターンのグラフである。

【図４】本発明の力覚付与装置の実施形態で用いられるユニットフォースパターンのグラフである。

【図５】本発明の力覚付与装置の実施形態のユニットフォースパターンの並べ方を示す図である。

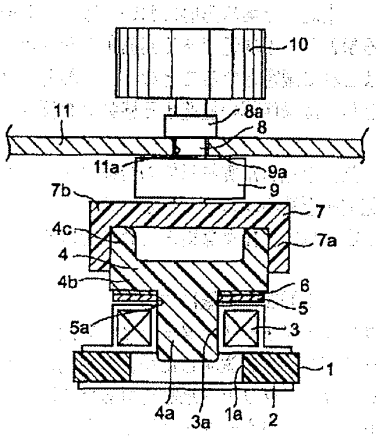
＊【図６】従来の力覚付与装置のブロック図である。

【図７】従来の力覚付与装置のフォースパターンの発生力のグラフである。

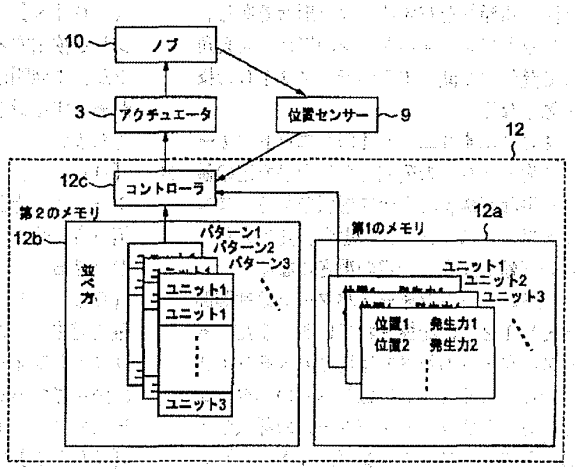
【符号の説明】

３　アクチュエータ
９　位置センサ
１０　ノブ（操作部）
１２　制御部
１２ａ　第１のメモリ
１２ｂ　第２のメモリ
１２ｃ　コントローラ

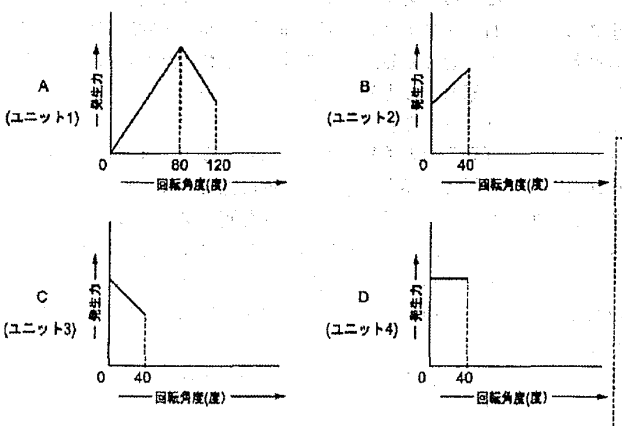
【図１】



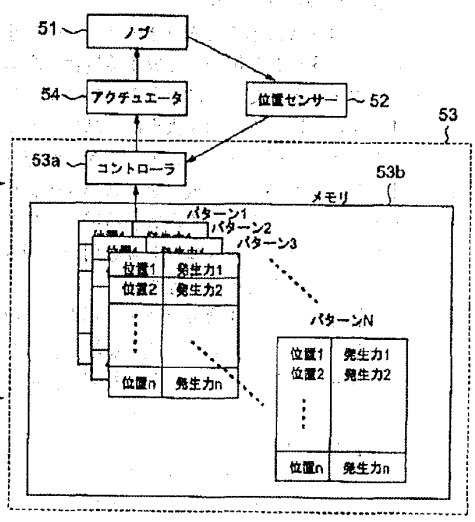
【図２】



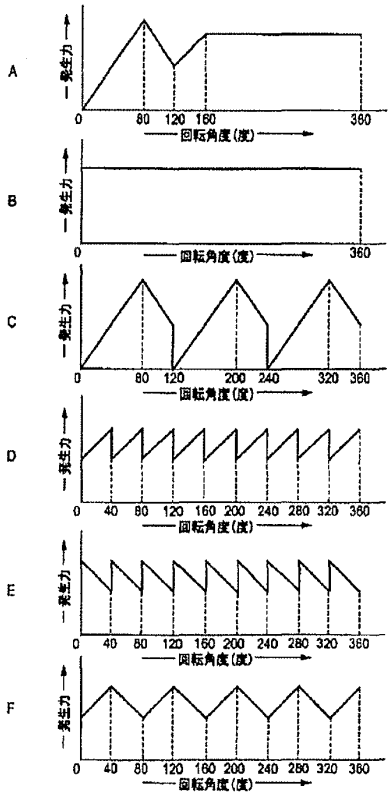
【図４】



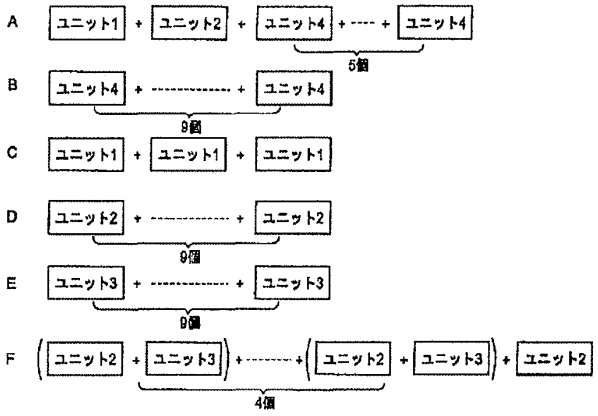
【図６】



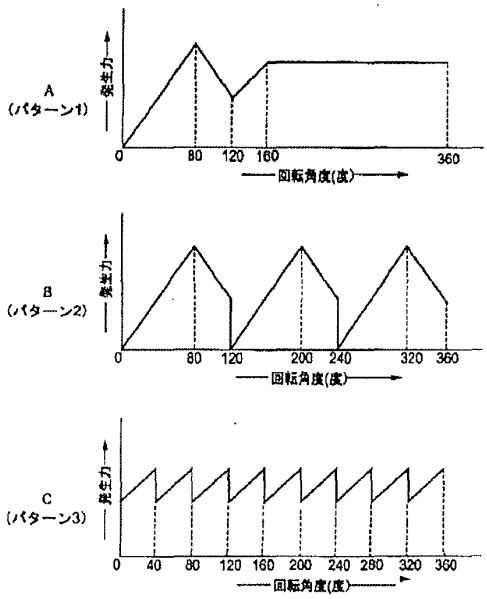
【図３】


A
B
C
D
E
F
発生力
回転角度(度)
0
40
80
120
160
200
240
280
320
360

【図５】


A
ユニット1
ユニット2
ユニット4
ユニット4
5個
B
ユニット4
ユニット4
9個
C
ユニット1
ユニット1
ユニット1
D
ユニット2
ユニット2
9個
E
ユニット3
ユニット3
9個
F
ユニット2
ユニット3
ユニット2
ユニット3
ユニット2
4個

【図７】


A
(パターン1)
B
(パターン2)
C
(パターン3)
発生力
回転角度(度)
0
40
80
120
160
200
240
280
320
360

Espacenet

Bibliographic data: JP2004094570 (A) — 2004-03-25

EQUIPMENT OPERATING DEVICE

No documents available for this priority number.

Inventor(s): IIZAKA ATSUSHI; SAKAMOTO KIYOMI; YAMASHITA ATSUSHI ± (IIZAKA ATSUSHI, ; SAKAMOTO KIYOMI, ; YAMASHITA ATSUSHI)

Applicant(s): MATSUSHITA ELECTRIC IND CO LTD ± (MATSUSHITA ELECTRIC IND CO LTD)

Classification: **- international:*B60R11/02; G06F3/023;*** (IPC1-7): B60R11/02; G06F3/023

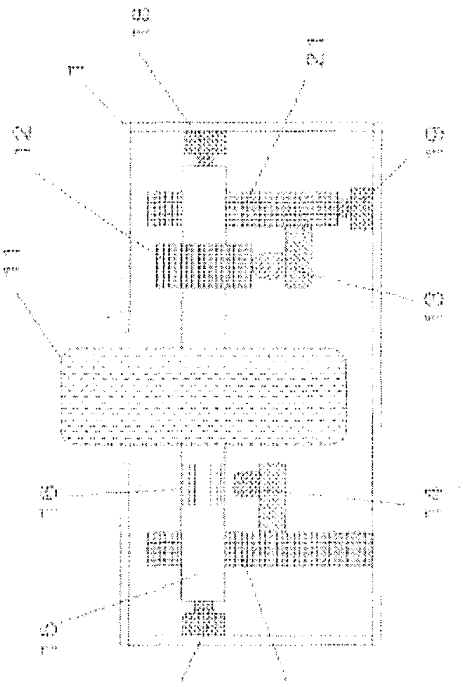
- cooperative:

Application number: JP20020254337 20020830

Priority number (s): JP20020254337 20020830

Abstract of JP2004094570 (A)

PROBLEM TO BE SOLVED: To provide a jog dial capable of conducting an operation for a menu arranged two-dimensionally by a natural-feeling force applying manner. ; SOLUTION: This device is provided with the columnar jog dial 11, the jog dial 11 is shift-operated along a rotary shaft direction (right and left direction) of the jog dial 11 in addition to a turning operation, the menu arranged two-dimensionally is selected by the turning operation and the shift operation along the left and right directions, and the turning operation allows both a digital operation having click-stop feeling and an analogue operation having no click-stop feeling. ; COPYRIGHT: (C)2004,JPO



Last updated: 13.03.2013 Worldwide
Database 5.8.11.1; 92p

JP 2004-94570 A 2004.3.25

PRIOR ART REFERENCE

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(P2004-94570A)
(43)公開日　平成16年3月25日(2004.3.25)

(51)Int.Cl.[7]	F I			テーマコード（参考）
G06F 3/023	G06F	3/023	340Z	3D020
B60R 11/02	B60R	11/02	C	5B020

審査請求 未請求　請求項の数 9　OL　（全 13 頁）

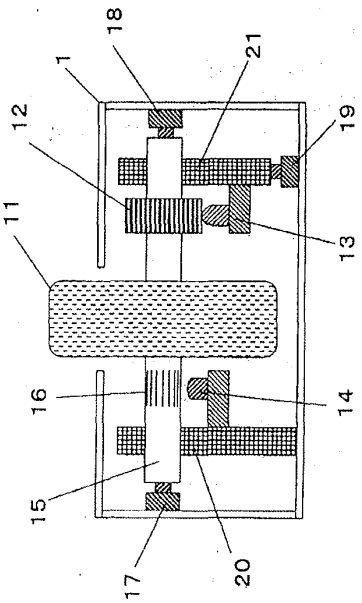
(21)出願番号　特願2002-254337(P2002-254337)
(22)出願日　平成14年8月30日(2002.8.30)

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最終頁に続く

(54)【発明の名称】機器操作装置

(57)【要約】
【課題】２次元に配置したメニューの操作を感覚的に自然な力の加え方で操作可能なジョグダイヤルを提供する。
【解決手段】円柱状のジョグダイヤル１１を装備し、ジョグダイヤル１１は回動操作に加えて、ジョグダイヤル１１の回転軸方向（左右方向）への移動操作が可能であり、回動操作と左右方向への移動操作により２次元に配置したメニューの選択を行うことができ、回動操作は節度感の有るデジタル的な操作と節度感の無いアナログ的な操作の両方を可能としている。
【選択図】　図３



PRIOR ART REFERENCE

【特許請求の範囲】
【請求項１】
回動操作と軸方向への移動操作とが可能な操作手段と、前記操作手段の回動方向および回動量を検出するエンコーダ手段と、前記操作手段の軸方向への移動方向を検出する左右移動検出手段とを備えることを特徴とする機器操作装置。
【請求項２】
請求項１記載の機器操作装置において、前記左右移動検出手段は前記操作手段と共に左右移動する軸の左右端によって押されるスイッチであることを特徴とする機器操作装置。
【請求項３】
請求項１記載の機器操作装置において、前記左右移動検出手段は前記操作手段と共に左右移動する軸に設置したスイッチ操作部によって押されるスイッチであることを特徴とする機器操作装置。
【請求項４】
請求項３記載の機器操作装置において、前記左右移動検出手段のスイッチは１つのスライドスイッチであることを特徴とする機器操作装置。
【請求項５】
請求項１記載の機器操作装置において、前記左右移動検出手段は前記操作手段の左右端によって押されるスイッチであることを特徴とする機器操作装置。
【請求項６】
請求項１～５のいずれかに記載の機器操作装置において、前記操作手段の回動操作に節度感を与えるクリック機構を有することを特徴とする機器操作装置。
【請求項７】
請求項６に記載の機器操作装置において、前記クリック機構が節度感を発生するタイミング信号を出力することを特徴とする機器操作装置。
【請求項８】
請求項６または７に記載の機器操作装置において、前記クリック機構は節度感の有無を切換え可能な機構を有することを特徴とする機器操作装置。
【請求項９】
請求項８に記載の機器操作装置において、前記クリック機構における節度感の有無を操作対象であるメニューの内容応じて切り換えることを特徴とする機器操作装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】
本発明は、機器の操作を行う機器操作装置に関し、特に、車両などに搭載される空調システムやナビゲーション、オーディオなどの機器の操作を行う機器操作装置に関する。
【０００２】
【従来の技術】
従来、携帯電話端末に搭載されている、いわゆるジョグダイヤルは、円筒型の操作部（ジョグダイヤル）が携帯電話端末の前面に突出するように設けられ、この円筒型の操作部を回動操作することができるとともに、携帯電話端末の内側方向に押下操作ができるようにされている。そして、ジョグダイヤルの回動操作は、例えば、画面に表示された縦に並んだメニューなどの選択項目の選択動作を意味し、ジョグダイヤルの押下操作は、その選択項目の決定動作を意味するものとして用いられている。また、円筒型のジョグダイヤルの左右には押下操作可能なボタンが設けられており、当該ボタンによってメニューの左右方向選択が可能となっている。特開２００２－９１６９４号公報には円柱状のジョグダイヤルの一端を押下操作しながら回動操作する方法は開示されている。
【０００３】
【発明が解決しようとする課題】
ところが、前述した従来の携帯電話のジョグダイヤルはメニューの左右方向選択をボタンの押下操作により行っているが、押下操作のための力を加える方向とメニュー選択の方向

とがことなるため感覚的不一致が生じる。また、押下操作にはメニューの左右方向選択と選択項目の決定の２つがあり、誤操作しやすい。

【０００４】

また、特開２００２－９１６９４号公報のジョグダイヤルも、操作のために力を加える方向と画面に表示されたメニュー選択の方向とが一致しないため、感覚的不一致が生じ操作しにくい。

【０００５】

特に、車両に搭載される機器を操作する場合には、運転者が車両の運転への注意力を妨げられないように、できるだけ感覚的に操作しやすい機器操作装置が求められている。このため、操作のための力を加える方向とメニュー選択の方向を一致させることが必要である。

【０００６】

本発明は、縦方向のメニュ選択、横方向のメニュー選択、選択項目の決定を回動操作と軸方向への移動操作とを可能にすることにより一つの操作手段のみで操作でき、かつ操作のために加える力の方向とメニュー選択の方向が一致することにより、感覚的に操作しやすい機器操作装置を提供することを目的とする。

【０００７】

【課題を解決するための手段】

上記課題を解決するため、第１の発明の機器操作装置は、回動操作と、軸方向への移動操作とが可能にされた操作手段と、操作手段の回動方向および回動量を検出するエンコーダ手段と、操作手段の軸方向への移動方向を検出する左右移動検出手段とを備えることを特徴とする。

【０００８】

この第１の発明の機器操作装置によれば、操作手段に側方から力を加えることにより左右方向のメニュー選択が可能となり、操作のために力を加える方向とメニュー選択方向を一致させることができ、操作性が向上し誤操作が減少する。

【０００９】

第２の発明の機器操作装置は、第１の発明の機器操作装置において、左右移動検出手段は操作手段と共に左右移動する軸の左右端によって押されるスイッチであることを特徴とする。

【００１０】

この第２の発明の機器操作装置によれば、シンプルな構成で、操作手段に側方から力を加えることにより左右方向のメニュー選択を可能とし、操作性が向上し誤操作が減少する。

【００１１】

第３の発明の機器操作装置は、第１の発明の機器操作装置において、左右移動検出手段は操作手段と共に左右移動する軸に設置したスイッチ操作部によって押されるスイッチであることを特徴とする。

【００１２】

この第３の発明の機器操作装置によれば、シンプルな構成でかつ軸方向の長さを増加させることなく、操作手段に側方から力を加えることにより左右方向のメニュー選択を可能とし、操作性が向上し誤操作が減少する。

【００１３】

第４の発明の機器操作装置は、第３の発明の機器操作装置において、左右移動検出手段のスイッチは１つのスライドスイッチであることを特徴とする。

【００１４】

この第４の発明の機器操作装置によれば、シンプルな構成でかつ軸方向の長さを増加させることなく、さらに左右方向の移動検出を１つのスイッチで実現し、操作手段に側方から力を加えることにより左右方向のメニュー選択を可能とし、操作性が向上し誤操作が減少する。

【００１５】

第５の発明の機器操作装置は、第１の発明の機器操作装置において、左右移動検出手段は操作手段の左右端によって押されるスイッチであることを特徴とする。

【００１６】

この第５の発明の機器操作装置によれば、シンプルな構成でかつ軸方向の長さを増加させることなく、かつ軸にスイッチ操作部を設ける必要も無く、操作手段に側方から力を加えることにより左右方向のメニュー選択を可能とし、操作性が向上し誤操作が減少する。

【００１７】

第６の発明の機器操作装置は、第１～５の発明のいずれかの機器操作装置において、操作手段の回動操作に節度感を与えるクリック機構を有することを特徴とする。

【００１８】

この第６の発明の機器操作装置によれば、２次元的に構成されたメニューの選択を縦方向、横方向共にそれぞれの方向の力でデジタル的に選択でき、操作性が向上する。

【００１９】

第７の発明の機器操作装置は、第６の発明の機器操作装置において、クリック機構が節度感を発生するタイミング信号を出力することを特徴とする。

【００２０】

この第７の発明の機器操作装置によれば、出力するタイミング信号を用いて節度感と表示画面の変更タイミングを同期させることができ操作性がより向上する。

【００２１】

第８の発明の機器操作装置は、第６または第７の発明の機器操作装置において、クリック機構は節度感の有無を切換え可能な機構を有することを特徴とする。

【００２２】

この第８の発明の機器操作装置によれば、２次元的に構成されたメニューの選択を縦方向、横方向共にそれぞれの方向の力でデジタル的に選択でき、かつ無段階で調整するアナログ的な入力も可能となる。

【００２３】

第９の発明の機器操作装置は、第８の発明の機器操作装置において、クリック機構における節度感の有無を操作対象であるメニューの内容に応じて切り換えることを特徴とする。

【００２４】

この第９の発明の機器操作装置によれば、デジタル的なメニュー選択とアナログ的な入力がメニューの内容に応じて自動的に切り換わり、機器操作装置は多機能デバイスとしてさらに操作性が向上する。

【００２５】

【発明の実施の形態】

以下、図面を参照しながら、本発明による機器操作装置の一実施の形態について説明する。

【００２６】

以下に説明する実施の形態においては、車両に本発明による機器操作装置を搭載した場合を説明する。図１は、本実施の形態の機器操作装置が搭載された車両のコックピット部分の外観を説明するための図である。

【００２７】

図１に示すように、１は機器操作装置、３はディスプレイである。機器操作装置１は運転席と助手席の間で、センタコンソールの延長部に設置されており、運転者または助手席の乗員が手で操作するようになっている。操作対象はナビゲーションシステムやオーディオ、空調、テレビなどであり、操作を行うためのメニューはディスプレイ３に表示される。

【００２８】

図２は機器操作装置１の外観図である。図２に示すように、機器操作装置１には機器の操作対象を選択するためのボタン４～８とボタン４～８によって選択された操作対象のメニュー操作を行うための操作手段１１が装備されている。ボタンの数は片手の指の本数にあわせて５つとしており、見なくてもボタンが押せるように配置している。機器操作装置１

はシリアル通信などの通信手段により車載機器２に接続されており、機器操作装置１の操作により車載機器２を操作することができるようになっている。また、車載機器２から機器操作装置１へメニューの情報を送ることもできる。

【００２９】

次に、図３を用いて、機器操作装置１の操作手段１１に回動操作と、軸方向への移動操作と、押下操作とを可能にさせる機構について説明する。操作手段１１は４輪車のタイヤのような円筒形状をしており、操作手段１１の中心を貫通している軸１５に固定されている。操作手段１１の形状は回動操作と軸方向への移動操作がしやすい形状が好ましく、２輪車のタイヤのような形状をしていてもよい。軸１５は軸受け２０，２１により回転可能に支持されるとともに左右方向にスライド可能に支持される。軸１５の両端にはスイッチ１７，１８が設置されており、軸１５が左または右方向にスライドすることにより、それぞれスイッチ１７または１８が押される。また、軸１５には光エンコーダ１４によって軸１５の回転を検出するために等間隔の線１６がバーコードのように印刷されている。等間隔の線１６の長さは軸１５が左右移動しても回転が検出できる程度になっている。さらに、クリック機構１３とギア１２が設けられており、軸１５に固定されたギア１２が回転しクリック機構１３と接触することにより、操作手段１１の回動操作に節度感を与えることができる。等間隔の線１６の線の数はギア１２の歯数の４倍に設定しており、ギア１２の歯（凸部）の中央位置と等間隔の線１６の線の位置が一致するようにしている。クリック機構１３は節度感の有無をギア１２との接触の有無により切換可能な機構を有し、メニューに応じてデジタル的な回動（節度感あり）およびアナログ的な回動（節度感なし）を実現できる。この機構により、操作手段１１を回動操作するとその回転が軸１５の回転として光エンコーダ１４によって検出される。なお、等間隔の線１６はギア１２の側面に印刷すればギア１２の歯の中央位置と等間隔の線１６の位置を一致させやすくなる。

【００３０】

次に、図４を用いて操作手段１１の軸方向への移動操作について説明する。

【００３１】

図４に示すように操作手段１１に左右方向へ力を加えると軸１５が左右にスライドしてスイッチ１７または１８を押し、左右方向への移動操作が検出される。移動操作が検出された後、軸１５にはスイッチ１７または１８に内蔵のバネによって元の位置へ戻す力が働き、軸１５および操作手段１１は元の位置へ押し戻される。このとき左右移動検出手段はスイッチ１７、１８によって構成されており、もっともシンプルな構成である。なお、スイッチ１７、１８は軸１５の端によって直接押されなくとも力を伝達する機構を介して間接的に押されるようにしてもよい。

【００３２】

次に図３を用いて操作手段１１の押下操作について説明する。

【００３３】

スイッチ１９は操作手段１１の押下操作を検出する。スイッチ１９は操作手段１１の押下操作により軸１５によって軸受け２１が押下げられて押される。このとき軸受け２０は動かないが、軸１５の傾きを許容する遊びを有した軸受けになっている。好ましくは、軸受け２０も軸受け２１と同様に上下に動く構造にし、操作手段１１が押下操作によって真下へ下がるようにするとよい。なお、軸受け２０の軸受け部分を軸１５の角度変化が可能な構造（ピロ軸受け）にしてもよい。

【００３４】

次に、図５、６を用いて節度感の有無を切り換える機構について説明する。

【００３５】

図５は機器操作装置１のクリック機構１３の説明図、図６は機器操作装置１の節度感の有無の説明図である。

【００３６】

クリック機構１３のベース部３４は軸受け２１に設置させており、ベース部３４にはギア１２と接触して節度感を発生させる板バネ３０が板バネ固定ネジ３５によって固定されて

いる。板バネ３０の凸部はギア１２の凹部と接触するように固定されており、ギア１２が回転することによってギア１２の凸部によって板バネ３０が押下げられ、さらにギア１２が回転すると板バネ３０の凸部はギア１２の凹部に接触する。このとき操作手段１１の回動操作によって節度感が発生する。節度感を持たせているときも回転量の検出は光エンコーダ１４によって行うため、軸１回転に対してギア１２の歯数の４倍の数だけ印刷されている等間隔の線１６中で、どの線がギア１２の歯（凸部）に対応するかが分からない。そこで、ギア１２の歯（凸部）が板バネ３０を押下げた時に押されるスイッチ３７と、スイッチ３７を押すためのバー３６を設け、等間隔の線１６のどの線がギア１２の歯（凸部）に対応するかが分かるようにしており、節度感が得られるタイミング信号を出力できるようになっている。なお、ギア１２の歯数と等間隔の線１６の線の数を同一にすることによって、節度感が得られるタイミング信号の出力を光エンコーダにさせてもよい。

【００３７】

また、板バネ３０は凸部の先で９０度に曲げられその先がさらに９０度に曲げられたＬ字型の板バネコントロール部３１になっている。ベース部３４には押し出し機構３３と押し出し機構３３により押し出されるピストン３２が取り付けられており、押し出し機構３３によりピストン３２が押し出されると板バネコントロール部３１がピストン３２によって押下げられ、板バネ３０の凸部はギア１２が回転してもギア１２と接触しなくなり、操作手段１１の回動操作に節度感が無い状態となる。図６は、板バネコントロール部３１がピストン３２によって押下げられた状態を示している。押し出し機構３３はソレノイドであり、ピストンを押し出すことができる。板バネ３０の凸部がギア１２と接触しない状態まで下がることをスイッチ３７によって妨げられないようにスイッチ３７のストロークは大きくとっている。

【００３８】

次に、図７、８、９を用いて左右移動検出手段の別の構成について説明する。

【００３９】

左右移動検出手段は図７に示すように、スイッチ１７、１８を設置して軸１５に取り付けたスイッチ操作部２２によって押されるようにしてもよく、この構成にすることによって機器操作装置１の軸方向の長さを短くすることができる。

【００４０】

また、左右移動検出手段は図８に示すように、スライドスイッチ２４とスイッチ操作部２３によって構成することもできる。操作手段１１に左右方向へ力を加えると軸１５が左右にスライドして、スイッチ操作部２３がスライドスイッチ２４に接触することにより、スライドスイッチ２４を左右に操作する。この構成により、機器操作装置１の軸方向の長さが短くなることに加え、左右移動検出手段を１つのスイッチで実現できる。

【００４１】

さらに、左右移動検出手段は図９に示すように、スイッチ１７，１８を軸受け２０，２１上に設置することにより、操作手段１１の側面によってスイッチ１７，１８を直接または間接的に押すような機構にすることもできる。

【００４２】

次に、図１０、１１、１２を用いて機器操作装置１の使用例について空調の設定を例にして説明する。、図１０、１１、１２は、機器操作装置１により空調操作を行う場合のディスプレイの表示例である。本実施の形態では、操作対象にはボタン４～８のそれぞれに空調、オーディオ、テレビ、ナビゲーション、インフォメーションを割り当てている。ボタン４～８に割り当てる操作対象や順序は異なっていてもよい。

【００４３】

空調の設定を行うためには、図２のボタン４を押して操作対象を空調に設定する。ボタン４を押すと同時にモニター３には図１０または１１または１２のような表示例１００が表示される。空調の設定では吹き出し口の設定と温度設定と風量設定の３つの設定を行うことができる。設定項目選択枠１１０の位置によって、どの項目の設定変更が可能な状態にあるかを確かめることができる。図１０では吹き出し口の設定が可能な状態にあり、図１

１では温度設定が可能な状態にあり、図１２では風量設定が可能な状態にある。ボタン４が押された時点での設定項目選択枠１１０の位置は前回最後に設定した項目の位置となる。設定項目選択枠１１０の位置を変更するには操作手段１１に左右方向の力を加えて軸方向への移動操作を行う。図１０のように吹き出し口の設定が可能な状態から図１２の風量設定が可能な状態に変更するには操作手段１１を２回右方向に押す。表示例１００において現在選択させている設定項目に対して、新たに設定したい項目の表示されている方向と同じ方向に力を加えて操作手段１１を操作することで設定項目を変更することができ、感覚的に自然である。

【００４４】

次に３つの設定項目における設定変更について説明する。

【００４５】

まず、図１０を用いて吹き出し口の設定について説明する。シンボル１０１、１０２、１０３、１０４、１０５は自動車の空調システムにおける吹き出し口の位置を表したものであり、このシンボルを選択することによって吹き出し口の位置を変更することができる。シンボル１０１はフロントウィンドウの曇り止めのために主に用いる。シンボル１０２はフロントウィンドウの曇り止めと足元から風が出る。シンボル１０３はインパネ上部から風が出る。シンボル１０４はインパネ上部と足元から風が出る。シンボル１０５は足元から風が出る。そして、シンボル１０６は空調システムによる自動設定であり、適切な吹き出し口から風が出る。

【００４６】

吹き出し口選択枠１０７は現在選択されているシンボルを囲むように配置される。図１０ではシンボル１０４が選択されている。吹き出し口の変更は設定項目選択枠１１０がシンボル１０１～１０６を囲む位置にあるときのみ可能である。図１０は吹き出し口の変更が可能な状態を表している。吹き出し口の変更には操作手段１１を回動操作し、車両の前方向きに力を加えて回転させるとシンボル１０３、シンボル１０２、シンボル１０１へと選択が変更され、逆に回転させるとシンボル１０５、シンボル１０６へと選択が変更される。吹き出し口の選択は６つの項目選択であるため、シンボルを変更するごとに節度感が得られるようになっている。そのため、設定項目選択枠１１０がシンボル１０１～１０６を囲む位置にあるときはクリック機構は節度感が有る状態になる（図５）。

【００４７】

選択された吹き出し口は、他の設定を行ったり空調以外の機能操作を行ったりしても、新たに吹き出し口の変更をするまで変わらない。

【００４８】

次に、図１１を用いて温度設定について説明する。設定温度表示部１１３に現在設定されている車室内温度が表示されており、設定温度表示バー１１２にも設定温度目盛１１１に対応した現在の設定温度が表示されている。設定温度の変更は設定項目選択枠１１０が設定温度表示部１１３、設定温度表示バー１１２、設定温度目盛１１１を囲む位置にあるときにのみ可能となる。

【００４９】

設定温度の変更が可能な状態で操作手段１１を回動操作することにより、設定温度を変更することができる。車両の前方向きに力を加えて回転させると設定温度が上昇し、逆に回転させると設定温度が下降する。設定温度が変更されると同時に設定温度表示部１１３および設定温度表示バー１１２が変化する。本実施の形態の空調システムでは設定温度は０．５℃単位で変更可能であるため、０．５℃の変化毎に節度感を持たせるようにしており、設定項目選択枠１１０が温度設定が可能な位置にある場合、クリック機構は節度感が有る状態になる（図５）。また、本実施の形態の空調システムでは設定できる温度の範囲が１６℃以上、３２℃以下であるため、設定温度１６℃の状態で温度を下げる操作をしたり、設定温度３２℃の状態で温度を上げる操作をしても設定温度は変化しない。

【００５０】

設定温度は他の設定を行ったり空調以外の機能操作を行っても、新たに設定温度の変更を

するまで変わらない。

【００５１】

最後に、図１２を用いて風量設定について説明する。風量設定は大きく３つに分かれている。１つ目は手動で風量設定が自由に行える手動設定であり、手動風量設定枠１２３の輝度が高くなっているときに手動設定が選択されている。２つ目は空調システムにおける自動風量設定であり、自動風量設定枠１２４の輝度が高くなっているときに自動設定が選択されている。３つ目は送風無しであり、送風無枠１２５の輝度が高くなっているときに送風無しが選択させている。

【００５２】

図１２では手動風量設定枠１２３の輝度が高くなっており、手動設定が選択されている。風量表示バー１２２は手動設定により設定されている風量を表しており、設定範囲１２１の下端が送風ゼロ（風量無し）であり、上端が風量最大である。風量の変更は設定項目選択枠１１０が手動風量設定枠１２３、自動風量設定枠１２４、送風無枠１２５を囲む位置にある場合にのみ可能である。風量の変更が可能な状態で操作手段１１を回動操作することによって風量を変更することができる。図１２では手動風量設定枠１２３の輝度が高くなっており、手動設定が選択されているので、操作手段１１を車両の前方向きに力を加えて回転させると風量が増加し、逆に回転させると風量は減少する。手動設定における風量は風量ゼロから風量最大まで無段階で調整できるようになっているため、手動風量設定枠１２３の輝度が高くなった手動設定の状態においてクリック機構は節度感が無い状態となる（図６）。

【００５３】

本実施の形態の空調システムでは手動操作における風量最大の状態で風量を増加させる操作をしても風量は変化しない。一方、手動操作における風量ゼロの状態で風量を減少させる方向の操作を行った場合、クリック機構が節度感ありの状態に変化し、節度感を伴って手動設定から自動風量設定（ＡＵＴＯ）に切り換わり自動風量設定枠１２４の輝度が高くなる。さらに操作手段１１を車両の後ろ方向に力を加えて回転させると節度感を伴って送風無設定（ＯＦＦ）となり、送風無枠１２５の輝度が高くなる。逆に送風無設定の状態から操作手段１１を車両の前方向に力を加えて回転させると節度感を伴って自動風量設定となり、さらに回転させると節度感を伴って手動設定となり、さらに回転させると節度感の無い状態に変化し、手動設定による風量設定が行えるようになる。

【００５４】

いずれの設定を行っている場合においても、操作対象を切り換えるためのボタン４～８が押されれば、新たな操作対象の操作画面が表示され、新たな操作が行えるようになる。

【００５５】

【発明の効果】

以上説明したように、本発明の機器操作装置によれば、２次元に配置されたメニューに対して、変更したい方向に力を加えて操作することができるため、操作の為に加える力の方向が感覚的に自然であるため操作性がよく誤操作が少なくなるという効果がある。

【００５６】

また、回動操作においては節度感の有るデジタル的な操作と節度感の無いアナログ的な操作をメニューに応じて切り換え可能なため、誤操作が少なくなると共に操作効率がよくなるという効果がある。

【図面の簡単な説明】

【図１】本発明の一実施の形態による機器操作装置の搭載位置の説明図

【図２】本発明の一実施の形態による機器操作装置の外観図

【図３】本発明の一実施の形態による機器操作装置の断面図

【図４】本発明の一実施の形態による機器操作装置の左右方向操作の説明図

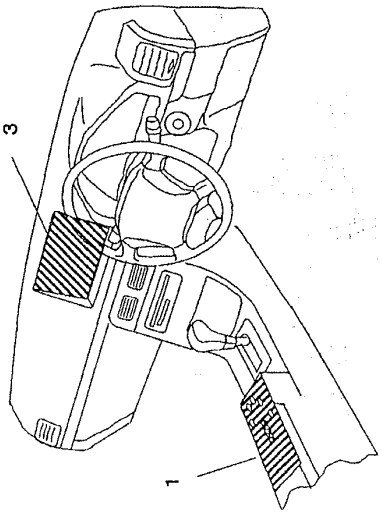
【図５】本発明の一実施の形態による機器操作装置のクリック機構の説明図

【図６】本発明の一実施の形態による機器操作装置の節度感の有無の説明図

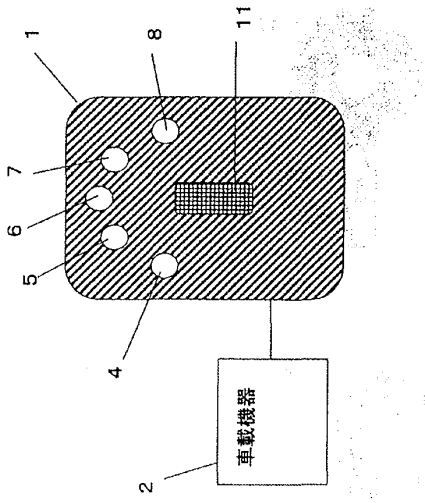
【図７】本発明の一実施の形態による機器操作装置の左右方向操作を検出するスイッチの

別の設置例の説明図
【図８】本発明の一実施の形態による機器操作装置の左右方向操作を検出するスイッチの別の設置例の説明図
【図９】本発明の一実施の形態による機器操作装置の左右方向操作を検出するスイッチの別の設置例の説明図
【図１０】本発明の一実施の形態による機器操作装置により空調操作を行う場合のディスプレイの表示例を示す図
【図１１】本発明の一実施の形態による機器操作装置により空調操作を行う場合のディスプレイの表示例を示す図
【図１２】本発明の一実施の形態による機器操作装置により空調操作を行う場合のディスプレイの表示例を示す図
【符号の説明】
１　機器操作装置
３　ディスプレイ
４～８　ボタン
１１　操作手段
１７　スイッチ
１８　スイッチ
１００　表示例

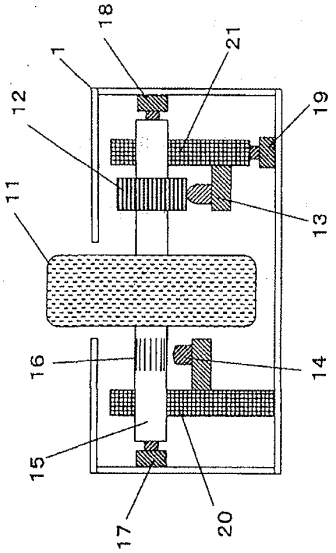
【図１】



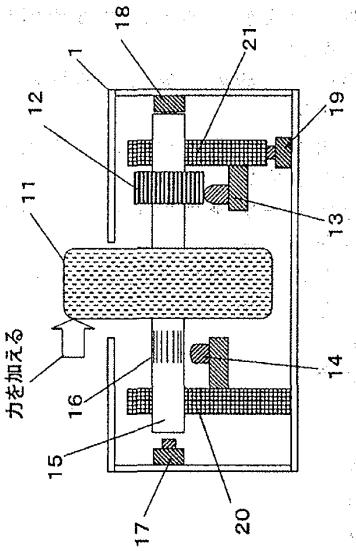
【図２】



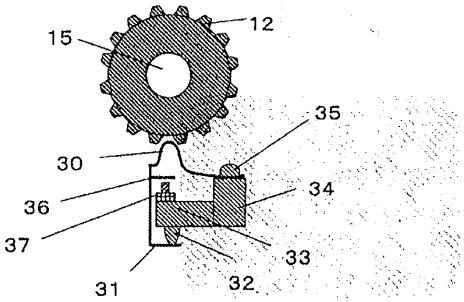
【図３】


18
1
21
12
19
11
13
16
14
15
17
20

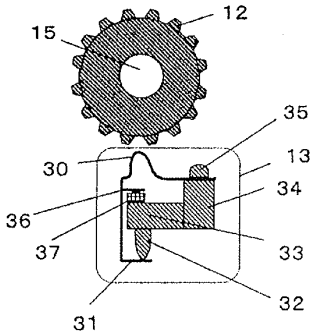
【図４】


18
1
21
12
19
11
13
力を加える
16
14
15
17
20

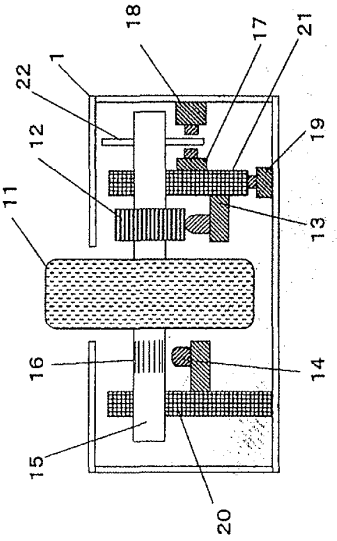
【図５】


15
12
35
30
34
36
37
33
31
32

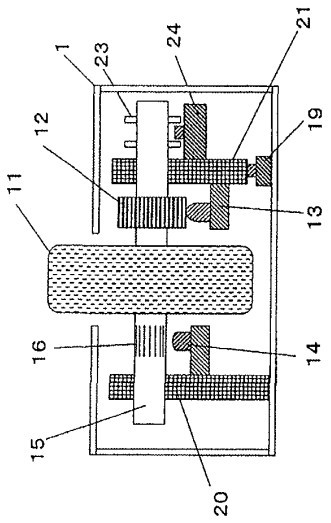
【図６】


15
12
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36
37
33
32
31

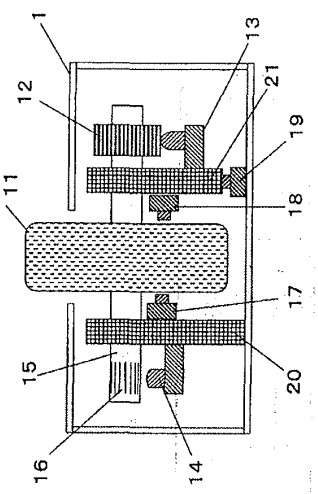
【図７】


18
17
21
22
1
12
19
11
13
16
14
15
20

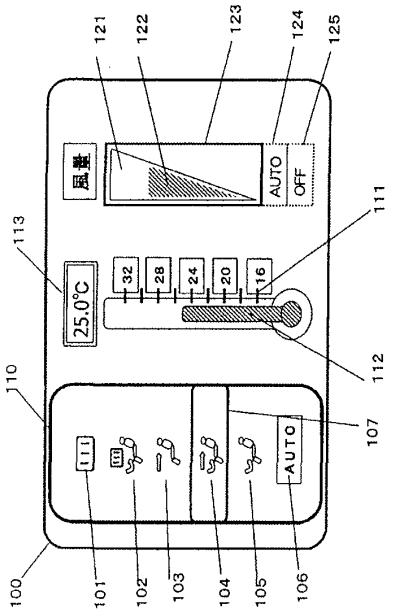
【図８】



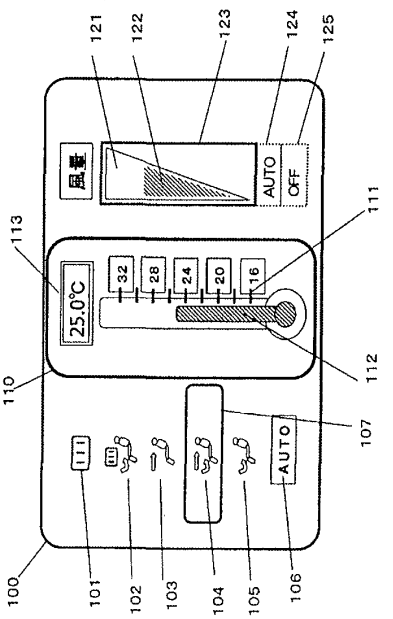
【図９】



【図１０】

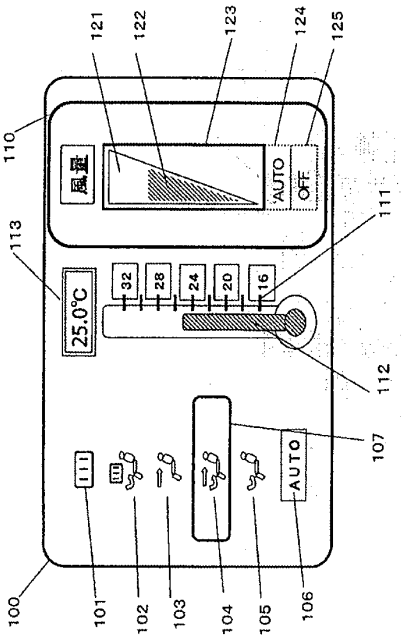


【図１１】



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【図１２】


121
122
123
124
125
110
風量
AUTO
OFF
111
113
32
28
24
20
16
25.0℃
112
107
AUTO
100
101
102
103
104
105
106

フロントページの続き

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Espacenet

Bibliographic data: JP2006251845 (A) — 2006-09-21

INNER FORCE SENSE APPLYING TYPE INPUT DEVICE

No documents available for this priority number.

Inventor(s): HAYASAKA SATORU; KURIBAYASHI HIROMI ± (HAYASAKA SATORU, ; KURIBAYASHI HIROMI)

Applicant(s): ALPS ELECTRIC CO LTD ± (ALPS ELECTRIC CO LTD)

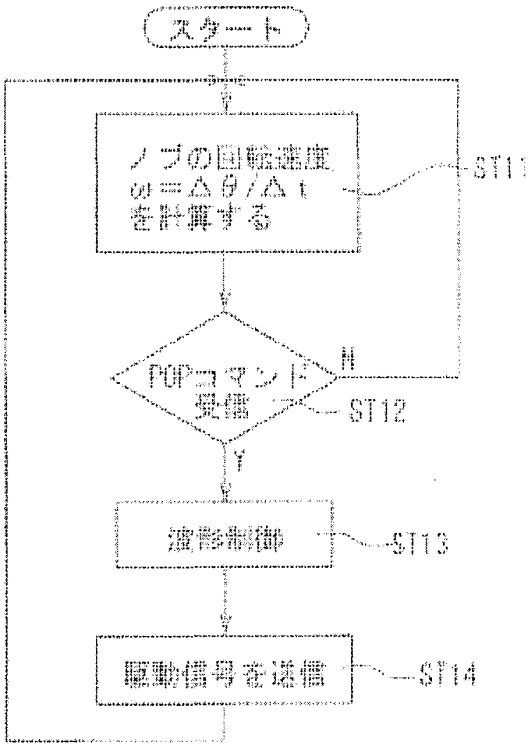
Classification: **- international:** ***G05G5/03; G05G7/04; G06F3/01***
- cooperative:

Application number: JP20050063287 20050308

Priority number (s): JP20050063287 20050308

Abstract of JP2006251845 (A)

PROBLEM TO BE SOLVED: To give a sense of operation by pop force to a user, and to stop a cursor, a pointer, or the like in a position intended by the user even when the user lets go of a control knob from this state. ; SOLUTION: A rotational speed of the control knob 6 is calculated on the basis of a rotational angle signal. It is judged whether a pop force command is being received. When the user is operating the control knob in a state of generating pop force, control of changing a waveform of the pop force is carried out, and a drive signal is outputted to a manual operation part by using the waveform. ; COPYRIGHT: (C) 2006,JPO&NCIPI



Last updated: 13.03.2013 Worldwide Database 5.8.11.1; 92p

PRIOR ART REFERENCE

(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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(51) Int.Cl.			F I			テーマコード（参考）
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G05G	5/03	(2006.01)	G05G	5/03	B	
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審査請求 未請求　請求項の数 4　OL　（全 8 頁）

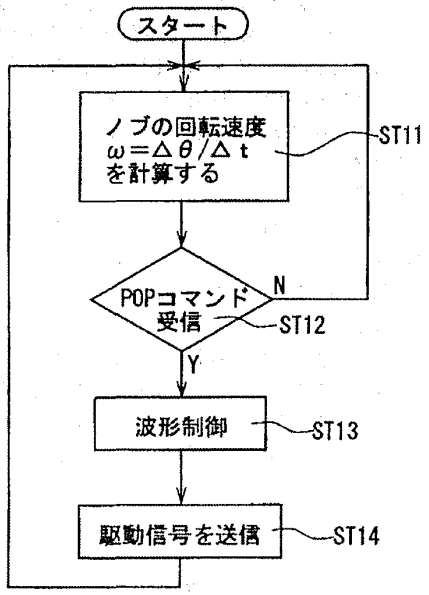
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Fターム(参考)　3J070 AA14　BA07　BA17　BA90　DA01

(54)【発明の名称】力覚付与型入力装置

(57)【要約】
【課題】ユーザに対してポップフォースによる操作体感を与えると共に、この状態からユーザが操作ノブから手を離してもユーザが意図する位置にカーソルやポインタなどを停止させること。
【解決手段】回転角信号に基づいて操作ノブ６の回転速度を計算する。ポップフォースコマンドを受信しているかを判断する。ポップフォースが発生する状態でユーザが操作ノブ６を操作している場合に、ポップフォースの波形を変える制御を行い、その波形を用いて手動操作部に対して駆動信号を出力する。
【選択図】図４



PRIOR ART REFERENCE

【特許請求の範囲】
【請求項１】
手動操作可能な手動操作手段と、前記手動操作手段に力覚を付与するアクチュエータと、前記手動操作手段の回転状態に基づく位置信号を出力すると共に、前記アクチュエータの駆動制御を行う制御手段と、を具備し、前記制御手段は、前記位置信号が第１領域に隣接する第２領域にあるときに、前記位置信号を前記第２領域から前記第１領域に復帰させる復帰反力を発生するように前記アクチュエータの駆動制御を行うと共に、前記位置信号が前記第２領域にあるときにポップフォースを付与する駆動信号を出力し、前記ポップフォースは、前記手動操作手段を戻す第１の力と、前記手動操作手段を送る第２の力とからなり、少なくとも前記第２領域から前記第１領域に戻る際には、前記第１の力が前記第２の力よりも相対的に小さくなることを特徴とする力覚付与型入力装置。
【請求項２】
前記ポップフォースは、少なくとも前記第２領域から前記第１領域に戻る際には、前記手動操作手段を送る前記第２の力のみになることを特徴とする請求項１記載の力覚付与型入力装置。
【請求項３】
前記制御手段は、前記手動操作手段の回転状態に基づいて前記手動操作手段の回転速度を求める速度演算手段と、前記速度演算手段の結果に基づいて前記ポップフォースの波形を制御する波形制御手段と、を具備することを特徴とする請求項１又は請求項２記載の力覚付与型入力装置。
【請求項４】
前記波形制御手段は、前記手動操作手段を送る前記第２の力のみになるように波形を制御することを特徴とする請求項３記載の力覚付与型入力装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は入力装置に関し、特に少なくとも一方向に手動操作可能な手動操作部を備えた力覚付与型入力装置に関する。
【背景技術】
【０００２】
従来より、車載用機器を手動で操作する際に、力覚付与型入力装置が使用されている。この力覚付与型入力装置は、操作ノブを回転させて、操作ノブの回転軸に取り付けられたセンサにより回転角度を検出し、この回転角度の位置に対応する力覚（トルク）を求め、操作ノブに取り付けられたアクチュエータにこの力覚を付与する指示を送り、アクチュエータが操作ノブに力覚を付与する。これにより、ユーザは、操作ノブの力覚を受けて所定の操作感触を得る。
【０００３】
【特許文献１】特開２００３－２９５９５９号公報
【発明の開示】
【発明が解決しようとする課題】
【０００４】
このような力覚付与装置においては、所定の領域、例えばディスプレイに表示されている領域を超えてカーソルやポインタなどを移動させるために操作ノブを回転の限界まで大きく回転させて画面スクロールを行うときに、操作ノブにポップフォース（画面の段階的なスクロールなどをユーザに体感させるために所定の間隔で所定時間発生させる瞬発回転力）を付与する。
【０００５】
しかしながら、画面スクロールを行っている状態からユーザが操作ノブから手を離すと、ポップフォースにより操作ノブが必要以上に回転してユーザが意図する位置にカーソルやポインタなどを停止させることができないという問題がある。

【０００６】
本発明はかかる点に鑑みてなされたものであり、ユーザに対してポップフォースによる操作体感を与えると共に、この状態からユーザが操作ノブから手を離してもユーザが意図する位置にカーソルやポインタなどを停止させることができる力覚付与型入力装置を提供することを目的とする。
【課題を解決するための手段】
【０００７】
本発明の力覚付与型入力装置は、手動操作可能な手動操作手段と、前記手動操作手段に力覚を付与するアクチュエータと、前記手動操作手段の回転状態に基づく位置信号を出力すると共に、前記アクチュエータの駆動制御を行う制御手段と、を具備し、前記制御手段は、前記位置信号が第１領域に隣接する第２領域にあるときに、前記位置信号を前記第２領域から前記第１領域に復帰させる復帰反力を発生するように前記アクチュエータの駆動制御を行うと共に、前記位置信号が前記第２領域にあるときにポップフォースを付与する駆動信号を出力し、前記ポップフォースは、前記手動操作手段を戻す第１の力と、前記手動操作手段を送る第２の力とからなり、少なくとも前記第２領域から前記第１領域に戻る際には、前記第１の力が前記第２の力よりも相対的に小さくなることを特徴とする。
【０００８】
この構成によれば、ユーザが第２領域（復帰反力付与領域）から第１領域（選択移動領域）に戻す場合に、ポップフォースの波形を制御するので、ポップフォースにより操作ノブが必要以上に勝手に回転することがなくなり、ユーザが意図した位置にカーソルやポインタなどを停止することが可能となる。
【０００９】
本発明の力覚付与型入力装置においては、前記ポップフォースは、少なくとも前記第２領域から前記第１領域に戻る際には、前記手動操作手段を送る前記第２の力のみになることが好ましい。本発明の力覚付与型入力装置においては、前記制御手段は、前記手動操作手段の回転状態に基づいて前記手動操作手段の回転速度を求める速度演算手段と、前記速度演算手段の結果に基づいて前記ポップフォースの波形を制御する波形制御手段と、を具備することが好ましい。この場合において、前記波形制御手段は、前記手動操作手段を送る前記第２の力のみになるように波形を制御することが好ましい。
【発明の効果】
【００１０】
本発明によれば、手動操作可能な手動操作手段と、前記手動操作手段に力覚を付与するアクチュエータと、前記手動操作手段の回転状態に基づく位置信号を出力すると共に、前記アクチュエータの駆動制御を行う制御手段と、を具備し、前記制御手段は、前記位置信号が第１領域に隣接する第２領域にあるときに、前記位置信号を前記第２領域から前記第１領域に復帰させる復帰反力を発生するように前記アクチュエータの駆動制御を行うと共に、前記位置信号が前記第２領域にあるときにポップフォースを付与する駆動信号を出力し、前記ポップフォースは、前記手動操作手段を戻す第１の力と、前記手動操作手段を送る第２の力とからなり、少なくとも前記第２領域から前記第１領域に戻る際には、前記第１の力が前記第２の力よりも相対的に小さくなるので、ユーザに対してポップフォースによる操作体感を与えると共に、この状態からユーザが操作ノブから手を離してもユーザが意図する位置にカーソルやポインタなどを停止させることができる。
【発明を実施するための最良の形態】
【００１１】
以下、本発明の実施の形態について添付図面を参照して詳細に説明する。本実施の形態においては、力覚付与型入力装置がディスプレイを有する車載機器の力覚付与型入力装置である場合について説明する。なお、本発明において、第１領域とは、力覚の観点からは操作感触付与領域であり、画面表示の観点からは選択移動領域又は連続移動領域であり、第２領域とは、力覚の観点からは復帰反力付与領域であり、画面表示の観点からは画面スクロール領域である。

【００１２】
本実施の形態においては、ディスプレイに表示されている文字や項目を選択する場合の力覚付与型入力装置の制御について説明する。図１は、本実施の形態に係る力覚付与型入力装置の手動操作部の構成を示す正面図である。図１において、力覚付与型入力装置は、電磁コイルで構成されたアクチュエータ１を有する。このアクチュエータ１には、操作軸２が挿通されており、一方の端部（下端）側にはコード板３が取り付けられており、他方の端部（上端）には、操作ノブ６が取り付けられている。コード板３は、その面が操作軸２の軸方向と直交するように操作軸２に取り付けられている。コード板３の側方には、コード板３の周縁部を囲繞するように回転角センサであるフォトインタラプタ４が配置されている。したがって、操作ノブ６を回転することにより、操作軸２に取り付けられたコード板が操作ノブ６の回転に応じて回転し、その回転をフォトインタラプタ４で検出するようになっている。また、アクチュエータ１と操作ノブ６との間には、パネル板５が配置されている。

【００１３】
図２は、本発明の実施の形態１に係る力覚付与型入力装置の構成を示す図である。この力覚付与型入力装置は、図１に示す手動操作部（図２においては、操作ノブ６、アクチュエータ１としての回転モータ及びフォトインタラプタ４で示している）と、手動操作部を制御する制御部７とを有する。この力覚付与型入力装置は、車載機器本体側を制御する本体側制御部８と電気的に接続されており、この本体側制御部８は、ディスプレイ９の表示を制御するように構成されている。

【００１４】
制御部７は、フォトインタラプタ４から出力される回転状態、すなわち回転角信号に基づいて回転速度を求める回転速度演算部７３と、回転速度演算部７３で算出された回転速度にしたがってポップフォース（画面の段階的なスクロールなどをユーザに体感させるために所定の間隔で所定の時間発生させる瞬発回転力）の波形を制御する波形制御部７２と、回転位置情報を力覚（トルク）情報に変換する変換部７４と、回転位置情報と力覚情報とを対応づける情報（例えばテーブル）を格納したメモリ７５と、変換部７４から出力される力覚情報と波形制御部７２から出力されるポップフォースの波形情報とに基づいて駆動信号を生成し出力する力覚制御部７１とを有する。

【００１５】
次に、上記構成を有する力覚付与型入力装置の動作について説明する。図３は、本発明の実施の形態１に係る力覚付与型入力装置の操作反力の状態を説明するための図である。ここでは、例示として、図２に示すディスプレイ９の表示を左に移動させる場合に、反時計回りに操作ノブ６を回転させ、表示を右に移動させる場合に、時計回りに操作ノブ６を回転させる。なお、操作ノブ６の回転方向と表示の移動方向との関係は、これに限定されず、ディスプレイ９の表示を左に移動させる場合に、時計回りに操作ノブ６を回転させ、表示を右に移動させる場合に、反時計回りに操作ノブ６を回転させても良い。図２に示すディスプレイ９において、表示「Ｄ」から表示「Ｃ」に移動させる場合、操作ノブ６を反時計回りに回転させる。すなわち、図３における選択移動領域（操作感触付与領域）内のＳ５からＳ４に移動する。このとき、操作ノブ６の回転により操作軸２が回転すると共にコード板３が回転する。この回転はフォトインタラプタ４により検出され、回転により発生した回転角の信号が制御部７の回転速度演算部７３及び変換部７４に送られる。

【００１６】
回転速度演算部７３においては、フォトインタラプタ４からの回転角信号に基づいて操作ノブ６の回転速度を算出する。変換部７４においては、回転角信号に対応する回転位置信号を本体側制御部８に出力する。また、変換部７４においては、メモリ７５に格納された回転位置情報と力覚（トルク）情報との関係を用いてトルク情報を力覚制御部７１に送る。また、回転速度の情報は、波形制御部７２に出力され、後述するポップフォースの波形制御において用いられる。本体側制御部８では、制御部７からの位置信号に基づいてディスプレイ９の表示を「Ｄ」から「Ｃ」に移動させる表示制御を行う。また、本体側制御

部８は、手動操作部に対してクリック感に相当する力覚を付与するコマンドを制御部７の力覚制御部７１に出力する。力覚制御部７１は、本体側制御部８のコマンドにしたがって手動操作部の回転モータに駆動信号を出力する。

【００１７】

駆動信号が回転モータに出力される、すなわち回転モータに所定の電流が流れると、回転モータは、はじめに回転操作方向と反対方向の回転トルクを徐々に大きくなるように操作ノブ６に付与し、Ｓ５とＳ４の中間地点からＳ４までにおいて回転操作方向と同じ方向の回転トルクを徐々に小さくなるように操作ノブ６に付与する。

【００１８】

すなわち、図３に示すように、上記のような選択移動領域（操作感触付与領域：第１領域）では、例えばＳ５からＳ４に向けてはじまる操作では、操作ノブ６を回転させる際に、その操作方向の逆方向に加えられる操作反力、いわゆる力覚（トルク）が付与される。この力覚は、図３に示すように、操作ノブ６の回転量（位置）に比例して大きくなる。これは、ディスプレイ９の表示では、カーソル（図２においては枠で表わす）「Ｄ」から「Ｃ」に移動する直前の位置までに対応する。そして、ディスプレイ９の表示で枠が「Ｃ」に移動すると、急激に操作反力の向きが逆方向になる、すなわち表示「Ｃ」領域への引き込み力が力覚として付与される。このようにして、図３に示す選択移動領域においては、操作ノブ６の回転により、操作ノブ６への力覚の付与と、ディスプレイ９の表示の移動とが連動して行われる。

【００１９】

ディスプレイ９に表示されている領域を超えて枠を移動させるために操作ノブ６を回転の限界まで大きく回転させると、すなわち、図３において、選択移動領域である第１領域から画面スクロール領域（復帰反力付与領域：第２領域）、すなわち第２領域に移行すると、上記と同じように回転角の信号が制御部７の回転速度演算部７３に送られ、回転角信号から回転速度が求められると共に、変換部７４により回転速度から変換された位置信号が本体側制御部８に出力される。本体側制御部８では、制御部７からの位置信号がディスプレイ９の範囲外である、すなわち画面スクロール状態であるかどうかを判断し（例えば図３におけるE_0点）、画面スクロール状態である場合には、ポップフォースと呼ばれる力覚を付与するコマンドを制御部７の力覚制御部７１に対して出力する。力覚制御部７１では、コマンドにしたがって、図３に示すような波形のポップフォースＸを駆動信号としてアクチュエータ１に出力する。アクチュエータ１はポップフォースの駆動信号に基づいて操作ノブ６に力覚を付与する。また、本体側制御部８では、制御部７からの位置信号に基づいてディスプレイ９の表示を次々にスクロールさせる表示制御を行う。ここで、ポップフォースＸは、操作ノブ６を戻す力x_1と、操作ノブ６を送る力、すなわちx_1と反対方向の力x_2とを有する力である。

【００２０】

このようにユーザが操作ノブ６を画面スクロール領域まで回転させて画面スクロールを行っている状態で、目的とする位置で枠を停止させる場合には、ユーザは操作ノブ６から手を離す。このとき、図３における画面スクロール領域から選択移動領域に移行して上述したように目的とする位置で枠を停止させようとするが、選択移動領域直前の位置、すなわち図３におけるE_1でポップフォースＸと同じ波形のポップフォースが発生すると、このポップフォースのために操作ノブ６が回転して目的とする位置から枠がずれてしまう。このため、ポップフォースを発生させている状態からユーザが操作ノブ６から手を離したときに、その操作ノブ６の回転速度に応じてポップフォースを制御する。すなわち、ユーザが操作ノブ６から手を離すと、操作ノブ６が勢いよく回転するので、その回転速度を検出して、その回転速度に応じてポップフォースの波形を変える。具体的には、図３に示すように、選択移動領域近傍でのポップフォースの波形を変える（ポップフォースＹ）。

【００２１】

制御部７の波形制御部７２では、ポップフォースＸの波形を図５（ａ）に示すような波形に変える制御を行う。図５（ａ）に示すポップフォースは、ポップフォースＸに比べて

、操作ノブ６を戻す力x_1（第１の力）が弱くなっており、相対的に操作ノブ６を戻す力x_1（第１の力）が操作ノブ６を送る力x_2（第２の力）よりも弱くなっている。このようにポップフォースにおける操作ノブ６を戻す力x_1（第１の力）を相対的に弱くしている。ユーザが操作ノブ６から手を離した後において、操作ノブ６が必要以上に勝手に回転するのは、操作ノブ６を戻す力が大きいことによるので、このようにポップフォースにおける操作ノブ６を戻す力x_1（第１の力）を相対的に弱くすることにより、操作ノブ６が必要以上に勝手に回転することを防止できる。なお、ポップフォースＸの波形を変える場合において、図５（ｂ）に示すように、操作ノブ６を送る力x_2（第２の力）のみになるように波形を制御しても良い。このようにしても、操作ノブ６が必要以上に勝手に回転することを防止できる。

【００２２】

図４は、本発明の実施の形態１に係る力覚付与型入力装置におけるポップフォースの制御を説明するためのフロー図である。まず、制御部７の回転速度演算部７３において、回転角信号に基づいて操作ノブ６の回転速度$\omega = \Delta\theta / \Delta t$を計算する（ＳＴ１１）。次いで、ポップフォース（ＰＯＰ）コマンドを受信しているか、すなわちユーザが操作ノブ６をポップフォースが発生する状態（ユーザが操作ノブ６を画面スクロール領域まで回転させて画面スクロールを行っている状態）で操作しているかどうかを判断する（ＳＴ１２）。次いで、波形制御部７２において、回転速度に応じてポップフォースの波形を変える制御を行う（ＳＴ１３）。すなわち、波形制御部１２１において、ポップフォースＸの波形を図５（ａ）又は図５（ｂ）に示すような波形に変える。そして、この波形を含む駆動信号を手動操作部に対して出力する（ＳＴ１４）。

【００２３】

このように本実施の形態においては、ユーザが操作ノブ６を画面スクロール領域まで回転させて画面スクロールを行っている状態（復帰反力付与領域）から手を離して選択移動領域（操作感触付与領域）に戻す場合に、回転速度に応じてポップフォースの波形を変えるような制御を行う。このため、ポップフォースにより操作ノブ６が必要以上に勝手に回転することがなくなり、ディスプレイ９においてユーザが意図した位置にカーソルや枠を停止させることが可能となる。

【００２４】

本発明は上記実施の形態に限定されず、種々変更して実施することが可能である。上記実施の形態において、添付図面に図示されている部材の構成（特に手動操作部の構成）、材料などについては、これに限定されず、本発明の効果を発揮する範囲内で適宜変更することが可能である。また、上記実施の形態においては、操作ノブを回転する場合について説明しているが、本発明は、操作ノブを上下左右方向に平行移動させた場合においてポップフォースを発生させる構成についても適用することが可能である。この場合においては、位置信号は回転状態から求めるのではなく、平行移動状態から求める。また、上記実施の形態においては、操作ノブが戻る際に波形を制御する場合について説明しているが、本発明においては、特別な波形制御を行わずに、もともと記憶されているポップフォースの波形を第１の力が第２の力よりも相対的に小さくなるようにしても良い。その他、本発明の目的の範囲を逸脱しない限りにおいて適宜変更して実施することが可能である。

【図面の簡単な説明】

【００２５】

【図１】本実施の形態に係る力覚付与型入力装置の手動操作部の構成を示す正面図である。

【図２】本発明の実施の形態に係る力覚付与型入力装置の構成を示す図である。

【図３】本発明の実施の形態に係る力覚付与型入力装置の操作反力の状態を説明するための図である。

【図４】本発明の実施の形態に係る力覚付与型入力装置におけるポップフォースの波形制御を説明するためのフロー図である。

【図５】（ａ），（ｂ）は、本発明の実施の形態に係る力覚付与型入力装置のポップフォ

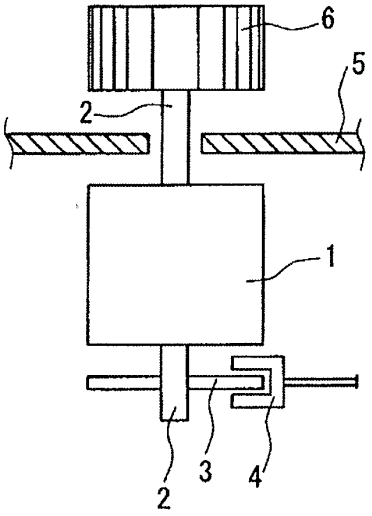
ースの波形を説明するための図である。

【符号の説明】

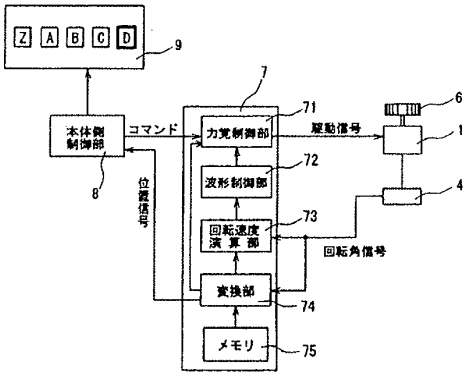
【００２６】

１　アクチュエータ
２　操作軸
３　コード板
４　フォトインタラプタ
５　パネル板
６　操作ノブ
７　制御部
８　本体側制御部
９　ディスプレイ
７１　力覚制御部
７２　波形制御部
７３　回転速度演算部
７４　変換部
７５　メモリ

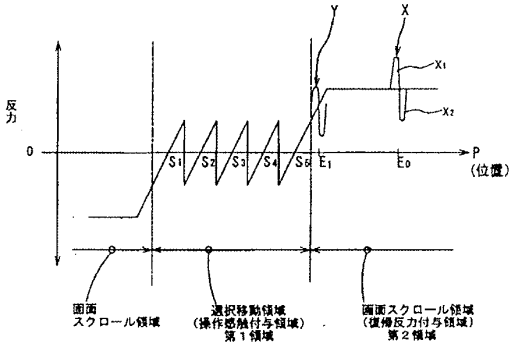
【図１】



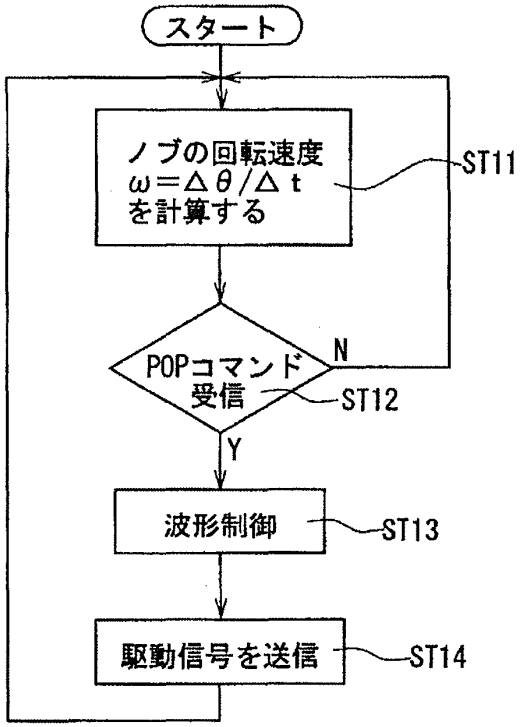
【図２】



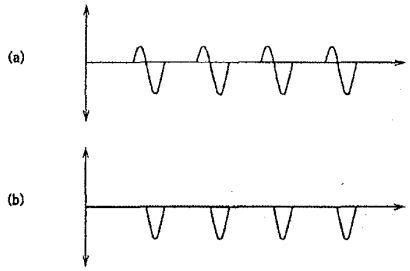
【図３】



【図４】


スタート
ノブの回転速度
ω＝△θ/△ｔ
を計算する
ST11
POPコマンド
受信
ST12
N
Y
波形制御
ST13
駆動信号を送信
ST14

【図５】


(a)
(b)

Espacenet

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SWITCH DEVICE

No documents available for this priority number.

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Applicant(s): TOKAI RIKA CO LTD ± (TOKAI RIKA CO LTD)

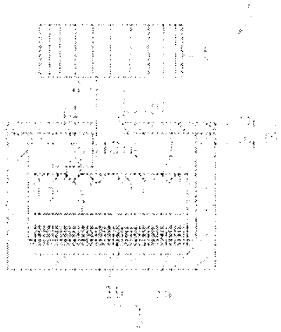
Classification: - international: ***B60R16/02; H01H19/02; H01H19/11; H01H19/20; H01H9/16***
- cooperative: **H01H19/03**; H01H2003/008; H01H3/503; H01H3/52

Application number: JP20060295566 20061031

Priority number (s): JP20060160841 20060609 ; JP20060295566 20061031

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Abstract of JP2008016426 (A)



PROBLEM TO BE SOLVED: To provide a switch device high in general versatility which can be stopped and held at an arbitrary operation position and thus the operation region of which can be changed and set arbitrarily. SOLUTION: A switch operation shaft 4 rotatably supported on a switch case 2 is stuck to a driven plate 6 made of a magnetic substance. An electromagnet 3 is placed in the switch case 2 and slidably fixed to the lower surface of the driven plate 6. When a current is supplied to a coil 3b of the electromagnet 3 to make the electromagnet 3 generate a magnetic force; the driven plate 6 is attracted/fixed by/to the electromagnet 3, and can makes a switch operation shaft 4 be stopped and held at an arbitrary operation position. ; COPYRIGHT: (C)2008,JPO&INPIT

Last updated: 13.03.2013 Worldwide Database 5.8.11.1; 92p

PRIOR ART REFERENCE

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B60R 16/02	***(2006.01)***	H01H 9/16	G	

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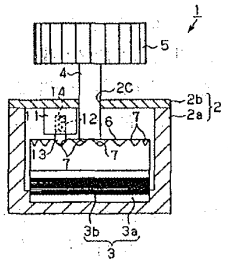
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最終頁に続く

(54)【発明の名称】スイッチ装置

(57)【要約】
【課題】任意の操作位置に停止保持することができ、ひいてはその操作範囲を任意に変更設定できて汎用性の高いスイッチ装置を提供する。
【解決手段】スイッチケース２に回転可能に支持されたスイッチ操作軸４は、磁性体よりなる従動板６を固着している。スイッチケース２内には、その従動板６の下面と摺接可能に電磁石３が配置固定されている。電磁石３のコイル３ｂに電流を供給して電磁石３に磁力を発生させると、従動板６は電磁石３に吸着され固定され、スイッチ操作軸４を任意な操作位置で停止保持させることができる。
【選択図】図２



PRIOR ART REFERENCE

【特許請求の範囲】
【請求項１】
スイッチ操作軸を操作しその操作位置に応じて機器の制御量を設定するスイッチ装置において、
前記スイッチ操作軸の動きに従動する従動部材と、
磁力の誘起に基づいて前記従動部材を吸着固定して、前記従動部材を介して前記スイッチ操作軸の操作位置を停止保持する吸着部材と
を備えたことを特徴とするスイッチ装置。
【請求項２】
請求項１に記載のスイッチ装置において、
前記スイッチ操作軸は、スイッチケースに対して回転可能に支持され、前記スイッチ操作軸を回転操作することで前記操作位置を切り換える操作軸であり、
前記従動部材は、前記スイッチ操作軸に対して一体回転するように取着され、
前記吸着部材は、前記スイッチケースに対して固定され、前記従動部材を吸着固定し、その従動部材に対する吸着力にて前記スイッチ操作軸を回転停止に保持することを特徴とするスイッチ装置。
【請求項３】
請求項１又は２に記載のスイッチ装置において、
前記従動部材は、前記スイッチ操作軸の動きに従動するように同スイッチ操作軸に設けた磁性体であり、前記吸着部材は、前記磁性体を吸着固定する電磁石であることを特徴とするスイッチ装置。
【請求項４】
請求項３に記載のスイッチ装置において、
前記スイッチ操作軸の操作位置を検出し、予め定めた操作位置にスイッチ操作軸が位置したとき前記電磁石を駆動させる制御回路を設けたことを特徴とするスイッチ装置。
【請求項５】
請求項２～４にいずれか１つに記載のスイッチ装置において、
前記スイッチケースには、前記スイッチ操作軸に節度感を付与する節度機構を設けたことを特徴とするスイッチ装置。
【請求項６】
請求項５に記載のスイッチ装置において、
前記節度機構は、前記スイッチケース及び前記従動部材のうちの一方において該従動部材が動く方向に並設された複数の溝と、他方において、少なくとも前記吸着部材による前記スイッチ操作軸の非吸着状態における前記従動部材の動きに応じて各溝に選択的に嵌合するように設けられた節度ピースとを有する非吸着作用型節度機構を含むことを特徴とするスイッチ装置。
【請求項７】
請求項５又は６に記載のスイッチ装置において、
前記吸着部材は、弾性部材を介して前記スイッチケースに対して固定され、
前記節度機構は、予め設定された前記スイッチ操作軸の複数の操作位置において前記吸着部材による該スイッチ操作軸の吸着・非吸着を行うことにより、それら操作位置において前記スイッチ操作軸に節度感を付与する吸着作用型節度機構を備えていることを特徴とするスイッチ装置。
【請求項８】
請求項７に記載のスイッチ装置において、
前記弾性部材は、前記吸着部材と前記スイッチケースとの間に介在されたゴムであることを特徴とするスイッチ装置。
【請求項９】
スイッチ操作軸を操作しその操作位置に応じて機器の制御量を設定するスイッチ装置において、

前記スイッチ操作軸の動きに従動する従動部材と、
磁力の誘起に基づいて前記従動部材を吸着固定して、前記従動部材を介して前記スイッチ操作軸の操作位置を停止保持する吸着部材と、
前記吸着部材をスイッチケースに固定するべくそれらの間に介在された弾性部材と、
予め設定された前記スイッチ操作軸の複数の操作位置において前記吸着部材による該スイッチ操作軸の吸着・非吸着を行うことにより、それら操作位置において前記スイッチ操作軸に節度感を付与する節度付与手段と
を備えたことを特徴とするスイッチ装置。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、各種機器を作動させる際に操作するスイッチ装置に関する。
【背景技術】
【０００２】
従来、各種機器を作動させる際に操作するスイッチ装置として、回転操作によって機器電源のオン・オフ又は機器の制御量を変更するロータリースイッチが用いられ、この種のロータリースイッチが例えば特許文献１～３に開示されている。これらロータリースイッチでは、確実なスイッチ切り換えや快適なスイッチ操作感を有するように、節度機構を備えている。例えば機械式の節度機構の場合、ロータリースイッチの固定側に凹部、回転側に凸部を各々設け、これら凹部及び凸部の噛合いによって節度を発生させている。
【特許文献１】特開２００４－２２３０１号公報
【特許文献２】特開２００４－２２０９５７号公報
【特許文献３】特開２００３－０８６０５９号公報
【発明の開示】
【発明が解決しようとする課題】
【０００３】
ところで、ロータリースイッチは、摘みを予め定めた回転操作範囲内で操作し、その回動操作量に相対して機器の制御量を設定することができることから、制御量を高精度に調整して機器を運転させる場合に有効である。そして、この種のロータリースイッチは、用途に応じて、種々の回転操作範囲が、例えば、１２０度、１８０度、２７０度、３６０度、又は、３６０度以上等、のものが用意されている。これら回転操作範囲は、摘みを回転支持する操作軸と係合し回転を規制するストッパ部材を設けそのストッパ部材の配置位置等を調整することによって決定されていた。従って、ロータリースイッチは、回転操作範囲が相違するだけで、異なるロータリースイッチとなっていた。
【０００４】
そのため、各種機器を作動させるためのロータリースイッチが多数備え付けられた車両においては、それぞれ摘みの回転操作範囲が異なるロータリースイッチが多数使用されている。従って、車両においては、操作範囲に異なるロータリースイッチを多数用意しなければならず、部品点数の増加を招くとともに部品管理の複雑化を招いていた。また、ロータリースイッチの汎用性を図る上で問題があった。
【０００５】
本発明の目的は、任意の操作位置に停止保持することができ、ひいてはその操作範囲を任意に変更設定できて汎用性の高いスイッチ装置を提供することにある。
【課題を解決するための手段】
【０００６】
請求項１の発明は、スイッチ操作軸を操作しその操作位置に応じて機器の制御量を設定するスイッチ装置において、前記スイッチ操作軸の動きに従動する従動部材と、磁力の誘起に基づいて前記従動部材を吸着固定して、前記従動部材を介して前記スイッチ操作軸の操作位置を停止保持する吸着部材とを備えた。
【０００７】

請求項２の発明は、請求項１に記載のスイッチ装置において、前記スイッチ操作軸は、スイッチケースに対して回転可能に支持され、前記スイッチ操作軸を回転操作することで前記操作位置を切り換える操作軸であり、前記従動部材は、前記スイッチ操作軸に対して一体回転するように取着され、前記吸着部材は、前記スイッチケースに対して固定され、前記従動部材を吸着固定し、その従動部材に対する吸着力にて前記スイッチ操作軸を回転停止に保持する。

【０００８】

請求項３の発明は、請求項１又は２に記載のスイッチ装置において、前記従動部材は、前記スイッチ操作軸の動きに従動するように同スイッチ操作軸に設けた磁性体であり、前記吸着部材は、前記磁性体を吸着固定する電磁石である。

【０００９】

請求項４の発明は、請求項３に記載のスイッチ装置において、前記スイッチ操作軸の操作位置を検出し、予め定めた操作位置にスイッチ操作軸が位置したとき前記電磁石を駆動させる制御回路を設けた。

【００１０】

請求項５の発明は、請求項２～４のいずれか１つに記載のスイッチ装置において、前記スイッチケースには、前記スイッチ操作軸に節度感を付与する節度機構を設けた。

請求項６は、請求項５に記載のスイッチ装置において、前記節度機構は、前記スイッチケース及び前記従動部材のうちの一方において該従動部材が動く方向に並設された複数の溝と、他方において、少なくとも前記吸着部材による前記スイッチ操作軸の非吸着状態における前記従動部材の動きに応じて各溝に選択的に嵌合するように設けられた節度ピースとを有する非吸着作用型節度機構を含むことを要旨とする。

【００１１】

請求項７は、請求項５又は６に記載のスイッチ装置において、前記吸着部材は、弾性部材を介して前記スイッチケースに対して固定され、前記節度機構は、予め設定された前記スイッチ操作軸の複数の操作位置において前記吸着部材による該スイッチ操作軸の吸着・非吸着を行うことにより、それら操作位置において前記スイッチ操作軸に節度感を付与する吸着作用型節度機構を備えていることを要旨とする。

【００１２】

請求項８は、請求項７に記載のスイッチ装置において、前記弾性部材は、前記吸着部材と前記スイッチケースとの間に介在されたゴムであることを要旨とする。

請求項９は、スイッチ操作軸を操作しその操作位置に応じて機器の制御量を設定するスイッチ装置において、前記スイッチ操作軸の動きに従動する従動部材と、磁力の誘起に基づいて前記従動部材を吸着固定して、前記従動部材を介して前記スイッチ操作軸の操作位置を停止保持する吸着部材と、前記吸着部材をスイッチケースに固定するべくそれらの間に介在された弾性部材と、予め設定された前記スイッチ操作軸の複数の操作位置において前記吸着部材による該スイッチ操作軸の吸着・非吸着を行うことにより、それら操作位置において前記スイッチ操作軸に節度感を付与する節度付与手段とを備えたことを要旨とする。

【発明の効果】

【００１３】

請求項１の発明によれば、吸着部材は磁力の誘起に基づいて従動部材と吸着固定するようにしたので、吸着部材と従動部材を、どんな相対位置においても吸着固定させることができる。その結果、スイッチ操作軸を、任意な操作位置で停止保持させることができ、ひいてはその操作範囲を任意に変更設定できて汎用性の高いものとすることができる。

【００１４】

請求項２の発明によれば、スイッチ操作軸を、任意な回転操作位置で停止保持させることができ、ひいてはその回転操作範囲を任意に変更設定できる。

請求項３の発明によれば、電磁石を通電させることで簡単に所望のタイミングにて磁力を発生させることでき、従動部材（磁性体）を吸着固定させることができる。

【００１５】
請求項４の発明によれば、スイッチ操作軸の操作位置を検出し、予め定めた操作位置にスイッチ操作軸が位置したとき、スイッチ操作軸を、任意な操作位置で停止保持させることができる。そして、例えば、制御回路にて任意の２位置でスイッチ操作軸を停止保持するようにすることにより、スイッチ装置は、その操作範囲を任意に変更設定でき汎用性の高いスイッチとすることができる。
【００１６】
請求項５の発明によれば、スイッチ操作軸を、任意な回転操作位置まで操作するとき、節度機構によって節度感が付与される。
請求項６の発明によれば、スイッチ操作軸が吸着部材によって吸着されていない状態にあっては、スイッチ操作軸が操作されると、その操作位置と対応する溝に節度ピースが嵌合する。そして、操作位置が変わると嵌合する溝も変化するため、その都度節度感が得られる。よって、節度感を伴ったスイッチ操作軸の操作を確実に行うことができる。
【００１７】
請求項７の発明によれば、吸着対応位置となる操作位置にスイッチ操作軸が操作され、その吸着状態でスイッチ操作軸が操作されると吸着部材も従動する。このとき、吸着部材の動きによって弾性部材が弾性変形するため、スイッチ操作軸に加わる反発力が徐々に高まる。そして、非吸着対応位置となる操作位置に達すると、スイッチ操作軸のみが動くこととなるため、弾性部材からの反発力がスイッチ操作軸に加わらなくなるとともに、該弾性部材の弾性変形も解除されて吸着部材が従動前の位置に戻る。よって、スイッチ操作軸に節度感を付与することができる。しかも、吸着対応位置及び非吸着対応位置を自由に設定することができるため、スイッチ装置の汎用性をさらに向上させることができる。
【００１８】
請求項８の発明によれば、吸着部材とスイッチケースとの間にゴムを介在させるだけで済むため、簡単な構成でスイッチ操作軸の操作に節度感を付与することができる。
請求項９の発明によれば、吸着部材は磁力の誘起に基づいて従動部材を吸着固定する。このため、吸着部材と従動部材を、どんな相対位置においても吸着固定させることができる。その結果、スイッチ操作軸を、任意な操作位置で停止保持させることができ、ひいてはその操作範囲を任意に変更設定できて汎用性の高いものとすることができる。しかも、スイッチ操作軸を吸着部材によって吸着することにより、スイッチ操作軸に節度感を付与することができる。
【発明を実施するための最良の形態】
【００１９】
（第１実施形態）
以下、本発明を具体化したスイッチ装置の第１実施形態を図１及び図２に従って説明する。
【００２０】
図１はスイッチ装置の全体斜視図、図２は、スイッチ装置の内部構造を説明するための縦断面図である。図１及び図２において、スイッチ装置１は、車両のセンタークラスター（図示略）に配設された車両に装備された各種機器を作動させる際のスイッチ操作部材である。スイッチ装置１はスイッチケース２を備えている。スイッチケース２は、上方が開口した箱状のケース本体２ａとそのケース本体２ａの開口部を閉塞する平板状の蓋体２ｂとから構成されている。スイッチケース２の底部には、吸着部材としての電磁石３がスイッチケース２に対して移動不能に固設されている。電磁石３は、円柱状の鉄心３ａと、同鉄心３ａに巻回されたコイル３ｂとから構成されている。電磁石３は、スイッチケース２の外からコイル３ｂに電流が供給されると磁界が発生する。
【００２１】
スイッチケース２の蓋体２ｂには、回転操作可能なスイッチ操作軸４が設けられている。スイッチ操作軸（以下、単に操作軸という）４は、蓋体２ｂに形成された貫通穴２Ｃに貫挿され、回転可能で軸線方向に移動不能に支持されている。操作軸４の基端部（スイッ

チケース２の外側に突出した側の端部）には、ノブ５が固着されている。操作軸４の先端部（スイッチケース２内に突出した側の端部）には、従動部材としての従動板６が設けられている。従動板６は、磁性体、本実施形態では鉄製で形成されている。従動板６は、操作軸４に固着され、操作軸４と一体回転する。そして、従動板６は、その下面が前記電磁石３の円柱状の鉄心３ａの磁極面と摺接可能に配置されている。

【００２２】

従って、電磁石３のコイル３ｂに電流が供給されず電磁石３がオフの状態で、ノブ５を操作して操作軸４を回転させると、従動板６は、操作軸４の回転と一体回転する。この時、従動板６は、その下面が鉄心３ａの磁極面を摺接しながら操作軸４とともに回転する。

【００２３】

また、電磁石３のコイル３ｂに電流が供給されて電磁石３がオン状態になると、電磁石３は、磁力を発生し、従動板６の下面を鉄心３ａの磁極面に吸着する。従動板６は、電磁石３に吸着されると、電磁石３がスイッチケース２に固設されてことから移動不能なり、操作軸４をその操作位置で停止保持する。なお、電磁石３による操作軸４の停止保持力（電磁石３の吸着力）は、ノブ５をある程度の力で回しても操作軸４が回転しない程度の停止保持力であって、ノブ５を大きな力で回すと、操作軸４は電磁石３の吸着力に抗して回転するようになっている。この停止保持力は、予め設定されていて、停止保持力を感じた時は、予め定めた回転操作範囲の一方の端であってそれ以上の回転操作が回転不能と感じる強さであって、かつ、反対方向に大きな力で回したとき、操作軸４が電磁石３の吸着力に抗して回転操作範囲の他方の端へ回転できる強さに設定している。そして、この停止保持力を得るために電磁石３の吸着力を試験、実験等で求め、電磁石３のコイル３ｂに流す電流値を決定している。

【００２４】

従動板６の上面には、中心位置から外周に向かって放射状に延びる溝７が等間隔に複数形成されている。

前記蓋体２ｂの裏面には、基台１１が固設され、その基台１１に形成された収容穴１２には、先端が略半球状をなす円柱状の節度ピース１３が相対移動可能な状態で収容されている。収容穴１２の底面と節度ピース１３との間には、コイルスプリング１４が配設されている。コイルスプリング１４は、その付勢力にて節度ピース１３を従動板６の上面（溝７）に弾圧させている。

【００２５】

節度ピース１３が溝７に嵌合した状態から、ノブ５（操作軸４）が回動操作されると、節度ピース１３がコイルスプリング１４の付勢力に抗して、隣接する溝７の間にある山部を乗り越え隣接する溝７に嵌合する。このとき、山部を乗り越えるのに必要な操作力が、節度感として従動板６を介して操作軸４（ノブ５）に付与される。従って、ノブ５の回動操作を続けることによって節度ピース１３が山部の乗り越え毎に、操作軸４（ノブ５）には節度感が付与される。詳述すると、電磁石３がオフ状態であって従動板６が電磁石３に吸着されていないとき、ノブ５の回動操作時には節度感が付与される。

【００２６】

なお、スイッチケース２内には、図示しない前記操作軸４の回動と連動しその回動を検出するスイッチ機構が設けられている。このスイッチ機構はスイッチ回路２６（図３参照）を備え、スイッチ回路２６から操作軸４の回動量に相対した電気信号を出力するようになっている。

【００２７】

図３は、スイッチ装置１の作動を制御するスイッチ制御回路２０示す。スイッチ制御回路２０は、ＣＰＵ２１、ＲＯＭ２２，ＲＡＭ２３及びインターフェース２４を備えている。ＣＰＵ２１は、ＲＯＭ２２に記憶した各種プログラムに基づき、ＲＡＭ２３を作業記憶メモリとして電磁石３を駆動制御するとともに、操作軸４（ノブ５）の操作量に応じた信号を生成し外部装置２５に出力する。ＲＯＭ２２は、前記操作軸４（ノブ５）の回転操作範囲を決定する一端（ホームポジション）と他端（最大操作量）の２位置が予め記憶され

ている。

【００２８】

ＣＰＵ２１は、スイッチ回路２６と接続され、スイッチ回路２６から操作軸４（ノブ５）の回動量に相対した電気信号を入力する。ＣＰＵ２１は、スイッチ回路２６から電気信号を入力すると、予め定めたプログラムに基づいてその電気信号の値に対する操作軸４（ノブ５）の回動量（操作位置）を算出する。そして、ＣＰＵ２１は、操作軸４（ノブ５）の操作位置がＲＯＭ２２に記憶した一端（ホームポジション）又は他端（最大操作量）である時、駆動回路２７にオン信号を出力する。駆動回路２７は、オン信号に応答して前記電磁石３のコイル３ｂに電流を供給する。ＣＰＵ２１は、算出した操作軸４（ノブ５）の操作位置がＲＯＭ２２に記憶した一端（ホームポジション）と他端（最大操作量）の間にある時、駆動回路２７にオフ信号を出力する。駆動回路２７は、オフ信号に応答して前記電磁石３のコイル３ｂへの電流の供給を遮断する。

【００２９】

また、ＣＰＵ２１は、算出した操作位置に対する制御信号を生成する。そして、ＣＰＵ２１は、制御信号を生成すると、その制御信号をインターフェース２４を介して外部装置２５に出力する。外部装置２５は、入力された制御信号（ノブ５の操作位置）に基づいて図示しない機器を作動制御する。

【００３０】

次に、上記のように構成したスイッチ装置１の作用について説明する。

今、操作軸４（ノブ５）の操作位置が一端（ホームポジション）に位置し、電磁石３に従動板６が吸着されている状態で、その吸着力に抗してノブ５を他端（最大操作量）位置側に回転操作すると、スイッチ回路２６からそのノブ５（操作軸４）を操作量に応じた電気信号がＣＰＵ２１に出力される。

【００３１】

ＣＰＵ２１は、電気信号に基づいて操作軸４（ノブ５）の回動量（操作位置）を算出する。ＣＰＵ２１は、算出した操作位置に対する制御信号を生成し、インターフェース２４を介して外部装置２５に出力する。また、ＣＰＵ２１は、算出した操作位置が、ＲＯＭ２２に記憶した一端（ホームポジション）又は他端（最大操作量）と一致するかどうか判断する。そして、一致していない時、ＣＰＵ２１は、駆動回路２７にオフ信号を出力し、電磁石３のコイル３ｂへの電流の供給を遮断する。従って、従動板６は電磁石３による吸着力が消失することによって、ノブ５は、電磁石３の吸着力の影響を受けないで、節度機構、即ち、コイルスプリング１４にて溝７に付勢されている節度ピース１３によって節度感を感じながら操作される。

【００３２】

そして、ノブ５を他端（最大操作量）位置まで操作すると、ＣＰＵ２１は駆動回路２７にオン信号を出力し、電磁石３のコイル３ｂに電流を供給する。電磁石３は従動板６を吸着し、ノブ５を摘んでいる指に抵抗力を与える。この抵抗感によって、ノブ５が他端（最大操作量）位置まで操作されたと判断し、操作をやめ、摘んでいた指をノブ５から離す。

【００３３】

なお、他端（最大操作量）位置から一端（ホームポジション）側に向かっての回転操作も同様に行われる。

本実施形態の構成によれば、以下に記載の効果を得ることができる。

【００３４】

（１）本実施形態によれば、スイッチ操作軸４に磁性体よりなる従動板６を固着するとともに、その従動板６をスイッチケース２内に固設した電磁石３に対して摺接可能に配置した。そして、電磁石３のコイル３ｂに電流を供給して電磁石３に磁力を発生させると、従動板６は、電磁石３に吸着され固定される。つまり、従動板６は、電磁石３の通電タイミングを制御するだけで任意な位置で電磁石３に吸着固定させることができる。その結果、スイッチ操作軸４を、任意な操作位置で停止保持させることができ、ひいてはその回転操作範囲を任意に変更設定できて汎用性の高いものとすることができる。

【００３５】
（２）本実施形態によれば、スイッチ操作軸４を任意な操作位置で停止保持するのに磁力を利用し、その磁力を電磁石３にて発生させた。従って、停止保持機構は、電磁石３をスイッチケース２の底部に配設し、それに隣接した位置に従動板６を配置するだけでの非常に簡単な構成にすることができるとともに、スイッチ装置１の更なる小型化を図ることができる。
【００３６】
（３）本実施形態によれば、ノブ５（スイッチ操作軸４）の停止保持する位置の設定は、ＲＯＭ２２にその位置を記憶するだけでよいので、任意の位置に回動停止保持させる設定は非常に簡単に行うことができる。
【００３７】
（４）本実施形態によれば、従動板６の上面に放射状に延びる溝７が等間隔に複数形成し、前記蓋体２ｂの裏面に基台１１を設け、その基台１１にコイルスプリング１４の付勢された節度ピース１３を従動板６の溝７に弾圧させて、節度機構を形成した。従って、ノブ５の回動操作を続けることによって節度ピース１３が山部の乗り越え毎に、ノブ５（操作軸４）に節度感を付与することができる。
【００３８】
（第２実施形態）
次に、本発明を具体化した第２実施形態を図４及び図５に基づいて説明する。ここでは第１実施形態と相違する点を主に述べ、共通する点については同一部材番号を付すのみとしてその説明を省略する。
【００３９】
図４に示すように、本実施形態において電磁石３は、従動板６よりもスイッチケース２の蓋体２ｂ側に配設されている。詳しくは、電磁石３の鉄心３ａには貫通孔３ｃが設けられ、その貫通孔３ｃに操作軸４が挿通されている。また、電磁石３は、ゴムによって構成された弾性部材３１を介して蓋体２ｂに固定されている。この弾性部材３１は、例えば平面視でドーナツ状、正面視で板状をなしており、電磁石３における従動板６との接触面とは逆側の面（図４における上面）に固着されている。このため、電磁石３に対して操作軸４の回転方向への力が加わると、弾性部材３１が弾性変形することにより、電磁石３がその方向に回転する。
【００４０】
このため、電磁石３のコイル３ｂに電流が供給されていない状態、すなわち電磁石３のオフ状態にあっては、従動板６は電磁石３によって吸着されないため、前記ノブ５が操作されて操作軸４が回転すると、従動板６も同様に回転する。これに対し、電磁石３のオン状態にあっては、従動板６が電磁石３によって吸着されるため、操作軸４が回転すると、従動板６と電磁石３とが一体に回転する。この際、弾性部材３１が弾性変形することによって電磁石３の回転が許容されるものの、該弾性部材３１の弾性変形量が増すに従って反力が大きくなっていく。すなわち、電磁石３のオン状態にあっては、ノブ５を回転させるために必要な操作力が徐々に強くなっていくこととなる。
【００４１】
そして、本実施形態において前記ＣＰＵ２１は、前記第１実施形態と同様にノブ５（操作軸４）の回転操作範囲を制御するとともに、こうした操作力の変化を利用して、該ノブ５の操作に節度感を付与する節度感付与制御を行うようになっている。そこで、該ＣＰＵ２１によって行われる節度感付与制御について説明する。詳しくは、例えば図５（ａ）にポイントＰ０からポイントＰ９で示す範囲が前記ノブ５の回転操作範囲として設定され、その回転操作範囲内において５箇所の操作位置（第１操作位置Ｓ１～第５操作位置Ｓ５）が設定され、且つそれら操作位置Ｓ１～Ｓ５間に節度感を付与する態様について説明する。
【００４２】
この場合、ＣＰＵ２１は、第１操作位置Ｓ１となるポイントＰ０とポイントＰ１との間

、第２操作位置Ｓ２となるポイントＰ２とポイントＰ３との間、第３操作位置Ｓ３となるポイントＰ４とポイントＰ５との間、第４操作位置Ｓ４となるポイントＰ６とポイントＰ７との間、第５操作位置Ｓ５となるポイントＰ８とポイントＰ９との間において、電磁石３をオフ状態にする。このため、これら操作位置Ｓ１～Ｓ４においては、ノブ５が操作されると操作軸４及び従動板６のみが回転することとなるため、該ノブ５を回転させるために必要な操作力は非常に小さくなる。

【００４３】

これに対し、ＣＰＵ２１は、各操作位置Ｓ１～Ｓ５の間、すなわちポイントＰ１とポイントＰ２との間、ポイントＰ３とポイントＰ４との間、ポイントＰ５とポイントＰ６との間、ポイントＰ７とポイントＰ８との間において、電磁石３をオン状態にする。このため、各ポイント間においては従動板６が電磁石３に吸着され、従動板６とともに電磁石３も回転する。このとき、弾性部材３１の弾性変形により電磁石３の回転が許容されるため、各ポイントＰ１，Ｐ３，Ｐ５，Ｐ７においてはノブ５を回転させるために必要な操作力は比較的小さくて済む。しかしながら、各ポイントＰ２，Ｐ４，Ｐ６，Ｐ８に操作が進むに従って弾性部材３１からの反力が大きくなるため、該操作力が徐々に大きくなっていく。そして、該ノブ５の操作がそれらポイントＰ２，Ｐ４，Ｐ６，Ｐ８に達すると、ＣＰＵ２１は電磁石３をオフ状態にするため、弾性部材３１の弾性変形が解除されて電磁石３が回転前の状態に戻るとともに、ノブ５を回転させるために必要な操作力も小さくなる。よって、電磁石３による従動板６の吸着有無が制御されることにより、各操作位置Ｓ１～Ｓ５の間において節度感が付与されることとなる。

【００４４】

また、ＣＰＵ２１は、ノブ５の操作に節度感を付与する際に、該ノブ５を回転させるために必要な操作力が、最大操作力Ｆmax よりも小さな操作力Ｆとなる時点で電磁石３をオフ状態に切り換えるようになっている。すなわち、各ポイントＰ２，Ｐ４，Ｐ６，Ｐ８は、ノブ５を回転させるために必要な操作力が操作力Ｆとなる位置に設定されており、ＣＰＵ２１は、これらポイントＰ２，Ｐ４，Ｐ６，Ｐ８で電磁石３をオフ状態に切り換えることにより、操作力Ｆでのノブ５の操作を可能としている。なお、最大操作力Ｆmax とは、弾性部材３１が限界まで弾性変形を生じ、それ以上の力が加わった際には、電磁石３と従動板６との間で摺動を開始するに至る操作力を示す。

【００４５】

さらに、ＣＰＵ２１は、ノブ５が回転操作範囲の限界位置（ポイントＰ９で示す位置）に達すると、電磁石３をオン状態に切り換える。その後も継続してノブ５が回転操作され、ポイントＰ１０で示すようにノブ５を回転させるために必要な操作力が最大操作力Ｆmax に達しても、ＣＰＵ２１は電磁石３のオン状態を保持する。このため、操作者は、ポイントＰ１０で示す位置までノブ５を操作する際に、該ノブ５の回転操作範囲の限界位置に達した旨を認識可能となる。

【００４６】

ちなみに、本実施形態における弾性部材３１を介在させず、前記第１実施形態のように電磁石３をスイッチケース２の蓋体２ｂに直接固定し、本実施形態と同様に電磁石３のオン・オフ制御によってノブ５の操作に節度感を付与した場合には、次のような不都合が生じる。すなわち、例えば図５（ｂ）に示すように、それぞれの節度感付与箇所（Ｐ１－Ｐ２間、Ｐ３－Ｐ４間、Ｐ５－Ｐ６間、及びＰ７－Ｐ８間）において電磁石３がオン状態となると、操作位置Ｓ１～Ｓ５を切り換えるべくノブ５を回転させるために必要な操作力は、何れも最大操作力Ｆmax となる。また、ノブ５の回転操作範囲の限界位置（ポイントＰ９）においても、該操作力は最大操作力Ｆmax となる。このため、操作位置Ｓ１～Ｓ５を切り換えるために大きな操作力が必要となって操作性が低下するとともに、回転操作範囲の限界位置であるか否かを操作者は認識しにくくなってしまう。

【００４７】

したがって、本実施形態によれば、以下のような効果を得ることができる。

（５）従動板６を電磁石３によって吸着する吸着対応位置となる操作位置（ポイントＰ

１，Ｐ３，Ｐ５，Ｐ７）にノブ５（操作軸４）が操作され、その吸着状態でノブ５が操作されると、電磁石３も従動して回転する。このとき、電磁石３の動きによって弾性部材３１が弾性変形するため、ノブ５に加わる反発力が徐々に高まる。そして、ノブ５が非吸着対応位置となる操作位置（ポイントＰ２，Ｐ４，Ｐ６，Ｐ８）に達すると、操作軸４及び従動板６のみが動くこととなるため、弾性部材３１からの反発力がノブ５に加わらなくなるとともに、該弾性部材３１の弾性変形も解除されて電磁石３が従動前の位置に戻る。よって、こうした電磁石３のオン・オフ制御によってノブ５（操作軸４）の操作に節度感を付与することができる。しかも、吸着対応位置及び非吸着対応位置を自由に設定することができるため、スイッチ装置１の汎用性をさらに向上させることができる。

【００４８】

（６）弾性部材３１を用いるとともに電磁石３のオン・オフ制御によってノブ５の操作に節度を付与する吸着作用型節度機構を用いることにより、前記第１実施形態における節度機構（溝７や節度ピース１１等）からなる非吸着作用型節度機構が不要となる。このため、スイッチ装置１の構造を簡素化しつつ、節度感を確実に付与することができる。

【００４９】

（７）弾性部材３１としてゴムを用いている。よって、電磁石３とスイッチケース２との間にゴムを介在させるだけで済むため、簡単な構成でノブ５（操作軸４）の操作に節度感を付与することができる。

【００５０】

（８）電磁石３とスイッチケース２との間に弾性部材３１を介在させることにより、電磁石３によって従動板６を吸着した状態でノブ５を回転操作すると、弾性部材３１が弾性変形許容量分だけ電磁石３も回動する。そして、ノブ５に対する操作力が解除されると、その電磁石３と共にノブ５も元の位置に戻る。このため、こうした作用を利用することにより、スイッチ装置１をモーメンタリ式スイッチ装置として利用することができる。

【００５１】

なお、本実施形態は上記構成に限定されず、例えば、以下の態様に変更してもよい。

・前記各実施形態のスイッチ装置１は、ノブ５（スイッチ操作軸４）の回転操作範囲は、特に限定しなかったが、４５度、９０度、１２０度、１８０度、２７０度、３６０度等適宜変更して実施してもよい。勿論、３６０度以上（例えば４５０等）であってもよい。

【００５２】

・前記各実施形態のスイッチ装置１では、任意の停止保持する位置を２位置設けたが、これを３位置に設けて実施してもよい。例えば、ホームポジションの位置（第１停止保持位置）に対して、時計回り方向に停止保持する位置（第２停止保持位置）を設け、反時計回り方向に停止保持する位置（第３停止保持位置）を設ける。そして、ホームポジションの位置を基準に、時計回り方向と反時計回り方向に回転操作範囲を設定できるようにして実施する。このとき、時計回り方向の回転操作範囲と反時計回り方向の回転操作範囲を同じにしたり、異ならして実施したりしてもよい。

【００５３】

・前記第１実施形態のスイッチ装置１は、従動板６の上面に形成した溝７、その溝７にコイルスプリング１４にて弾圧する節度ピース１３等からなる節度機構を備えたが、節度機構を備えないスイッチ装置に応用してもよい。

【００５４】

・前記各実施形態のスイッチ装置１は、ノブ５を介してスイッチ操作軸４を回転操作するロータリー式のスイッチ装置であったが、スイッチ操作軸をスライド移動して操作位置を切り換えるスライド式のスイッチ装置に応用してもよい。

【００５５】

・前記各実施形態のスイッチ装置１は、従動板６全体を磁性体で形成したが、例えば、合成樹脂等で形成した板体の下面に、磁性体の板（例えば鉄板）を接着した構成で実施してもよい。

【００５６】

・前記第１実施形態のスイッチ装置１は、従動板６の下面に電磁石３を配置したが、第２実施形態のように電磁石３を従動板６の上面に配置して実施してもよい。また、第２実施形態のスイッチ装置１においては、第１実施形態のように電磁石３を従動板６の下面に配置され、その従動板６とスイッチケース２のケース本体２ａの底部との間に介在されてもよい。

【００５７】

・前記第２実施形態において、弾性部材３１は、必ずしもゴムによって構成されている必要はなく、例えばバネ材などによって構成されてもよい。ただし、構成の容易化・簡素化の観点では、ゴムが適用されることが望ましい。

【００５８】

・前記第２実施形態において、ＣＰＵ２１は、ノブ５の回転操作範囲内において、電磁石３のオン・オフ制御を行うことにより、該ノブ５の操作に節度感を付与するようになっているが、こうした節度感付与制御を必ずしも行うようになっていなくてもよく、単にノブ５の回転操作範囲の制御のみを行うようになっていてもよい。

【００５９】

・前記第２実施形態において、ＣＰＵ２１は、ノブ５の操作に節度感を付与する節度感付与制御のみを行い、該ノブ５の回転操作範囲の制御を行わないようになっていてもよい。

【００６０】

・前記第２実施形態において、弾性部材３１は、平面視で略ドーナツ状をなすように形成された一つのゴム材によって構成されている。しかしながら、弾性部材３１は、こうした形状に限らず、複数の板状物によって構成されていてもよい。すなわち、弾性部材３１の形状は、如何様に変更されてもよい。また、弾性部材３１は、電磁石３の周面とスイッチケース２のケース本体２ａの内側面との間に介在されていてもよい。　・スイッチ装置１の搭載先は車両のカーナビゲーションシステム、エアコンシステム、オーディオシステム等の各種機器に限定されず、家庭用電化製品等の他の機器に搭載してもよい。

【図面の簡単な説明】

【００６１】

【図１】本発明の第１実施形態におけるスイッチ装置の全体斜視図。

【図２】同実施形態におけるスイッチ装置の内部構造を説明するための縦断面図。

【図３】同実施形態におけるスイッチ装置の電気的構成を説明するための電気回路図。

【図４】本発明の第２実施形態におけるスイッチ装置の内部構造を説明するためのたて断面図。

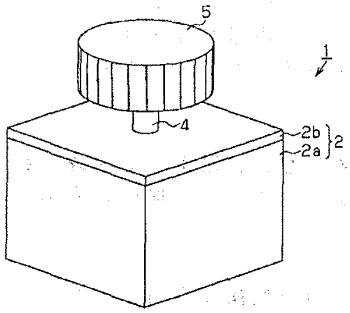
【図５】（ａ）は同実施形態のスイッチ装置におけるスイッチ操作軸の移動量と操作力との関係を示すグラフ、（ｂ）は比較例としてのスイッチ装置におけるスイッチ操作軸の移動量と操作力との関係を示すグラフ。

【符号の説明】

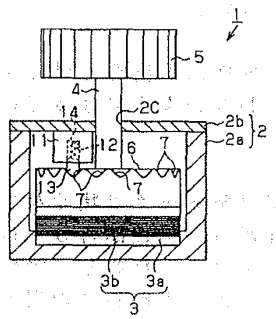
【００６２】

１…スイッチ装置、２…スイッチケース、３…電磁石、３ａ…鉄心、３ｂ…コイル、４…スイッチ操作軸、５…ノブ、６…従動板、７…溝、１３…節度ピース、１４…コイルスプリング、２０…スイッチ制御回路、２１…ＣＰＵ、２２…ＲＯＭ、２６…スイッチ回路、２７…駆動回路、３１…弾性部材。

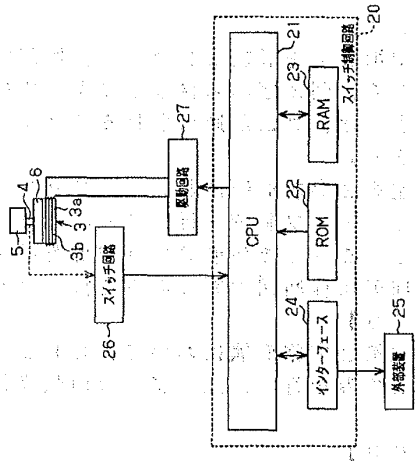
【図１】


5
1
4
2b
2a
2

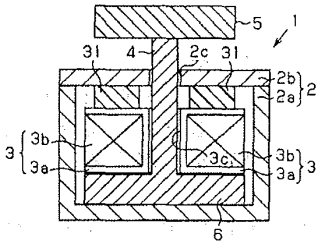
【図２】


1
5
4
14
2C
2b
2a
2
11
13
12
6
7
3
7
7
3b
3a
3

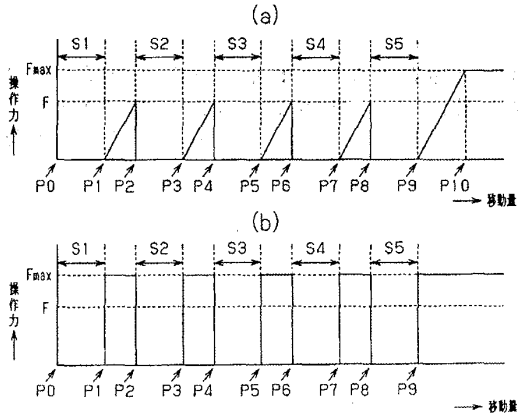
【図３】


20
21
23
RAM
スイッチ制御回路
27
駆動回路
4
6
3a
3
3b
5
スイッチ回路
CPU
22
ROM
26
24
インターフェース
25
外部装置

【図４】


5
1
31
4
2c
31
2b
2a
2
3
3b
3a
3c
3b
3a
3
6

【図５】


(a)
S1
S2
S3
S4
S5
Fmax
F
操作力
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
移動量
(b)
S1
S2
S3
S4
S5
Fmax
F
操作力
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
移動量

フロントページの続き

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Electronic Acknowledgement Receipt

EFS ID:	16736781
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Amber Johnson
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	30-AUG-2013
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Application Type:	Utility under 35 USC 111(a)

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Miscellaneous Incoming Letter	Transmittal.pdf	38890 354fe94bb1d7c473c1983ff726048ba00e640482	no	1

Warnings:	
Information:	

2	Transmittal Letter	Certification.pdf	205151 cd32c31bd1bd88ea105faa15fa2301de6a746fd9	no	5
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	08A.pdf	62375 222f0bc8ec620267f472c948e6de859bad50682e	no	1
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Foreign Reference	JP2003295959.pdf	685229 64c4d1c84c2097a7812075e9e7a91015a41bc54a	no	9
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5	Foreign Reference	JP2004094570.pdf	878006 69482b6c9e517453e2ec4f924d48ee60454f83d4	no	15
Warnings:					
Information:					
6	Foreign Reference	JP2006251845.pdf	609689 43a57d7009e977e43de603afdee78020cccb094	no	10
Warnings:					
Information:					
7	Foreign Reference	JP2008016426.pdf	1054185 5cee0b7d52f9120d5913007d5d4adc85cadae5df	no	15
Warnings:					
Information:					
8	Non Patent Literature	JPOA.pdf	152967 3b757ab6e36cc020089d7ef30f648176c44fe363	no	3
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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.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Conf No.: 2809
Michael D. Levin	)	
	)	Art Unit: 2629
Serial No. 11/965,046	)	
	)	Examiner: **Zubajlo, Jennifer L.**
Filed: December 27, 2007	)	
	)	

For: VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK

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

TRANSMITTAL

Sir:

Transmitted herewith are the following documents for filing in the above-identified application:

1. Supplemental Information Disclosure Statement;
2. Form PTO/SB/08a listing Five (5) Documents;
3. Four (4) Foreign Patent References; and
4. One (1) Non-Patent Literature Reference.

The Commissioner is hereby authorized to charge any deficiency to Deposit Account Number 20-1430.

Respectfully submitted,

Date: 8/30/2013

Michael T. Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

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I hereby certify that this correspondence is being electronically filed with The United States Patent Office via EFS-Web on August 30, 2013.

Amber C. Johnson

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Michael D. Levin	)	
	)	Conf. No.: 2809
Serial No. 11/965,046	)	
	)	Art Unit: 2629
Filed: December 27, 2007	)	
	)	Examiner: Zubajlo, Jennifer L.
For: **VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK**	)	
	)	
	)	
	)	
Attorney Ref. IMM253 (51851-339922)	)	

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

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

Sir:

Pursuant to 37 C.F.R. §§ 1.97 and 1.98, applicant(s) hereby submit(s) an Information Disclosure Statement for consideration by the Examiner.

I.. LIST OF PATENTS, PUBLICATIONS OR OTHER INFORMATION

The patents, publications, or other information submitted for consideration by the Office are listed on the PTO/SB/08 forms attached hereto.

II. COPIES (check at least one box)

a. ☐ This application was filed before June 30, 2003. Accordingly, submitted herewith is a legible copy of (i) each U.S. and foreign patent; (ii) each publication or that portion which caused it to be listed; and (iii) all other information or that portion which caused it to be listed.

b. ☒ This application was filed on or after June 30, 2003. Accordingly, copies of cited U.S. patents and patent application publications therefore are not included. Copies of foreign patent documents and non-patent literature are included.

c. ☐ Some or all of the documents listed on the PTO/SB/08 forms are not enclosed because they were cited in the International Search Report and copies should already be in the PTO file. If copies are needed, please contact the undersigned.

III. CONCISE EXPLANATION OF THE RELEVANCE
(check at least one box)

a. ☒ **DOCUMENTS IN THE ENGLISH LANGUAGE**
The patents, publications, or other information listed on the attached PTO/SB/08 forms are in the English language and therefore, do not require a statement of relevancy.

b. ☒ **DOCUMENTS NOT IN THE ENGLISH LANGUAGE**

A concise explanation of the relevance of all patents, publications, or other information listed that is not in the English language is as follows:

JP 2003-295959 – English language abstract provided
JP 2004-094570 – English language abstract provided
JP 2006-251845 – English language abstract provided
JP 2008-016426 – English language abstract provided

c. ☐ **ENGLISH LANGUAGE SEARCH REPORT**
An English language version of the search report or action that indicates the degree of relevance found by the foreign office is attached, thereby satisfying the requirement for a concise explanation. See MPEP 609(III)(A)(3).

d. ☐ **OTHER**
The following additional information is provided for the Examiner's consideration.

FEES

IV. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(b):
(check one box)

a. ☐ within three months of the filing date of a national application (37 C.F.R. § 1.97(b)(1)). No fee or statement is required. *(This section is not to be used with RCE's.)*

b. ☐ within three months of the date of entry of the national stage as set forth in § 1.491 in an international application (37 C.F.R. § 1.97(b)(2)). No fee or statement is required.

c. ☐ before the mailing of a first Office action after the filing of or concurrently with a Request for Continued Examination under § 1.114 (37 C.F.R. § 1.97(b)(4)). No fee or statement is required.

d. ☐ before the mailing date of a first Action on the merits (37 C.F.R. § 1.97(b)(3)). No fee or statement is required.

In the event that a first Office Action on the merits has been issued, please consider this IDS under 37 C.F.R. § 1.97(c) and see the statement under 37 C.F.R. § 1.97(e) below, or, if no statement has been made, charge our deposit account in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

V. ☒ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(c):
(check one box)

before the mailing date of a Final Office Action under 37 C.F.R. § 1.113 (See 37 C.F.R. § 1.97(c)(1)) or before the mailing date of a Notice of Allowance under 37 C.F.R. § 1.311 (See 37 C.F.R. § 1.97(c)(2)).

a. ☐ No statement; therefore, a fee in the amount of $180.00 as required by 37 C.F.R. § 1.17(p).

b. ☒ See the statement below. No fee is required.

VI. ☐ THIS IDS IS BEING FILED UNDER 37 C.F.R. § 1.97(d)
after the period specified in 37 C.F.R. 1.97(c) but before payment of the issue fee; see statement and payment of fees below.

VII. STATEMENT UNDER 37 C.F.R. § 1.97(e) (check only one box)
The undersigned hereby states that

a. ☒ each item of information contained in the IDS was first cited in any communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS;

b. ☐ no item of information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of IDS was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of the IDS.

c. ☐ Some of the items of information were cited in a communication from a foreign Patent Office. As to this information, the undersigned states that each item of information contained in the IDS was first cited in a communication from a foreign Patent Office in a counterpart foreign application not more than three months prior to the filing of this IDS. As to the remaining information, the undersigned hereby states that no item of this remaining information contained in the IDS was cited in a communication from a foreign Patent Office in a counterpart foreign application and, to the best of my knowledge after making reasonable inquiry, was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing of this statement.

VIII. ☐ PATENT TERM ADJUSTMENT

Each item of information contained in this Information Disclosure Statement was first cited in a communication from a foreign patent office in a counterpart application and this communication was not received by any individual designated in § 1.56(c) more than thirty days prior to the filing of this Information Disclosure Statement. 37 C.F.R. § 1.704(d).

IX. PAYMENT OF FEES (check one box)

☐ Payment by credit card Form PTO-2038 in the amount of $180 required by 37 C.F.R. § 1.17(p) is enclosed for the above-identified fee.

☐ Please charge Deposit Account No. 20-1430 in the amount required by 37 C.F.R. § 1.17(p) for the above-indicated fee. A triplicate copy of this paper is attached.

☒ No fee is required.

If the Examiner has any questions concerning this IDS, he/she is requested to contact the undersigned. If it is determined that this IDS has been filed under the wrong rule, the PTO is requested to consider this IDS under the proper rule and charge the appropriate fee to Deposit Account No. 20-1430.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 20-1430 for any additional fees required under 37 C.F.R. § 1.16 or under § 1.17.

Respectfully submitted,

Date: 8/30/2013

By: _____
Michael T. Morlock (Reg. No. 62,245)

Attachment(s):

- ☒ PTO/SB/08
- ☒ Documents
- ☐ Fee
- ☐ Other

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/965,046	12/27/2007	Michael D. Levin	IMM253	2809

34300 7590 02/01/2016

Kilpatrick Townsend and Stockton, LLP
1001 W Fourth Street
Winston-Salem, NC 27101

EXAMINER
ZUBAJLO, JENNIFER L

ART UNIT	PAPER NUMBER
2623	

MAIL DATE	DELIVERY MODE
02/01/2016	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.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte MICHAEL D. LEVIN

Appeal 2013-010046
Application 11/965,046
Technology Center 2600

Before JAMES R. HUGHES, CATHERINE SHIANG, and MELISSA A. HAAPALA, *Administrative Patent Judges*.

HUGHES, *Administrative Patent Judge*.

DECISION ON APPEAL

STATEMENT OF THE CASE

Appellant seeks our review under 35 U.S.C. § 134(a) of the Examiner's Final decision rejecting claims 1–7 and 9–20. Claim 8 has been canceled. (App. Br. 1.)[1] We have jurisdiction under 35 U.S.C. § 6(b).

We reverse.

---

[1] We refer to Appellant's Specification ("Spec.") filed December 27, 2007 (claiming benefit of US 60/877,333 filed December 27, 2006); Appeal Brief ("App. Br.") filed February 5, 2013; and Reply Brief ("Reply Br.") filed August 12, 2013. We also refer to the Examiner's Answer ("Ans.") mailed June 11, 2013, and Final Office Action (Final Rejection) ("Final Act.") mailed August 21, 2012.

Appellant's Invention

The invention at issue on appeal concerns vibrotactile feedback systems, computer-readable media, and methods for generating a vibrotactile signal. The method includes the steps of receiving an input signal responsive to manipulation of an input device (touch pad) configured to control various systems, receiving a detent profile comprising haptic data associated with a virtual detent and corresponding to one of the systems, and generating a vibrotactile signal. (Spec. ¶¶ 2, 5–7; Abstract.)

Illustrative Claim

Independent claim 1, reproduced below with the key disputed limitations emphasized, further illustrates the invention:

1. A method comprising:

receiving an input signal comprising information associated with a manipulation of an input device configured to control a plurality of systems, wherein the input device comprises a touch-pad;

receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent; and

generating a vibrotactile signal configured to cause an actuator to produce a vibrotactile effect to the input device, the vibrotactile effect comprising the virtual detent.

Rejection on Appeal

The Examiner rejects claims 1–7 and 9–20 under 35 U.S.C. § 103(a) as being unpatentable over Grant (US 2006/0119573 A1, published June 8, 2006) and Nyyssonen (US 2007/0222765 A1, published Sept. 27, 2007 (filed Mar. 22, 2006)).

ISSUE

Based upon our review of the administrative record, Appellant's contentions, and the Examiner's findings and conclusions, the pivotal issue before us follows:

Does the Examiner err in concluding that Grant and Nyyssonen would have collectively taught or suggested "receiving a detent profile associated with one of the systems, the detent profile comprising haptic data associated with a virtual detent" (hereinafter the "disputed limitation") within the meaning of Appellant's claim 1 and the commensurate limitations of claims 9, 10, 14, and 15?

ANALYSIS

The Examiner provides the same basis for rejecting independent claims 1, 9, 10, 14, and 15 (Final Act. 2–4; Ans. 4–6, 8–10), and rejects representative claim 1 under 35 U.S.C. § 103(a) as being obvious in view of Grant and Nyyssonen. (Final Act. 2–4.) Appellant contends that the combination of Grant and Nyyssonen (Tuomo), and in particular Nyssonen, do not teach or suggest the disputed feature of representative claim 1. (App. Br. 11–13; Reply Br. 1–3.) Specifically, Appellant contends that Nyyssonen does not mention or suggest detents. (App. Br. 12–13; Reply Br. 2.) Appellant further points out that the Examiner's citation to Lloyd (US 7,720,552 B1) for support of virtual detents (Ans. 9) also fails to describe virtual detents. (Reply Br. 3.)

We agree with Appellant that combination of Grant and Nyyssonen does not teach the recited "receiving a detent profile associated with one of

the systems, the detent profile comprising haptic data associated with a virtual detent" (claim 1). We find, as did the Examiner (Ans. 4–5, 8–9), that Grant describes generating a vibrotactile signal (haptic effects) and Nyyssonen similarly describes generating vibrotactile feedback as well as describing a virtual knob (volume knob). We also agree with the Examiner that Lloyd describes a virtual knob with incremental adjustments. (Ans. 9.) However, we agree with Appellant that merely providing a general disclosure of vibrotactile feedback (Grant and Nyyssonen) and a virtual knob (Nyyssonen) does not sufficiently describe detent profiles for a particular system/device. As explained by Appellant, a detent provides a sense of mechanical resistance while operating a virtual control for a virtual device (Spec. 4; *see* Figures 9A–9H). The Examiner fails to show any of the cited references discloses virtual knobs having increments or haptic effects associated therewith. Further, the Examiner's explanation that virtual knob increments are well known (citing Lloyd) (Ans. 8–9) still fails to sufficiently describe specific haptic effects associated with such a virtual knob. Appellant's claim 1 requires receiving specific data (a detent profile), which includes haptic data, and generating a vibrotactile signal to produce a vibrotactile effect (haptic feedback), which simulates (provides a sense of) mechanical resistance like a detent for an analog knob (the recited "virtual detent").

The Examiner, improperly, picks disparate pieces from the Grant and Nyyssonen references (as well as Lloyd) while using Appellant's claim as a road map and filling in the gaps with the knowledge of one of ordinary skill in the art (*see, e.g.*, Ans. 8–9 ("Nyyssonen does not use the word 'detent', [but] he teaches virtual knobs which are obviously divided into discrete

increments in order for certain movements or actions to occur . . ." "Since these discrete increments are well known with volume control, they would be obviously used and with the vibro-tactile feedback associated with user input . . .")). Thus, the record indicates that the Examiner's rejections are based upon impermissible hindsight in view of Appellant's disclosure. *See In re Warner*, 379 F.2d 1011, 1017 (CCPA 1967) ("A rejection based on section 103 clearly must rest on a factual basis, and these facts must be interpreted without hindsight reconstruction of the invention from the prior art.").

The Examiner has not sufficiently shown (Final Act. 2–4; Ans. 4–6, 8–10), nor do we find, that the cited portions of Grant and Nyyssonen teach the disputed claim limitation. In particular, the Examiner does not sufficiently explain how Nyyssonen provides a detent profile that can be utilized to produce a virtual detent haptic effect. Accordingly, we agree that the Examiner erred, as the analysis in the Examiner's rejection is not sufficient to show that claims 1–7 and 9–20 are unpatentable without further explanation.

Consequently, we are constrained by the record before us to find that the Examiner erred in concluding Grant and Nyyssonen teach the disputed limitation of Appellant's claim 1. Independent claims 9, 10, 14, and 15 include limitations of commensurate scope. Claims 2–7, 11–13, and 16–20 depend on claims 1, 10, and 15, respectively. Accordingly, we reverse the Examiner's obviousness rejection of claims 1–7 and 9–20.

CONCLUSION

Appellant has shown that the Examiner erred in rejecting claims 1–7 and 9–20 under 35 U.S.C. § 103(a).

DECISION

We reverse the Examiner's rejection of claims 1–7 and 9–20.

REVERSED

Substitute for form 1449A/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				Application Number	11/965,046
				Filing Date	December 27, 2007
				First Named Inventor	Michael D. Levin
				Art Unit	2623
(Use as many sheets as necessary)				Examiner Name	Zubajlo, Jennifer L.
Sheet	1	of	1	Attorney Docket Number	IMM253 (051851/0339922)

U.S. PATENT DOCUMENTS

Examiner Initials *	Cite No.[1]	Document Number Number - Kind Code[2] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	1.	US 2004/0178989	09-16-2004	Shahoian	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3] - Number[4] - Kind Code[5] (*if known*)	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	2.	JP 2003-084901	03-20-2003	Nissan Motor		
	3.	WO 02/073587	09-19-2002	Immersion Corp.		
	4.	JP 3085481	05-10-2002		Claims	
	5.	WO 03/036457	05-01-2003	Apple Computer Inc.		
	6.	WO 2006/94308	09-08-2006	Apple Computer Inc.		
	7.	JP 2005-267080	09-29-2005	Sony Corp.		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials *	Cite No.[1]	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[2]
	8.	Japanese Patent Office, Notice of Reasons for Rejection, Application No. 2009-5440901 dated Feb. 4, 2014.	
	9.	Korean Patent Office, Notice of Preliminary Rejection, Application No. 10-2014-7010835 dated July 29, 2014.	
	10.	Korean Patent Office, Notice of Preliminary Rejection, Application No. 10-2009-7015696 dated January 23, 2014.	
	11.	Japanese Patent Office, Pretrial Report, Application No. 2009-544090 dated July 23, 2014.	
	12.	Japanese Patent Office, Notice of Reasons for Rejection, Application No. 2013-217205 dated September 30, 2014.	
	13.	Japanese Patent Office, Notice of Reasons for Rejection, Application No. 2009-544090 dated October 28, 2014.	
	14.	Japanese Patent Office, Decision of Rejection, Application No. 2013-217205 dated August 18, 2014.	

Examiner Signature		Date Considered	

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	
	)	Conf No.: 2809
Michael D. Levin	)	
	)	Art Unit: 2623
Serial No. 11/965,046	)	
	)	Examiner: **Zubajlo, Jennifer L.**
Filed: December 27, 2007	)	
	)	

For: VIRTUAL DETENTS THROUGH VIBROTACTILE FEEDBACK

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Alexandria, VA 22313-1450

TRANSMITTAL

Sir:

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1. Supplemental Information Disclosure Statement;
2. Form PTO/SB/08a listing Fourteen (14) Documents;
3. Six (6) Foreign Patent Documents; and
4. Seven (7) Non-Patent Literature Documents.

The Commissioner is hereby authorized to charge any deficiency to Deposit Account Number 20-1430.

Respectfully submitted,

Date: 2/11/2016

/Michael T. Morlock/
Michael T. Morlock
Reg. No. 62,245

KILPATRICK TOWNSEND & STOCKTON LLP
1001 West Fourth Street
Winston-Salem, NC 27101-2400
(336) 607-7300

Certificate of Electronic Filing
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/Amber C. Johnson/
Amber C. Johnson

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EFS ID:	24890245
Application Number:	11965046
International Application Number:	
Confirmation Number:	2809
Title of Invention:	Virtual Detents Through Vibrotactile Feedback
First Named Inventor/Applicant Name:	Michael D. Levin
Customer Number:	34300
Filer:	Michael T. Morlock/Amber Johnson
Filer Authorized By:	Michael T. Morlock
Attorney Docket Number:	IMM253
Receipt Date:	11-FEB-2016
Filing Date:	27-DEC-2007
Time Stamp:	14:31:48
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	Foreign Reference	JP3085481.pdf	224960 727bf75925805a8b567e22640a75ff9389cb528e	no	26
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Information:					

2	Non Patent Literature	JPOA07232014.pdf	145454 e7faa73bb1b87bed15bca8267597805add8ab0da	no	3
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3	Non Patent Literature	JPOA08182015.pdf	113038 44c3b4a326132f1b873b3d40b504f1fdad8cb91c	no	3
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4	Non Patent Literature	JPOA09302014.pdf	100639 c0d9f238d728a19b81acd7a034b42db1ba818f15	no	3
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5	Non Patent Literature	JPOA10282014.pdf	697088 386308cebda9c851cd22f999ae4797605d12409f	no	13
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6	Non Patent Literature	KROA01232014.pdf	359026 c95451269670d707b1ba9c2dc73ff86f7407e8e2	no	8
Warnings:					
Information:					
7	Non Patent Literature	KROA07292014.pdf	359794 c24385aaf0784cce73385c6ad340be55b5d55964	no	8
Warnings:					
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8	Foreign Reference	JP2005267080.pdf	2884139 89225cca9e581569003982296ecd904284e109cf	no	33
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9	Foreign Reference	WO02073587.pdf	5013557 b5ec86f29ca17e86d6c25eedbdbf13c0bee69774	no	67
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10	Foreign Reference	WO03036457.pdf	3109379 e04fb3b33ca1f1da756c2df39f9ea1ae2606e55c	no	54
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11	Foreign Reference	WO06094308.pdf	4399345 5980ba3eddc0d2cc3c05648810319a16691f8aed	no	68
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12	Foreign Reference	JP2003084901.pdf	968590 8cb71b7058edc35c3e8540d51a257db225c5e247	no	12
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Information:					
13	Transmittal Letter	Certification.pdf	103242 db83456ebec6331641aa2dcc2990ecddc66116d3	no	5
Warnings:					
Information:					
14	Information Disclosure Statement (IDS) Form (SB08)	08a.pdf	111754 5cbf876b15d829a93354627794 7a827f7585d0d1	no	1
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15	Miscellaneous Incoming Letter	Transmittal.pdf	68328 80ca265087b51e093e4021a68d4bf3880ba6c89c	no	1
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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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CLAIMS

[Claims]
[Claim 1]In tactile feeling feedback touch control which inputs a signal into a computer and outputs power to a user of touch control, It consists of a touch input device which has a substantially flat contact surface, and at least one actuator connected to this touch input device, It operates so that the aforementioned touch input device may input a position signal into a processor of the aforementioned computer based on a position on the aforementioned contact surface where a user touched, The aforementioned position signal expresses a position with two dimensions, and the aforementioned actuator outputs power to the aforementioned touch input device, Tactile feeling feedback touch control as for which tactile feeling is given to a user who is touching the aforementioned contact surface, the aforementioned actuator outputs the aforementioned power based on power information outputted by the aforementioned processor, and the aforementioned actuator outputs power to the aforementioned touch input device directly.

[Claim 2]The tactile feeling feedback touch control according to claim 1 which arranges cursor in graphic environment where the aforementioned computer was partially displayed on a display device based on the aforementioned position signal at least.

[Claim 3]The tactile feeling feedback touch control according to claim 1 into which the aforementioned touch input device is a touchpad and this touchpad is separated from a display screen of the aforementioned computer.

[Claim 4]The tactile feeling feedback touch control according to claim 1 by which the aforementioned touch input device is contained in a display screen of the aforementioned computer as a touch screen.

[Claim 5]The tactile feeling feedback touch control according to claim 1 by which the aforementioned touch input device is united with a housing of the aforementioned computer.

[Claim 6]The tactile feeling feedback touch control according to claim 5 whose aforementioned computer is a portable computer.

[Claim 7]The tactile feeling feedback touch control according to claim 1 currently provided by housing in which the aforementioned touch input device is separated from the aforementioned computer.

[Claim 8]The tactile feeling feedback touch control according to claim 1 with which a user touches the aforementioned contact surface with a finger.

[Claim 9]The tactile feeling feedback touch control according to claim 1 with which a user touches the aforementioned contact surface using a physical object which a user held.

[Claim 10]The tactile feeling feedback touch control according to claim 9 in which said physical object is a stylus.

[Claim 11]The tactile feeling feedback touch control according to claim 1 currently united with a housing of a handheld device with which the aforementioned touch input device is operated by at least one hand of a user.

[Claim 12]The tactile feeling feedback touch control according to claim 11 which is a remote control with which the aforementioned handheld device controls a function of an electronic device or an instrument.

[Claim 13]The tactile feeling feedback touch control according to claim 1 which said at least one actuator was the 1st actuator, and was connected to the aforementioned touch input device since power was outputted to the aforementioned touch input device and which has an actuator of at least one addition.

[Claim 14]The tactile feeling feedback touch control according to claim 1 which is the linearity power which is outputted substantially at right angles to a surface of the aforementioned contact surface of the aforementioned touch input device as for the aforementioned power.

[Claim 15]The tactile feeling feedback touch control according to claim 14 which the aforementioned actuator is a linear actuator which outputs power with linear flexibility, and the aforementioned actuator is firmly connected with the aforementioned touchpad, and is firmly connected with a basic housing.

[Claim 16]The tactile feeling feedback touch control according to claim 14 which the aforementioned actuator is a rotary actuator which outputs power with rotational flexibility, and is converted to the aforementioned linearity power on the aforementioned touch input device as for outputted power.

[Claim 17]The tactile feeling feedback touch control according to claim 1 in which the aforementioned actuator contains an electrostrictive actuator.

[Claim 18]The tactile feeling feedback touch control according to claim 1 in which the aforementioned actuator contains a speech coil actuator.

[Claim 19]The tactile feeling feedback touch control according to claim 1 in which the aforementioned actuator contains a pager motor.

[Claim 20]The tactile feeling feedback touch control according to claim 1 in which the aforementioned actuator contains a solenoid.

[Claim 21]The tactile feeling feedback touch control according to claim 1 which consists of a touch equipment microprocessor separated from the aforementioned processor, and gives a control signal to the aforementioned actuator.

[Claim 22]The tactile feeling feedback touch control according to claim 1 by which the aforementioned actuator outputs vibration or pulse tactile feeling to the aforementioned touch input device.

[Claim 23]The tactile feeling feedback touch control according to claim 1 which at least one region concerned gives the aforementioned position signal here, and gives a signal used by aforementioned computer in order that other at least one region may control a different function including a region where the aforementioned touch input device differs in plurality.

[Claim 24]The tactile feeling feedback touch control according to claim 23 for which said different function includes a rate control function of value.

[Claim 25]The tactile feeling feedback touch control according to claim 23 in which said different function includes button press.

[Claim 26]The tactile feeling feedback touch control according to claim 23 connected with tactile feeling which differs in said at least one region from one region besides the above outputted to the aforementioned touch input device.

[Claim 27]The tactile feeling feedback touch control according to claim 23 which will output tactile feeling if a user moves a contactant object to one region besides the above from the one aforementioned region.

[Claim 28]The tactile feeling feedback touch control according to claim 1 which has further a sensor which detects movement and a position of the aforementioned touch input device substantially at right angles to the aforementioned contact surface and to which an input signal based on movement or a position detected [aforementioned] is transmitted to the aforementioned computer.

[Claim 29]The tactile feeling feedback touch control according to claim 2 which the aforementioned processor outputs the aforementioned power information and gives aforementioned tactile feeling according to an interaction of the aforementioned cursor and a graphic object in the aforementioned graphic environment.

[Claim 30]If a menu is displayed on the aforementioned graphic environment and the aforementioned cursor moves between menu elements in this menu, The tactile feeling feedback touch control according to claim 2 which outputs a pulse to the aforementioned touch input device, moves the aforementioned touch input device along with the aforementioned z-axis by this pulse, and conveys the aforementioned pulse to a user who is touching the aforementioned contact surface.

[Claim 31]If an icon is displayed on the aforementioned graphic environment and the aforementioned cursor moves in this icon top, The tactile feeling feedback touch control according to claim 2 which outputs a pulse to the aforementioned touch input device, moves the

aforementioned touch input device along with the aforementioned z-axis by this pulse, and conveys the aforementioned pulse to a user who is touching the aforementioned contact surface.

[Claim 32]If a menu is displayed on the aforementioned graphic environment and the aforementioned cursor moves between menu elements in this menu, The tactile feeling feedback touch control according to claim 2 which outputs a pulse to the aforementioned touch input device, moves the aforementioned touch input device along with the aforementioned z-axis by this pulse, and conveys the aforementioned pulse to a user who is touching the aforementioned contact surface.

[Claim 33]If a hyperlink is displayed on this web page and the aforementioned cursor moves in this hyperlink top while displaying a web page on the aforementioned graphic environment, The tactile feeling feedback touch control according to claim 2 which outputs a pulse to the aforementioned touch input device, moves the aforementioned touch input device along with the aforementioned z-axis by this pulse, and conveys the aforementioned pulse to a user who is touching the aforementioned contact surface.

[Claim 34]In tactile feeling feedback touch control which inputs a signal into a computer and outputs power to a user of touch control, It consists of a touch input device which has a substantially flat contact surface, and at least one actuator connected to this touch input device, It operates so that the aforementioned touch input device may input a position signal into a processor of the aforementioned computer based on a position on the aforementioned contact surface where a user touched, The aforementioned position signal expresses a position with two dimensions, and the aforementioned actuator is connected to inertial mass, Tactile feeling feedback touch control which the aforementioned actuator meets substantially an axis vertical to said flat contact surface, outputs an inertia force, and conveys the aforementioned inertia force to a user who is touching the aforementioned contact surface via the aforementioned touch input device.

[Claim 35]The tactile feeling feedback touch control according to claim 34 which arranges cursor in graphic environment where the aforementioned computer was partially displayed on a display device based on the aforementioned position signal at least.

[Claim 36]The tactile feeling feedback touch control according to claim 34 which the aforementioned actuator is a linear actuator and this actuator makes move the aforementioned inertial mass to a 2-way in accordance with a linearity axis substantially vertical to said flat contact surface.

[Claim 37]The tactile feeling feedback touch control according to claim 34 which is the touchpad with which the aforementioned touch input device is separated from a display screen of the aforementioned computer.

[Claim 38]The tactile feeling feedback touch control according to claim 34 which the aforementioned touch input device is contained in a display device of the aforementioned computer, and gives a touch screen.

[Claim 39]In equipment which gives an input to computer paraphernalia which perform graphic environment, and gives a user tactile feeling feedback, Consist of a touch input device contacted by user and an actuator connected to this touch input device, and the aforementioned touch input device, A position contacted by user on the flat surface of this touch input device is determined, It has at least one sensor which gives a position signal which shows the aforementioned position to the aforementioned computer paraphernalia, The aforementioned computer paraphernalia arrange cursor in the aforementioned graphic environment based on the aforementioned position signal partially at least, and the aforementioned actuator, A control signal pulled out from power information outputted by the aforementioned computer paraphernalia is received, Equipment which gives tactile feeling feedback to a user who correlates with an interaction produced in the aforementioned graphic environment between graphic objects where the aforementioned actuator outputs power on the aforementioned touch input device by the aforementioned power information, and which differ in the aforementioned power from the aforementioned cursor.

[Claim 40]The equipment according to claim 39 which is the linearity power whose aforementioned power outputted to the aforementioned touch input device is substantially vertical to the aforementioned surface of the aforementioned touch input device.

[Claim 41]The equipment according to claim 39 which it has further a touch equipment microprocessor which is separated from a host processor of the aforementioned computer paraphernalia, and this microprocessor receives the aforementioned power information from the aforementioned host processor, and transmits the aforementioned control signal to the aforementioned actuator.

[Claim 42]The equipment according to claim 39 with which an interaction produced within the aforementioned graphic environment includes a collision between the aforementioned cursor and said different graphic object.

[Claim 43]The equipment according to claim 39 in which said different graphic objects are either an icon, a window and a menu item including selection of said different graphic object according [an interaction produced within the aforementioned graphic environment] to the aforementioned cursor.

[Claim 44]The equipment according to claim 39 which transmits information which is movable, detects movement in alignment with the aforementioned axis, and expresses this movement to the aforementioned computer paraphernalia in accordance with an axis in which the aforementioned touch input device is substantially vertical to said flat surface of this touch input device.

[Claim 45]The equipment according to claim 39 whose aforementioned actuator the aforementioned computer paraphernalia are movable, the aforementioned touch input device is united with a housing of the aforementioned computer paraphernalia, and is an electrostrictive actuator.

[Claim 46]In a host computer system and a tactile feeling touch screen interface to be used,

Consist of a touch screen which has the substantially flat surface, and at least one actuator connected to said flat touch surface, and the aforementioned touch screen, Display graphic images, and it operates so that a position signal may be reported to a processor of the aforementioned computer based on a position on the aforementioned surface of a touch on which a user is in contact, A tactile feeling touch screen interface which the aforementioned position signal expresses a position of the aforementioned contact by two dimensions, and outputs power with the aforementioned actuator vertical to said flat surface which a user in contact with the aforementioned surface senses.

[Claim 47]The tactile feeling touch screen interface according to claim 46 whose aforementioned actuator is an electrostrictive actuator which gives vibration force to said flat touch surface.

[Claim 48]The tactile feeling touch screen interface according to claim 46 which is a speech coil actuator with which the aforementioned actuator gives vibration force to said flat touch surface.

[Claim 49]It is equipped with said flat touch surface by flexible connecting mechanism, and by this said flat touch surface, It is along in the direction vertical to said flat touch surface when the aforementioned electrostrictive actuator makes the aforementioned power act, and is the movable tactile feeling touch screen interface according to claim 47 to a housing.

[Claim 50]It is equipped with the aforementioned touch surface by flexible connecting mechanism, and by this said flat touch surface, It is along in the direction vertical to said flat touch surface when the aforementioned speech coil actuator makes the aforementioned power act, and is the movable tactile feeling touch screen interface according to claim 48 to a housing.

[Claim 51]The tactile feeling touch screen interface according to claim 47 which uses a many electrostrictive actuator in combination with making the aforementioned power act.

[Claim 52]The tactile feeling touch screen interface according to claim 47 which uses a many speech coil actuator in combination with making the aforementioned power act.

[Claim 53]The tactile feeling touch screen interface according to claim 46 which is the vibration force as which the aforementioned power is specified by a periodic waveform.

[Claim 54]The tactile feeling touch screen interface according to claim 46 which is the pulse power in which the aforementioned power is specified by a single cycle of a periodic waveform.

[Claim 55]The tactile feeling touch screen interface according to claim 46 which is the vibration force specified by a cycle of a wave-like predetermined number with the aforementioned periodic power.

[Claim 56]The tactile feeling touch screen interface according to claim 46 which is the vibration force as which the aforementioned power is specified by periodic waveform and an envelope.

[Translation done.]

Detailed Description

[Detailed explanation of the device]
[0001]
[The background of a device]
This design about the interface of the computer by a user, and a mechanical apparatus generally, It is equipment used for taking an interface with a computer and an electronic device in more detail, and is related with the equipment which gives a user tactile feeling feedback (haptic feedback).
[0002]
Human being has taken the electronic device and the mechanical apparatus, and the interface with various applications, and it is more natural, and is easy to use it, and the demands to a useful interface are fixed concerns. In relation to this design, human being has taken computer paraphernalia and an interface with various applications. It is interacting with computer generation environment, such as a game, a simulation, and an application program, in a certain field. Computer input units, such as a mouse and a trackball, are used for controlling cursor within graphic environment, and give an input to such applications.
[0003]
In a certain interface device, a force feedback (force feedback) or tactile perception feedback (tactile feedback) is also given to a user. Here, these are collectively called "tactile feeling feedback (haptic feedback)." For example, the joy stick of a tactile feeling version, a mouse, a gamepad, a steering wheel, and other equipment can output power to a user based on the event and interaction which are produced within graphic environment like a game and other application programs.
[0004]
In the portable computer or electronic device like a laptop computer, a mouse needs very big work space. As a result, compact equipment like a trackball is used. A "touchpad" is still more reputable at a portable computer. This is a rectangular flat small pad and is provided near the keyboard of a computer. A touchpad detects the position of a pointing object by various detection technology like a capacity sensor or a pressure sensor of detecting the pressure which acts on this touchpad. A user usually touches a touchpad by a fingertip and moves the cursor which made move a finger on this pad and was displayed in the graphic environment. In other embodiments, by pressing a stylus chip on a touchpad, the user can make it connected with a touchpad, can operate a stylus, and can move this stylus.
[0005]
I hear that tactile feeling feedback is not given to a user, and one problem about the existing touchpad has it. Therefore, the user of a touchpad cannot experience tactile feeling which assists or tells a user about the control task of targeting or others within graphics type environment. The conventional touchpad cannot acquire the advantage of the software which is performed on a portable computer and in which existing tactile feeling is possible.
[0006]
[The outline of a device]
This design is turned to the flat tactile feeling feedback type touch control used for giving an input to a computer system. This control can be made into the touch screen which can consider it as the touchpad provided by the portable computer, or is looked at by various pieces of equipment. Tactile feeling outputted to touch control improves the interaction in graphic environment and operation which were displayed, when controlling an electronic device.

[0007]
In more detail, this design inputs a signal into a computer and is related with the tactile feeling feedback type touch control which outputs power to a user. This touch input device inputs a position signal into the processor of a computer based on the position of the user contact on a contact surface including the touch input device which has a contact surface where this control is substantially flat. A computer arranges cursor in the graphic environment partially displayed on the display device based on the position signal at least. At least one actuator is connected to a touch input device, power is outputted to this touch input device, and tactile feeling is given to the user who touches a contact surface. An actuator outputs power to an actuator based on the power information outputted by the processor.
[0008]
A touch input device can be used as the touchpad separated from the display screen of the computer, or can be included in the display screen of a computer as a touch screen. A touch input device can be provided in the housing which could unite with the housing of a computer or a handheld device, or was separated from the computer. A user touches a contact surface by the finger, or a stylus and other objects. As for power, it is preferable that it is the linearity power outputted substantially at right angles to the surface of the contact surface of a touch input device. An actuator contains an electrostrictive actuator, a speech coil actuator, a pager motor, a solenoid, or the actuator of other types. According to one embodiment, an actuator is connected between a touch input device and a basic life table surface (grounded surface). According to other embodiments, an actuator is connected to inertial mass. Here, an actuator meets an axis vertical to a flat contact surface substantially, and outputs an inertia force to a touch input device. The microprocessor of the touch equipment separated from the general purpose processor of the computer receives power information from a host computer, gives a control signal based on this power information, and controls an actuator.
[0009]
As for a pulse, vibration, and tactile feeling like a spatial texture (spatial texture), it is preferable to be outputted according to the interaction of the controlled cursor and the graphic object in graphic environment. For example, when between the menu elements in a menu is moved to cursor and an icon top is moved, or when a hyperlink top is moved, it can output. The touch input device can include the region where a large number differ. Here, at least one region gives a position signal, and other at least one region gives the signal used by computer, and controls the rate control function of value, and a different function like button press. the association between a different region or this region -- things -- you can make it connected with tactile feeling
[0010]
This design gives tactile feeling advantageously to the flat touch control apparatus of a touchpad or a computer like a touch screen. Tactile feeling helps a user, tells a user about the interaction and event within a graphic user interface or other environment, and makes the cursor target task easy. This design makes a portable computer device hold such touch control, and uses the software which enabled the existing tactile feeling feedback. The tactile feeling touch equipment disclosed here is inexpensive, and is compact, and its power consumption is low, and it can be easily built into an extensive portable computer, a desktop computer, and an electronic device.
[0011]
Other advantages are these things [reaching, reading the following Descriptions of this design and examining Drawings] of this design, and become clear in a person skilled in the art.
[0012]

[The embodiment of a device]
Fig.1 is a perspective view of the portable computer 10 containing the tactile feeling touchpad of this design. The computer 10 is preferable and portable, i.e., "laptop."
It is a computer, and a user can carry, or it can transport and, in addition to a fixed power source, electric power is supplied by the portable power supply of a battery or others. The computer 10 executes 1 or two or more host application programs, and, thereby, a user does an interaction (dialog) via peripheral equipment.
[0013]
The computer 10 contains the input and output unit of versatility which was illustrated containing the keyboard 14 which gives a character or a toggle (toggle) input to a computer, and the touchpad 16 of this design from the display device 12 which outputs graphic images to a user, and a user. Although any of a display device various type may be sufficient as the display device 12, to a portable computer, its flat panel equipment is the most common. Based on the application program and/or operation system which are operating, the display device 12, The graphic environment 18 like the graphical user interface (GUI) which includes a publicly known graphic object in the cursor 20, the window 22, the icon 24, and the other GUI environment to which it can be made to move by a user input can be displayed. Other equipment, such as memory storage (a hard disk drive, a DVD-ROM drive, etc.), a network server or a client, and a game controller, may be incorporated or connected to the computer 10. According to the embodiment of an alternative plan, the computing device placed on the table or other surfaces, an erect arcade game machine, and the other bodies are equipped with the computer 10, and the extensive form containing the portable device carried and used by a user's one hand can be taken. For example, the host computer 10 can be made into a video game console, a personal computer, a workstation, a television "set top box (set top box)", a "network computer", other calculations, or an electronic device.
[0014]
As for the touchpad equipment 16 of this design, it is preferable that it seems to be similar to the conventional touchpad in appearance. The pad 16 has the flat and rectangular smooth surface, as shown in a figure, it can arrange it under the keyboard 14 in the housing of the computer 10, or it can be arranged to other regions of a housing. When a user operates the computer 10, a user places a fingertip or other objects on the touchpad 16, and moves the cursor in the graphic environment 18 where move this fingertip and it corresponds.
[0015]
The touchpad 16 inputs coordinate data into the main microprocessor of the computer 10 based on the detection position of the object on this touchpad (or neighborhood) at the time of operation. Like many conventional touchpads, the touchpad 16 can use the detector of different types, such as a capacity type and a resisted type. The working example of the touchpad of a certain existing is disclosed, for example in US,5521336,B or No. 5943044. Typically, a capacity type touchpad detects the position of the surface of a touchpad, or the object of the neighborhood based on the capacitive coupling between the capacitors of a touchpad and an object. Typically, a resisted type touchpad is pressure perception which detects a pressure of an object to a finger, and a stylus and other pads.
A conductive layer in a pad, trace, a switch, etc. electrically connect with this pressure.
A resisted type and the touchpad of other form can detect the size of the pressure applied by the user, and pressure intensity can be used for them for the proportionality or the variable input to the computer 10. If a resisted type touchpad is added to the position whose pressure it is partially

deformable typical at least, and is specific, the conductor in the position concerned will electrically connect it. Such deformable nature is useful about this design. It is because the size of the pulse outputted on a touchpad which is used for this design, or power like vibration can be amplified potentially. Power can be amplified if the adaptation suspension system (tuned compliant suspension) adjusted between the actuator and the object which moves is provided. According to the embodiment of this design, the touchpad of the other form which needs neither a capacity type touchpad nor remarkable contact pressure is better suitable. When the overpressure on a touchpad is many, it is because it interferes with movement of the touchpad for tactile feeling feedback. The detection technology of other form can also be used for a touchpad. Here, the term of a "touchpad" contains any detection devices contained in touchpad equipment besides the surface of the touchpad 16.

[0016]

As for the touchpad 16, it is preferable to carry out operation similar to the existing touchpad, and cursor correlates the speed of the fingertip on a touchpad with the distance which moves in a graphic environment. For example, if a finger is promptly moved so that a user may cross a pad, cursor will move a bigger distance than the case where a user moves a fingertip still more gently. If a user's fingertip arrives at the edge of a touchpad before cursor arrives at the desired destination, it will keep on a user's lifting a finger from a touchpad simply, moving, putting on the place distant from the edge, and moving cursor. This is separating a mouse from the surface, lifting it and changing the position of a mouse, and offset between cursor, and a similar function "to deduce (indexing)." Many touchpads can provide the specific region assigned to the specific function which is unrelated to the cursor. Such an embodiment is described in detail below with reference to Fig. 7. If a user does "tap (tap)" (an object is promptly contacted to a pad and is detached) of the touchpad in a specific position and gives instructions, it may enable it to ** the touchpad 16 in a certain embodiment. For example, while a user does the tap of the pad or does a "double-tap" with a finger, he selects this icon as an icon for the controlled cursor in piles.

[0017]

The touchpad 16 is provided with the capability to output tactile feeling feedback like a stereoscopic vision to the user who contacts as physically as this touchpad 16 (contact), in this design. About many embodiments which explain the structure of a tactile feeling feedback touchpad in full detail, it describes in detail by the following. Preferably, it is linearity (or substantially linearity), and the power outputted to a touchpad is turned along with the z-axis, and is substantially vertical to the surface of the touchpad 16, and the upper surface of the computer 10. Such movement is not preferable, although power is given to the touchpad 16 and plane (x-y) movement can be made to cause instead of z-axis movement in the surface of the surface in a different embodiment in addition to z-axis movement.

[0018]

1 or two or more actuators which were connected with the touchpad 16 can be used, and various tactile feeling can be outputted to the user in contact with a pad. For example, a shock, vibration (variable or fixed amplitude), and textures (texture) can be outputted. In the power outputted to a pad, it is partial at least irrespective of the position of a finger, or an objective state based on the state of the controlled object in the position of the finger on a pad, or the graphic environment of the host computer 10. Since a microprocessor and other electronic controllers control the size and/or direction of a power output of an actuator using an electronic signal, the power outputted to the touchpad 16 is considered to be "computer control." As for the pad 16 whole, it is preferable to really [single] have tactile feeling as a component. The tactile feeling feedback

actuator and the related gearing of itself are provided to each moving part of a pad, and it can make it possible to give tactile feeling to it in other embodiments only at a specific position. For example, a certain embodiment may include the touchpad which has a different portion to which it can bend or can be made to move to other portions of a pad.
[0019]
According to other embodiments, the touchpad 16 can be provided in the separate housing connected to some computers 10 via the cable or the wireless communication, and this housing receives power information from the computer 10, and it sends position information to this computer 10. For example, Universal Serial Bus (USB), a fire wire, or the standard serial bus can connect a touchpad to the computer 10. In such an embodiment, the computer 10 can be used as a desktop, a deferment computer, or equipment, and does not need to be a portable device.
[0020]
1 or the button 26 beyond it can also be provided in the housing of the computer 10 used in relation to the touchpad 16. A user's hand can access a button easily, can push each button, and can give a clear input signal to a host computer. Typically, each button 26 is equivalent to the similar button looked at by the mouse input device, it can be used for the left button choosing a graphic object by this (a click or a double click), and the right button can carry out a context menu etc. According to a certain embodiment, tactile feeling feedback and/or a kinesthetic-sense force feedback can be given to 1 or two or more buttons 26. Other characteristics of this disclosure may be used with this design.
[0021]
In a certain embodiment, 1 or two or more flexible regions 28 which it can be contacted in it by the user and can give tactile feeling feedback to it when a user operates the touchpad 16 in the housing of the computer paraphernalia 10 can be included.
Thus, the housing can give tactile feeling (it is use of eccentric rotation mass to motor connected to housing) feedback, and the touchpad 16 can give separate tactile feeling feedback. Thereby, the host can control two different tactile feeling to a user simultaneously. For example, vibration of a low frequency wave can be transmited to a user via a housing, and high frequency oscillation can be transmited to a user via the touchpad 16. Other buttons or other control provided with tactile feeling feedback can also give tactile feeling feedback independently from other control.
[0022]
As for a host application program and/or an operating system, it is preferable to display environmental graphic images on the display device 12. The software and environment which are performed with the host computer 12 have an extensive kind. For example, a host application program, A word processor, a spreadsheet, video or a computer game, a paint program, An operating system, a graphical user interface, The web page or browser which uses a simulation, HTML, or a VRML command, It can be considered as the application program of others which output a force-feedback command to the touchpad 16 using the input from a science analysis program, a virtual reality training program, application, or the touchpad 16. For example, many games and other application programs, I-Force which can be obtained from IMASHON Corporation of San Jose, California, U.S., including force-feedback functionality (registered trademark), The protocol/driver of a standard like FEELit (registered trademark) or Touchsense (registered trademark) may be used, and it may communicate with the touch panel 16.
[0023]
The touchpad 16 can include a circuit required to process the command signal from a host's

microprocessor while reporting a control signal to the microprocessor of the host computer 10. For example, it is used for a suitable sensor (and related circuit) reporting the position of the finger of the user on the touchpad 16. Touchpad equipment receives the signal from a host and includes the circuit which outputs tactile feeling using 1 or two or more actuators according to this host signal. According to a certain embodiment, in order to execute the power command which the touchpad 16 reported touchpad sensor data to the host, and/or was received from this host, the microprocessor of the separated part can be provided. The aforementioned command contains the type of tactile feeling, and the parameter which describes ordered tactile feeling, for example. As an alternative plan, the touchpad microprocessor can only pass the data poured from the general purpose processor to the actuator. A command/parameter, and the poured data can be included in the term of "power information." A touchpad microprocessor can perform tactile feeling independently, after receiving a host command by controlling a touchpad actuator. Or the host processor can maintain the bigger degree of control (degree of control) by controlling an actuator still more directly exceeding tactile feeling. According to other embodiments, a logic circuit like the state machine (state machine) provided by the touchpad 16 can treat tactile feeling instructed by the host general purpose processor. The structure and the control method of using it for reading a sensor signal and giving the tactile feeling feedback to equipment are described in US,5734373,B in detail.

[0024]

Fig.2 is a perspective view of other embodiments of the equipment which can contain the active touchpad 16 of this design. Can use equipment as the handheld computer remote control 30, and this handheld computer remote control, It is what a user grips and operates it single hand and accesses the function of an electronic device or apparatus remotely. (For example, the Internet or the network computer connected to a television, a video cassette recorder, a DVD player, an audio/video receiver, and a television). For example, in order to operate the function of the controlled equipment, some buttons 32 can be included in the remote control 30. The touchpad 16 can be further provided so that the directional input (directional input) which the user complicated further can be given. For example, the equipment (controlled apparatus) controlled may have a selection screen to which cursor is moved. As the touchpad 16 controls cursor by two dimensions, it is controllable. The touchpad 16 contains the capability to output tactile feeling to a user as mentioned above, based on the controlled value or event. For example, a touchpad or a user can be made to output a pulse by volume level (volume level) which passes through the middle point or reaches a maximum level.

[0025]

A computer system [like Web-TV of Microsoft Corporation as one application] whose controlled equipment is, Or it can be considered as other computer computing devices which display the web page accessed via a graphical user interface and/or a network like the Internet. The user can control the direction of cursor by moving a finger (or other objects) on the touchpad 16. Cursor can be used in order to choose and/or operate an icon, a window, a menu item, a graphical button, a slide bar, a scroll bar, a graphical user interface, or the graphic object of others in a desktop.

Cursor can also be used in order to choose and/or operate the GUARAFIKARU object on web pages, such as Rink, an image, and a button. Other force senses relevant to a graphical object are described below with reference to Fig.7.

[0026]

Fig.3 is a perspective view of 1st Embodiment 40 of the touchpad 16 of this design which gives a

user tactile feeling feedback. According to this embodiment, 1 or two or more electrostrictive actuators 42 are connected to the lower surface of the touchpad 16. The electrostrictive actuator 42 is driven with a suitable publicly known electronic device to a person skilled in the art. According to a certain embodiment, if the single electrostrictive actuator 42 is arranged in the center of the touchpad 16, or its neighborhood or the spatial restriction of a housing requires such a position, it will be detached and arranged at one side. According to other embodiments, two or more electrostrictive actuators 42 can be arranged to the region to which touchpads differ. A dashed line shows one form. Here, the actuator 42 is arranged in each corner of the pad 16, and the center of a pad.

[0027]

The electrostrictive actuator 42 can output a small pulse, vibration, or texture feeling to the touchpad 16, respectively, and if the user is in contact with the touchpad, it can output it also to a user. The touchpad 16 whole is preferably moved by the power outputted by the actuator 42. Preferably, it is linearity (or substantially linearity), and the power outputted to a touchpad is along the z-axis, and is substantially vertical to the surface of the touchpad 16, and the upper surface of the computer 10.

According to a different embodiment, as mentioned above, power is made to act on the touchpad 16, in addition to z-axis movement, it replaces with it, and side two side (x-y) movement of a pad is caused in the surface. For example, the first linear actuator can give movement of a x axis, and the second linear actuator can give movement to the y-axis and/or a x axis.

[0028]

The frequency of vibration outputted by the actuator 42 can be changed by giving a control signal which is different in the actuator 42. A pulse or the size of vibration is controllable based on the given control signal. If the many actuator 42 is provided, a stronger vibration can be given to a touchpad by driving a two or more actuator simultaneously. One actuator is provided by the final edge of a touchpad, and when it is the only actuator which it drives, the user can experience a vibration stronger than the opposite side of a touchpad by the side which has an actuator of a touchpad. A different size and the localized effect are not all and can be acquired by driving some actuators. Since the tip of the finger of the user in contact with a pad is quite sensitive, the power outputted to validating [tactile feeling] and impressing people does not need to have big amplitude.

[0029]

In addition to the finger in contact with a touchpad, a user may hold other objects which carry out direct contact to a touchpad. Tactile feeling outputted to a touchpad can be transmited via the object held at the user's hand. For example, the user can hold the stylus which has a point which contacts the touchpad 16 more correctly than a finger. Other objects may be used. According to a certain embodiment, an object special to improving tactile feeling can be used. For example, other objects which have a stylus, a flexible portion, and adaptability can strengthen at least some touchpad tactile feeling which is experienced by the user.

[0030]

The electrostrictive actuator 42 has some advantages over the touchpad 16. Since these actuators can be made very thinly and small, they can be used within a typical compact housing with portable electronic equipment. Since these require very low electric power, they are suitable for the equipment with which electric power is limited (for example, electric power is supplied with a battery). According to the embodiment of shoes to be disclosed here, the electric power for actuators can be separated from the bus which connects a computer to a touchpad (or touch

screen), and can be pulled. For example, when the touchpad 16 is provided by the separate housing, a pad can be connected to a computer by Universal Serial Bus, and electric power and data (for example, the flowing power data, the power command) can be supplied to a pad from this computer.

[0031]

Fig.4 is a side view of Embodiment 40 of the touchpad 16 of this design, as shown in Fig.3.The touchpad 16 is directly connected with the installed electrostrictive actuator 42 which operates so that power may be generated to the touchpad 16, when an electronic signal is input into an actuator. Typically, an electrostrictive actuator contains two layers which can move mutually, when current is given to an actuator. Here, a basic part of an actuator has stood it still to the envelopment housing 41.

On the other hand, a moving part of an actuator and a touchpad moves to the housing 41. Operation of the electrostrictive actuator which outputs power based on input electric signals is publicly known to a person skilled in the art.

[0032]

The touchpad 16 can be connected only with the actuator 42, or can be additionally connected with the housing of computer paraphernalia in other positions except the actuator 42. It is the preferable adaptation connection (compliant connection) for which other connecting mechanisms (coupling) use the material and the element like a spring or a bubble. As for the touchpad 16, when such connection is not made adaptively, it is preferable to have adaptability (compliance) by itself so that the portion of a pad may respond and move to the power of an actuator and tactile feeling may be transmited to a user still more effectively.

[0033]

Since the touchpad is directly connected with the actuator 42, any power generated can be directly given to the touchpad 16. An electrical signal is preferably acquired from a microprocessor and what kind of circuit required of converting a microprocessor signal to a suitable signal and using it with the actuator 42.

[0034]

Fig.5 is a side view of other Embodiments 50 of this design.

The touchpad 16 is arranged on 1 or two or more springs 52.

The spring 52 connects the touchpad 16 with the rigid housing of the computer 10, and enables it to move this touchpad 16 along with the z-axis 56. Although a pulse (shock) or vibration effective in the pad 16 is generated, only movement of the very small range is required. In order to restrict the life performance of the touchpad 16 to the range of the request which was along the z-axis, stopper (not shown) can be arranged.

[0035]

The actuator 54 is connected with it, in order to give power to this touchpad and to make the touchpad 16 move this touchpad to it along with the z-axis. According to this embodiment, the actuator 54 is a linearity speech coil actuator, and the moving part (bobbin) of the actuator concerned is directly connected to the touchpad 16 here.

The actuator 54 is grounded to the housing of the computer 10, outputs linearity power to the touchpad 16, and drives a touchpad along with the z-axis. A short pulse and shock are outputted, or the moving part of an actuator is vibrated, and vibration which has the frequency of a specific request can be given. The spring 52 can return the touchpad 16 to a static position, after the power from an actuator moves a touchpad up and down. The spring can make the power further outputted by the actuator 54 as adaptation support was provided and mentioned above in the

touchpad 16 expand. According to other embodiments, although the touchpad 16 is connected with a rigid housing, the spring element different type like flat spring, foam, and another flexible body and adaptation material can be used.
[0036]
According to a certain embodiment, the user can press the touchpad 16 along with the z-axis, and can give an additional input to the computer 10. For example, they are a photo sensor, a magnetic sensor, and PORUHEMUSU (polhemus) for detecting the position of the touchpad which was along the z-axis.
A sensor etc. can be used. The position on the z-axis can be used for giving a proportionality input to a computer. The power type [other] like spring power, braking force, an inertia force, and the power of other datum references can be outputted along with the z-axis. The 3-D elevation (elevation) can be simulated within graphical environment by moving a pad to different height along with the z-axis. When the pad 16 can use it as an analog input based on the distance which the whole pad moves along with the z-axis, and/or when kinesthetic (power) feedback is given with z-axis flexibility, movement of the wider range of the pad 16 which was along the z-axis is desirable. An elastomer layer can be provided, when a user can press the touchpad 16, can close a switch and can give a button or a switch input to the computer 10 (using a contact switch, an optical switch, etc.). When z shaft movement of such a pad 16 is permitted, z shaft movement needs the power of a comparatively big quantity for moving a pad in early stages at least. It is because movement of such the z-axis is not desired while the user is doing normal use of the pad.
[0037]
The speech coil actuator 54 contains a coil and a magnet preferably. Here, current flows through a coil, interacts with the magnetic field of a magnet, and it causes power in the flexible region (a coil or a magnet) of an actuator so that it may be publicly known to a person skilled in the art. The actuator type [other] like the actuator of a standard loudspeaker, E core type actuator, a solenoid, a pager (pager) motor, a DC motor, a movable magnet motor, and others can also be used. In accordance with an axis vertical to the z-axis, in accordance with other different directions (rotation or linearity) from the z-axis, an actuator can be arranged so that a linear motion may be outputted. Here, such output movement is converted to the linear motion which was along the z-axis with a certain mechanism publicly known to a person skilled in the art.
[0038]
The touchpad 16 can be integrally used as an elastomer layer and/or a printed-circuit board by a subassembly. Here, 1 or two or more actuators are connected with a printed-circuit board, and tactile feeling is given to the touchpad 16. A spiral spring can be provided so that it may engage with electric contact. Or two or more speech coil actuators can also be arranged in a lower different position of the touchpad 16.
[0039]
Fig.6 is a side view of 3rd Embodiment 60 of the tactile feeling touchpad 16 of this design. According to this embodiment, the holding part of an actuator is connected with the touchpad 16, and the flexible region of an actuator is connected with inertial mass, and gives inertia tactile feeling.
[0040]
The touchpad 16 can adapt itself to the rigid housing of computer paraphernalia like the above-mentioned embodiment, and it can equip with it (compliantly). For example, it can equip with 1 or two or more spring elements 62 between a touchpad and a housing. These springs can be used as adaptation (compliant) materials, such as a spiral spring or flat spring, rubber, foam, and a

flexible body.
[0041]
1 or two or more actuators 64 are connected below the touchpad 16. The electrostrictive actuator is shown by the embodiment of Fig 6. A part of each actuator 66 is connected with the touchpad 16, and other portions 68 are connected with the mass 70. Thereby, if the portion 68 moves to the portion 66, the mass 70 will move with the portion 68. Mass 70 can be used as any object which has the weight of a request like a plastic or a metallic material. The mass 70 moves in accordance with about z axes, and it does not connect with a housing, but a free movement is possible. An inertia force is caused by movement of the mass 70 which is along the z-axis, this inertia force is transmited to the touchpad 16 via the actuator 64, and the touchpad 16 moves along with the z-axis by the adaptation connecting member 62. The user who is touching the touchpad 16 senses movement of the touchpad 16 as tactile feeling.
[0042]
According to a different embodiment, the actuator of other types can be used.
For example, a linearity speech coil actuator which was described in Fig 5 can be used, and inertial mass is connected with the linearity flexible region of this speech coil actuator. Other actuators, such as a solenoid, a pager motor, a move magnetic actuator, and E core actuator, can be used. A rotation actuator can also be used and a rotational output is converted to linear power in accordance with about z axes here. For example, rotational force can be converted using a flexible body (flexure).
[0043]
The direction and flexibility by which power is given to a touchpad to inertial mass in a preferable linearity force means (linear force implementation) are important. when the basic component of power is given to the flat working clearance (namely, -- it is along X or a Y-axis) of a touchpad to inertial mass, in even [the inside of two-dimensional flexibility], or both, it interferes in a short pulse or signal with a user's purpose movement. The capability of the user who guides a controlled graphical object like cursor to a predetermined target correctly by this is impaired. Since the main functions of a touchpad are exact target attainment (targeting), tactile feeling which bends target attainment or is impaired is not desirable even if it is gentle. In order to solve this problem, the touchpad equipment of this design gives the inertia force which was along substantially the Z-axis which intersects perpendicularly with XY axis on the surface of a touchpad. In such a form, a powerful level can give a user tactile feeling perceptually, without impairing the capability to position a user control graphical object correctly in XY axis of a screen. Since tactile feeling is turned to the 3rd flexibility to two-dimensional flat working clearance, a shock and vibration output the feeling which comes out of a screen like a three-dimensional collision or the divot (divots), or enters along with the Z-axis. Thereby, the actuality of tactile feeling increases and an interaction to which people are impressed more is generated. For example, the upward pulse outputted when moving cursor across a window boundary generates the illusion of a user moving a finger or other objects and making it collide in a window boundary.
[0044]
Fig 7 is a plan view of the touchpad 16 of this design. Only being able to use the touchpad 16 as a pointing device by a certain embodiment, all the regions of a pad give control to cursor here. According to other embodiments, the region where pads differ can be specified as a different function. According to some embodiments of these regions, each region can provide an actuator down this region. On the other hand, in the embodiment of other regions, the single actuator

which gives power to the pad 16 whole may be used. According to the illustrated embodiment, the central cursor control region 70 is used for positioning cursor.
[0045]
The cursor control region 70 of the pad 16 can make power output to a pad pad based on an interaction with the event in the controlled cursor, graphic environment, and/or the graphic environment concerned. The user can move a finger or other objects in the region 70, and can move the cursor 20 corresponding to this. As for power, it is preferable to be connected with the interaction with the graphic object displayed as cursor. For example, up-and-down motion (jolts), i.e., "pulse" feeling, can be outputted, promptly, it goes up in a desired size, and disappears, namely, the feeling is a single shock of the power which decreases promptly in zero or a small size. The touchpad 16 moves the z-axis up and down and can give a pulse. Also being able to output a vibratory sense, this feeling is power which carries out a temporal change periodically typically. The touchpad 16 or its portion moves, goes and comes back to a z-axis top by this vibration. This vibration is outputted by a host or the partial microprocessor, and simulates the specific effect produced with host application.
[0046]
The force sense of other types which can be outputted to the touchpad 16 is texture power (texture force). Although this type of power is similar to pulse power, it is dependent on the position of the finger of the user on the region of a touchpad, and/or the position of the cursor within graphic environment. Thus, a texture collision is outputted depending on whether cursor moved exceeding the position of the collision in a graphic object. It depends for this type of power spatially. That is, when cursor moves across the specified texture area, power is outputted depending on the position of the cursor concerned. Power is not outputted while cursor is placed between "bump (bumps)" of a texture. And power will be outputted if cursor moves exceeding a bump. A host's control can attain this (for example, if cursor has a grating top dragged, a host will send a pulse signal.).
.According to a certain embodiment, the microprocessor of a separate touchpad can concentrate on the tactile feeling feedback to a touchpad. The texture effect can be attained using local control (for example, a host transmits the high level command provided with the texture parameter, and feeling is controlled directly by the touchpad processor.). In other cases, the texture can attain vibration by showing a user. It depends for vibration on the current speed of the finger (or other objects) of the user on a touchpad. Vibration is not produced while the finger is standing it still. If a finger is moved quickly, the frequency and amplitude of vibration will increase. This feeling can be locally controlled by a touchpad processor (if it is), or can be controlled by a host. The local control by a pad processor eliminates the communication duty in a certain embodiment. Other spatial force senses can be outputted. Each force sense described here can be outputted simultaneously, and it can combine and it can also be outputted so that it may wish.
[0047]
The graphic object of a different type can be related with tactile feeling. Tactile feeling can be outputted to the touchpad 16 based on the interaction between cursor and a window. For example, when a "bump" or pulse of the z-axis is outputted to a touchpad and cursor moves across the boundary of a window, a user can be told about the position of cursor. When cursor moves in the boundary of a window, a texture force sense is not outputted. A texture can be made into a series of bumps spatially arranged in the region of a window by a predetermined pattern. If it is made to move across the bump region which had cursor specified, bump power

will be outputted on a touchpad. When moving cursor over the link in the displayed web page, or a selectable object like an icon, a pulse or bump power can be made to output. Vibration which means the graphic object in which cursor carries out a current position can also be outputted. The characteristics of the document currently displayed on the window can also be related with a force sense. For example, the pulse of a touchpad can be outputted, if the specific region of a window is passed and the page pause in a document is scrolled. The page pause or line pause in a document can also be similarly related with a bump or a force sense like vibration.
[0048]
After the menu item of the displayed menu chooses heading and the graphic button of a menu, a user can choose it. Each menu item in a menu can be related with a force sense. For example, when cursor crosses between menu items, a vertical (z-axis) bump or a pulse can be outputted. Feeling over a certain menu selection can be made stronger than other things, and the importance or the frequency of use can be instructed. Namely, a size (strong) with larger menu selection used most than the menu selection used few
You can make it connected with a pulse. Incompetent menu selection can be made into a weak pulse or a non-pulse now, in order that the menu selection concerned may show that is not possible for the present. Pulse feeling can be sent when providing the tile menu (tiled menus) in which a sub menu is displayed like the Windows (registered trademark) of Microsoft after a specific menu element is chosen, and a sub menu is displayed. This is dramatically useful. It is because the user does not expect that a sub menu is displayed when cursor is moved on a menu element. The icon can make it connected with a texture, a pulse, and vibration like the window mentioned above. Drawing or a CAD program has many characteristics which can be related with similar tactile feeling, such as a control point etc. of the displayed grid (or it is not visible) line or a dot, and the drawn object.
[0049]
By other related interactions, when rate (rate) control or a scrolling feature is attained with a touchpad (use of cursor), it can be shown that display vibration on equipment and scrolling is advancing. (It is volume like) When it reaches in the end of the numerical range which can be adjusted, having outputted the pulse and having reached in the end of the range can be shown. Pulse feeling can be used in order to show the position of "tic (ticks)" to setting out within the limits and the discrete value which were adjusted. A pulse can also be outputted in order to tell a user about the time of reaching the center of the range. Also being able to use the pulse of different strength, large strength shows a more important tic. In other situations, the strength and/or frequency of vibration are related with adjustment of control, and the present size of the adjusted value of the volume (volume) or others can be shown. In other interactions, in order to show that the control facility is working, a vibratory sense can be used. In a certain case, a user performs the function to choose, cut off or stick a document, but between press and execution of a function of the button which orders it the function, delay arises for delay of processing or other delay. Pulse feeling can be used in order that a function may show that (cut off or stick) was performed.
[0050]
The size of the power outputted on a touchpad can be made dependent on the event and interaction in graphic environment. For example, the pulse of power can be made into the power of a size which comes out with cursor and differs depending on the type of a meeting (encounter) **** graphic object. For example, when cursor moves across a window, the pulse of a bigger size can be outputted. On the other hand, when cursor moves exceeding an icon, the pulse of a

smaller size can be outputted. The active window where the size of the pulse was distinguished from the background window, It can be made to depend on other characteristics of a graphic object for a different menu item in the file folder icon of a different priority specified by the user, the icon for games distinguished from the icon for business applications, and a drop-down menu, etc. As for a user or a developer, it is preferable that a specific graphic object can be related with customized tactile feeling.

[0051]

The user independent event can use the antenna feeling on a touchpad, and can also relay it to a user (relay). The event produced within graphic environment, such as an appointment reminder, a receipt of an E-mail, and explosion in a game, can be expressed using the power of vibration, a pulse, and other hourly bases. Since the event from which the same type differs is expressed, a force sense can be changed. For example, the specific user who sends an E-mail, the priority of an event, a specific task. Although a different event or a different event of the characteristics like the start of (download [for example,] of the document from a network or data) or Conclusion is distinguished, vibration of different frequency can be used. Since it demands to stand by to a user while a host system "is thinking", and a function is performed or is accessed (when a timer is usually displayed by the host), it may surprise, when a function is completed. He will not notice that the function was completed if the user has let the screen out of sight. Pulse feeling can be sent in order to show that "under thinking" finished.

[0052]

Although it desires to enable it to choose an option or a software function when a user positions across the region on a screen using a touchpad, the designer of software, Pushing a physical button, or striking a touchpad hard and choosing an option does not require. Permitting such selection now has a problem. It is because a user performs the physical check of execution when pushing a physical button. The pulse sent to the touchpad of this design can act as a physical check on which a user does not push a button or other control machinery for selection. For example, a related function can be performed, if cursor can be made to be placed exceeding a web page element (web page element) and cursor is in the region of a predetermined time request. This is instructed to a user via the tactile feeling pulse sent to the pad 16.

[0053]

The above-mentioned force sense can also be used in a game or a simulation. for example, vibration can be outputted while operating the dirt road shoulder of the road where the racing car which a user controls was displayed -- carry out and the engine of a car starts -- a grounder -- a grounder -- when it is as **, vibration of a variable frequency can be outputted. The size of a pulse can be based on the size (and/or, size of different graphic object / actual entity which interacts with this) etc. of the violence of a collision or explosion, the controlled graphic object, or an actual entity (entity). A force sense can also be outputted based on the user independent event in a game or a simulation like a pulse when [whose a bullet is a user character] it explodes by the way.

[0054]

Other control devices and grips which contain the touchpad 16 of this design in a housing include a gamepad, a mouse, a track ball device or a pressure ball object (pressure sphere) for operating the cursor and other graphic objects in computer generation environment, etc. For example, the touchpad 16 can be provided in the housing of a computer mouse, and can give an additional input to a host computer. An alternative disturbance filter (selective disturbance filtering) of power like the description to US,6020876,B, The molding (shaping) of force signals

which drives the touchpad using a shock wave like the description to US,5959613,B can be used with this design. Such a shock is effective, when driving with the electric power accumulated in the battery on the computer 10, or when driving from a bus like USB connected to the host computer.

[0055]

The touchpad 16 is regulatory region which is different in the main cursor control regions 70, and can also provide the regulatory region which gives a separate input. At a certain embodiment, a different region can be physically marked by the line, and a boundary or a texture on the surface of the pad 16 (to and/or, sound from the computer 10). visual in whether the user is in contact with which region of a pad by this -- you can be told auditorily and/or in tactile feeling.

[0056]

For example, scrolling or the rate control regions 62a and 62b, scrolling a document **** (audio volume -- it and) [loudspeaker-] Value, such as monitor display luminance, can be adjusted and it can be used for giving the input which performs a bread (panning) / tilt, then a rate control task that was said for the view in a game or a virtual reality simulation. The region 62a can be used by putting a finger (or other objects) on this region. Here, the upper part of the region concerned increases value, or carries out a scroll up etc., and the lower part of the region outside this decreases value, and carries out scrolling down etc. According to the embodiment which can read the quantity of the pressure installed in the pad 16, the quantity of a pressure can control the amount of adjustments directly. For example, the larger pressure can scroll a document more quickly. The region 62b is applicable to rate control adjustment of level (left/right) scrolling, different value, a view, etc., etc.

[0057]

The specific tactile feeling effect can be related with the control areas 62a and 62b. For example, when using the rate control region 62a or 62b, vibration of specific frequency can be outputted to the pad 16. According to the embodiment which has a many actuator, the actuator installed directly under the region 62a or 62b is driven, and tactile feeling further localized to the "active" (used now) region can be given. When a part of region 62 is pressed for rate control, a pulse is outputted to a pad (or region of this pad) and a page is scrolled, the time of specific value passing, etc. can be shown. While the user is touching the region 62a or 62b, vibration can also be outputted continuously.

[0058]

Other regions 64 can also be arranged to the touchpad 16. For example, each region 64 can be provided with a small rectangular area like a button, a user can instruct this region, and the function relevant to this indication area can be made to start. The region 64 executes a program, opens a window, or closes, The sequence (queue) of a web page is carried out for the "next" and "returning" by a web browser, Electric power is supplied in the computer 10 and "sleep" Mohd is started, in a game, it can shoot at a gun, and from a buffer, it can cut off or stick, data can be carried out [e-mail can be checked,], and the computer function of choosing a font can be started. The region 64 can reproduce the function and button which were provided by the application program, or can provide a new different function.

[0059]

The region 64 as well as the region 62 can be related with tactile feeling, respectively. For example, the region 64 can give pulse feeling, when this region is chosen by the user, and momentary feedback of the function concerned having been chosen can be given. A region same

type can be related with tactile feeling of similar feeling. For example, each word processor region 64 can cause the pulse of specific length, when it is instructed, and on the other hand, the game related region can give the different pulse of length or vibration. When a user moves a pointing object from one region 62 to another side, what tactile feeling (it is (like a pulse)) was outputted to the pad 16, and the area boundary crossed can be expressed.

[0060]

As for a region, it is preferable for PURIGU comfort to be possible in the function in which they besides the size and form are related. Thus, the function to the region 64 can be changed based on a user's liking which was input into the computer and/or was memorized by the computer 10 based on the active application program in graphic environment. Preferably, the size and the position of each region can be adjusted with a user or an application program, and all the regions or some can be completely removed, if wished. As for a user, it is preferable that specific tactile feeling can be assigned to a specific region or a region specific type based on the function of the type relevant to the region concerned. A tool like the IMASHON studio (registered trademark) which can be obtained from IMASHON Corporation of U.S. California state San Jose can design different tactile feeling.

[0061]

The regions 62 and 64 do not need to be physical regions of the touchpad 16. That is, all the surfaces of the touchpad 16 only supply the coordinates of a user contact portion to the processor of a computer, and it can be specified where the region where the software of a computer differs is placed. The computer can interpret coordinates and can interpret a touchpad input signal based on the position of a user contact portion as a signal of the type with which a cursor control signal or rate control differs from a button function etc. When there is a local touchpad microprocessor, the microprocessor concerned interprets the function relevant to a user contact position, and it may be made to report a suitable signal or data to a host processor as an alternative plan (a position coordinate and a button signal). Thereby, a host processor can keep low processing not known. According to other embodiments, the touchpad 16 can be designed physically to output a different signal to a computer based on a different region marked on the surface of the touchpad which a user touches. For example, each region is detectable by a different sensor or sensor array.

[0062]

Fig.8 a and 8b are other plan views and cross sectional views of the computer paraphernalia 80 of an embodiment including the form of the tactile feeling touchpad 16 of this design. The equipment 80 is a "Personal Digital Assistant."

It is a form of a portable computer device like (PDA), a "pen input (pen-based)" computer, an "Electronic Book", or similar equipment (here, it gathers and these are called a "Personal Digital Assistant" or PDA). These pieces of the equipment which can input information because a user contacts a display screen, and can be read with a certain style relates to the embodiment of this design. PalmPilot who can obtain such equipment from 3 Qom Corporation, A cellular mobile telephone or a pager etc. which has pocket-size computer paraphernalia which can be obtained from Newton which can be obtained from Apple Computer, Casio, Hewlett Packard, and other makers, and a touch screen is included.

[0063]

According to one embodiment of the equipment 80, the display screen 82 has covered the great portion of surface of the computer paraphernalia 80 typically. The screen 82 is a flat-panel display publicly known to a person skilled in the art.

A text, an image, animation, etc. can be displayed.
In a certain embodiment, the screen 80 is a function like the screen of a personal computer. It is preferable that the display screen 82 is a "touch screen" containing the sensor which can input information into the computer paraphernalia 80 because a user contacts the screen 80 physically (). That is, they are other forms of flat "touch equipment" similar to the touchpad 16. . For example, a transparent sensor film can be put on the screen 80. Here, the film can detect the pressure from the object in contact with this film. The sensor apparatus which performs a touch screen is publicly known to a person skilled in the art.
[0064]
The user can choose the button and other graphic objects by which graphical display was carried out by pressing a finger or a stylus to the exact place where the graphic object of the screen 82 is displayed. furthermore -- some embodiments are that a user displays the graphic "ink" image 85 on the place which pressed the tip of a stylus, or a finger and other objects -- a user -- a screen -- "it pulling" or "it drawing"
Things are to be made. A handwritten character can be recognized as a command, data, and other inputs by the software performed by the microprocessor of equipment. According to other embodiments, the user can give an input additionally or in alternative plan via speech recognition. Here, the microphone of equipment inputs a user's sound and this sound is converted to a suitable command or data by the software performed with equipment. A specific command can be given to the equipment 80, when the physical button 84 is included in the housing of the equipment 80 and the button concerned is pushed. Much PDA is characterized by there being no keyboard of the standard which carries out a character input from a user. Rather, the input mode of alternative plans, such as a stylus describing a character and voice input, is used for a screen. However, of course, as for some PDA, the touch screen can include a perfect function keyboard. Here, this keyboard is farther [typically / than the keyboard of standard size] small. According to the yet another embodiment, the laptop computer of the standard size provided with the standard keyboard may contain the touch input type display screen of the flat panel. Such a screen (Fig.1 is the same as that of the screen 12) can provide tactile feeling feedback of this design.
[0065]
In this design, the touch screen 82 gives a user tactile feeling feedback like the touchpad 16 described by the above-mentioned embodiment. 1 or two or more actuators 86 can be connected below the touch panel 82, and a pulse, vibration, and tactile feeling feedback like a texture can be given. For example, as shown in Fig.8 a, the actuator 86 can be arranged near each corner of the screen 82. Other forms of an actuator can be used. The user can experience tactile feeling feedback via the finger touched the screen 82, or a held object like the stylus 87.
[0066]
As for the touch screen 82, as shown in Fig.8 b, it is preferable to connect with the housing 88 of the equipment 80 by 1, two or more springs, or the adaptation element 90 like a spiral spring, flat spring, a flexible body, and adaptation materials (foam, rubber, etc.). The touch panel 82 moves in accordance with about z axes by an adaptation element. Tactile feeling feedback similar to the embodiment of the touchpad mentioned above by this is given. The actuator 86 can be used as an electrostrictive actuator, a speech coil actuator, and any type mentioned above in the embodiment of the touchpad of other actuators. As shown in Fig.8 b, direct continuation of the actuator 86 can be carried out to the touch screen 82 like the embodiment of the touchpad of Fig.3.As an alternative plan, like the embodiment of the touchpad of Fig.6, inertial mass can be

moved and inertia feedback can be given to the z-axis of a touch screen. Other characteristics over a touchpad mentioned above are applicable like Embodiment 80 of a touch screen.
[0067]
In the embodiment of the touch input device (a touchpad and a touch screen) described here, it is advantageous to detect a user's contact with a touch input device. Since it is necessary to output tactile feeling feedback only while the user is touching touch equipment, tactile feeling feedback stops by this detection, when the object does not touch a touch input device (an actuator "stops"). These characteristics can save the battery electric power of a portable device. When the microprocessor (or similar circuit) of local touch equipment is used by computer, such a microprocessor can suspend an actuator output, when user contact is not detected. Thereby, the additional calculation burden of a host processor is eased.
[0068]
Although this device was described by some preferable embodiments, those change, substitution, **, etc. are clear to a person skilled in the art by reading through a Description and examining Drawings. For example, it can be used for the actuator of the type with which many differ outputting tactile feeling to a user. Many characteristics described in one embodiment can be mutually exchanged and used about other embodiments. In order to describe clearly, the existing technology was used, but these do not limit this design.

[Translation done.]

Brief Description of Drawings

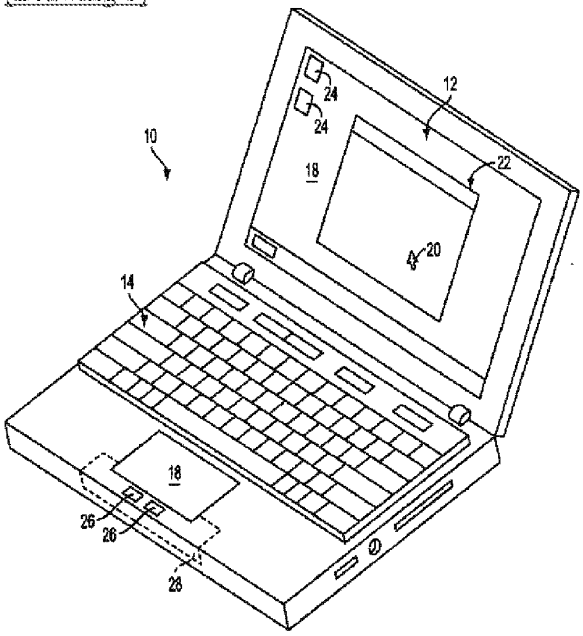
Brief Description of the Drawings]
[Drawing 1]The perspective view of the tactile feeling touchpad of this design.
[Drawing 2]The perspective view of the remote control containing the touchpad of this design.
[Drawing 3]The perspective view of a 1st embodiment of the touchpad of this design containing 1 or two or more actuators which were connected below the touchpad.
[Drawing 4]The side view of a 1st embodiment of this design in which direct continuation of the electrostrictive actuator was carried out to the touchpad of this design.
[Drawing 5]The side view of a 2nd embodiment of the touchpad of this design containing a linear actuator.
[Drawing 6]The side view of a 3rd embodiment of the touchpad of this design which has inertial mass.
[Drawing 7]The plan view of one example of the touchpad of this design which has different regulatory region.
[Drawing 8](a) is a plan view showing the embodiment of the touch screen of this design. (b) is a cross sectional view showing the embodiment of the touch screen of this design.
[Explanations of letters or numerals]
10 Computer
12 Display screen
14 Keyboard
16 Touchpad 16
18 Graphic environment

20 Cursor
22 Window
24 Icon

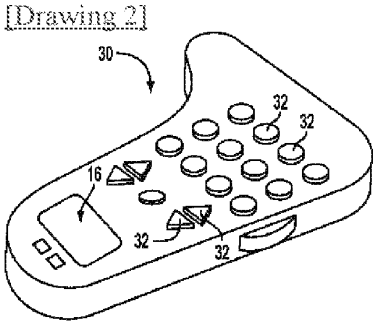
Drawings

DRAWINGS

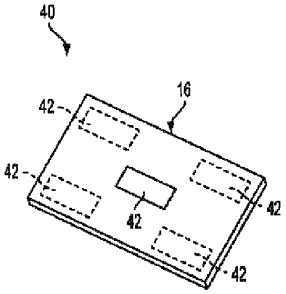
[Drawing 1]



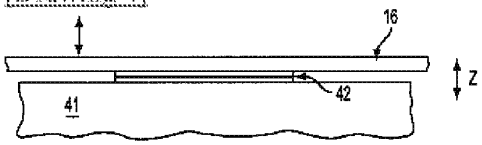
[Drawing 2]



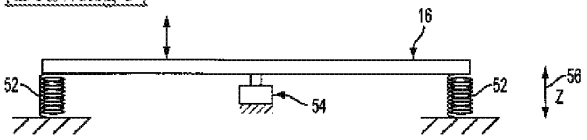
[Drawing 3]



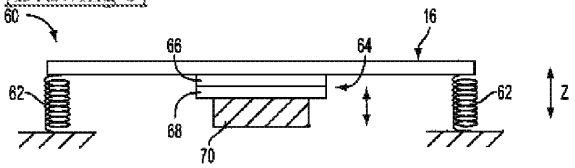
[Drawing 4]



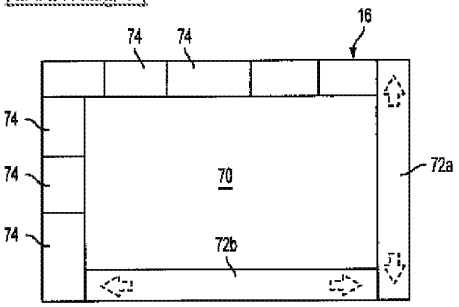
[Drawing 5]



[Drawing 6]

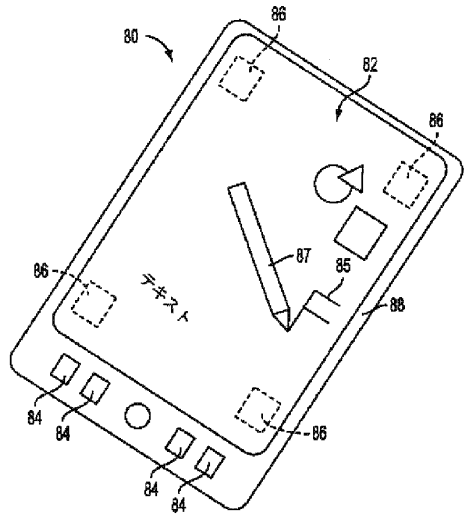


[Drawing 7]

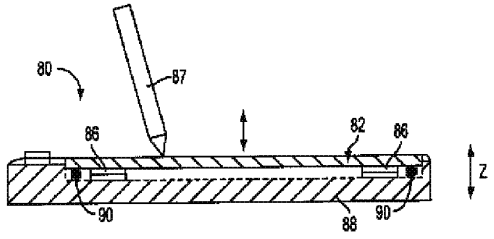


[Drawing 8]

(a)



(b)



[Translation done.]

Espacenet

Bibliographic data: JP2005267080 (A) — 2005-09-29

INPUT DEVICE WITH TACTILE FUNCTION, INFORMATION INPUT METHOD AND ELECTRONIC EQUIPMENT

Inventor(s): TAKASHIMA KOICHIRO ± (TAKASHIMA KOICHIRO)

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Classification: - **international:** ***G06F3/033; G06F3/041;*** (IPC1-7): G06F3/033
- **cooperative:**

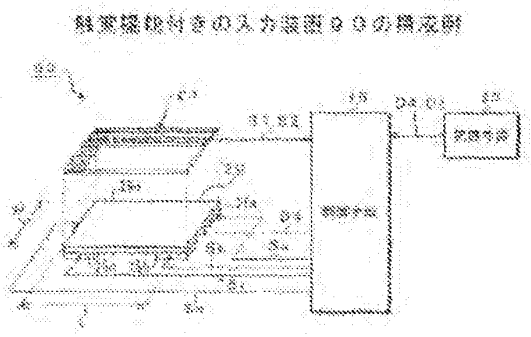
Application number: JP20040076869 20040317

Priority number(s): JP20040076869 20040317

Also published as: JP4345534 (B2)

Abstract of JP2005267080 (A)

PROBLEM TO BE SOLVED: To apply the tactile sense synchronizing with the three-dimensional display operation of an icon to be moved and displayed like a circle or an ellipse to an operator, and to decide the input of the icon when the icon reaches an input decision position preliminarily set on the orbit. ;SOLUTION: This input device 90 with a tactile function is configured to be brought into contact with one of a plurality of icons displayed on a display picture for input item selection wherein a picture input operation is performed so that a circle or an ellipse can be drawn on the display picture, and provided with an input means 24 for detecting the selected contact position of the icon and a contact position during movement, a display means 29 for moving and displaying the icon like a circle or an ellipse based on position information acquired from the input means 24 and actuators 25a to 24d for vibrating the display picture based on the display position of the icon to be moved and displayed by the display means 29. ;COPYRIGHT: (C)2005,JPO&NCIPI



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(51)Int.Cl.[7]	F I	テーマコード（参考）
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Ｆターム(参考)　5B087 AA09 BC12 BC31

(54)【発明の名称】触覚機能付き入力装置、情報入力方法及び電子機器

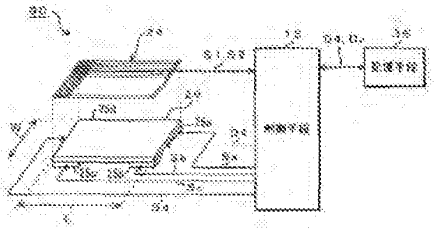
(57)【要約】

【課題】　円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した触覚を操作者に与えできるようにすると共に、その軌跡上に予め設定された入力確定位置にアイコンが到達したとき、当該アイコンの入力を確定できるようにする。

【解決手段】　入力項目選択用の表示画面に表示された複数のアイコンの１つに接触して当該表示画面上で円又は楕円を描くように画面入力操作される触覚機能付き入力装置９０であって、アイコンの選択接触位置及び移動中の接触位置を検出する入力手段２４と、この入力手段２４から得られる位置情報に応じてアイコンを円状又は楕円状に移動表示する表示手段２９と、この表示手段２９によって移動表示されるアイコンの表示位置に基づいて表示画面を振動するアクチュエータ２５ａ～２５ｄとを備えるものである。

【選択図】　図２

触覚機能付きの入力装置９０の構成例



【特許請求の範囲】
【請求項１】
入力項目選択用の表示画面に表示された複数のアイコンの１つに接触して当該表示画面上で円又は楕円を描くように画面入力操作される触覚機能付き入力装置であって，
前記アイコンの選択接触位置及び移動中の接触位置を検出する検出手段と，
前記検出手段から得られる位置情報に基づいて前記アイコンを円状又は楕円状に移動表示する表示手段と，
前記表示手段によって移動表示されるアイコンの表示位置に基づいて前記表示画面を振動する振動手段とを備えることを特徴とする触覚機能付き入力装置。
【請求項２】
前記振動手段は，
予め準備された複数の表示画面の内容及び当該表示画面中のアイコン毎に異なった触覚を与える複数の振動パターンを発生することを特徴とする請求項１に記載の触覚機能付き入力装置。
【請求項３】
前記円状又は楕円状の軌跡上に基準位置が設定され，当該基準位置にアイコンが到達したとき，当該アイコンの入力を確定するようにしたことを特徴とする請求項１に記載の触覚機能付き入力装置。
【請求項４】
前記入力項目選択用の表示画面を表示するための表示情報と，当該表示情報に対応したアイコンの選択接触位置及び振動モードに関する制御情報とを前記表示画面毎に記憶した記憶手段を備えることを特徴とする請求項１に記載の触覚機能付き入力装置。
【請求項５】
前記検出手段から得られる位置情報に基づいて前記表示手段の表示制御及び前記振動手段の出力制御をする制御手段を備えることを特徴とする請求項１に記載の触覚機能付き入力装置。
【請求項６】
前記制御手段は，
前記検出手段から得られる位置情報に基づいて前記記憶手段から制御情報を読出して前記振動手段に供給し，前記表示情報に対応した振動モードを発生するように制御することを特徴とする請求項１に記載の触覚機能付き入力装置。
【請求項７】
前記制御手段は，
前記表示画面中のアイコンを奥行方向に遠近感を有して３次元的に表示するように前記表示手段を表示制御し，
前記アイコンが表示画面の奥から手前に近づくに従って，前記表示画面を低周波数かつ小振幅の振動から，高周波数かつ大振幅の振動を発生するように前記振動手段を出力制御することを特徴とする請求項１に記載の触覚機能付き入力装置。
【請求項８】
前記制御手段は，
前記アイコンが表示画面の奥から手前に近づくに従って，前記表示画面を周波数５０Ｈｚ乃至１００Ｈｚ程度であって，振幅５μｍ乃至２０μｍ程度の小さい振動から，周波数１５０Ｈｚ乃至４００Ｈｚ程度であって，振幅１５μｍ乃至４０μｍ程度の大きな振動を発生するように前記振動手段を出力制御することを特徴とする請求項７に記載の触覚機能付き入力装置。
【請求項９】
予め準備された入力項目選択用の表示画面の中からアイコンを選択して情報を入力する方法であって，
前記入力項目選択用の表示画面に複数のアイコンを表示する行程と，
表示された前記表示画面で１つのアイコンの接触を待機する行程と，

前記アイコンが接触された状態で円又は楕円を描くように画面入力操作を受付ける行程と、
前記アイコンの選択接触位置及び移動中の接触位置を検出する行程と、
検出された前記接触位置に基づく位置情報を検出して前記アイコンを円状又は楕円状に移動表示する行程と、
移動表示される前記アイコンの表示位置に基づいて前記表示画面を振動する行程とを有することを特徴とする情報入力方法。
【請求項１０】
前記表示画面の内容及び当該表示画面中のアイコン毎に異なった触覚を与えるための複数の振動パターンを予め作成する行程を有することを特徴とする請求項９に記載の情報入力方法。
【請求項１１】
前記円状又は楕円状の軌跡上に予め基準位置を設定する行程と、
当該基準位置にアイコンが到達したとき、当該アイコンの入力を確定する行程とを有することを特徴とする請求項９に記載の情報入力方法。
【請求項１２】
前記入力項目選択用の表示画面を表示するための表示情報と、当該表示情報に対応したアイコンの選択接触位置及び振動モードに関する制御情報とを前記表示画面毎に作成する行程を有することを特徴とする請求項９に記載の情報入力方法。
【請求項１３】
前記表示画面中のアイコンを奥行方向に遠近感を有して３次元的に表示する行程と、
前記アイコンが表示画面の奥から手前に近づくに従って、前記表示画面を低周波数かつ小振幅の振動から、高周波数かつ大振幅の振動を発生する行程を有することを特徴とする請求項９に記載の情報入力方法。
【請求項１４】
前記アイコンが表示画面の奥から手前に近づくに従って、前記表示画面を周波数５０Ｈｚ乃至１００Ｈｚ程度であって、振幅５μｍ乃至２０μｍ程度の小さい振動から、周波数１５０Ｈｚ乃至４００Ｈｚ程度であって、振幅１５μｍ乃至４０μｍ程度の大きな振動を発生する行程を有することを特徴とする請求項１３に記載の情報入力方法。
【請求項１５】
入力項目選択用の表示画面に表示された複数のアイコンの１つに接触して当該表示画面上で円又は楕円を描くように画面入力操作される触覚機能付き入力装置を有した電子機器であって、
前記触覚機能付き入力装置は、
前記アイコンの選択接触位置及び移動中の接触位置を検出する検出手段と、
前記検出手段から得られる位置情報に基づいて前記アイコンを円状又は楕円状に移動表示する表示手段と、
前記表示手段によって移動表示されるアイコンの表示位置に基づいて前記表示画面を振動する振動手段とを備えることを特徴とする電子機器。
【請求項１６】
前記振動手段は、
予め準備された複数の表示画面の内容及び当該表示画面中のアイコン毎に異なった触覚を与える複数の振動パターンを発生することを特徴とする請求項１５に記載の電子機器。
【請求項１７】
前記円状又は楕円状の軌跡上に基準位置が設定され、当該基準位置にアイコンが到達したとき、当該アイコンの入力を確定するようにしたことを特徴とする請求項１５に記載の電子機器。
【請求項１８】
前記入力項目選択用の表示画面を表示するための表示情報と、当該表示情報に対応したアイコンの選択接触位置及び振動モードに関する制御情報とを前記表示画面毎に記憶した

記憶手段を備えることを特徴とする請求項１５に記載の電子機器。
【請求項１９】
前記検出手段から得られる位置情報に基づいて前記表示手段の表示制御及び前記振動手段の出力制御をする制御手段を備えることを特徴とする請求項１５に記載の電子機器。
【請求項２０】
前記制御手段は、
前記検出手段から得られる位置情報に基づいて前記記憶手段から制御情報を読出して前記振動手段に供給し、前記表示情報に対応した振動モードを発生するように制御することを特徴とする請求項１５に記載の電子機器。
【請求項２１】
前記制御手段は、
前記表示画面中のアイコンを奥行方向に遠近感を有して３次元的に表示するように前記表示手段を表示制御し、
前記アイコンが表示画面の奥から手前に近づくに従って、前記表示画面を低周波数かつ小振幅の振動から、高周波数かつ大振幅の振動を発生するように前記振動手段を出力制御することを特徴とする請求項１５に記載の電子機器。
【請求項２２】
前記制御手段は、
前記アイコンが表示画面の奥から手前に近づくに従って、前記表示画面を周波数５０Ｈｚ乃至１００Ｈｚ程度であって、振幅５μｍ乃至２０μｍ程度の小さい振動から、周波数１５０Ｈｚ乃至４００Ｈｚ程度であって、振幅１５μｍ乃至４０μｍ程度の大きな振動を発生するように前記振動手段を出力制御することを特徴とする請求項２１に記載の電子機器。
【請求項２３】
表示画面の任意の位置に接触して当該表示画面上で直線を描くように画面入力操作される触覚機能付き入力装置を有した電子機器であって、
前記触覚機能付き入力装置は、
前記表示画面に特定のアイコンを表示する表示手段と、
前記表示画面に接触された特定の位置及び移動中の接触位置を検出する検出手段と、
前記検出手段から得られる位置情報に基づいて前記表示手段に表示された特定のアイコンの表示位置に基づいて前記表示画面を振動する振動手段とを備えることを特徴とする電子機器。
【請求項２４】
前記表示手段に表示された送信ボタン用の前記アイコンの表示位置をタッチされたか否かを検出し、当該タッチに基づいて所定周波数、振幅及び回数の振動を与えて「送信ＯＫ」を触覚で確認させる送信ボタンモードが準備されることを特徴とする請求項２３に記載の電子機器。
【発明の詳細な説明】
【技術分野】
【０００１】
本発明は、予め準備された入力項目選択用の表示画面の中からアイコンを選択して情報を入力する情報処理装置や、携帯電話機、情報携帯端末装置等に適用して好適な触覚機能付き入力装置、情報入力方法及び電子機器に関する。
【０００２】
詳しくは、入力項目選択用の表示画面に表示されたアイコンの表示位置に基づいて表示画面を振動する振動手段を備え、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した触覚をユーザに付与できるようにすると共に、円状又は楕円状の軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定できるようにしたものである。
【背景技術】

【０００３】
近年、ユーザ（操作者）は、携帯電話機やＰＤＡ（Personal Digital Assistants）等の携帯端末装置に様々なコンテンツを取り込み、それを利用するようになってきた。これらの携帯端末装置には入力装置が具備される。入力装置にはキーボードや、ＪＯＧダイヤル等の入力手段、表示部を合わせたタッチパネルなどが使用される場合が多い。
【０００４】
この種の携帯端末装置に関連して特許文献１には、携帯情報端末及びプログラムが開示されている。この携帯情報端末によれば、端末装置本体に表示部と、本体のほぼ中央にＪＯＧダイヤルとを備える。ＪＯＧダイヤルは、表示部とは別の位置に設けられる。このＪＯＧダイヤルは、時計方向又は反時計方向に回転され、この回転に連動して表示部に表示された画像が回転するようになされる。しかも、ＪＯＧダイヤルを本体の方向に押下すると、画像範囲を変更するようになされる。このように情報端末を構成すると。より快適に各種の操作を実行できるというものである。つまり、ＪＯＧダイヤルは、メカ的な構造を採用することによって、操作者に、表示部において、入力項目を選択する毎に、表示部の変化と同期した触覚を操作者に与えられる。
【０００５】
また、他の触覚入力機能付きの携帯端末装置には、各種方式のタッチパネルと表示部とを合わせた入力機能付表示部を備えたものがある。この種の携帯端末装置によれば、操作者の視覚からみて、表示部の奥行き方向以外の２次元において、アイコン表示位置を直接タッチして入力項目を選択するようになされる。このように、操作者は、表示部に表示される各種アイコン等を直接さわる（入力する、タッチする）等の感覚で、入力操作を行うことができ、目の移動等も、ＪＯＧダイヤル方式に比べて少なく、より直接的に入力項目を選択することができるというものである。
【０００６】
【特許文献１】特開２００３－２５６１２０号公報（第２乃至３頁　第１図）
【発明の開示】
【発明が解決しようとする課題】
【０００７】
ところで、従来例に係る触覚入力機能付きの情報処理装置や、携帯電話機、情報携帯端末装置等の電子機器によれば、以下のような問題がある。
【０００８】
ｉ．特許文献１に見られるような表示部とＪＯＧダイヤルとが分離配置された携帯情報端末によれば、機械的な構造が発生せしめる単一の触覚のみしか与えることができず、操作者に取って、インパクトのある触覚となっていないのが現状である。
【０００９】
ii．また、各種方式のタッチパネルと表示部とを合わせた入力機能付きの携帯端末装置によれば、表示部でアイコンを選択した際に、その選択と同期した触覚を操作者に与えることができていない。
【００１０】
iii．特許文献１に見られるようなＪＯＧダイヤルの機能をタッチパネルに導入しようとした場合に、単に組み合わせただけでは、円状又は楕円状に移動表示されるアイコンの表示動作に同期した触覚を操作者に与えることは困難である。
【００１１】
そこで、この発明はこのような従来の課題を解決したものであって、円状又は楕円状に移動表示されるアイコンの表示動作に同期した触覚を操作者に付与できるようにすると共に、その軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定できるようにした触覚機能付き入力装置、情報入力方法及び電子機器を提供することを目的とする。
【課題を解決するための手段】
【００１２】

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上述した課題は、入力項目選択用の表示画面に表示された複数のアイコンの１つに接触して当該表示画面上で円又は楕円を描くように画面入力操作される触覚機能付き入力装置であって、アイコンの選択接触位置及び移動中の接触位置を検出する検出手段と、この検出手段から得られる位置情報に基づいてアイコンを円状又は楕円状に移動表示する表示手段と、この表示手段によって移動表示されるアイコンの表示位置に基づいて表示画面を振動する振動手段とを備えることを特徴とする触覚機能付き入力装置によって解決される。

【００１３】

本発明に係る触覚機能付き入力装置によれば、操作者は、選択項目の表示画面に表示された任意のアイコンの１つに接触して当該表示画面上を円状又は楕円状に移動するように画面入力操作する。これを前提にして、検出手段は、アイコンの選択接触位置及び移動中の接触位置を検出するようになされる。表示手段は、検出手段から得られる位置情報に基づいてアイコンを円状又は楕円状に移動表示する。振動手段は、表示手段によって移動表示されるアイコンの表示位置に基づいて表示画面を振動するようになる。

【００１４】

従って、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した振動（触覚）を操作者に与えることができる。また、同一の場所で異なる複数のクリック感（触覚）を発生することができる。これにより、従来例のような視覚及び聴覚と単一種類の触覚ではなく、視覚及び聴覚の２つの間に十分な相関が採れ、それぞれを区別できる多種類の触覚を発生する入力装置を提供することができる。しかも、円状又は楕円状の軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定することができ、より豊かな入力操作を行うことができる。

【００１５】

本発明に係る情報入力方法は、予め準備された入力項目選択用の表示画面の中からアイコンを選択して情報を入力する方法であって、入力項目選択用の表示画面に複数のアイコンを表示する行程と、表示された表示画面で１つのアイコンの接触を待機する行程と、アイコンが接触された状態で円又は楕円を描くように画面入力操作を受付ける行程と、アイコンの選択接触位置及び移動中の接触位置を検出する行程と、検出された接触位置に基づく位置情報を検出してアイコンを円状又は楕円状に移動表示する行程と、移動表示されるアイコンの表示位置に基づいて表示画面を振動する行程とを有することを特徴とするものである。

【００１６】

本発明に係る情報入力方法によれば、予め準備された入力項目選択用の表示画面の中からアイコンを選択して情報を入力する場合に、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した触覚を操作者に与えることができる。しかも、円状又は楕円状の軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定することができる。

【００１７】

本発明に係る第１の電子機器は、入力項目選択用の表示画面に表示された複数のアイコンの１つに接触して当該表示画面上で円又は楕円を描くように画面入力操作される触覚機能付き入力装置を有した電子機器であって、触覚機能付き入力装置は、アイコンの選択接触位置及び移動中の接触位置を検出する検出手段と、この検出手段から得られる位置情報に基づいてアイコンを円状又は楕円状に移動表示する表示手段と、この表示手段によって移動表示されるアイコンの表示位置に基づいて表示画面を振動する振動手段とを備えることを特徴とするものである。

【００１８】

本発明に係る第１の電子機器によれば、本発明に係る触覚機能付き入力装置が応用されるので、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した触覚を操作者に与えることができる。しかも、円状又は楕円状の軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定することができる。当該電子機器の小型化が図れる。

【００１９】
本発明に係る第２の電子機器は、表示画面の任意の位置に接触して当該表示画面上で直線を描くように画面入力操作される触覚機能付き入力装置を有した電子機器であって、触覚機能付き入力装置は、表示画面に特定のアイコンを表示する表示手段と、表示画面に接触された特定の位置及び移動中の接触位置を検出する検出手段と、この検出手段から得られる位置情報に基づいて表示手段に表示された特定のアイコンの表示位置に基づいて表示画面を振動する振動手段とを備えることを特徴とするものである。
【００２０】
本発明に係る第２の電子機器によれば、表示画面の任意の位置に接触して当該表示画面上で直線を描くように画面入力操作される場合を前提にして、振動手段は、表示画面に接触された特定の位置及び移動中の接触位置を検出して得られる位置情報と、特定のアイコンの表示位置とに基づいて表示画面を振動するようになされる。
【００２１】
例えば、予め送信ボタンモードが準備され、この送信ボタンモードによれば、表示手段に表示された送信ボタン用のアイコンの表示位置をタッチされたか否かを検出し、当該タッチに基づいて所定振幅数、振幅及び回数の振動を与えて「送信ＯＫ」を触覚で確認させるようになされる。
【００２２】
従って、操作者が特定のアイコンの入力動作をしようとした場合に、視覚的あるいは聴覚的な入力動作に関する情報が無くとも、操作者が意図した入力動作を確認させるような触覚確認機能を実現することができる。
【発明の効果】
【００２３】
本発明に係る触覚機能付き入力装置によれば、円状又は楕円状に移動表示されるアイコンの表示位置に基づいて表示画面を振動する振動手段を備えるものである。
【００２４】
この構成によって、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した振動（触覚）を操作者に与えることができる。また、同一の場所で異なる複数のクリック感（触覚）を発生することができる。これにより、従来例のような視覚及び聴覚と単一種類の触覚ではなく、視覚及び聴覚の２つの間に十分な相関が採れ、それぞれを区別できる多種類の触覚を発生する入力装置を提供することができる。
【００２５】
しかも、円状又は楕円状の軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定することができ、より豊かな入力操作を行うことができる。このような構成から、表示手段とは別の場所に、従来例のようなロータリーエンコーダーやタクトスイッチ等を設ける必要が無くなる。また、入力装置自体の小型化が図れるので、これを組み入れた電子機器の小型化及びデザインの自由度を向上させることができる。
【００２６】
本発明に係る情報入力方法によれば、予め準備された入力項目選択用の表示画面の中からアイコンを選択して情報を入力する場合に、円状又は楕円状に移動表示されるアイコンの表示位置に基づいて表示画面を振動するようになされる。
【００２７】
この構成によって、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した触覚を操作者に与えることができる。しかも、円状又は楕円状の軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定することができる。
【００２８】
本発明に係る第１の電子機器によれば、本発明に係る触覚機能付き入力装置が応用されるので、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した触覚を操作者に与えることができる。しかも、円状又は楕円状の軌跡上に予め設定された基準

位置にアイコンが到達したとき、当該アイコンの入力を確定することができる。当該電子機器の小型化が図れる。

【００２９】

本発明に係る第２の電子機器によれば、表示画面に接触された特定の位置及び移動中の接触位置を検出して得られる位置情報と、特定のアイコンの表示位置とに基づいて表示画面を振動する振動手段を備えるものである。

【００３０】

この構成によって、操作者が特定のアイコンの入力動作をしようとした場合に、視覚的あるいは聴覚的な入力動作に関する情報が無くとも、操作者が意図した入力動作を確認させるような触覚確認機能を実現することができる。

【発明を実施するための最良の形態】

【００３１】

続いて、この発明に係る触覚機能付き入力装置、情報入力方法及び電子機器の一実施例について、図面を参照しながら説明をする。

【実施例１】

【００３２】

図１は本発明に係る第１の実施例としての触覚入力機能付き携帯電話機１００の構成例を示す斜視図である。

この実施例では、入力項目選択用の表示画面に表示されたアイコンの表示位置に基づいて表示画面を振動する振動手段を備え、円状又は楕円状に移動表示されるアイコンの３次元的な表示動作に同期した触覚を操作者に付与できるようにすると共に、円状又は楕円状の軌跡上に予め設定された基準位置にアイコンが到達したとき、当該アイコンの入力を確定できるようにしたものである。

【００３３】

図１に示す携帯電話機１００は電子機器の一例であり、触覚機能付きの入力装置９０を有している。この入力装置９０は、入力項目選択用の表示画面に表示された複数のアイコンＩＣｘ（ｘ＝１～ｎ）の１つに接触して当該表示画面上で円又は楕円を描くように画面入力操作されるものである。

【００３４】

この例で、携帯電話機１００は下部筐体１０及び上部筐体２０を備え、これらの筐体１０及び２０間は、回転レンジ機構１１によって可動自在に係合されている。この回転レンジ機構によれば、下部筐体１０の操作面の一端に設けられた図示しない軸部と、下部筐体１０の裏面の一端に設けられた図示しない軸受け部とが回転自在に係合され、上部筐体２０は下部筐体１０に対して角度±１８０°の回転自由度を有して面結合されている。

【００３５】

下部筐体１０には、複数の押しボタンスイッチ１２から成る操作パネル１８が設けられる。押しボタンスイッチ１２は、「０」～「９」数字キー、「＊」や「＃」等の記号キー、「オン」や「オフ」等のフックボタン、メニューキー等から構成される。下部筐体１０において、操作パネル面の下方には、通話用のマイクロフォン１３が取り付けられ、送話器として機能するようになされる。

【００３６】

また、下部筐体１０の下端部には、モジュール型のアンテナ１６が取り付けられ、その上端内部側面には、大音響用のスピーカー３６ａが設けられ、着信メロディ等を放音するようになされる。下部筐体１０には、バッテリー１６や回路基板１７等が設けられ、下部筐体１０の裏面にはカメラ３４が取り付けられている。

【００３７】

上述の下部筐体１０に対して、回転レンジ機構１１によって可動自在に係合された上部筐体２０には、その表面の上方に通話用のスピーカー３６ｂが取り付けられ、受話器として機能するようになされる。上部筐体２０のスピーカー取り付け面の下方には、触覚機能付き入力装置９０が設けられる。

【００３８】
図２は、触覚機能付きの入力装置９０の構成例を示す概念図である。図２に示す触覚機能付き入力装置９０は、入力項目選択用の表示画面に表示された複数のアイコンＩＣｘの１つに接触して当該表示画面上で円又は楕円を描くように画面入力操作されるものである。

【００３９】
入力装置９０は、長さがＬｃｍ程度で、幅がＷｃｍ程度の液晶表示ディスプレイから成る表示手段２９と、この表示手段２９の上方に同等な大きさの入力手段２４とが積層されて構成される。入力手段２４は検出手段の一例を構成し、アイコンＩＣｘの選択接触位置及びアイコン接触移動中の接触位置を検出するようになされる。入力手段２４には蓄積電極となる透明電極をマトリクス状に配置したタッチパネルが使用される。タッチパネルは、静電容量シートとしての静電容量方式の入力デバイスである。

【００４０】
入力手段２４の下方に配置された表示手段２９には、入力手段２４から得られる位置情報に基づいてアイコンＩＣｘを円状又は楕円状に移動表示するようになされる。位置情報には位置情報及び入力量（力）が含まれる。位置情報はアイコン接触時の位置検出信号Ｓ１により得られ、入力量（力）は同アイコン接触時の入力検出信号Ｓ２から得られる。

【００４１】
この表示手段２９の例えば、裏面の隅には、振動手段の一例となる４個のアクチュエータ２５ａ～２５ｄが取り付けられ、表示手段２９によって移動表示されるアイコンＩＣｘの表示位置に基づいて表示画面を振動するようになされる。アクチュエータ２５ａ～２５ｄは圧電素子から構成される。アクチュエータ２５ａには制御手段１５から振動制御信号Ｓａが供給される。アクチュエータ２５ｂには同様にして振動制御信号Ｓｂが供給され、アクチュエータ２５ｃには振動制御信号Ｓｃが供給され、アクチュエータ２５ｄには振動制御信号Ｓｄが各々供給される。振動制御信号Ｓａ～Ｓｄは、複数の振動パターンを発生するための信号である。

【００４２】
アクチュエータ２５ａ～２５ｄは、予め準備された複数の表示画面の内容及び当該表示画面中のアイコン毎に異なった触覚を与える複数の振動パターンを発生する。このようにすると、各種アイコンＩＣｘをなぞるたびに辿った振動モードを触感でき、操作者に対して表示内容の項目や、その種類等を振動パターンの種類によって知らしめることができる。

【００４３】
上述の入力手段２４、表示手段２９及び４個のアクチュエータ２５ａ～２５ｄには制御手段１５が接続される。制御手段１５には記憶手段３５が接続され、入力項目選択用の表示画面を、例えば、３次元的に表示するための表示データＤ４や、当該表示データＤ４に対応したアイコンＩＣｘの選択接触位置及び振動モードに関する制御情報Ｄｃ等を表示画面毎に記憶したものである。

【００４４】
制御情報Ｄｃには、表示手段２９におけるアプリケーション（３次元的な表示や、各種表示内容）に同期した複数の異なった触覚を発生でき、その触覚を発生せしめる複数の具体的な振動波形、及び、アプリケーション毎の具体的な触覚発生モードを設定するアルゴリズムが含まれる。記憶手段３５には、ＥＥＰＲＯＭや、ＲＯＭ、ＲＡＭ等が使用される。

【００４５】
この例で制御手段１５は、入力手段２４から出力される位置情報に基づいて表示手段２９の表示制御及びアクチュエータ２５ａ～２５ｄの出力制御をする。例えば、制御手段１５は、入力手段２４から得られる位置検出信号Ｓ１及び入力検出信号Ｓ２に基づいて記憶手段３５から制御情報Ｄｃを読出してアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを供給し、表示データＤ４に対応した振動モードを発生するように制御する。

【００４６】
この例で、制御手段１５は、表示画面中のアイコンＩＣｘを奥行方向に遠近感を有して３次元的に表示するように表示手段２９を表示制御し、アイコンＩＣｘが表示画面の奥から手前に近づくに従って、表示画面を低周波数かつ小振幅の振動から、高周波数かつ大振幅の振動を発生するようにアクチュエータ２５ａ～２５ｄを出力制御する。
【００４７】
例えば、制御手段１５は、アイコンＩＣｘが表示画面の奥から手前に近づくに従って、表示画面を周波数５０Ｈｚ乃至１００Ｈｚ程度であって、振幅５μｍ乃至２０μｍ程度の小さい振動から、周波数１５０Ｈｚ乃至４００Ｈｚ程度であって、振幅１５μｍ乃至４０μｍ程度の大きな振動を発生するようにアクチュエータ２５ａ～２５ｄを出力制御する。このようにすると、円状又は楕円状に移動表示されるアイコンＩＣｘの３次元的な表示動作に同期して触覚を変化するようにできる。
【００４８】
次に、触覚入力機能付きの携帯電話機１００の内部構成例及び感触フィードバック入力方法について説明をする。図３は、触覚入力機能付き携帯電話機１００の内部構成例を示すブロック図である。
【００４９】
図３に示す携帯電話機１００は、下部筐体１０の回路基板１７に各機能のブロックを実装して構成される。なお、図１及び図２に示した各部及び手段と対応する部分は、同一符号で示している。携帯電話機１００は、制御手段１５、操作パネル１８、受信部２１、送信部２２、アンテナ共用器２３、入力手段２４、アクチュエータ２５ａ～２５ｄ，表示手段２９、電源ユニット３３、カメラ３４及び記憶手段３５を有している。
【００５０】
図３に示す入力手段２４は、図２では静電容量方式の入力デバイスを説明したが、カーソリングと選択の機能を区別できるものであれば何でも良く、例えば、抵抗膜方式、表面波弾性方式（ＳＡＷ）、光方式、複数段方式タクトスイッチ等の入力デバイスであっても良く、好ましくは位置情報と力情報を制御手段１５に与えられる構成の入力デバイスであれば良い。上述の入力手段２４は操作者３０の指３０ａを介して少なくとも位置検出信号Ｓ１および入力値（押圧力）となる入力検出信号Ｓ２が入力される。
【００５１】
制御手段１５は、Ａ／Ｄドライバ３１、ＣＰＵ３２，画像処理部２６及びアクチュエータ駆動回路３７を有している。Ａ／Ｄドライバ３１には、入力手段２４からの位置検出信号Ｓ１および入力検出信号Ｓ２が供給される。Ａ／Ｄドライバ３１ではカーソリングとアイコン選択の機能を区別するために位置検出信号Ｓ１および入力検出信号Ｓ２よりなるアナログ信号をデジタルデータに変換する。この他にＡ／Ｄドライバ３１は、このデジタルデータを演算処理して、カーソリング入力かアイコン選択情報かを検出し、カーソリング入力かアイコン選択かを区別するフラグデータＤ３あるいは位置情報Ｄ１または入力検出情報Ｄ２をＣＰＵ３２に供給するようになされる。これらの演算はＣＰＵ３２内で実行してもよい。
【００５２】
Ａ／Ｄドライバ３１にはＣＰＵ３２が接続される。ＣＰＵ３２はシステムプログラムに基づいて当該電話機全体を制御するようになされる。記憶手段３５には当該電話器全体を制御するためのシステムプログラムデータが格納される。図示しないＲＡＭはワークメモリとして使用される。ＣＰＵ３２は電源オンと共に、記憶手段３５からシステムプログラムデータを読み出してＲＡＭに展開し、当該システムを立ち上げて携帯電話機全体を制御するようになされる。
【００５３】
例えば、ＣＰＵ３２は、Ａ／Ｄドライバ３１からの入力データＤ１～Ｄ３を受けて所定の指令データＤを電源ユニット３３や、カメラ３４、記憶手段３５、アクチュエータ駆動部３７、映像＆音声処理部４４等のデバイスに供給したり、受信部２１からの受信データ

を取り込んだり、送信部２へ送信データを転送するように制御する。

【００５４】

ＣＰＵ３２には、アクチュエータ駆動部３７が接続され、ＣＰＵ３２からの制御情報Ｄｃに基づいて振動制御信号Ｓａ～Ｓｄを発生する。振動制御信号Ｓａ～Ｓｄは、正弦波形からなる出力波形を有している。アクチュエータ駆動部３７には複数のアクチュエータ２５ａ、２５ｂ、２５ｃ、２５ｄ・・・が接続され、各々の振動制御信号Ｓａ～Ｓｄに基づいて振動するようになされる。

【００５５】

ＣＰＵ３２にはアクチュエータ駆動部３７の他に画像処理部２６が接続され、アイコンＩＣｘを３次元的に表示するための表示情報Ｄ４を画像処理するようになされる。画像処理後の表示情報Ｄ４を表示手段２９に供給するようになされる。

【００５６】

操作者３０は指３０ａに振動を受けて触感としてＣＰＵ３２からの機能毎の振動を感じる。また表示手段２９の表示内容は操作者の目による視覚により、スピーカー３６ａ、３６ｂ等からの放音は、操作者の耳による聴覚により各機能を判断するようになされる。

【００５７】

上述のＣＰＵ３２には操作パネル１８が接続され、例えば、相手方の電話番号を手動入力する際に使用される。表示手段２９には上述のアイコン選択画面の他に映像信号Ｓｖに基づいて着信映像を表示するようにしてもよい。

【００５８】

また、図３に示すアンテナ１６は、アンテナ共用器２３に接続され、着呼時、相手方からの無線電波を基地局等から受信する。アンテナ共用器２３には受信部２１が接続され、アンテナ１６から導かれる受信データを受信して映像や音声等を復調処理し，復調後の映像及び音声データＤｉｎをＣＰＵ３２等に出力するようになされる。受信部２１には、ＣＰＵ３２を通じて映像＆音声処理部４４が接続され、デジタルの音声データをデジタル／アナログ変換して音声信号Ｓｏｕｔを出力したり、デジタルの映像データをデジタル／アナログ変換して映像信号Ｓｖを出力するようになされる。

【００５９】

映像＆音声処理部４４には大音響用及び受話器を構成するスピーカー３６ａ、３６ｂが接続される。スピーカー３６ａは、着呼時、着信音や着信メロディ等を鳴動するようになされる。スピーカー３６ｂは、音声信号Ｓｉｎを入力して相手方の話声３０ｄ等を拡大するようになされる。この映像＆音声処理部４４にはスピーカー３６ａ、３６ｂの他に、送話器を構成するマイクロフォン１３が接続され、操作者の声を集音して音声信号Ｓｏｕｔを出力するようになされる。映像＆音声処理部４４は、発呼時、相手方へ送るためのアナログの音声信号Ｓｉｎをアナログ／デジタル変換してデジタルの音声データを出力したり、アナログの映像信号Ｓｖをアナログ／デジタル変換してデジタルの映像データを出力するようになされる。

【００６０】

ＣＰＵ３２には受信部２１の他に、送信部２２が接続され、相手方へ送るための映像及び音声データＤｏｕｔ等を変調処理し、変調後の送信データをアンテナ共用器２３を通じアンテナ１６に供給するようになされる。アンテナ１６は、アンテナ共用器２３から供給される無線電波を基地局等に向けて輻射するようになされる。

【００６１】

上述のＣＰＵ３２には送信部２２の他に、カメラ３４が接続され、被写体を撮影して、例えば、静止画情報や動作情報を送信部２２を通じて相手方に送信するようになされる。電源ユニット３３は、バッテリー１４を有しており、制御手段１５、操作パネル１８、受信部２１、送信部２２、入力手段２４、アクチュエータ２５ａ～２５ｄ、表示手段２９、カメラ３４及び記憶手段３５にＤＣ電源を供給するようになされる。

【００６２】

このように、触覚入力機能付きの携帯電話機１００によれば、表示手段２９と操作者の

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視覚からみて、奥行き方向以外の２次元において、操作者がタッチしたアイコンの位置情報を直接入力することができ、かつ、操作者の入力操作に応じて、表示手段２９が振動する構成とすることができる。また、異なるアプリケーションを使用している際に、そのアプリケーションの操作の意味に応じた異なる複数の振動モードを発生できるようになる。

【００６３】

図４Ａ～Ｃは、入力装置９０におけるアイコン選択時の位置情報の決定例（円）を示す図である。図４Ａは、単位円とアイコンＩＣｘの表示軌跡円との関係例を示す図である。

【００６４】

この例では、表示手段２９の表示画面上の任意の位置に単位円を設定し、その単位円を基準としたアイコンＩＣｘの表示軌跡円を設定する。更に、アイコンＩＣｘの表示軌跡円の円周上に基準位置の一例となる入力確定位置を設定する。この入力装置９０では、アイコンＩＣｘが入力確定位置に到達したとき、そのアイコンＩＣｘの入力を確定するようになされる。

【００６５】

図４Ａにおいて、Ｉは半径「１」の単位円であり、表示手段２９の表示画面上の任意の位置に設定される。この単位円Ｉを特定するために、Ｘ－Ｙ座標系を設定したとき、単位円Ｉはその Ｘ軸上に点Ｚ（＝１）を設定することにより得られる。また、IIは単位円Ｉを基準としたアイコンＩＣｘの表示軌跡円である。この例では半径「３」の場合を例に挙げている。単位円Ｉの回転中心点Ｏは一定であり、その位相判別基準となる点Ｚも一定である。

【００６６】

回転中心点Ｏは、表示手段２９の画面の中心ではなく，その単位円Ｉを基準としたアイコンＩＣｘの表示軌跡円IIの中心である。この表示軌跡円IIの円周上にはアイコンＩＣｘが並べられて表示される。回転中心点Ｏの座標は、（X_0，Y_0）である。実際の点Ｏは、$X_0 \neq 0$、$Y_0 \neq 0$である。アイコンＩＣｘは時計方向（順方向）回り及び反時計方向（逆方向）回りに回転する場合を前提とする。

【００６７】

ＰＲは入力確定位置であり、表示軌跡円II上であって、例えば、Ｘ－Ｙ座標系のＸ軸上に設定される。この例では、入力確定位置ＰＲにアイコンＩＣｘが到達したとき、当該アイコンＩＣｘの入力を確定するようになされる。

【００６８】

この例で、単位円Ｉにおいて、点Ｚを点Ｏに対して円運動させる。この際に得られるＸ及びＹの値（$X_Z - X_0$、$Y_Z - Y_0$）の変化量をＤａｔａ１とする。このＤａｔａ１は、Ｘ，Ｙの値として取り扱われ、予め、記憶手段３５に記憶され、演算時に、記憶手段３５から画像処理部２６又はＣＰＵ３２に読み出される。このＤａｔａ１を使用してアイコンＩＣｘ選択時の位置情報の決定するようになされる。

【００６９】

ここで表示手段２９の表示画面上でアイコンＩＣｘが操作者によって選択され、押下接触された位置を入力開始点Ａとする。点Ａの座標は（X_A，Y_A）であり、Ｄａｔａ２によってりえられる。また、回転中心点Ｏと点Ｚとの間の線分（半径）の長さをＯＺとし、回転中心点Ｏと点Ａとの間の線分（半径）の長さをＯＡとする。この例では、入力開始点Ａが検出されたとき、長さＯＺとＯＡとの比（ＯＡ／ＯＺ）が、（１）式、すなわち，

【００７０】

【数１】

$$\frac{OA}{OZ} = \frac{\sqrt{(X_A - X_O)^2 + (Y_A - Y_O)^2}}{\sqrt{(X_Z - X_O)^2 + (Y_Z - Y_O)^2}} \quad \cdots (1)$$

【００７１】
によって求められる。
【００７２】
この長さの比（ＯＡ／ＯＺ）を算出した後，その演算結果にＤａｔａ１を乗算して点Ａの座標（X_A，Y_A），すなわち，アイコンＩＣｘの入力開始点Ａを示すＤａｔａ２を求める。これにより，点Ａの位相を決定するための準備が終了する。
【００７３】
次に，アイコンＩＣｘの入力開始点ＡのＤａｔａ２と（X_A-X_0，Y_A-Y_0）を比較する。これはＸ，Ｙ値が共に一致する位相を見出すためである。これにより，点Ａの位相を決定することができる。
【００７４】
図４Ｂは単位円Ｉ及び表示軌跡円IIに関する回転角度θとＸの値との関係例，図４Ｃは同様にして回転角度θとＹの値との関係例を各々示すグラフである。図４Ｂにおいて，縦軸はＸの値であり，図４Ｃにおいて，縦軸はＹの値であり，横軸はいずれも回転角度（位相）θである。
【００７５】
図４Ｂに示すＤａｔａＩのグラフは，単位円Ｉを描画するためのＸの値である。Ｄａｔａ２のグラフは，アイコンＩＣｘの表示軌跡円IIを描画するためのＸの値である。図４Ｃに示すＤａｔａＩのグラフは，単位円Ｉを描画するためのＹの値である。Ｄａｔａ２のグラフは，アイコンＩＣｘの表示軌跡円IIを描画するためのＹの値である。グラフはいずれも正弦波形を示している。このＸ，Ｙ値に基づくＤａｔａ２に対応する表示情報Ｄ４により，操作者が選択したアイコンＩＣｘを引きずっている間中，表示軌跡円IIに沿ってアイコンＩＣｘを入力確定位置ＰＲまで移動させることができる。
【００７６】
図５Ａ～Ｄは，アイコン移動方向の検出例（円）及びパルス波形例を示す図である。この例では，図４Ａ等で入力開始点Ａが決定された後に，操作者が表示画面上でアイコンＩＣｘを接触したまま時計方向（順方向）又は反時計方向（逆方向）に引きずったかをＣＰＵ３２で判別するようになされる。
【００７７】
図５Ａは，Ｘ軸のＤａｔａ２のグラフに方向判別角度θ１，θ２を設定した図である。図５Ａにおいて，入力開始点Ａを基準して，Ｘ軸の＋方向（時計方向）には，判定角度θ１が設定される。同様にして，Ｘ軸の－方向（反時計方向）にも判定角度θ２が設定される。判定角度θ１は一定であり，アイコンＩＣｘを時計方向に移動したか否かを判別する閾値である。この判定角度θ１を越える移動がなされた場合に，図５Ｃに示すようなパルス信号ＳＰ１を１パルスだけ発生するようになされる。
【００７８】
判定角度θ２も一定であり，アイコンＩＣｘを反時計方向に移動したか否かを判別する閾値である。この判定角度θ２を越える移動がなされた場合に，図５Ｄに示すようなパルス信号ＳＰ２を１パルスだけ発生するようになされる。この例で，角度θ１＝－１×θ２であり，図中，θ１＝－θ２＝９０°の場合を示している。ＣＰＵ３２は，パルス信号ＳＰ１，ＳＰ２を検出してアイコンＩＣｘの移動方向を認識するようになされる。
【００７９】
図５Ｂは，Ｙ軸のＤａｔａ２のグラフに方向判別角度θ１，θ２を設定した図である。図５Ｂにおいて，入力開始点Ａを基準して，Ｙ軸の＋方向（時計方向）には，判定角度θ１が設定される。同様にして，Ｙ軸の－方向（反時計方向）には，判定角度θ２が設定される。上記の位相におけるＤａｔａ２上のＸ，Ｙ値をそれぞれ時計方向を（X_{n+1}，Y_{n+1}）とし，反時計方向を（X_{n-1}，Y_{n-1}）とする。
【００８０】
そして，入力開始点Ａから移動が継続されて現在の接触位置に至り，その点をＢとし，そのＢ点の位置座標値を（X_B，Y_B）としたとき，パルス信号ＳＰ１の発生条件，つまり

、アイコンＩＣｘが時計方向へ移動されたことを判別する条件（以下、順方向判別条件という）として、（２）式、すなわち、

$$X_B - X_A = X_\alpha,$$
$$Y_B - Y_A = Y_\alpha, \quad \cdots\cdots (2)$$

が与えられる。

【００８１】

また、反対に、パルス信号ＳＰ２の発生条件、つまり、アイコンＩＣｘが反時計方向へ移動されたことを判別する条件（以下、逆方向判別条件という）として、（３）式、すなわち、

$$X_B - X_A = X_\beta,$$
$$Y_B - Y_A = Y_\beta, \quad \cdots\cdots (3)$$

が与えられる。上記順又は逆方向判別条件に基づいてアイコンＩＣｘが入力点Ｂに到達した場合は、ＣＰＵ３２は回転処理を実行し、点Ｂを次の入力開始点として回転検出を実行する。

【００８２】

図５Ｃは、パルス信号ＳＰ１を示す波形図である。図５Ｃに示すパルス信号ＳＰ１は、入力開始点Ａからアイコンアイコンを接触したまま時計方向になぞりを開始した場合に発生される信号である。パルス信号ＳＰ１のパルス幅は、判別角度θ１を反映して設定される。

【００８３】

ＣＰＵ３２は、パルス信号ＳＰ１の立ち上がりに基づいてアクチュエータ２５ａ～２５ｄや、表示手段２９の表示制御を実行する。例えば、入力開始点Ａを基準して、入力開始点Ａからアイコンアイコンを接触したまま時計方向になぞりを開始した後、入力確定位置ＰＲに近づくにつれて振動を大きくするようにアクチュエータの振動パターンを制御する。選択されたアイコンＩＣｘに係る振動が最も大きくなされるのは、入力確定位置ＰＲである。最も小さく振動されるのは、入力確定位置ＰＲから１８０°反転した位置である。

【００８４】

同様にして、その入力開始点Ａから入力確定位置ＰＲに近づくにつれてアイコンＩＣｘの表示を大きくするように表示手段２９を制御する。選択されたアイコンＩＣｘが最も大きく表示されるのは、入力確定位置ＰＲである。最も小さく表示されるのは、入力確定位置ＰＲから１８０°反転した位置である（接近モード）。

【００８５】

図５Ｄは、パルス信号ＳＰ２を示す波形図である。図５Ｄに示すパルス信号ＳＰ２は、入力開始点Ａからアイコンアイコンに接触したまま反時計方向になぞりを開始した場合に発生される信号である。パルス信号ＳＰ２のパルス幅は、パルス信号ＳＰ１と同じパルス幅に設定される。

【００８６】

ＣＰＵ３２は、パルス信号ＳＰ２の立ち上がりに基づいてアクチュエータ２５ａ～２５ｄや、表示手段２９の表示制御を実行する。例えば、入力開始点Ａからアイコンアイコンを接触したまま反時計方向になぞりを開始した後、入力確定位置ＰＲから遠ざかるにつれて振動を小さくするようにアクチュエータの振動パターンを制御する。同様にして、入力確定位置ＰＲから遠ざかるにつれてアイコンＩＣｘの表示を小さくするように表示手段２９を制御する（遠ざかりモード）。

【００８７】

図６Ａ～Ｃは、入力装置９０におけるアイコン選択時の位置情報の決定例（楕円）を示す図である。図６Ａは、単位円とアイコンＩＣｘの表示軌跡楕円との関係例を示す図である。

【００８８】

この例では、表示手段２９の表示画面上の任意の位置に単位円を設定し、その単位円を基準としたアイコンＩＣｘの表示軌跡楕円を設定する。これは、アイコンＩＣｘを３次元

的に表示するためである。この例でも、アイコンＩＣｘの表示軌跡楕円の円周上に基準位置の一例となる入力確定位置ＰＲを設定する。この入力装置９０では、アイコンＩＣｘが入力確定位置ＰＲに到達したとき、そのアイコンＩＣｘの入力を確定するようになされる。

【００８９】

図６Ａにおいて、Ｉは半径「１」の単位円であり、表示手段２９の表示画面上の任意の位置に設定される。この単位円Ｉを特定するために、Ｘ－Ｙ座標系を設定したとき、単位円ＩはそのＸ軸上に点Ｚ（＝１）を設定することにより得られる。また、IIIは単位円Ｉを基準としたアイコンＩＣｘの表示軌跡楕円である。この例では長手方向の半径が「３」で、短手方向の半径が「２」の場合を例に挙げている。単位円Ｉの回転中心点Ｏは一定であり、その位相判別基準となる点Ｚも一定である。

【００９０】

回転中心点Ｏは、単位円Ｉを基準としたアイコンＩＣｘの表示軌跡楕円IIIの中心である。この表示軌跡楕円IIIの楕円周上にはアイコンＩＣｘが遠近感を有して並べられ表示される（図８～図１０参照）。回転中心点Ｏの座標は、（X_0，Y_0）である。実際の点Ｏは、$X_0 \neq 0$、$Y_0 \neq 0$である。アイコンＩＣｘは時計方向（順方向）回り及び反時計方向（逆方向）回りに回転する場合を前提とする。この例でも、表示軌跡楕円III上であって、Ｘ－Ｙ座標系のＸ軸上に入力確定位置ＰＲが設定される。この入力確定位置ＰＲにアイコンＩＣｘが到達したとき、当該アイコンＩＣｘの入力を確定するようになされる。

【００９１】

この例で、入力確定位置ＰＲの付近では、アイコンＩＣｘの移動距離を多くするように表示される。入力確定位置ＰＲから１８０°反転した位置では、アイコンＩＣｘの移動距離を少なくするように表示される。これはアイコンＩＣｘの遠近感を演出するためである。このような３次元的な表示をする場合に、単位円Ｉにおいて、点Ｚを点Ｏに対して円運動させる。この際に得られるＸ及びＹの値（$X_i - X_0$、$Y_i - Y_0$）の変化量をＤａｔａ１としたとき、オフセットデータ（以下Ｄａｔａ３という）を演算するようになされる。すなわち、単位円Ｉを基準としたアイコンＩＣｘの表示軌跡楕円IIIは、点Ｚを中心Ｏの周りに回転させたときのＸ、Ｙ値を示すＤａｔａＩに、Ｄａｔａ３を乗算したＤａｔａＩ’に基づいて入力開始点Ａを検出し決定するようになされる。

【００９２】

図６Ｂは、Ｘ及びＹ軸におけるＤａｔａ３のオフセット内容例を示す図である。横軸は角度θであり、縦軸は倍率である。Ｄａｔａ３のグラフによれば、角度（位相）１８０°で１倍、位相０°で２倍の一次関数的な倍率を設定するようになされる。従って、角度９０°及び２７０度では、倍率が１．５倍となる。

【００９３】

図６Ｃは、Ｘ軸におけるＤａｔａ３の乗算前後のグラフ例を示している。図６Ｃに示す一点鎖線は、Ｘ軸のＤａｔａ３の乗算前のＤａｔａＩのグラフを示している。実線は、Ｄａｔａ３の乗算後のＸの値を示すＤａｔａＩ’のグラフを示している。つまり、Ｘ軸についての演算は、ＤａｔａＩ’＝ＤａｔａＩ×Ｄａｔａ３である。

【００９４】

図６Ｄは、Ｙ軸におけるＤａｔａ３の乗算前後のグラフ例を示している。図６Ｄに示す一点鎖線は、Ｙ軸のＤａｔａ３の乗算前のＤａｔａＩのグラフを示している。実線は、Ｄａｔａ３の乗算後のＹの値を示すＤａｔａＩ’のグラフを示している。つまり、Ｙ軸についての演算は、ＤａｔａＩ’＝ＤａｔａＩ×Ｄａｔａ３である。その後の処理については、図４Ｂ、Ｃ及び図５Ａ～Ｄと同様であるため、その説明を省略する。

【００９５】

図７Ａは、単位円Ｉ及び表示軌跡楕円IIIに関する回転角度θとＸの値との関係例，図７Ｂは同様にして回転角度θとＹの値との関係例を各々示すグラフである。図７Ａにおいて、縦軸はＸの値であり、図７Ｂにおいて、縦軸はＹの値であり，横軸はいずれも回転角度θである。

【００９６】
図７Ａに示すＤａｔａ１’のグラフは、単位円１のＸの値にＤａｔａ３を演算したものである。Ｄａｔａ２のグラフは、アイコンＩＣｘの表示軌跡楕円ＩＩＩを描画するためのＸの値である。図７Ｂに示すＤａｔａ１’のグラフは、単位円１のＹの値にＤａｔａ３を演算したものである。Ｄａｔａ２のグラフは、アイコンＩＣｘの表示軌跡楕円ＩＩＩを描画するためのＹの値である。グラフはいずれも正弦波形を示している。
【００９７】
このＸ，Ｙ値に基づくＤａｔａ２に対応する表示情報Ｄ４により，操作者が選択したアイコンＩＣｘを引きずっている間中，表示軌跡楕円ＩＩＩに沿ってアイコンＩＣｘを入力確定位置ＰＲまで移動させることができる。このようにして、表示画面上のアイコンＩＣｘの表示軌跡楕円ＩＩＩにおける回転角度（位相）θ毎に、その移動量に対応した回転検出アルゴリズムを予め作成することができる。
【００９８】
次に，表示手段２９のアイコン選択表示画面Ｐ１１～Ｐ１６の遷移図を参照して入力装置９０の動作例を説明する。
【００９９】
図８Ａは、表示手段２９におけるアイコン選択表示画面（以下単に表示画面ともいう）Ｐ１１の表示例を示す遷移図である。図８Ａに示す表示画面Ｐ１１には、６個のアイコンＩＣ１～ＩＣ６が表示される。この例では、表示画面の左斜め下方に入力確定位置ＰＲが設定される。この入力確定位置ＰＲに表示されるアイコンＩＣｘの入力が確定される。
【０１００】
図８Ｂは，操作者の指の動きを示す図である。この例で操作者の指は，この時点でまだ表示画面Ｐ１１に触られておらず非接触状態である。図８Ｃは、ＣＰＵ３２が認識する位置情報を示す図である。この例で操作者の指は、まだ表示画面Ｐ１１に触られていないので、未定である。図８Ｄは、アクチュエータ２５ａ～２５ｂにおける振動波形例を示す図である。横軸は時間ｔである。この例で操作者の指は，まだ，表示画面Ｐ１１に触られていないので、無振動状態である。図８Ｅは、振動音、つまり、触覚イメージを示す図である。この例で操作者の指は、まだ表示画面Ｐ１１に触られていないので、触覚無し状態である。
【０１０１】
ここで、操作者の指が表示画面Ｐ１２でアイコンＩＣ２に触れた（単クリックモードが選択された）場合を例に挙げる。図８Ｂに示す操作者の指の動きによれば，アイコンＩＣ２に例えば０．３秒以上触れることにより、非接触状態から接触状態へ遷移する。このとき、表示画面Ｐ１２で選択された斜線に示すアイコンＩＣ２の表示色を変えるようにしてもよい。図８Ｃに示すアイコンＩＣ２の入力開始点，例えば図６Ａに示した点Ａの位置情報（X_A，Y_A）がＣＰＵ３２によって検出され認識される。
【０１０２】
ＣＰＵ３２は、位置情報（X_A、Y_A）の検出に基づいてアクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａに振動制御信号Ｓａを出力し、アクチュエータ２５ｂに振動制御信号Ｓｂを出力し、アクチュエータ２５ｃに振動制御信号Ｓｃを出力し、アクチュエータ２５ｄに振動制御信号Ｓｄを各々出力する。
【０１０３】
アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて約０．１ｍｓ程度振動するようになされる。図８Ｄに示す振動波形によれば，周波数ｆｘ＝２００Ｈｚ，振幅Ａｘ＝４０μｍ，回数Ｎｘ＝１回の振動パターンで振動する。以下［ｆｘ　Ａｘ　Ｎｘ］＝［２００　４０　１］と表記する。触覚的には，図８Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「ビッ」という感触が操作者の指に伝達する（単クリックモード）。
【０１０４】

その後、操作者がアイコンＩＣ２に指を触れたまま時計方向になぞりを開始すると、表示手段２９は、図８Ａに示した表示画面Ｐ１２から図９Ａに示す表示画面Ｐ１３へ表示遷移するようになされる（接近モード）。この接近モードでは、表示画面Ｐ１２等において、正四角点から波線四角点に至るように楕円上の弧をなぞるように指を移動するようになされる。アイコンＩＣ２等の遠近表示制御は、指の移動早さと同期させることが好ましい。

【０１０５】

このとき、図９Ｂに示す操作者の指の動きによれば、アイコンＩＣ２に触れたままであり、接触状態を継続する。図９Ｃに示した位置情報に関しては、アイコンＩＣ２の入力開始点から次の入力点に移行する。次の入力点は、順方向判別条件に基づいて判定される。この例では、図６Ａに示したような次の点Ｂの位置情報（X_B、Y_B）がＣＰＵ３２によって検出され認識される。ＣＰＵ３２で接近モードが認識されると、振動モードを設定するフラグを立てるようになされる。振動モードは、入力開始点Ａと次の入力点Ｂとの差分を算出し、この差分値に基づいて設定するようになされる。

【０１０６】

ＣＰＵ３２は、入力点Ｂの位置情報（X_B、Y_B）の検出に基づいて表示画面Ｐ１３から表示画面Ｐ１４へ表示遷移するように表示手段２９を制御すると共に、アクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。

【０１０７】

この例で、図９Ｄに示す振動波形例によれば、５段階に区分された振動パターンが構成される。第１段階は、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［５０　１０　１］の振動パターンで振動し、第２段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［１００　２０　１］の振動パターンで振動し、第３段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［２００　３０　１］の振動パターンで振動し、第４段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［４００　４０　１］の振動パターンで振動し、第５段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［５００　５０　１］の振動パターンで各々連続して振動するようになされる。

【０１０８】

触覚的には、図９Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「グッーグッグッグッグッ」という感触が操作者の指に伝搬する。その後、操作者がアイコンＩＣ２の移動を停止して、そのアイコンＩＣ２から指を放すと、図９Ａに示した表示画面Ｐ１４から図１０Ａに示す表示画面Ｐ１５へ表示遷移するようになされる。

【０１０９】

図１０Ａに示す表示画面Ｐ１５には、アイコンＩＣ２から指が放された後にも、わずか時計方向に移動し、その後、図１０Ｂに示す表示画面Ｐ１６に落ち着く状態を示している。この動作モードを「ブルブルモード」とする。このブルブルモードは、アイコンＩＣ２が振動しているように見せるアニメーション効果を狙ったものである。これは補助的動作なので省略してもよい。

【０１１０】

この際の操作者の指の動きによれば、正に、指を放した瞬間に、アクチュエータ２５ａ～２５ｄが振動パターンに基づいて振動する。図１０Ｄに示す振動波形例によれば、図１０Ａに示した表示画面Ｐ１５で時計方向に行き過ぎたアイコンＩＣ２を波線に回る位置に戻すべく、第１段階で周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［１００　２０　１］の振動パターンで振動し、その第２段階で［ｆｘ　Ａｘ　Ｎｘ］＝［４００　４０　１］の振動パターンで連続して振動する。触覚的には、アクチュエータ２５ａ～２５ｂの振動と共に図１０Ｅに示すように「グッグッ」という感触が、当該入力装置９０を持つ操作者の手に伝搬する。

【０１１１】

また、図１０Ｄに示す振動波形例によれば、図１０Ａに示した表示画面Ｐ１６で反時計

方向に行き過ぎたアイコンＩＣ２を波線に囲む位置に戻すべく、第１段階で周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［４００　４０　１］の振動パターンで振動し、その第２段階で［ｆｘ　Ａｘ　Ｎｘ］＝［１００　２０　１］の振動パターンで連続して振動する。

【０１１２】

触覚的には、アクチュエータ２５ａ～２５ｂの振動と共に図１０Ｅに示すように「グッグッ」という感触が、当該入力装置９０を持つ操作者の手に伝搬する。なお、図１０Ｃに示す位置情報については、図１０Ａに示した表示画面Ｐ１６の波線内にアイコンＩＣ２が停止した時点で入力が確定され、ＣＰＵ３２は、入力情報＝"1"を入力するようになされる。

【０１１３】

図１１Ａ及びＢは、接近モードで適用する他の振動波形例を示す図である。図１１Ａは、図９Ｄで説明した振動波形例である。この例では、図１１Ａに示す振動波形例に対して各段階における回数Ｎｘを可変設定するようにしたものである。

【０１１４】

この例で、図１１Ｂに示す振動波形例によれば、図１１Ａに示す振動波形例と同様にして５段階に区分された振動パターンから構成される。第１段階は、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［５０　１０　１］の振動パターンで振動し、第２段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［１００　２０　２］の振動パターンで振動し、第３段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［２００　３０　４］の振動パターンで振動し、第４段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［４００　４０　８］の振動パターンで振動し、第５段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［５００　５０　１０］の振動パターンで各々連続して振動するようになされる。

【０１１５】

触覚的には、アクチュエータ２５ａ～２５ｂの振動と共に図９Ｅに示したように「グーグッグッグッグッ」という感触に比べて、より一層、操作者の指に強く伝搬するようになる。

【０１１６】

図１２は、触覚入力機能付きの携帯電話機１００における情報処理例を示すフローチャートである。

この実施例では、予め準備された入力項目選択用の表示画面の中からアイコンＩＣ２を選択して情報を入力する場合を前提とする。入力項目選択用の表示画面に複数のＩＣ１～ＩＣ６等を表示し、ここで表示された表示画面で１つのアイコンＩＣ２の接触を待機し、アイコンＩＣ２が接触された状態で円又は楕円を描くように画面入力操作を受け付け、アイコンＩＣ２の選択接触位置及び移動中の接触位置を検出し、ここで検出された接触位置に基づく位置情報を検出してアイコンＩＣ２を円状又は楕円状に移動表示し、ここで移動表示されるアイコンＩＣ２の表示位置に基づいて表示画面を振動する場合を例に挙げる。

【０１１７】

また、入力項目選択用の表示画面Ｐ１１～Ｐ１６の内容及び当該表示画面中のアイコン毎に異なった触覚を与えるための複数の振動パターンは、予め作成され、記憶手段３５等に格納される。アイコンＩＣ２は、表示画面Ｐ１１～Ｐ１６等の奥から手前に近づくに従って、表示画面Ｐ１１～Ｐ１６を低周波数かつ小振幅の振動から、高周波数かつ大振幅の振動を発生するようになされる。

【０１１８】

更にまた、表示画面Ｐ１１～Ｐ１６を表示するための表示データＤ４と、当該表示データＤ４に対応したアイコンＩＣ２の選択接触位置及び振動モードに関する制御情報Ｄｃとを表示画面毎に予め作成し、記憶手段３５等に格納される。このようにすると、各種アイコンをなぞるたびに違った振動モードを触感でき、操作者に対して表示内容の境目や、その種類等を振動パターンの種類によって知らしめることができる。

【０１１９】

なお、動作モードについては、アイコン選択モードと他の処理モードとが準備され、このモード切り替えに基づいて各種情報処理をするようになされる。他の処理モードには、電話モードやメール作成及び送信表示モードが含まれる。電話モードには、相手方に電話を発信する操作が含まれる。アイコンＩＣ２が電話モードを選択する入力項目である場合を例に採る。

【０１２０】

これらを情報処理条件にして、図１２に示すフローチャートのステップＲ１で電源オンを待機する。例えば、ＣＰＵ３２は電源オン情報を検出してシステムを起動する。電源オン情報は通常、時計機能等が稼働し、スリーピング状態にある携帯電話機等の電源スイッチをオンされたときに発生する。

【０１２１】

そして、ステップＲ２に移行してＣＰＵ３２は、アイコン選択モード又はその他の処理モードに基づいて制御を分岐する。アイコン選択モードとは、アイコン選択表示画面Ｐ１１等に表示された複数のアイコンＩＣ１～ＩＣ６の中から１つのアイコンＩＣ２を選択する動作をいう。アイコン選択モードが設定された場合は、表示画面中のアイコンＩＣ２が奥行方向に遠近感を有して３次元的に表示され、ステップＲ３に移行して表示画面Ｐ１１に接触（タッチ）されたか否かを検出する。

【０１２２】

表示画面Ｐ１１のいずれかにタッチされた場合は、ステップＲ４に移行して表示画面Ｐ１１でタッチされたアイコンＩＣ２の入力位置を検出する。このとき、図８Ｂに示したように操作者の指の動きによれば、アイコンＩＣ２に例えば０．３秒以上触れることにより、非接触状態から接触状態へ遷移する。図８Ｃに示したアイコンＩＣ２の入力開始点、例えば図６Ａに示した点Ａの位置情報（X_1，Y_1）がＣＰＵ３２によって検出され認識される。

【０１２３】

アイコン以外の位置にタッチされた場合は、ステップＲ６に移行して無振動モードを実行する。無振動モードとは、アクチュエータ２５ａ～２５ｂを動作させない状態を維持する動作をいう。従って、当該携帯電話機１００は触覚無し状態である。その後、ステップＲ７に移行する。

【０１２４】

上述のステップＲ４でアイコンＩＣ２の入力開始位置が検出された場合は、ステップＲ５に移行して、ＣＰＵ３２は単クリックモードを実行する。この単クリックモードでは、ＣＰＵ３２が位置情報（X_1，Y_1）の検出に基づいてアクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａに振動制御信号Ｓａを出力し、アクチュエータ２５ｂに振動制御信号Ｓｂを出力し、アクチュエータ２５ｃに振動制御信号Ｓｃを出力し、アクチュエータ２５ｄに振動制御信号Ｓｄを各々出力する。

【０１２５】

アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて約０．１ｍｓ程度振動するようになされる。図８Ｄに示した振動波形によれば、周波数ｆｘ＝２００Ｈｚ、振幅Ａｘ＝４０μｍ、回数Ｎｘ＝１回の振動パターンで振動する。触覚的には、図８Ｅに示したようにアクチュエータ２５ａ～２５ｂの振動と共に「ピッ」という感触が操作者の指に伝搬する。その後、ステップＲ７に移行する。

【０１２６】

そして、ステップＲ７でそのアイコンＩＣ２の接触状態が引き続いているか否かを判別する。そのアイコンＩＣ２の接触状態が引き続いている場合は、ステップＲ８に移行して、その入力開始点、例えば、移動後の入力点Ｂを検出し位置情報を取得する。その後、ステップＲ９に移行してＣＰＵ３２は、上述したような位置情報を記憶処理する。そして、ステップＲ１０に移行して、図５Ｃ及びＤに示したような１パルスを超える移動が検出されたかを判別する。この判別結果に基づいて、操作者の指の動きが時計（順）方向又は反

時計（逆）方向に移動したかにより制御を分岐する。

【０１２７】

アイコンＩＣ２をタッチした操作者の指が時計方向に移動した場合は、ステップＲ１２に移行して接近モードを実行する。この接近モードでは、図５Ｃに示したように、パルス信号ＳＰ１の立ち上がりに基づいてＣＰＵ３２は、アクチュエータ２５ａ～２５ｄや、表示手段２９の表示制御を実行する。例えば、入力開始点Ａから入力確定位置ＰＲに近づくにつれてアイコンＩＣ２の表示を大きくするように表示手段２９を制御する。選択されたアイコンＩＣ２が最も大きく表示されるのは、入力確定位置ＰＲである。

【０１２８】

また、入力開始点Ａを基準して、入力開始点ＡからアイコンＩＣ２を接触したまま時計方向になぞりを開始した後、入力確定位置ＰＲに近づくにつれて振動を大きくするようにアクチュエータの振動パターンを制御する。選択されたアイコンＩＣ２に係る振動が最も大きくなされるのは、入力確定位置ＰＲである。

【０１２９】

例えば、図９Ｄに示したように、５段階に区分された振動パターンによりアクチュエータ２５ａ～２５ｄが振動制御される。第１段階では、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［５０　１０　１］の振動パターンで振動され、第２段階では、［ｆｘ　Ａｘ　Ｎｘ］＝［１００　２０　１］の振動パターンで振動され、第３段階では、［ｆｘ　Ａｘ　Ｎｘ］＝［２００　３０　１］の振動パターンで振動され、第４段階では、［ｆｘ　Ａｘ　Ｎｘ］＝［４００　４０　１］の振動パターンで振動され、第５段階は、［ｆｘ　Ａｘ　Ｎｘ］＝［５００　５０　１］の振動パターンで各々連続して振動するようになされる。触覚的には、図９Ｅに示したようにアクチュエータ２５ａ～２５ｂの振動と共に「グッーグッグッグッグッ」という感触が操作者の指に伝搬する。

【０１３０】

また、ステップＲ１１でアイコンＩＣ２をタッチした操作者の指が反時計方向に移動した場合は、ステップＲ１３に移行して遠ざかりモードを実行する。遠ざかりモードでは、図５Ｄに示したパルス信号ＳＰ２の立ち上がりに基づいてＣＰＵ３２は、アクチュエータ２５ａ～２５ｄや、表示手段２９の表示制御を実行する。例えば、入力開始点AからアイコンＩＣ２を接触したまま反時計方向になぞりを開始した後、入力確定位置ＰＲから遠ざかるにつれて振動を小さくするようにアクチュエータの振動パターンを制御する。同様にして、入力確定位置ＰＲから遠ざかるにつれてアイコンＩＣ２の表示を小さくするように表示手段２９を制御する。

【０１３１】

その後、ステップＲ７に戻って、そのアイコンＩＣ２の接触状態が引き続いているか否かを判別する。ここで操作者は、アイコンＩＣ２の移動を停止して、そのアイコンＩＣ２から指を放す。その結果、アイコンＩＣ２の接触状態停止が検出され、この場合は、ステップＲ１４に移行して入力を確定する。その後、ステップＲ１６に移行してＣＰＵ３２は終了判断をする。例えば、電源オフ情報を検出して情報処理を終了する。電源オフ情報が検出されない場合は、ステップＲ２に戻る。ステップＲ２で他の処理モードが設定された場合は、ステップＲ１５に移行して通信処理等の他の処理モードを実行する。

【０１３２】

例えば、ＣＰＵ３２は、Ａ／Ｄドライバ３１からの入力データＤ１～Ｄ３を受けて所定の指令データＤを映像＆音声処理部４４に供給したり、受信部２１からの受信データを取り込んだり、送信部２へ送信データを転送するように制御する。

【０１３３】

ＣＰＵ３２は操作パネル１８から、相手方の電話番号を手動入力するようになされる。また、図３に示した下部筐体１０に設けられたマイクロフォン１３を通して操作者（ユーザ）の声が集音され、その音声信号Ｓｏｕｔが映像＆音声処理部４４に出力される。映像＆音声処理部４４では、発呼時、相手方へ送るためのアナログの音声信号Ｓｉｎをアナログ／デジタル変換してデジタルの音声データを出力したり、アナログの映像信号Ｓｖをアナロ

グ／デジタル変換してデジタルの映像データを出力するようになされる。

【０１３４】

また、映像＆音声処理部４４にＣＰＵ３２を介して接続された送信部２２では、相手方へ送るための映像及び音声データＤoutを変調処理し、変調後の送信データをアンテナ共用器２３を通じアンテナ１６に供給するようになされる。アンテナ１６は、アンテナ共用器２３から供給される無線電波を基地局等に向けて輻射するようになされる。

【０１３５】

更に、相手方からの無線電波は、基地局等からアンテナ共用器２３を通して受信される。受信部２１では、アンテナ１６から導かれる受信データを受信して映像や音声等を復調処理し、復調後の映像及び音声データＤinをＣＰＵ３２等に出力するようになされる。ＣＰＵ３２は、映像＆音声処理部４４を制御して、デジタルの音声データをデジタル／アナログ変換して音声信号Ｓoutを出力したり、デジタルの映像データをデジタル／アナログ変換して映像信号Ｓｖを出力するようになされる。映像＆音声処理部４４に接続されたスピーカー３６ｂは、音声信号Ｓinを入力して相手方の話声等を拡大するようになされる。

【０１３６】

その後、ステップＲ１６に移行する。これにより、アイコン選択表示画面Ｐ１１等に表示された１つのアイコンＩＣ２の選択し、このアイコン選択に基づいて相手方に電話番号を発信したり，相手方を通話できるようになる。

【０１３７】

このように、本発明に係る第１の実施例としての触覚入力機能付きの携帯電話機及び情報入力方法によれば、操作者は、アイコン選択表示画面Ｐ１１等に表示された任意のアイコンＩＣ２の１つに接触して当該表示画面上を円状又は楕円状に移動するように画面入力操作する。これを前提にして、入力手段２４は、アイコンＩＣ２の選択接触位置及び移動中の接触位置を検出するようになされる。表示手段２９は、入力手段２４から得られる位置情報に基づいてアイコンＩＣ２を円状又は楕円状に移動表示する。アクチュエータ２５ａ～２５ｄは、表示手段２９によって移動表示されるアイコンＩＣ２の表示位置に基づいて表示画面を振動するようになる。

【０１３８】

従って、円状又は楕円状に移動表示されるアイコンＩＣ２の３次元的な表示動作に同期した振動（触覚）を操作者に与えることができる。また、同一の場所で異なる複数のクリック感（触覚）を発生することができる。これにより、従来例のような視覚及び聴覚と単一種類の触覚ではなく，視覚及び聴覚の２つの間に十分な相関が採れ、それぞれを区別できる多種類の触覚を発生する触覚入力機能を有した携帯電話機１００を提供することができる。しかも、円状又は楕円状の軌跡上に予め設定された入力確定位置ＰＲにアイコンＩＣ２が到達したとき，当該アイコンＩＣ２の入力を確定することができ、より簡易な入力操作を行うことができる。

【０１３９】

このような構成から，表示手段２９とは別の場所に、従来例のようなロータリーエンコーダーやタクトスイッチ等を設ける必要が無くなる。また、入力装置自体の小型化が図れるので、これを組み入れた携帯電話機等の電子機器の小型化及びデザインの自由度を向上させることができる。携帯電話機等において、ボタンに表記する“ラベル表示”や，ボタンを押した際に発生する効果音をなくしても、入力者は自分の意図した入力動作を確認し，実現することができる。

【０１４０】

これにより、入力機能として，必要な複数の異なる機能をもつスイッチを同一の場所に集約して設けることができるようになり、部品点数の削減、コストダウンに寄与するところが大きい。

【実施例２】

【０１４１】

図１３～図１５は、第２の実施例に係るメール作成及び送信操作例（その１～３）を示

す遷移図である。

この実施例では、送信ボタンモードが準備され、メール作成及び送信操作時において、操作者が送信ボタンアイコン５０等の入力動作をしようとした場合に、視覚的あるいは聴覚的な入力動作に関する情報が無くとも、操作者が意図した入力動作を確認させるような触覚確認機能を実現できるようになされる。ここに送信ボタンモードとは、送信ボタンアイコン"の表示位置をタッチされたか否かを検出し、そのタッチに基づいて所定周波数、振幅及び回数の振動を与えて「送信ＯＫ」を触覚で確認させる動作をいう。

【０１４２】

本発明に係る第２の電子機器は、メール作成送信画面（以下単に送信画面という）の任意の位置に接触して当該送信画面上で直線を描くように画面入力操作される触覚機能付き入力機能を有している。第２の電子機器は、図３に示した携帯電話機１００の内部構成図において、表示手段２９の送信画面に送信ボタンアイコンを表示する。検出手段の一例となる入力手段２４は、送信画面に接触された操作者の指の位置及びその指の移動中の接触位置を検出するようになされる。ＣＰＵ３２は、入力手段２４から得られる位置情報と、表示手段２９に表示された送信ボタンアイコンの表示位置とに基づいて送信画面を振動するようにアクチュエータ駆動回路３７を制御するようになされる。

【０１４３】

この例で、図３に示したアクチュエータ駆動回路３７は、"送信ボタンアイコン"の表示位置と同一のタッチ位置の検出があった場合に、周波数ｆｘが３００Ｈｚ～５００Ｈｚ付近の高周波で、振幅Ａｘが１５μｍ～４０μｍ付近の大きさで、１度に回数Ｎｘが２～１０回程度のサイン波形の振動パターンを発生する。このような振動パターンに基づく振動制御信号Ｓａ～Ｓｄを発生して、アクチュエータ２５ａ～２５ｄに出力すると、「本当に送信してもよいか？」を操作者に振動で確認させることができる。

【０１４４】

図１３Ａは、表示手段２９におけるメール作成送信画面（以下単に送信画面という）Ｐ２１の表示例を示す図である。図１３Ａに示す送信画面Ｐ２１には、相手先表示領域ｗ１が割り当てられ、相手先の名前や電話番号等が表示される。この相手先表示領域ｗ１の下方には、本文記述領域ｗ２が割り当てられ、相手方へ転送するためのメール文を作成し記述するようになされる。

【０１４５】

この表示画面で右下方には、送信ボタンアイコン５０が表示される。送信ボタンアイコン５０は、本文記述領域ｗ２で作成されたメール文を相手方に送信する際に押下される。なお、送信画面Ｐ２１において、相手先表示領域ｗ１、本文記述領域ｗ２及び送信ボタンアイコン５０の表示領域以外を背景領域ｗ３ということにする。

【０１４６】

図１３Ｂは、操作者の指の動きを示す図である。この例で操作者の指は、この時点でまだ送信画面Ｐ２１に触られておらず非接触状態である。図１３Ｃは、ＣＰＵ３２が認識する位置情報を示す図である。この例で操作者の指は、まだ送信画面Ｐ２１に触られていないので未定である。図１３Ｄは、アクチュエータ２５ａ～２５ｂにおける振動波形例を示す図である。横幅は時間ｔである。この例で操作者の指は、まだ、送信画面Ｐ２１に触られていないので、無振動状態である。図１３Ｅは、振動音、つまり、触覚イメージを示す図である。この例で操作者の指は、まだ送信画面Ｐ２１に触られていないので、触覚無し状態である。

【０１４７】

この例では、従来方式と同様にして、本文記述領域ｗ２でメール文を作成し、その後、図１３Ａに示した送信画面Ｐ２１から送信画面Ｐ２２に表示画面が遷移し、その後、操作者の指が送信画面Ｐ２２で本文記述領域ｗ２に触れた（単クリックモードが選択された）場合を例に挙げる。なお、送信画面Ｐ２２～Ｐ２３は同一の内容が表示される。

【０１４８】

図１３Ｂに示す操作者の指の動きによれば、本文記述領域ｗ２に例えば０．３秒以上触

れることにより、非接触状態から接触状態へ遷移する。図中、斜線に示す四角部分は操作者の指の位置Ｐｘである。また、図１３Ｃに示す本文記述領域ｗ２への入力開始点、例えば図１３Ｃに示した位置Ｐｘの最初の点Ａの位置情報（X_a，Y_a）がＣＰＵ３２によって検出され認識される。

【０１４９】

ＣＰＵ３２は、位置情報（X_a，Y_a）の検出に基づいてアクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａに振動制御信号Ｓａを出力し、アクチュエータ２５ｂに振動制御信号Ｓｂを出力し、アクチュエータ２５ｃに振動制御信号Ｓｃを出力し、アクチュエータ２５ｄに振動制御信号Ｓｄを各々出力する。

【０１５０】

アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて約０．１ｍｓ程度振動するようになされる。図１３Ｄに示す振動波形によれば、周波数ｆｘ＝２００Ｈｚ、振幅Ａｘ＝４０μｍ、回数Ｎｘ＝１回の振動パターンで振動する。以下［ｆｘ　Ａｘ　Ｎｘ］＝［２００　４０　１］と表記する。触覚的には、図１３Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「ピッ」という感触が操作者の指に伝搬する（単クリックモード）。

【０１５１】

その後、操作者が本文記述領域ｗ２に指を触れたまま下部方向になぞりを開始する。このとき、表示手段２９は、図１３Ａに示した送信画面Ｐ２２と同じ内容で図１４Ａに示す送信画面Ｐ２３を表示している（本文モード）。この本文モードでは、送信画面Ｐ２２等において、黒四角点から送信ボタンアイコン５０に向かって斜線をなぞるように指を移動される。

【０１５２】

図１４Ｂに示す操作者の指の動きによれば、本文記述領域ｗ２に触れたままであり、接触状態を継続する。操作者の指の位置Ｐｘは下方にずれる。図１４Ｃに示した位置情報に関しては、本文記述領域ｗ２の入力開始点から次の入力点に移行する。この例では、次の点Ｂの位置情報（X_b，Y_b）がＣＰＵ３２によって検出され認識される。ＣＰＵ３２で本文モードが認識されると、振動モードを設定するフラグを立てるようになされる。振動モードは、入力開始点Ａと次の入力点Ｂとの差分を算出し、この差分値に基づいて設定するようになされる。

【０１５３】

ＣＰＵ３２は、入力点Ｂの位置情報（X_b，Y_b）の検出に基づいて送信画面Ｐ２３と送信画面Ｐ２４との内容が変わらないように表示手段２９を制御すると共に、アクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。

【０１５４】

この例で、図１４Ｄに示す振動波形例によれば、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［１００　２０　４］の振動パターンで振動するようになされる。触覚的には、図１４Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「ザラザラ」という感触が操作者の指に伝搬する。

【０１５５】

更に操作者の指がなぞり動作を継続する。そして、本文記述領域ｗ２から背景領域ｗ３に移行すべく、本文記述領域ｗ２と背景領域ｗ３との境目を通過する。この境目は、物理的な隔壁ではなく、表示上の仕切である。ＣＰＵ３２は、境目の位置情報の検出に基づいてアクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。制御情報Ｄｃは振幅５０μｍ及び振動時間１００ｍｓの振動パターンを発生させる内

容である。触覚上は”カックン”という振動を与えて、あたかも、物理的障壁を乗り越えたように演出される（登り境界モード）。

【０１５６】

この項目を通過して背景領域ｗ３に操作者の指が移行し、当該背景領域ｗ３でなぞり動作が更に継続される。ＣＰＵ３２は、入力点Ｅ等の位置情報（X_E、Y_E）の検出に基づいて送信画面Ｐ２３と送信画面Ｐ２４との内容が変わらないように表示手段２９を制御すると共に、アクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。

【０１５７】

この例で、図１４Ｄに示す振動波形例によれば、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［５０　１０　２］の振動パターンで振動するようになされる。触覚的には、図１４Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「ブゥー」という感触が操作者の指に伝達する（背景モード）。

【０１５８】

その後、操作者の指が図１５Ａに示す送信画面Ｐ２５の送信ボタンアイコン５０に到達する。このとき、背景領域ｗ３から送信ボタンアイコン５０に移行する際に、上述の登り境界モードとは反対の下り境界モードが実行され、それを触感する。更に、操作者の指が送信ボタンアイコン５０をなぞることで、送信ボタンモードが実行される。図１５Ｃに示す位置情報については、”送信ボタンアイコン”の表示位置（X_{i1}、Y_{i1}）とタッチ位置（X_{i2}、Y_{i2}）とが検出され、一致検出がなされる。

【０１５９】

”送信ボタンアイコン”の表示位置（X_{i1}、Y_{i1}）とタッチ位置（X_{i2}、Y_{i2}）とが一致する場合、ＣＰＵ３２は、送信ボタンアイコン５０の位置情報（X_{i1}、Y_{i1}）の検出に基づいて送信画面Ｐ２５の表示内容が変わらないように表示手段２９を制御すると共に、アクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。

【０１６０】

この例で、図１５Ｄに示す振動波形例によれば、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［４００　４０　１６］の振動パターンで振動するようになされる。触覚的には、図１５Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「ビビビビ」という感触が操作者の指に伝達する（送信ボタンモード）。

【０１６１】

その後、操作者は、指の移動を停止して、その送信ボタンアイコン５０から指を放すと、図１５Ａに示した送信画面Ｐ２５から送信画面Ｐ２６へ表示遷移するようになされる。送信画面Ｐ２６には、送信確認画面Ｐ２７がポップアップ表示される。送信確認画面Ｐ２７には、「Ｒｅａｌｌｙ」の文字と共に「本当に送信してもよろしいですか？」の文字情報及び「ＹＥＳ」及び「ＮＯ」の確認ボタンが表示される。このとき、操作者は、本当に送信する場合は、「ＹＥＳ」ボタンを押下する。ＣＰＵ３２は、「ＹＥＳ」ボタン押下により送信ＯＫ情報＝”１”を入力し、送信を確定するようになされる。送信を中止する場合は、「ＮＯ」ボタンを押下するようになされる。

【０１６２】

図１６は第２の実施例に係る触覚入力機能付きの携帯電話機の情報処理例を示すフローチャートである。

この実施例では、送信ボタンモードが準備され、メール作成及び送信操作時において、操作者が送信ボタンアイコン５０等の入力動作をしようとした場合に、視覚的あるいは聴覚的な入力動作に関する情報が無くとも、操作者が意図した入力動作を確認させるような

触覚確認機能を実現できるようになされる。

【０１６３】

これらを情報処理条件にして、図１６に示すフローチャートのステップＳＴ１で電源オンを待機する。ＣＰＵ３２は第１の実施例と同様にして電源オン情報を検出してシステムを起動する。そして、ステップＳＴ２に移行してＣＰＵ３２は、メール作成送信モード又はその他の処理モードに基づいて制御を分岐する。メール作成送信モードとは、メール作成送信画面（以下単に送信画面という）Ｐ２１の本文記述領域ｗ２でメール文を作成し、その後、送信ボタンアイコン５０の押下操作を待って相手方にメール文を送信する動作をいう。

【０１６４】

メール作成送信モードが設定された場合は、ステップＳＴ３に移行して送信画面Ｐ２１の本文記述領域ｗ２でメール文の作成処理を実行する。メール作成処理については、従来方式と同様に実行される。その後、ステップＳＴ４に移行して、送信画面Ｐ２１のいずれかにタッチされたかを検出する。

【０１６５】

送信画面Ｐ２１のいずれかにタッチされた場合は、ステップＳＴ５に移行して送信画面Ｐ２１で背景領域ｗ３がタッチされたか、又は、背景領域ｗ３以外がタッチされたかを検出する。このとき、図１３Ｂに示したように操作者の指の動きによれば、本文記述領域ｗ２に例えば０．３秒以上触れることにより、非接触状態から接触状態へ遷移する。ＣＰＵ３２は本文記述領域ｗ２で、例えば、入力開始点Ａを検出しその位置情報（X_1，Y_1）を取得する（図１３Ｃ参照）

背景領域ｗ３がタッチされた場合は、ステップＳＴ６に移行して背景モードを実行する。このとき、ＣＰＵ３２は、アクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。この例で、図１４Ｄに示す振動波形例によれば、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［５０　１０　２］の振動パターンで振動するようになされる。触覚的には、図１４Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「ブゥー」という感触が操作者の指に伝搬する。その後，ステップＳＴ８に移行する。

【０１６６】

また，ステップＳＴ５で背景領域ｗ３以外がタッチされた場合は、ステップＳＴ７に移行して単クリックモードを実行する。この単クリックモードでは、ＣＰＵ３２が位置情報（X_1，Y_1）の検出に基づいてアクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａに振動制御信号Ｓａを出力し、アクチュエータ２５ｂに振動制御信号Ｓｂを出力し、アクチュエータ２５ｃに振動制御信号Ｓｃを出力し、アクチュエータ２５ｄに振動制御信号Ｓｄを各々出力する。

【０１６７】

アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて約０．１ｍｓ程度振動するようになされる。図１３Ｄに示した振動波形によれば、周波数ｆｘ＝２００Ｈｚ，振幅Ａｘ＝４０μｍ、回数Ｎｘ＝１回の振動パターンで振動する。触覚的には、アクチュエータ２５ａ～２５ｂの振動と共に図１３Ｅに示したように「ピッ」という感触が操作者の指に伝搬する。

【０１６８】

その後、ステップＳＴ８に移行して、操作者の指の接触状態が引き続いているか否かを判別する。その操作者の指の接触状態が引き続いている場合は、ステップＳＴ９に移行して、再度、送信画面Ｐ２１等で背景領域ｗ３がタッチされたか、又は、背景領域ｗ３以外がタッチされたかを検出する。背景領域ｗ３がタッチされた場合は、ステップＳＴ６に戻って上述した処理を実行するようになされる。

【０１６９】
背景領域ｗ３以外がタッチされた場合は、ステップＳＴ１０に移行して本文記述領域ｗ２がタッチされたか、又は、本文記述領域ｗ２以外がタッチされたかを検出して制御を分岐する。本文記述領域ｗ２以外がタッチされた場合は、ステップＳＴ１１に移行して、本文モードを実行する。この本文モードでは、図１３Ａに示した送信画面Ｐ２２等において、黒四角形に示した点から送信ボタンアイコン５０に向かって直線をなぞるように指を移動される。
【０１７０】
図１４Ｂに示した操作者の指の動きによれば、本文記述領域ｗ２に触れたままであり、接触状態を継続する。図１４Ｃに示した位置情報に関しては、本文記述領域ｗ２の入力開始点から次の入力点に移行する。この例では、図６Ａに示したような次の点Ｂの位置情報（X_B，Y_B）がＣＰＵ３２によって検出され認識される。ＣＰＵ３２で本文モードが認識されると、振動モードを設定するフラグを立てるようになされる。振動モードは、入力開始点Ａと次の入力点Ｂとの差分を算出し、この差分値に基づいて設定するようになされる。
【０１７１】
ＣＰＵ３２は、入力点Ｂの位置情報（X_B，Y_B）の検出に基づいて送信画面Ｐ２３と送信画面Ｐ２４との内容が変わらないように表示手段２９を制御すると共に、アクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。
【０１７２】
この例で、図１４Ｄに示した振動波形例によれば、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［１００　２０　４］の振動パターンで振動するようになされる。触覚的には、図１４Ｅに示すようにアクチュエータ２５ａ～２５ｂの振動と共に「ザラザラ」という感触が操作者の指に伝搬する。
【０１７３】
また、上述のステップＳＴ１０で本文記述領域ｗ２以外がタッチされた場合は、ステップＳＴ１２に移行して送信ボタンアイコン５０がタッチされたか、又は、送信ボタンアイコン５０以外がタッチされたかを検出する。送信ボタンアイコン５０がタッチされた場合は、ステップＳＴ１３に移行して送信ボタンモードを実行する。この送信ボタンモードでは、操作者の指が図１５Ａに示したように送信画面Ｐ２５の送信ボタンアイコン５０に到達する。このとき、操作者の指が送信ボタンアイコン５０をなぞることで、送信ボタンモードが実行される。図１５Ｃに示した位置情報については、“送信ボタンアイコン”の表示位置（X_{11}，Y_{11}）とタッチ位置（X_{11}，Y_{11}）とが検出され、一致検出がなされる。
【０１７４】
“送信ボタンアイコン”の表示位置（X_{11}，Y_{11}）とタッチ位置（X_{11}，Y_{11}）とが一致する場合、ＣＰＵ３２は、アクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。
【０１７５】
この例で、図１５Ｄに示した振動波形例によれば、周波数ｆｘ、振幅Ａｘ及び回数Ｎｘに関して［ｆｘ　Ａｘ　Ｎｘ］＝［４００　４０　１６］の振動パターンで振動するようになされる。触覚的には、図１５Ｅに示したようにアクチュエータ２５ａ～２５ｂの振動と共に「ビビビビ」という感触が操作者の指に伝搬する。
【０１７６】
そして、操作者は、指の移動を停止して、その送信ボタンアイコン５０から指を放すと、図１５Ａに示した送信画面Ｐ２５から送信画面Ｐ２６へ表示遷移するようになされる。送信画面Ｐ２６には、送信確認画面Ｐ２７がポップアップ表示される。送信確認画面Ｐ２

７には、「Really」の文字と共に「本当に送信してもよろしいですか？」の文字情報、「ＹＥＳ」及び「ＮＯ」の確認ボタンが表示される。このとき、操作者は、本当に送信する場合は、「ＹＥＳ」ボタンを押下する。

【０１７７】

ＣＰＵ３２は、「ＹＥＳ」ボタン押下により送信ＯＫ情報＝"1"を入力し、送信を確定するようになされる。送信部２２では、相手方を呼出し、相手方へ送るためのメールデータを変調処理し、変調後の送信データをアンテナ共用器２３を通じアンテナ１６に供給するようになされる。アンテナ１６は、アンテナ共用器２３から供給される無線電波を基地局等に向けて輻射するようになされる。これにより、送信ボタンアイコン５０に基づいて相手方にメール文を送信することができる。

【０１７８】

なお、上述のステップＳＴ１２で送信ボタンアイコン５０以外がタッチされた場合は、ステップＳＴ１４に移行して、操作者の指の移動に伴う領域変化があったかを検出する。この例では、本文記述領域ｗ２から背景領域ｗ３に移行する場合を登り（上り）方向とし、背景領域ｗ３から本文記述領域ｗ２又は送信ボタンアイコン５０へ移行する場合を下り方向と定義している。

【０１７９】

操作者の指の移動に伴う上り方向の領域変化があった場合は、ステップＳＴ１５に移行して登り境界モードを実行する。この登り境界モードでは、本文記述領域ｗ２から背景領域ｗ３に移行する際に、ＣＰＵ３２は、境目の位置情報の検出に基づいてアクチュエータ駆動回路３７に制御情報Ｄｃを供給する。アクチュエータ駆動回路３７は、制御情報Ｄｃに基づいてアクチュエータ２５ａ～２５ｄに振動制御信号Ｓａ～Ｓｄを出力する。アクチュエータ２５ａ～２５ｂでは振動制御信号Ｓａ～Ｓｄに基づいて振動する。制御情報Ｄｃは振幅５０μｍ及び振動時間１００ｍｓの振動パターンを発生させる内容である。触覚上は"カックン"という振動を与えるようになされる。その後、ステップＳＴ８に戻る。

【０１８０】

また、操作者の指の移動に伴う下り方向の領域変化があった場合は、ステップＳＴ１６に移行して下り境界モードを実行する。この下り境界モードでは登り境界モードと同様にして触覚上は"カックン"という振動を与えるようになされる。その後、ステップＳＴ８に戻って、操作者の指の接触状態が引き続いているか否かを判別する。この例では、送信ボタンモードの実行によって、操作者の指の動きは非接触状態となっているので、ステップＳＴ１８に移行してＣＰＵ３２は終了判断をする。例えば、電源オフ情報を検出して情報処理を終了する。電源オフ情報が検出されない場合は、ステップＳＴ２に戻る。

【０１８１】

ステップＳＴ２で他の処理モードが設定された場合は、ステップＳＴ１７に移行して通信処理等の他の処理モードを実行する。通信処理については第１の実施例を参照されたい。その後、ステップＳＴ１８に移行して終了判断される。これにより、メール作成送信画面Ｐ２１等に表示された送信ボタンアイコン５０を押下し、この送信ボタンアイコン５０に基づいて相手方にメール文を送信できるようになる。

【０１８２】

このように、第２の実施例に係る触覚入力機能付きの携帯電話機によれば、送信ボタンモードが準備され、メール作成及び送信操作時において、表示手段２９に表示された送信ボタンアイコン５０の表示位置をタッチされたか否かを検出し、当該タッチに基づいて所定周波数、振幅及び回数の振動を与えて「送信ＯＫ」を触覚で確認させるようになされる。

【０１８３】

従って、操作者が送信ボタンアイコン５０等の入力動作をしようとした場合に、視覚的あるいは聴覚的な入力動作に関する情報が無くとも、操作者が意図した入力動作を確認させるような触覚確認機能を実現することができる。

【０１８４】

上述の実施例では電子機器に関して携帯電話機の場合について説明したが、この入力装置９０は、ノート型のパーソナルコンピュータ等の情報処理装置や、電子手帳、ゲーム機、電子書籍等の情報携帯端末装置の場合にも適用できる。第１の実施例と第２の実施例とは組み合わせも、また、別々に実施するようにしてもよい。

【産業上の利用可能性】

【０１８５】

この発明は予め準備された入力項目選択用の表示画面の中からアイコンを選択して情報を入力する情報処理装置や、携帯電話機、情報携帯端末装置等に適用して極めて好適である。

【図面の簡単な説明】

【０１８６】

【図１】本発明に係る第１の実施例としての触覚入力機能付き携帯電話機１００の構成例を示す斜視図である。

【図２】触覚機能付きの入力装置９０の構成例を示す概念図である。

【図３】触覚入力機能付き携帯電話機１００の内部構成例を示すブロック図である。

【図４】（Ａ）～（Ｃ）は、入力装置９０におけるアイコン選択時の位置情報の決定例（円）を示す図である。

【図５】（Ａ）～（Ｄ）は、アイコン移動方向の検出例（円）及びパルス波形例を示す図である。

【図６】（Ａ）～（Ｃ）は、入力装置９０におけるアイコン選択時の位置情報の決定例（楕円）を示す図である。

【図７】（Ａ）及び（Ｂ）は、表示軌跡楕円111に関する回転角度θとＸ、Ｙの値との関係例を示すグラフである。

【図８】３次元的なアイコン１Ｃｘの表示例及びその移動時の振動例（その１）を示す遷移図である。

【図９】３次元的なアイコン１Ｃｘの表示例及びその移動時の振動例（その２）を示す遷移図である。

【図１０】３次元的なアイコン１Ｃｘの表示例及びその移動時の振動例（その３）を示す遷移図である。

【図１１】（Ａ）及び（Ｂ）は、接近モードで適用する他の振動波形例を示す図である。

【図１２】、触覚入力機能付きの携帯電話機１００における情報処理例を示すフローチャートである。

【図１３】第２の実施例に係るメール作成及び送信操作例（その１）を示す遷移図である。

【図１４】メール作成及び送信操作例（その２）を示す遷移図である。

【図１５】メール作成及び送信操作例（その３）を示す遷移図である。

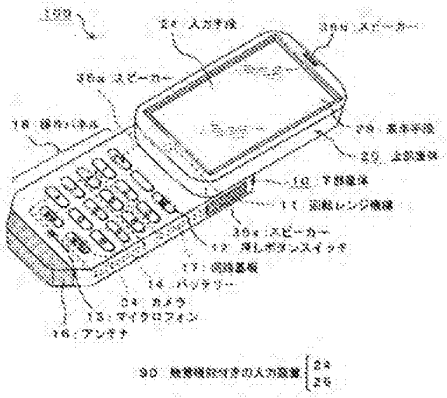
【図１６】第２の実施例に係る触覚入力機能付きの携帯電話機１００の情報処理例を示すフローチャートである。

【符号の説明】

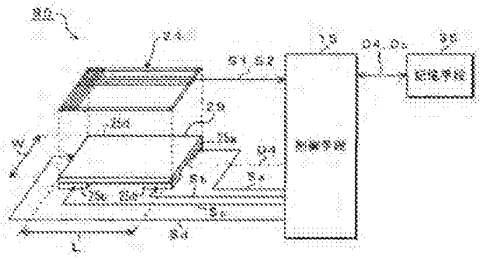
【０１８７】

１０・・・下部筐体、１１・・・回転レンジ機構、１６・・・制御手段、２０・・・上部筐体、２１・・・受信部、２２・・・送信部、２４・・・入力手段、２５ａ～２５ｄ・・・アクチュエータ（振動手段）、２９・・・表示手段、３２・・・ＣＰＵ（制御手段）、３５・・・記憶手段、５０・・・送信ボタンアイコン、１００・・・携帯電話機（電子機器）

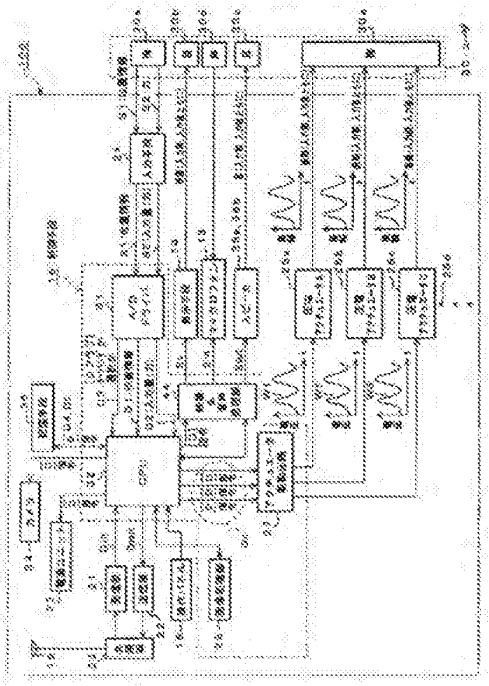
【図１】
触覚入力機能付きの携帯電話機１００の構成例



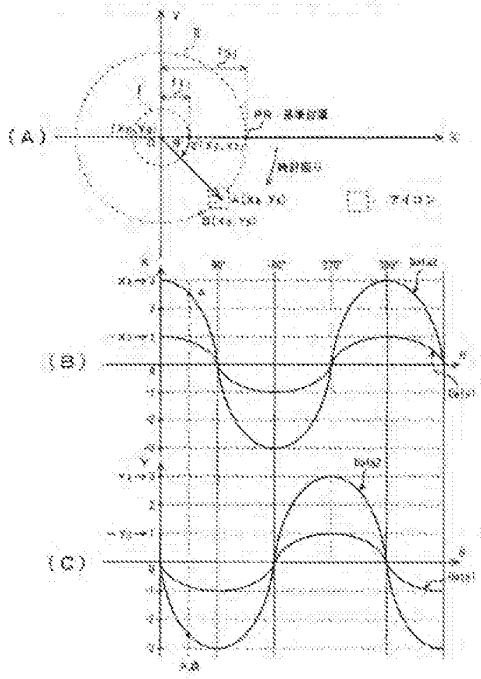
【図２】
触覚機能付きの入力装置９０の構成例



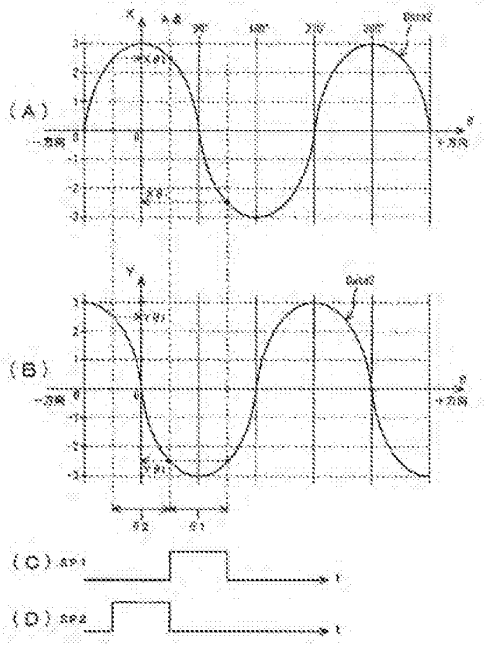
【図３】
携帯電話機１００の内部構成例



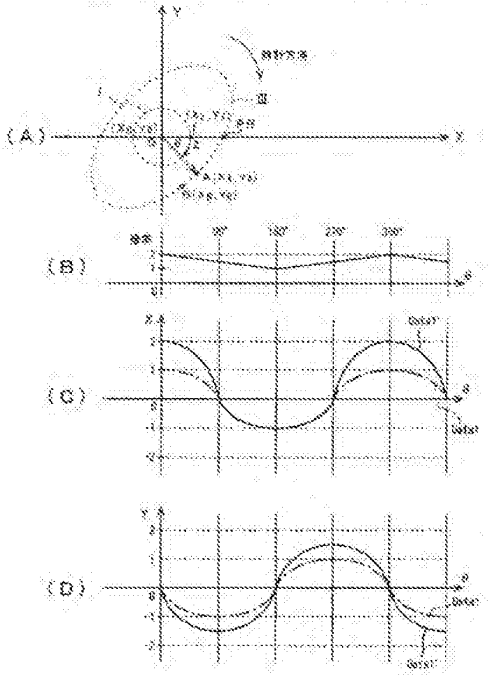
【図４】
アイコン選択時の位置情報の決定例(円)



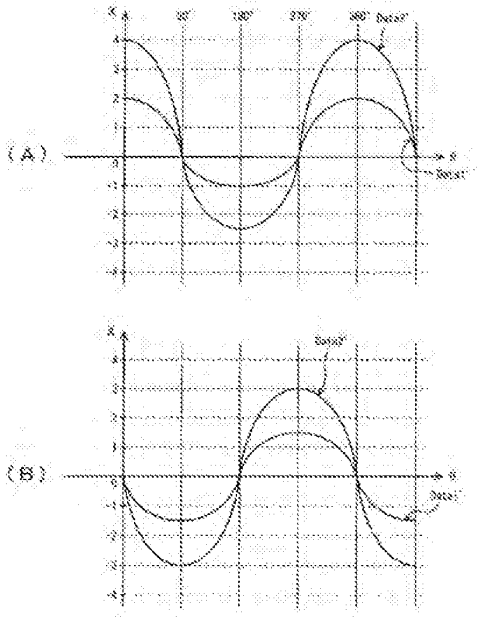
【図５】
アイコン移動方向の検出例(円)及びパルス波形例



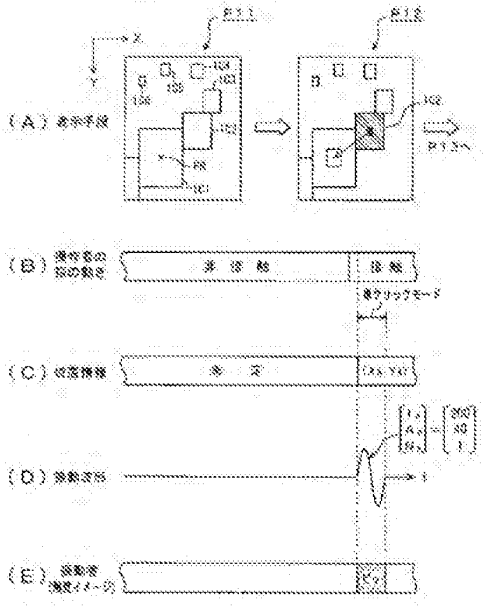
【図６】
アイコン選択時の位置情報の決定例(楕円)



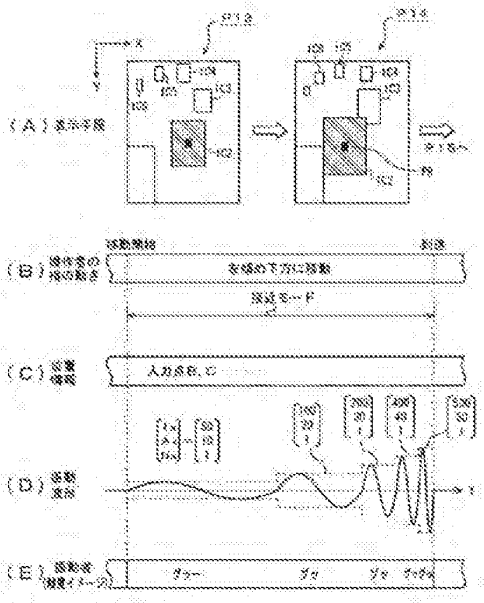
【図７】
表示軌跡楕円Ⅲに関する回転角度θとＸ、Ｙの値の関係例



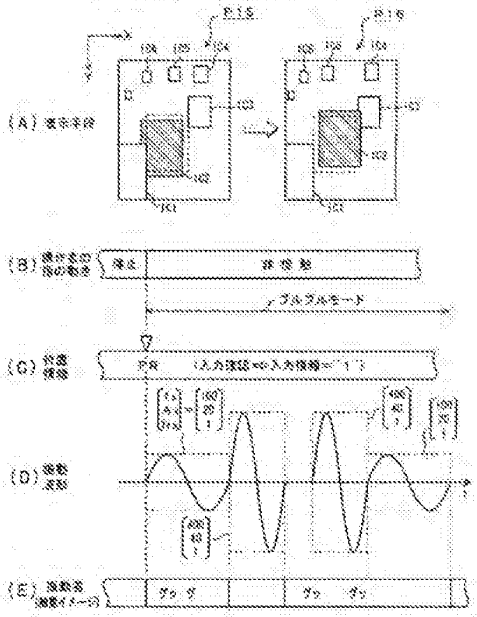
【図８】
３次元的なアイコンＩＣｘの表示例及びその移動時の振動例(その１)



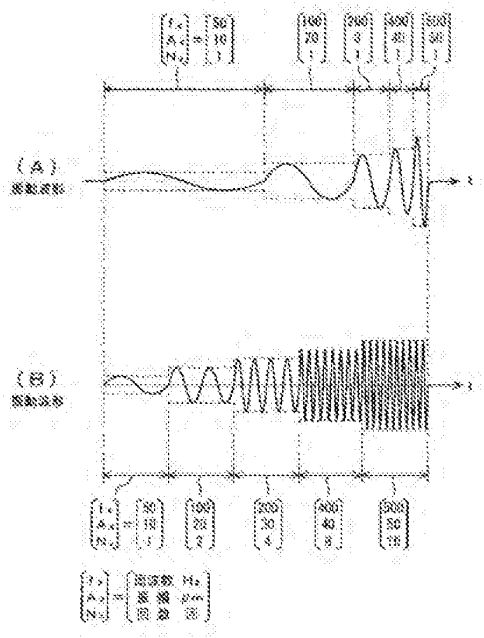
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３次元的なアイコンＩＣｘの表示例及び
その移動時の振動例（その２）



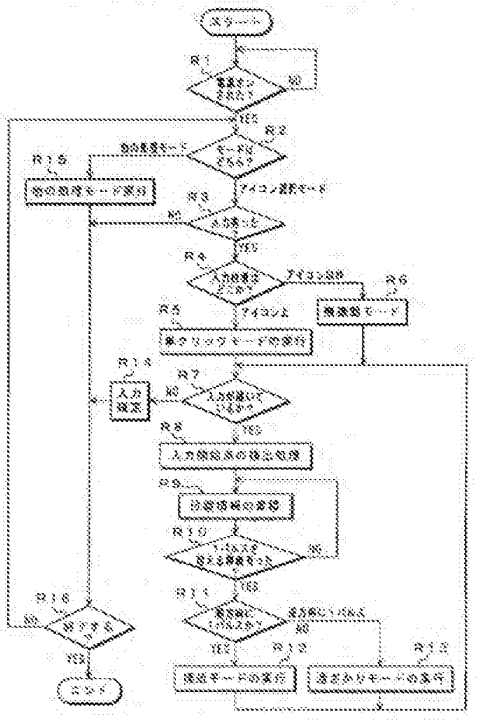
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その移動時の振動例（その３）



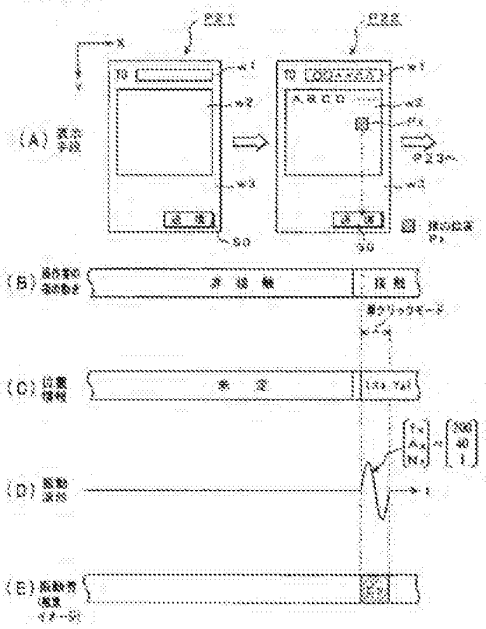
【図１１】
他の振動波形例



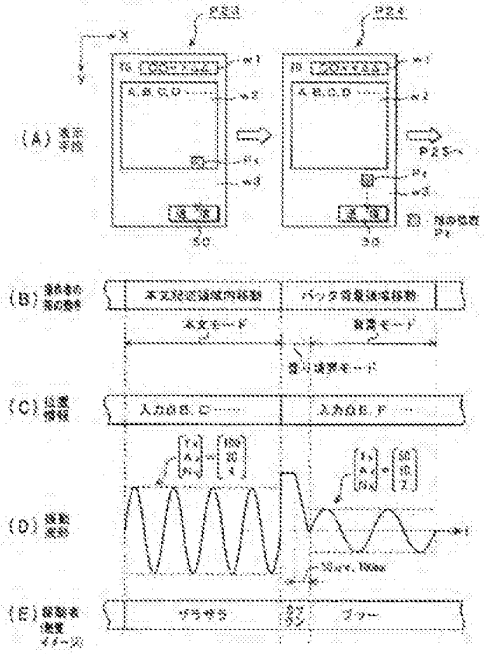
【図１２】
携帯電話機１００における情報処理例



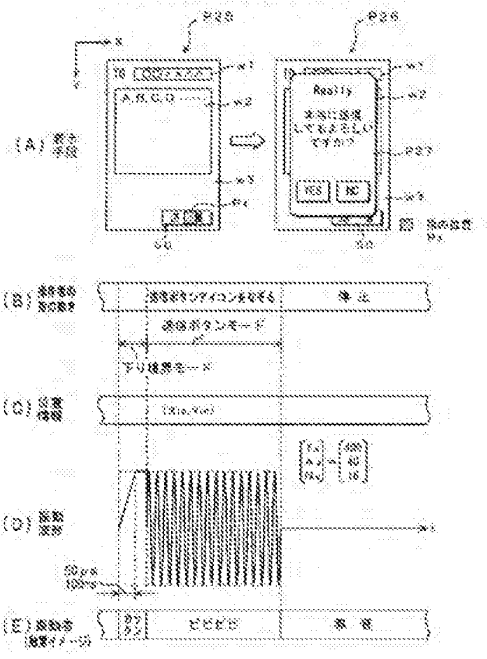
【図１３】
第２の実施例に係るメール作成及び送信操作例（その１）



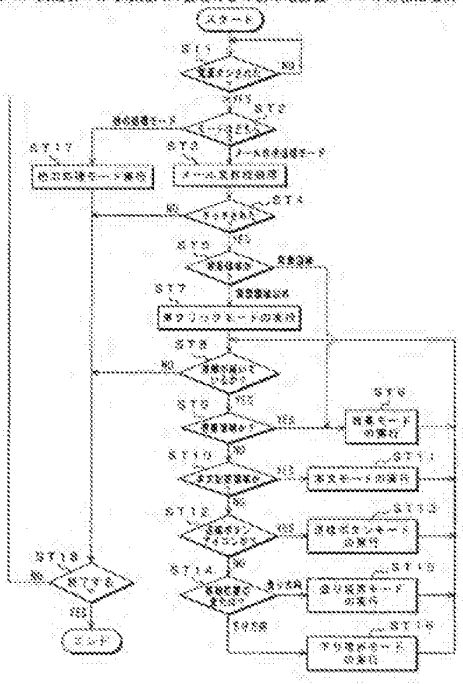
【図１４】
メール作成及び送信操作例（その２）



【図１５】
メール作成及び送信操作例（その３）



【図１６】
第２の実施例に係る検査入力装置付きの携帯電話機１００の情報処理例



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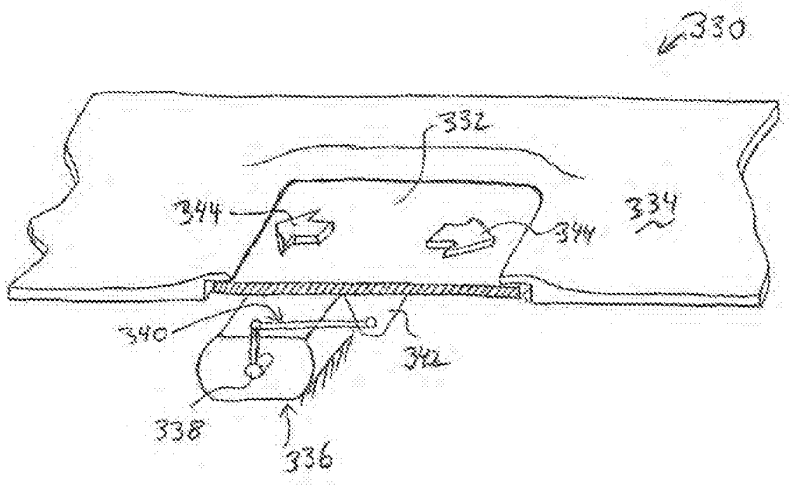
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(54) Title: HAPTIC INTERFACE FOR LAPTOP COMPUTERS AND OTHER PORTABLE DEVICES



(57) Abstract: A haptic feedback touch control to provide input to a computer. A touch input device includes a planar touch surface that provides position information to a computer based on a location of user contact. The computer can position a cursor in a displayed graphical environment based at least in part on the position information, or perform a different function. At least one actuator (336) is also coupled to the touch input device and outputs a force to provide a haptic sensation to the user. The actuator (336) can move the touchpad (332) laterally, or a separate surface member can be actuated. A flat E-core actuator, piezoelectric actuator, or other types of actuators can be used to provide forces. The touch input device can include multiple different regions to control different computer functions.

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HAPTIC INTERFACE FOR LAPTOP COMPUTERS AND OTHER PORTABLE DEVICES

BACKGROUND OF THE INVENTION

The present invention relates generally to the interfacing with computer and mechanical devices by a user, and more particularly to devices used to interface with computer systems and electronic devices and which provide haptic feedback to the user.

Humans interface with electronic and mechanical devices in a variety of applications, and the need for a more natural, easy-to-use, and informative interface is a constant concern. In the context of the present invention, humans interface with computer devices for a variety of applications. One such application is interacting with computer-generated environments such as games, simulations, and application programs. Computer input devices such as mice and trackballs are often used to control a cursor within a graphical environment and provide input in these applications.

In some interface devices, force feedback or tactile feedback is also provided to the user, collectively known herein as "haptic feedback." For example, haptic versions of joysticks, mice, gamepads, steering wheels, or other types of devices can output forces to the user based on events or interactions occurring within the graphical environment, such as in a game or other application program.

In portable computer or electronic devices, such as laptop computers, mice have typically too large a workspace to be practical. As a result, more compact devices such as trackballs are often used. Currently, a more popular device for portable computers are "touchpads," which are small rectangular, planar pads provided near the keyboard of the computer. The touchpad senses the location of a pointing object by any of a variety of sensing technologies, such as capacitive sensors or pressure sensors that detect pressure applied to the touchpad. The user contacts the touchpad most commonly with a fingertip and moves his or her finger on the pad to move a cursor displayed in the graphical environment. In other embodiments, the user can operate a stylus in conjunction with the touchpad by pressing the stylus tip on the touchpad and moving the stylus. Touchscreens are similar devices used to input information on a sensing pad layered on a display screen, and are used in such devices as personal digital assistants (PDA's) and other portable electronic devices.

One problem with existing touchpads and screens is that there is no haptic feedback provided to the user. The user of a touchpad is therefore not able to experience haptic sensations that assist and inform the user of targeting and other control tasks within the

graphical environment. The touchpads of the prior art also cannot take advantage of existing haptic-enabled software running on the computer.

SUMMARY OF THE INVENTION

The present invention is directed to haptic feedback planar touch controls used to provide input to a computer system. The control can be a touchpad provided on a portable computer, or can be a touch screen found on a variety of devices. The haptic sensations output on the touch control enhance interactions and manipulations in a displayed graphical environment or when controlling an electronic device.

More specifically, the present invention relates to a haptic feedback touch control for inputting signals to a computer and for outputting forces to a user of the touch control. The control includes a touch input device including an approximately planar touch surface operative to input a position signal to a processor of said computer based on a location of user contact on the touch surface. One or more actuators are coupled to the touch input device which can output a force to laterally move the touch input device approximately parallel to its surface to provide a haptic sensation to the user contacting it. The computer can position a cursor in a graphical environment displayed on a display device based on the position signal. The touch input device can be a separate touchpad or included as a touch screen.

In another embodiment, a haptic feedback touch control includes a touch input device including an approximately planar touch surface which inputs a position signal to a computer processor, a surface member located adjacent to the touch input device, where the user can contact the surface when pressing the touch input device, and an actuator coupled to the surface member. The actuator outputs a force on the surface member to provide a haptic sensation to the user. The surface member can be translated laterally, approximately in a plane parallel to the surface of the touch input device; for example, the surface member can be positioned over the touch input device and coextensive with the device surface, or the surface member can be positioned to a side of the touch input device such that the user touches the touch input device with one finger and touches the surface member with a different finger or palm. For example, the surface member can be positioned over a physical button that is located adjacent to said touch input device. Contact or inertial forces can be output on the surface member.

In another aspect of the present invention, an actuator providing a linear force output includes a ferromagnetic piece including a center pole located between two side poles, a coil wrapped around the center pole, a magnet adjacent to the center pole and side poles, and a backing plate coupled to the magnet, where the backing plate and magnet move with respect to

the ferromagnetic piece when current is flowed in the coil. Rollers can be positioned between the ferromagnetic piece and backing plate to allow the motion. A flexure can reduce the relative motion between plate and ferromagnetic piece in undesired directions and provide a spring centering force.

In another aspect, a haptic touch device includes a piezoelectric transducer coupled to a ground and including a metal diaphragm coupled to a ceramic element and a planar sensing element, such as a touchpad. A spacer is provided between the piezoelectric transducer and the planar sensing element, the metal diaphragm contacting the spacer. A spring element provides a spring restoring force to the planar sensing element.

In another aspect of the present invention, a method for providing haptic feedback to a touch input device includes receiving a position signal from the touch input device indicating a contact location on a surface where said user is pressing, and determining in which of a plurality of regions on the surface the contact location is positioned. An output force is associated with the user moving an object on or over the surface of the touch input device. A function can be associated with the region in which the contact location is positioned, such as rate control function of a value or moving a displayed cursor. The can be output when the user moves the object over a boundary to the contacted region from a different region of the touch input device.

The present invention advantageously provides haptic feedback to a planar touch control device of a computer, such as a touchpad or touch screen. The haptic feedback can assist and inform the user of interactions and events within a graphical user interface or other environment and ease cursor targeting tasks. Furthermore, the invention allows portable computer devices having such touch controls to take advantage of existing haptic feedback enabled software. The haptic touch devices disclosed herein are also inexpensive, compact and consume low power, allowing them to be easily incorporated into a wide variety of portable and desktop computers and electronic devices.

These and other advantages of the present invention will become apparent to those skilled in the art upon a reading of the following specification of the invention and a study of the several figures of the drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view of a laptop computer device including a haptic touchpad of the present invention;

FIGURE 2 is a perspective view of a remote control device including a touchpad of the present invention;

FIGURE 3 is a top plan view of a haptic touchscreen embodiment of the present invention;

FIGURE 4 is a block diagram of a haptic system suitable for use in the present invention;

FIGURE 5 is a perspective view of one embodiment of an actuator assembly suitable for use in an inertial embodiment of the present invention;

FIGURE 6 is a perspective view of the actuator assembly of Fig. 5 coupled to a touchpad;

FIGURE 7 is a perspective view of a separate palm surface providing inertial tactile sensations adjacent to a touchpad;

FIGURE 8a is a perspective view of a piezoelectric transducer suitable for use in providing inertial sensations in the present invention;

FIGURE 8b is a side elevational view of a piezoelectric transducer and structure of the present invention suitable for providing haptic sensations with a touch device;

FIGURE 9 is a perspective view of one embodiment of a translating surface member driven by linear actuators;

FIGURE 10 is a top plan view of another embodiment of a translating surface member driven by a rotary actuator;

FIGURE 11 is a perspective view of another embodiment of a translating surface member driven by a voice coil actuator;

FIGURE 12 is a perspective view of an embodiment of a translating surface adjacent to a touchpad;

FIGURE 13 is a perspective view of an embodiment of a touchpad translated in one direction by a rotary actuator;

FIGURE 14 is a perspective view of an embodiment of a touchpad translated in two directions by rotary actuators;

FIGURES 15a and 15b are perspective views of a first embodiment of a flat E-core actuator of the present invention suitable for translating a touchpad or a separate surface;

FIGURE 15c is a side view of the actuator of Figs. 15a-15b;

FIGURE 15d is a perspective view of the actuator of Figs. 15a-15b coupled to a touchpad;

FIGURES 16a and 16b are top and bottom perspective views of another embodiment of a flat E-core actuator of the present invention;

FIGURES 17a-17b are perspective and top views of surface-mounted E-core actuators of the present invention;

FIGURES 17c-17g are perspective and side views of the E-core actuators of Figs. 17a-17b; and

FIGURE 18 is a top plan view of an example of a haptic touchpad of the present invention having different control regions.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

FIGURE 1 is a perspective view of a portable computer 10 including a haptic touchpad of the present invention. Computer 10 can be a portable or "laptop" computer that can be carried or otherwise transported by the user and may be powered by batteries or other portable energy source in addition to other more stationary power sources. Computer 10 preferably runs one or more host application programs with which a user is interacting via peripherals.

Computer 10 may include the various input and output devices as shown, including a display device 12 for outputting graphical images to the user, a keyboard 14 for providing character or toggle input from the user to the computer, and a touchpad 16 of the present invention. Display device 12 can be any of a variety of types of display devices; flat-panel displays are most common on portable computers. Display device 12 can display a graphical environment 18 based on application programs and/or operating systems that are running on the CPU of computer 10, such as a graphical user interface (GUI), that can include a cursor 20 that can be moved by user input, as well as windows 22, icons 24, and other graphical objects well known in GUI environments. Other graphical environments or images may also be displayed, e.g. a game, movie or other presentation, spreadsheet or other application program, etc.

Other devices may also be incorporated or coupled to the computer 10, such as storage devices (hard disk drive, DVD-ROM drive, etc.), network server or clients, game controllers, etc. In alternate embodiments, the computer 10 can take a wide variety of forms, including computing devices that rest on a tabletop or other surface, stand-up arcade game machines, other portable devices or devices worn on the person, handheld or used with a single hand of the user, etc. For example, host computer 10 can be a video game console, personal computer, workstation, a television "set top box" or a "network computer", or other computing or electronic device.

Touchpad device 16 of the present invention preferably appears externally to be similar to the touchpads of the prior art. In many embodiments disclosed herein, such a pad 16 includes a planar, rectangular (or other shaped) smooth surface that can be positioned below the keyboard 14 on the housing of the computer 10, as shown, or may be positioned at other areas of the housing. When the user operates the computer 10, the user may conveniently place a fingertip or other object on the touchpad 16 and move the fingertip to correspondingly move cursor 20 in the graphical environment 18.

In operation, the touchpad 16 inputs coordinate data to the main microprocessor(s) of the computer 10 based on the sensed location of an object on (or near) the touchpad. As with many touchpads of the prior art, touchpad 16 can use capacitive, resistive, or a different type of sensing. Capacitive touchpads typically sense the location of an object on or near the surface of the touchpad based on capacitive coupling between capacitors in the touchpad and the object. Resistive touchpads are typically pressure-sensitive, where the pressure of a finger, stylus, or other object against the pad causes conductive layers, traces, switches, etc. in the pad to electrically connect. Some resistive or other types of touchpads can detect the amount of pressure applied by the user and can use the degree of pressure for proportional or variable input to the computer 10. Resistive touchpads typically are at least partially deformable, so that when a pressure is applied to a particular location, the conductors at that location are brought into electrical contact. Such deformability can be useful in the present invention since it can potentially amplify the magnitude of output forces such as pulses or vibrations on the touchpad as used in the present invention. Forces can be amplified if a tuned compliant suspension is provided between an actuator and the object that is moved. Capacitive touchpads and other types of touchpads that do not require significant contact pressure may be better suited for the present invention in some embodiments, since excessive pressure on the touchpad may in some cases interfere with the motion of the touchpad for haptic feedback. Other types of sensing technologies can also be used in the touchpad. Herein, the term "touchpad" preferably includes the surface of the touchpad 16 as well as any sensing apparatus included in the touchpad unit.

Touchpad 16 can operate similarly to existing touchpads, where the speed of the fingertip on the touchpad correlates to the distance that the cursor is moved in the graphical environment. For example, if the user moves his or her finger quickly across the pad, the cursor is moved a greater distance than if the user moves the fingertip more slowly. If the user's finger reaches the edge of the touchpad before the cursor reaches a desired destination in that direction, then the user can simply move his or her finger off the touchpad, reposition the finger away from the edge, and continue moving the cursor. This is an "indexing" function similar to lifting a mouse off a surface to change the offset between mouse position and cursor. Furthermore, many touchpads can be provided with particular regions that are each assigned to particular functions that can be unrelated to cursor positioning. Such an embodiment is described in greater detail below with respect to Fig. 18. In some embodiments the touchpad 16 may also allow a user to "tap" the touchpad (rapidly touch and remove the object from the pad) in a particular location to provide a command. For example, the user can tap or "double tap" the pad with a finger while the controlled cursor is over an icon to select that icon.

In the present invention, the touchpad 16 is provided with the ability to output haptic feedback such as tactile sensations to the user who is physically contacting the touchpad 16. Various embodiments detailing the structure of the haptic feedback touchpad are described in greater detail below. Some embodiments may move a device housing or separate moving surface, not the touchpad itself.

Using one or more actuators coupled to the touchpad 16 or an associated surface, a variety of haptic sensations can be output to the user who is contacting the touchpad (or housing or separate surface). For example, jolts, vibrations (varying or constant amplitude), and textures can be output. Forces output to the user can be at least in part based on the location of the finger on the pad or the state of a controlled object in the graphical environment of the host computer 10, and/or independent of finger position or object state. Such forces output to the user are considered "computer-controlled" since a microprocessor or other electronic controller is controlling the magnitude and/or direction of the force output of the actuator(s) using electronic signals.

In other embodiments, the touchpad 16 can be provided in a separate housing that is connected to a port of the computer 10 via a cable or via wireless transmission and which receives force information from and sends position information to the computer 10. For example, Universal Serial Bus (USB), Firewire, or a standard serial bus can connect such a touchpad to the computer 10.

One or more buttons 26 can also be provided on the housing of the computer 10 to be used in conjunction with the touchpad 16. The user's hands have easy access to the buttons, each of which may be pressed by the user to provide a distinct input signal to the host computer

12. Typically, each button 26 corresponds to a similar button found on a mouse input device, so that a left button can be used to select a graphical object (click or double click), a right button can bring up a context menu, etc. In some embodiments, one or more of the buttons 26 can be provided with tactile feedback.

Furthermore, in some embodiments, one or more moveable portions 28 of the housing of the computer device 10 can be included which is contacted by the user when the user operates the touchpad 16 and which can provide haptic feedback. Having a moveable portion of a housing for haptic feedback is described in U.S. Patent Nos. 6,184,868 and 6,088,019. In some embodiments, both the housing can provide haptic feedback (e.g., through the use of an eccentric rotating mass on a motor coupled to the housing) and the touchpad 16 can provide separate haptic feedback. This can allow the host to control two different tactile sensations simultaneously to the user; for example, a vibration of a low frequency can be conveyed through the housing to the user and a higher frequency vibration can be conveyed to the user through the touchpad 16. Each other button or other control provided with haptic feedback can also provide tactile feedback independently from the other controls.

The host application program(s) and/or operating system preferably displays graphical images of the environment on display device 12. The software and environment running on the host computer 12 may be of a wide variety. For example, the host application program can be a word processor, spreadsheet, movie, video or computer game, drawing program, operating system, graphical user interface, simulation, Web page or browser that implements HTML or VRML instructions, scientific analysis program, virtual reality training program or application, or other application program that utilizes input from the touchpad 16 and outputs force feedback commands to the touchpad 16. For example, many games and other application programs include force feedback functionality and may communicate with the touchpad 16 using a standard protocol/drivers such as I-Force®, FEELit®, or Touchsense™ available from Immersion Corporation of San Jose, California.

The touchpad 16 can include circuitry necessary to report control signals to the microprocessor of the host computer 10 and to process command signals from the host's microprocessor. For example, appropriate sensors (and related circuitry) are used to report the position of the user's finger on the touchpad 16. The touchpad device also includes circuitry that receives signals from the host and outputs tactile sensations in accordance with the host signals using one or more actuators. Some touchpads may be integrated with a printed circuit board (PCB) that includes some of these components and circuitry. In some embodiments, a separate, local microprocessor can be provided for the touchpad 16 to both report touchpad sensor data to the host and/or to carry out force commands received from the host, such commands including, for example, the type of haptic sensation and parameters describing the

commanded haptic sensation. Alternatively, the touchpad microprocessor can simply pass streamed data from the main processor to the actuators. The term "force information" can include both commands/parameters and/or streamed data. The touchpad microprocessor can implement haptic sensations independently after receiving a host command by controlling the touchpad actuators; or, the host processor can maintain a greater degree of control over the haptic sensations by controlling the actuators more directly. In other embodiments, logic circuitry such as state machines provided for the touchpad 16 can handle haptic sensations as directed by the host main processor. Architectures and control methods that can be used for reading sensor signals and providing haptic feedback for a device are described in greater detail in U.S. Patent No. 5,734,373.

In existing touchpad embodiments, such as those manufactured by Synaptics Corp., particular characteristics and features are provided. The standard surface material for a touchpad is textured Mylar, and typically any non-conductive object can be used on the touchpad surface and be detected, though textured surfaces are better when a user's finger is used to point. The touchpad can also sense through thin overlays. There is typically space available for the additional of haptic feedback components; for example, on a 40 x 60 touchpad, over half of the board can be available for haptic circuitry.

Many touchpads include a "palm check" feature, which allows the laptop to sense whether the user is contacting the touchpad with a finger or with a palm or other part of the hand. Since the user may only be resting his or her palm and not be intending to provide input, the palm check feature would ignore input that is determined to be provided by a user's palm. Basically, the palm check feature computes the contact area made by the conductive object (finger, palm, arm, etc.). If the contact area exceeds a certain threshold, the contact is rejected. This feature can be turned off in many embodiments.

FIGURE 2 is a perspective view of another embodiment of a device 30 which can include the active touchpad 16 of the present invention. The device can be a handheld remote control device 30, which the user grasps in one hand and manipulates controls to access the functions of an electronic device or appliance remotely by a user (such as a television, video cassette recorder or DVD player, audio/video receiver, Internet or network computer connected to a television, etc.). For example, several buttons 32 can be included on the remote control device 30 to manipulate functions of the controlled apparatus. A touchpad 16 can also be provided to allow the user to provide more sophisticated directional input. For example, a controlled apparatus may have a selection screen in which a cursor may be moved, and the touchpad 16 can be manipulated to control the cursor in two dimensions. The touchpad 16 includes the ability to output haptic sensations to the user as described herein, based on a

controlled value or event. For example, a volume level passing a mid-point or reaching a maximum level can cause a pulse to be output to the touchpad and to the user.

In one application, the controlled apparatus can be a computer system such as Web-TV from Microsoft Corp. or other computing device which displays a graphical user interface and/or web pages accessed over a network such as the Internet. The user can control the direction of the cursor by moving a finger (or other object) on the touchpad 16. The cursor can be used to select and/or manipulate icons, windows, menu items, graphical buttons, slider bars, scroll bars, or other graphical objects in a graphical user interface or desktop interface. The cursor can also be used to select and/or manipulate graphical objects on a web page, such as links, images, buttons, etc. Other force sensations associated with graphical objects are described below with reference to Fig. 18.

FIGURE 3 is a top plan view of another computer device embodiment 50 that can include any of the embodiments of haptic devices of the present invention. Device 50 is in the form of a portable computer device such as "personal digital assistant" (PDA), a "pen-based" computer, "web pad," "electronic book", or similar device (collectively known as a "personal digital assistant" (PDA) herein). Those devices which allow a user to input information by touching a display screen or readout in some fashion are relevant to the present invention, as well as devices allowing button input. Such devices can include the Palm Pilot® from 3Com Corp. or similar products, pocket-sized computer devices from Casio, Hewlett-Packard, or other manufacturers, E-books, cellular phones or pagers having touch screens, laptop computers with touch screens, etc.

In one embodiment of a device 50, a display screen 52 positioned adjacent a housing 54 may cover a large portion of the surface of the computer device 50. Screen 52 is preferably a flat-panel display as is well known to those skilled in the art and can display text, images, animations, etc.; in some embodiments screen 52 is as functional as any personal computer screen. Display screen 52 can be a "touch screen" that includes sensors which allow the user to input information to the computer device 50 by physically contacting the screen 50 (i.e. it is another form of planar "touch device" similar to the touchpad 16 of Fig. 1). For example, a transparent sensor film can be overlaid on the screen 50, where the film can detect pressure from an object contacting the film. The sensor devices for implementing touch screens are well known to those skilled in the art.

The user can select graphically-displayed buttons or other graphical objects by pressing a finger or a stylus to the screen 52 at the exact location where the graphical object is displayed. Furthermore, some embodiments allow the user to "draw" or "write" on the screen by displaying graphical "ink" images 56 at locations where the user has pressed a tip of a stylus, such as stylus 57, or a finger or other object. Handwritten characters can be recognized by

software running on the device microprocessor as commands, data, or other input. In other embodiments, the user can provide input additionally or alternatively through voice recognition, where a microphone on the device inputs the user's voice which is translated to appropriate commands or data by software running on the device. Physical buttons 58 can also be included in the housing of the device 50 to provide particular commands to the device 50 when the buttons are pressed. Many PDA's are characterized by the lack of a standard keyboard for character input from the user; rather, an alternative input mode is used, such as using a stylus to draw characters on the screen, voice recognition, etc. However, some PDA's also include a fully-functional keyboard as well as a touch screen, where the keyboard is typically much smaller than a standard-sized keyboard. In yet other embodiments, standard-size laptop computers with standard keyboards may include flat-panel touch-input display screens, and such screens (similar to screen 12 of Fig. 1) can be provided with haptic feedback according to the present invention.

In some embodiments of the present invention, the touch screen 52 may provide haptic feedback to the user similarly to the touchpad 16 described in previous embodiments. One or more actuators can be coupled to the touchscreen, or movable surfaces near the touchscreen, in a manner similar to the embodiments described below. The user can experience the haptic feedback through a finger or a held object such as a stylus 57 that is contacting the screen 52.

The touch screen 52 can be coupled to the housing 54 of the device 50 by one or more spring or compliant elements, such as helical springs, leaf springs, flexures, or compliant material (foam, rubber, etc.), to allow motion of the screen approximately along the z-axis, thereby providing haptic feedback. The screen can also be provided with flexures or other couplings allowing side-to-side (x and/or y) motion, similar to the appropriate embodiments described below.

FIGURE 4 is a block diagram illustrating a haptic feedback system suitable for use with any of the described embodiments of the present invention. The haptic feedback system includes a host computer system 74 and interface device 72.

Host computer system 74 preferably includes a host microprocessor 100, a clock 102, a display screen 76, and an audio output device 104. The host computer also includes other well known components, such as random access memory (RAM), read-only memory (ROM), and input/output (I/O) electronics (not shown).

As described above, host computer 74 can be a personal computer such as a laptop computer, and may operate under any well-known operating system. Alternatively, host computer system 74 can be one of a variety of home video game console systems commonly connected to a television set or other display, such as systems available from Nintendo, Sega,

Sony, or Microsoft. In other embodiments, host computer system 74 can be an appliance, "set top box", or other electronic device to which the user can provide input. Computer 74 can also be a portable, hand-held computer such as a PDA, or can be a vehicle computer, stand-up arcade game, workstation, etc.

Host computer 74 preferably implements a host application program with which a user is interacting via interface device 72 which includes haptic feedback functionality. For example, the host application program can be a video game, word processor or spreadsheet, Web page or browser that implements HTML or VRML instructions, scientific analysis program, movie player, virtual reality training program or application, or other application program that may utilize input of mouse 12 and which outputs haptic feedback commands to the device 72. Herein, for simplicity, operating systems such as Windows™, MS-DOS, MacOS, Unix, Palm OS, etc. are also referred to as "application programs." Herein, computer 74 may be referred as providing a "graphical environment," which can be a graphical user interface, game, simulation, or other visual environment and can include graphical objects such as icons, windows, game objects, etc. Suitable software drivers which interface such software with computer input/output (I/O) devices are available from Immersion Corporation of San Jose, California.

Display device 76 can be included in host computer 74 and can be a standard display screen (LCD, CRT, plasma, flat panel, etc.), 3-D goggles, or any other visual output device. Audio output device 104, such as speakers, is preferably coupled to host microprocessor 100 to provide sound output to user. Other types of peripherals can also be coupled to host processor 100, such as storage devices (hard disk drive, CD ROM drive, floppy disk drive, etc.) other input and output devices.

Interface device 72 is coupled to the computer 74 by a bus 80, which communicates signals between device 72 and computer 74 and may also, in some embodiments, provide power to the device 72. In other embodiments, signals can be sent between device 72 and computer 74 by wireless transmission/reception. In some embodiments, the power for the actuator can be supplemented or solely supplied by a power storage device provided on the device, such as a capacitor or one or more batteries. The bus 80 can be bi-directional to send signals in either direction between host 74 and device 72. Bus 80 can be a serial interface bus, such as an RS232 serial interface, RS-422, Universal Serial Bus (USB), MIDI, or other protocols well known to those skilled in the art; or a parallel bus or wireless link.

Device 72 may be a separate device from host 74 with its own housing, or may be integrated with the host computer housing, as in the laptop computer of Fig. 1. Device 72 can include or be associated with a dedicated local processor 110. Processor 110 is considered local to device 12, where "local" herein refers to processor 110 being a separate processor from any

host processors in host computer system 14. "Local" also may refer to processor 110 being dedicated to haptic feedback and sensor I/O of device 12. Processor 110 can be provided with software instructions (e.g., firmware) to wait for commands or requests from computer host 74, decode the command or request, and handle/control input and output signals according to the command or request. In addition, processor 110 can operate independently of host computer 74 by reading sensor signals and calculating appropriate forces from those sensor signals, time signals, and stored or relayed instructions selected in accordance with a host command. Suitable microprocessors for use as local processor 110 include lower-end microprocessors as well as more sophisticated force feedback processors such as the Immersion Touchsense Processor. Processor 110 can include one microprocessor chip, multiple processors and/or co-processor chips, digital signal processor (DSP) capability, and/or logic, state machines, an ASIC, etc.

Processor 110 can receive signals from sensor 112 and provide signals to actuator 88 in accordance with instructions provided by host computer 74 over bus 80. For example, in a local control embodiment, host computer 74 provides high level supervisory commands to processor 110 over bus 20 (such as a command identifier and one or more parameters characterizing the tactile sensation), and processor 110 decodes the commands and manages low level force control loops to sensors and the actuator in accordance with the high level commands and independently of the host computer 74. This operation is described in greater detail in US Patent 5,734,373. In the host control loop, force commands are output from the host computer to processor 110 and instruct the processor to output a force or force sensation having specified characteristics. The local processor 110 reports data to the host computer, such as locative data that describes the position of the device in one or more provided degrees of freedom. The data can also describe the states of buttons, switches, etc. The host computer uses the locative data to update executed programs. In the local control loop, actuator signals are provided from the processor 110 to an actuator 88 and sensor signals are provided from the sensor 112 and other input devices 118 to the processor 110. Herein, the term "tactile sensation" refers to either a single force or a sequence of forces output by the actuator 18 which provide a sensation to the user. For example, vibrations, a single jolt, or a texture sensation are all considered tactile sensations. The processor 110 can process inputted sensor signals to determine appropriate output actuator signals by following stored instructions. The processor may use sensor signals in the local determination of forces to be output on the user object, as well as reporting locative data derived from the sensor signals to the host computer.

In yet other embodiments, other hardware instead of processor 110 can be provided locally to device 72 to provide functionality similar to processor 110. For example, a hardware state machine incorporating fixed logic can be used to provide signals to the actuator 88 and receive sensor signals from sensors 112, and to output tactile signals.

In a different, host-controlled embodiment, host computer 74 can provide low-level force commands over bus 20, which are directly transmitted to the actuator 18 via processor 110 or other circuitry if there is no processor 110. Host computer 14 thus directly controls and processes all signals to and from the device 72, e.g. the host computer directly controls the forces output by actuator 88 and directly receives sensor signals from sensor 112 and input devices 118. Other embodiments may employ a "hybrid" organization where some types of forces (e.g. closed loop effects) are controlled purely by the local microprocessor, while other types of effects (e.g., open loop effects) may be controlled by the host.

Local memory 122, such as RAM and/or ROM, is preferably coupled to processor 110 in device 72 to store instructions for processor 110 and store temporary and other data. Memory 122 can also or alternatively be included on the processor 110. In addition, a local clock 124 can be coupled to the processor 110 to provide timing data.

Sensors 112 sense the position or motion (e.g. an object on a touchpad) in desired degrees of freedom and provides signals to processor 110 (or host 74) including information representative of the position or motion. Sensors suitable for detecting motion include capacitive or resistive sensors in a touchpad, contact sensors in a touchscreen, etc. Other types of sensors can also be used. Optional sensor interface 114 can be used to convert sensor signals to signals that can be interpreted by the processor 110 and/or host computer system 14.

Actuator(s) 88 transmits forces to the housing, manipulandum, buttons, or other portion of the device 72 in response to signals received from processor 110 and/or host computer 14. Device 72 preferably includes one or more actuators which are operative to produce forces on the device 72 (or a component thereof) and haptic sensations to the user. The actuator(s) are "computer-controlled", e.g., the force output from the actuators is ultimately controlled by signals originating from a controller such as a microprocessor, ASIC, etc. Many types of actuators can be used, including rotary DC motors, voice coil actuators, moving magnet actuators, E core actuators, pneumatic/hydraulic actuators, solenoids, speaker voice coils, piezoelectric actuators, passive actuators (brakes), etc. Some preferred actuator types are described below. Actuator interface 116 can be optionally connected between actuator 88 and processor 110 to convert signals from processor 110 into signals appropriate to drive actuator 88. Interface 116 can include power amplifiers, switches, digital to analog controllers (DACs), analog to digital controllers (ADCs), and other components, as is well known to those skilled in the art.

In some of the implementations herein, the actuator has the ability to apply short duration force sensation on the housing or manipulandum of the device, or via moving an inertial mass. This short duration force sensation can be described as a "pulse." The "pulse" can be directed substantially along a particular direction in some embodiments. In some

embodiments, the magnitude of the "pulse" can be controlled; the sense of the "pulse" can be controlled, either positive or negative biased; a "periodic force sensation" can be applied and can have a magnitude and a frequency, e.g. the periodic sensation can be selectable among a sine wave, square wave, saw-toothed-up wave, saw-toothed-down, and triangle wave; an envelope can be applied to the period signal, allowing for variation in magnitude over time. The wave forms can be "streamed" from the host to the device, , or can be conveyed through high level commands that include parameters such as magnitude, frequency, and duration.

Other input devices 118 can be included in device 72 and send input signals to processor 110 or to host 74 when manipulated by the user. Such input devices include buttons, dials, switches, scroll wheels, knobs, or other controls or mechanisms. Power supply 120 can optionally be included in device 72 coupled to actuator interface 116 and/or actuator 18 to provide electrical power to the actuator. Alternatively, power can be drawn from a power supply separate from device 72, or power can be received across bus 80. Also, received power can be stored and regulated by device 72 (and/or host 74) and thus used when needed to drive actuator 88 or used in a supplementary fashion.

The interface device 12 can be any of a variety of types; some embodiments are described further below. The touchpads or touchscreen described herein can be provided on a variety of types of devices, such as gamepads, joysticks, steering wheels, touchpads, spherical controllers, finger pads, knobs, track balls, remote control device, cell phone, personal digital assistant, etc.

Specific Embodiments

The present invention presents a variety of embodiments in which haptic feedback is provided to a user of a laptop computer or other portable computing device, and/or to the user of any computing device having a touchpad or similar input device.

Some embodiments are based on displacing the skin of a user's finger when it is in contact with a touchpad. These embodiments deliver high fidelity sensations while offering a good correlation between input and output right at the user's fingertip. Actuator and linkage solutions are described to drive any of the translation embodiments. Other embodiments are based on the stimulation of palm surfaces of the user that are normally in contact with the laptop computer 10. These surfaces can provide haptic sensations based on inertially coupled forces or translation of the palm surfaces. Translations of surfaces in plane with the upper surface of the touchpad or laptop (i.e. in the X and/or Y axes) are as effective at conveying haptic information as vibrations or displacements in the Z axis (those normal to the touchpad or

laptop upper surface). This can be important when the volumetric constraints of a laptop are considered.

In many of the embodiments described herein, it is also advantageous that contact of the user is detected by a touch input device. Since haptic feedback need only be output when the user is contacting the touch device, this detection allows haptic feedback to be stopped (actuators "turned off") when no objects are contacting the touch input device. This feature can conserve battery power for portable devices. If a local touch device microprocessor (or similar circuitry) is being used in the computer, such a microprocessor can turn off actuator output when no user contact is sensed, thus alleviating the host processor of additional computational burden until touch is again detected, when the actuator output is resumed.

In many preferred embodiments, haptics are added to a laptop computer or other device in a way that does not force the user to relearn how to control the laptop or force the manufacturer to stretch design and manufacturing too far from existing designs to provide the haptic content. For example, in laptop embodiments, as the user moves his or her finger across the touchpad, a cursor displayed on the laptop screen is correspondingly moved. Haptic effects can be output on the touchpad or other laptop component contacted by the user when the cursor interacts with a graphical object or area, when an event occurs, etc. In other applications, haptic effects can be output when events or interactions occur in a game or other application running on the laptop. Many types of actuators, sensors, linkages, amplification transmissions, etc. can be used with the present invention.

A touchpad surface, as manufactured currently, typically is coupled to a printed circuit board (PCB) that includes necessary electronics and standard connections for connecting and operating the touchpad in a laptop. Thus, when forces are applied to the touchpad, they are also applied to the PCB that is often directly coupled to the touchpad, e.g. underneath the touchpad.

The embodiments herein are designed with particular guidelines and characteristics. For example, the particular haptic experiences that feel compelling in a certain embodiment, the location where the tactile content is focused or located physically, the spatial correlation of the haptic feedback with the pointing of the user's finger on the touchpad, e.g. the feedback can be right under the finger , or originate somewhere in the case/housing of the laptop, the required force strength and power for compelling feedback, the way the user interacts with the device and effect on quality and content of the feedback (angle of finger contact, etc), and which actuators and mechanisms that can fit into the laptop form factor/housing are most desirable.

Preferably, existing haptic feedback software and drivers can be used with the embodiments described herein, such as TouchSense software from Immersion Corp. A

standardized module, such as a particular touchpad, that works for many different types of products is desirable, such as PDAs, laptops, cell phones, and remote controls.

The focus of these inventive embodiments is primarily on tactile feedback implementations, not kinesthetic force feedback embodiments. As described herein, there are two basic classes of tactile feedback as applied to the present invention: inertial haptic feedback and moving contact haptic feedback. Inertial feedback is generated using inertially coupled vibrations and is based on moving an inertial mass that is coupled to the housing/user through a compliant flexure, where the mass motions cause inertial vibrations in a surface contacted by the user. Moving contact feedback relates to directly moving a surface or member, with respect to an earth ground, against the user and usually is generated by creating small displacements of the user's skin.

The distinction between inertial and moving contact feedback can be made in terms of the actual mechanism used to provide information to the user. Both inertial and tactile stimulation cause displacement of the hand or finger tissue; the inertial feedback is coupled through some enclosure by the transmissibility of that enclosure and the compliance of whatever holds the enclosure. Moving contact feedback refers to a mechanism that is more direct in how it stimulates the user's tissue. Examples would be tactile dots or surfaces that shear the skin of the finger to cause sensation by locally deforming the finger or palm tissue. This distinction is made for the purposes of classifying two types of embodiments described below: inertial and surface translation.

A novel actuator, referred to as Flat-E herein, is described below and can be used in all of the embodiments herein and represents a class of very low profile, power efficient, high performance, planar actuators. A Flat-E actuator can achieve acceptable performance levels and approach the limited volume and form factor required for laptop and other device applications.

Inertial Embodiments

These embodiments move an inertial mass to cause inertial haptic feedback to the user, which is typically transmitted through an enclosure or mechanism such as a housing or other surface. In many cases, inertial mass does not impact any surfaces in its travel, although such impacts can alternatively be used to provide additional haptic effects.

FIGURE 5 is a perspective view of one embodiment 150 of an actuator assembly that can be used to provide inertial haptic sensations for touchpads and housings of devices of the present invention. Actuator assembly 150 includes a grounded flexure 160 and an actuator 155.

The flexure 160 can be a single, unitary piece made of a material such as polypropylene plastic ("living hinge" material) or other flexible material. Flexure 160 can be grounded to the housing of the device 12, for example, at portion 161.

Actuator 155 is coupled to the flexure 160. The housing of the actuator is coupled to a receptacle portion 162 of the flexure 160 which houses the actuator 155 as shown. A rotating shaft 164 of the actuator is coupled to the flexure 160 in a bore 165 of the flexure 160 and is rigidly coupled to a central rotating member 170. The rotating shaft 164 of the actuator is rotated about an axis A which also rotates member 170 about axis A. Rotating member 170 is coupled to a first portion 172a of an angled member 171 by a flex joint 174. The flex joint 174 is made very thin in the dimension it is to flex so that the flex joint 174 will bend when the rotating portion 170 moves the first portion 172a approximately linearly. The first portion 172a is coupled to the grounded portion 180 of the flexure by a flex joint 178 and the first portion 172a is coupled to a second portion 172b of the angled member by flex joint 182. The second portion 172b, in turn, is coupled at its other end to the receptacle portion 162 of the flexure by a flex joint 184.

The angled member 171 that includes first portion 172a and second portion 172b moves linearly along the x-axis as shown by arrow 176. In actuality, the portions 172a and 172b move only approximately linearly. When the flexure is in its origin position (rest position), the portions 172a and 172b are preferably angled as shown with respect to their lengthwise axes. This allows the rotating member 170 to push or pull the angled member 171 along either direction as shown by arrow 176.

The actuator 155 is operated in only a fraction of its rotational range when driving the rotating member 170 in two directions, allowing high bandwidth operation and high frequencies of pulses or vibrations to be output. A flex joint 192 is provided in the flexure portion between the receptacle portion 162 and the grounded portion 180. The flex joint 192 allows the receptacle portion 162 (as well as the actuator 155, rotating member 170, and second portion 172b) to move approximately linearly in the z-axis in response to motion of the portions 172a and 172b. A flex joint 190 is provided in the first portion 172a of the angled member 171 to allow the flexing about flex joint 192 in the z-direction to more easily occur.

By quickly changing the rotation direction of the actuator shaft 164, the actuator/receptacle can be made to oscillate along the z-axis and create a vibration on the housing with the actuator 155 acting as an inertial mass. In addition, the flex joints included in flexure 160, such as flex joint 192, act as spring members to provide a restoring force toward the origin position (rest position) of the actuator 155 and receptacle portion 172. In some embodiments, the stops can be included in the flexure 160 to limit the motion of receptacle portion 122 and actuator 155.

Other embodiments can provide other types of actuator assemblies to provide inertial sensations, such as a flexure that moves a separate inertial mass instead of the actuator itself. Or, an eccentric mass coupled to a rotating shaft of an actuator can be oscillated to provide rotational inertial tactile sensations to the housing. The eccentric mass can be unidirectionally driven or bidirectionally driven. Other types of actuator assemblies may also be used, such as a linear voice coil actuator, solenoid, moving magnet actuator, etc.

In one embodiment, an actuator assembly such as described above may be coupled to any of various locations of a laptop housing or other device housing and used to vibrate parts of the housing, relying on the transmission of vibrations through the product housing by the remotely mounted actuator module. The actuator assembly can be attached to different areas of the laptop housing or components to provide inertial haptic feedback when the inertial mass is oscillated.

The experience of the user may vary depending on the precise location of the actuator assembly on the laptop and with different tactile effects that are output. Locations for the coupling of the actuator assembly include the housing bottom, side, or front, a surface engaged by the user's palm when operating the device, an area adjacent to the touchpad or touchscreen, or coupled to the touchpad or touchscreen. An effective location may be the touchpad itself (e.g. coupling the actuator assembly to the bottom of the touchpad). In some embodiments, if the touchpad is rectangular, more compliance may be achieved along the long axis of the touchpad.

In general, haptic content is received by the user over a limited frequency range by attaching the actuator assembly to a location on the laptop. A particular location most effective for transmitting vibrations can be determined by experimentation, for example.

In many cases, the output of several types of haptic effects can be faint and muddy to the user, and effects having predominantly higher frequencies may be more perceptible. One effective tactile effect for this embodiment is a relatively high frequency "ringing" effect. Sympathetic vibrations in the laptop case and the touchpad may amplify these vibrations. An actuator designed to resonate at a certain ideal frequency may be used to present a wide spectrum of frequencies by amplitude modulation techniques. For example, a compelling 25 Hz square wave can be generated by modulating a 250 Hz natural frequency generated by a tuned resonant actuator such as a large piezo ceramic resonator (see Figs. 8a-8b). Such modulation schemes may rely on the actuator being tuned to the environment it lives in and the object it must drive. Some type of vibration isolation system can be used in some embodiments to keep the energy confined to the haptic module as opposed to allowing the energy to dissipate off into sympathetic modes in other portions of the laptop computer or other device.

FIGURE 6 is a perspective view of another embodiment, in which a touchpad module can be suspended in a compliant support structure and can be coupled to a harmonic source and vibrated along the Z-axis. In this example, a touchpad 200 can be moved with an actuator assembly 202 that moves the touchpad surface in the Z-axis, perpendicular to the surface of the touchpad. The touchpad can be coupled to the laptop housing 204 by one or more layers or supports of foam, rubber, or other compliant material, where a strip 206 of foam provided around the perimeter of the touchpad between the touchpad 200 and the housing 204 as shown in Fig. 6. The actuator assembly 202 can be coupled to the bottom of the touchpad assembly (or to another location) so that when the inertial mass is oscillated, the oscillations transfer to the touchpad and allow it move in the Z-direction with respect to the laptop housing 204. For example, the actuator assembly can be bonded directly to the bottom of the touchpad PCB. A floating assembly of a touchpad and a bezel (surface surrounding the touchpad) can alternatively be moved, as opposed to just moving the touchpad module in the Z-axis.

In another embodiment, a stand-alone touchpad device can be used, where the touchpad is housed in a separate housing and communicates with the laptop or other device via wires or transmissions. In one embodiment, the stand-alone touchpad device can be attached to a palm pad (or other member), with the actuator assembly coupled to the pad. When the inertial mass of the actuator assembly is oscillated, the inertial sensations are transmitted through the member to the touchpad, i.e. this effectively provides inertial coupling from the actuator assembly to the touchpad surface. A foam layer (or other compliant layer) can be coupled between the pad and ground to provide compliance and allow the pad and touchpad to move inertially. This embodiment may feel more compelling than the embodiments in which the actuator assembly is mounted to the laptop near or on the built-in touchpad, possibly due to the compliance of the foam which can allow stronger sensations to be output.

The entire touchpad can be provided with haptic sensations as a single unitary member; or, in other embodiments, individually-moving portions of the pad can each be provided with its own haptic feedback actuator and related transmissions so that haptic sensations can be provided for only a particular portion. For example, some embodiments may include a touchpad having different portions that may be flexed or otherwise moved with respect to other portions of the touchpad.

In another embodiment, the surface around or adjacent to the touchpad is coupled to harmonic vibration source (e.g., actuator assembly) and vibrates in one or more axes. For example, palm rest surfaces may be driven by an inertial actuator assembly housed in the laptop. FIGURE 7 is a perspective view of one example of an inertially-driven palm rest surface. A laptop computer 210 includes a touchpad 212 that functions like a typical touchpad. A palm rest surface 214 is positioned adjacent to the touchpad 212, where the surface 214 can

be attached to the laptop housing on a layer of resilient open cell foam or other compliant material. In some embodiments, the surface 214 can be textured with divots and/or bumps to allow a stronger contact by the user to the surface. An actuator assembly 216 is coupled to the palm rest surface 214; in the embodiment shown, the assembly 216 is coupled to the underside of the surface 214. The assembly can be any of the actuator assemblies described above. For example, the actuator assembly 216 can provide z-axis oscillations to the palm rest surface 214.

The user preferably rests a palm and/or some fingers on the palm rest surface 214 while the user is using the touchpad 212 with a pointing finger(s). Thus, the user is able to feel haptic sensations through the palm rest surface while operating the touchpad. Alternatively, one hand of the user is used to point and operate the touchpad, while the other hand rests on the palm surface 214 and senses haptic feedback. The palm surfaces are implemented as practically unavoidable contact surfaces and consequently a user is not likely to miss very many haptic events while using the touchpad. In some embodiments, how hard the user rests the palms on the surface can make a slight difference in perceived magnitude over the useful bandwidth, and may be a result of stiffness and mass of the particular device used. The stiffness of the coupling of the palm surface with the housing can be adjusted for a particular feel in different embodiments.

In a related embodiment, the actuator assembly can be mounted in different areas. For example, the actuator assembly can be attached to the bottom of an extension of a palm rest surface made of textured material mounted on a layer of resilient open cell foam or other compliant material.

In other embodiments, the palm surface can be translated in the X and/or Y directions, similarly to the touchpad translation described below. The inertial actuator assembly could be used to force the translation, or a different type of actuator, e.g. high actuator authority and fairly high stiffness in the translation mode to avoid unintentional hard stop limiting distortion, etc. The translating palm surface can be suitable for a flat actuator so that the assembly can be integrated into the laptop housing; flat actuators are described below.

FIGURE 8a is a perspective view of an actuator that can be used in another embodiment of an inertial haptic feedback device of the present invention. In this embodiment, a higher frequency mechanical oscillator, mechanically coupled to the touchpad, is modulated. One example of such an implementation may include a large-diameter commercially available thin piezoelectric transducer 230, e.g., 60mm in diameter with natural frequencies of 300 to 400 Hz when supported peripherally. The piezoelectric transducer preferably includes a thin diaphragm (sheet) of metal 231. One embodiment may include an added mass 232 at the ceramic center of the piezo diaphragm in order to add inertial mass and lower the natural frequency to achieve stronger inertial tactile sensations from the oscillating mass. The outer periphery of transducer

230 can be grounded and the mass 232 can oscillate normal to the disc surface to create inertial haptic sensations to the housing to which the transducer is attached.

Actuator 230 can function as a harmonic oscillator that runs at a relatively high frequency that transmits sensations to the hand or part of the laptop to which it is attached. Amplitude modulation (envelope control) may be used to produce a wider haptic spectrum than the single fundamental drum mode. Large diameter piezo drivers are available, for example, from Kingstate of Taiwan. Differently sized discs can also be used.

To provide the desired haptic sensations, a large piezo transducer or "buzzer" should provide large sustainable displacements (accelerations) of the mass and the carrier frequency (the frequency at which it oscillates) should be modulated with the haptic signal. Some electronics may be needed to operate this type of actuator. A high voltage supply can be generated from 5 volts. An oscillation circuit, e.g., self exciting, can drive the element. There can be a gating feature to start and stop the oscillation as well as a proportional control to allow modulation of the amplitude of the output. An all-digital implementation may be provided by gating the oscillator on and off.

FIGURE 8b is a side elevational view of another embodiment 234 of a piezoelectric transducer providing haptic feedback, where the transducer applies (non-inertial) vibrations directly to the touchpad (or touchscreen) along the z-axis. A housing 236 of the laptop or other device can include bezels which overlay a touchpad member 238, which the user physically contacts to provide input to a computer or processor. The touchpad member 238 can include the required electronics to interface the touchpad with other electronic components. The touchpad member 238 can rest on a spacer 240 having a particular mass chosen to allow efficient haptic output. The spacer 240 rests on the edge of a piezo metal diaphragm 231, which is part of the piezo transducer, and where an electrical lead 241 is coupled between the diaphragm 231 and a signal source 246. The piezo ceramic element 242, also part of the piezo transducer, is coupled to the metal diaphragm 231 and an electrical lead 243 is coupled between the element 242 and the signal source 246. A conductive electrode is plated on the ceramic element 242. A contact pad 248 is positioned between the element 242 and a bottom housing 250, where the contact pad is rigidly coupled to both ceramic element 242 and housing 250. The contact pad 248 is made small so that the diaphragm 231 will have increased bending, resulting in greater acceleration and stronger haptic effects. The bottom housing 250 can include a printed circuit board (PCB), for example. One or more preloaded spring elements 252 couple the touchpad member 238 to the bottom housing 250, e.g. leaf springs, helical springs, etc.

In operation, the piezo transducer moves along the z-axis when an oscillating current from signal source 246 is flowed through the diaphragm 231 and the ceramic element 242.

Thus, spacer 240 is provided only at the edges of the diaphragm 231 to allow the inner portion of the diaphragm and the ceramic element 242 to move, and the ceramic element pushes against the bottom housing 250, causing the diaphragm 231 to push against the spacer 240, which in turn pushes against the touchpad element 238. This pushes the touchpad element up, and the spring elements 252 provide a spring return force on the touchpad so that it will return to its neutral position. When the piezo transducer similarly moves in the opposite direction, as directed by the oscillating signal, this moves the touchpad element 238 down toward the bottom housing 250. The touchpad element thus oscillates along the z-axis and provides haptic sensations to the user contacting the touchpad element.

In some embodiments, the components of the touchpad embodiment 234 can be chosen to provide more effective haptic sensations. For example, if the piezo transducer oscillates at close to a natural frequency of the mechanical system (including the transducer itself), then stronger forces and more effective haptic sensations can be output. The natural frequency of this moving mechanical system can be approximately expressed as the square root of the expression k1 plus k2 divided by m, as shown below:

$$fn \approx \sqrt{(k1 + k2 / m)}$$

where fn is the natural frequency, k1 is the spring constant of the metal diaphragm 231 of the piezo transducer, k2 is the spring constant of the spring elements 252, and m is the total mass of the spacer 240, the touchpad 238, and the parts of the suspension attached to the touchpad. This mass, as well as the spring constants, can be selected to provide a desirable low natural frequency, such as about 120 Hz or less, which tends to cause effective haptic sensations. The spacer 240 can allow multiple piezo transducers, e.g. positioned side by side, to be positioned against the bottom housing 250, so that the multiple transducers can be driven in unison for stronger haptic effects or at different times to provide sensations at particular locations of the touchpad element 238.

One way to provide the drive signal is to provide an initial oscillating carrier signal at or near the natural frequency fn, modulate the carrier signal with an effect envelope, if applicable (e.g. shape the amplitude to a desired configuration to provide a desired frequency or effect), and drive an amplifier with the modulated signal, which in turn drives the piezo transducer. A sine wave carrier signal, as opposed to square wave or other types, used in such an embodiment tends to produce quieter haptic effects in the described embodiment of Fig. 8b, which is often more desirable.

In an alternate embodiment, the piezoelectric transducer and spacer can be reversed in orientation so that the spacer 240 contacts the bottom housing 250, the diaphragm 231 rests on the spacer 240, the ceramic element 242 is positioned above the diaphragm, and the ceramic

element directly impacts the touchpad element 238 or a pad coupled to the touchpad member when it is oscillated by the driving signal. In yet other embodiments, the ceramic element can be directly coupled to the touchpad element, but in general less strong and effective haptic effects are the result.

Surface Translation Embodiments

These embodiments translate a surface that is in contact with the user to provide haptic feedback to the user. The user feels the translating surface in shear with his or her skin, creating an immediate sensation. This type of haptic feedback is based on either surface motion in-plane without interactions with fixed surfaces or relative motion between adjacent surfaces that are in contact with the users finger or hand. Both translation of a surface in contact with or adjacent to the touchpad module surface (Figs. 9-12), as well as displacement of the touchpad surface itself (Figs. 13-14) are embodiments described below, as well as actuators that may be used for either application (Figs. 15-17). Moving-surface inventions described in U.S. Patent No. 5,184,868 can also be applied.

Small (< 1 mm) displacements between adjacent surfaces provide good signal transmission into finger tissue. Enhanced surfaces may have a physical surface texture (bumps, roughness, etc.) and can be shaped to engage the user for any position or orientation. In some embodiments, small lateral translations (displacements under the finger tip between .25mm to 0.5mm) can be more effective than remote inertial vibrations or even out-of-plane (z-axis) vibrations right under the touchpad, e.g., inertial coupling can have a more remote and disconnected feeling in some embodiments.

Separate Surface Translation

Displacing a separate surface member positioned on top of a touchpad module is very effective at providing well-correlated feedback. The feedback feels sufficiently synchronized that clear surfaces may be translated above visual displays, as in PDAs or touch screens. Translation of other surfaces to the side or otherwise adjacent to the touchpad can also be performed in other embodiments.

FIGURE 9 is a perspective view of a first separate surface translation embodiment 250 in which a separate thin surface that is in sliding contact with the touchpad module is moved laterally under the finger. A translating surface member ("surface") 252 is positioned on top of and covering the fixed touchpad 254. Extension members 256a and 256b which are coupled to the translating surface 252 can be extended approximately perpendicularly in the x- and y-directions away from the touchpad 254. An actuator 258a and 258b can be coupled to each

associated extension member 256a and 256b, respectively. In the described embodiment, the actuators 258 are linear actuators outputting a linear force on the associated extension member 256, thereby moving the translating surface in the direction of the output force. For example, the actuators can be "E" core actuators. The two pole magnet 259 is not shown on the actuator 258b to reveal the coil 260 under the ferromagnetic piece 382.

The sliding surface 252 can be any of a variety of stiff or substantially stiff materials; for example, Kapton (polyamid) flexible printed circuit board material can be used. The extension members 256 can incorporate a stiffener section to prevent buckling. The sliding surface 252 can be a textured surface that provides a friction force to engage the user skin tissue in contact with the surface. A region on the top of the moving surface 252 can include the texture having sufficient surface roughness to provide purchase on the skin without feeling rough to touch. On the underside of the moving surface, a low friction coating can be included to promote sliding between surface 252 and touchpad 254. This underside component can be very thin, for example, less than 0.010 inches (.25 mm) thick.

The user points to and contacts the moving surface 252 just as if it were the touchpad 254 itself. The surface 252 is made thin enough so that the touchpad 254 can detect all the contact of the user to the surface 252 as if the user were touching the location of the touchpad directly underneath the location touched on the surface 252.

In some embodiments, the actuators can be located relatively far from the moving surface (e.g., >10cm) and in these cases the stiffer extension members 256 may need to transmit tension and compression with as little friction or out-of-plane movement as possible. Fiber laminations of glass or carbon can perform this function, for example.

In some moving magnet actuator embodiments, thin rare earth magnetic pieces can be laminated to the moving surface 252 to act as the moving magnets. A high level of integration can be achieved, for example, if the moving magnet pieces are on the order of < 1 mm in thickness and the "E" core and coil are located below the distal segments of the extensions 256, e.g., mounted directly to the touchpad PCB itself. The coil wires can be soldered directly to the touchpad PCB.

FIGURE 10 is a top plan view of another translating surface embodiment 270 in which a separate moving tactile surface is positioned above, and in sliding contact with, the touchpad. This surface is translated relative to the touchpad by a high bandwidth actuator through a high fidelity mechanical linkage.

In this embodiment, a translating surface 272 is positioned over a touchpad 274, similar to the embodiment of Fig. 9. An extension member 276 can protrude in a direction (x-direction

here) towards a rotary actuator 278, which is this example is grounded to the laptop housing 280. The actuator 278 can be a DC rotary motor having a rotatable shaft 282 that is coupled to a coupling linkage 284 that is in turn coupled to the extension member 276. For example, a portion of the linkage from the actuator assembly 150 described above can be used. When the actuator 278 rotates the shaft 282 in either direction, the linkage converts the rotation to surface 272 translation in a corresponding direction (left or right). For example, a displacement of about +/- 1 mm can be achieved. The user feels the surface translation when moving a finger over the surface 272. Motor rotation can result in very clean high fidelity translation in the X axis. A DC motor design may work in a laptop given spare volume out at the sides or locations in the front of the enclosure or housing. A similar extension, linkage and motor can be provided in the y-direction to move the surface 272 in that direction. The input of the user is detected on the touchpad through the moving tactile surface.

The thin surface can be trimmed to fit inside the touchpad area with a small border all around. A rectangular extension can be cut out of a larger lamination to provide a fairly rigid strip that is driven with an actuator. This strip should be wide enough to allow the actuator to push on it in operation without the strip buckling.

As in the embodiment of Fig. 9, a smooth surface can be provided on the underside of surface 272 that contacts the touchpad to provide a smooth low-friction sliding interface with the touchpad plastic covering that the user's finger normally touches. The top side of the moving surface 272 can be made frictional to allow a good user grip, e.g. a texture like fine sandpaper. This can provide an excellent contact surface because it provides some mechanical bonding with the finger surface, but is not rough enough to feel rough to touch. Other embodiments can use a variety of types of friction surfaces. Other embodiments may also use flatter actuators, such as moving magnet actuators or voice coil actuators.

Two strips 286 of plastic or other material can be attached to the bezel surrounding the touchpad (i.e. the rim of the housing opening for the touchpad) and covering the edges of the surface 272 in order to constrain the moving surface 272 and keep it flat against and parallel to the touchpad 274.

The embodiments of Figs. 9 and 10 can provide compelling haptic sensations. Adding a surface above the touchpad does not substantially interfere with the sensor operation of the touchpad. A user can concurrently point and receive haptic feedback through motion of this surface relative to the fixed touchpad. It is simple for the user to provide input to the laptop or other electronic device when touching and moving a finger over the translation surface above the touchpad. In some embodiments, the moving surface can be held above, not in close contact with, the touchpad and so some compression by the user may be required to take the free play out and come into proximity with the sensor array.

When moving a cursor over displayed scroll bars and around on the desktop GUI displayed by the laptop, the user feels distinct, high fidelity effects that are well correlated spatially with the cursor. The character of the correlation may be different depending on whether the user moves a finger or object in the x- or the y-axis. The actuator in the shown embodiment 270 moves the surface 272 in the x-axis. Consequently, moving the cursor up and down over icons, the user may feel pops or similar tactile effects as unidirectional if the user does not concentrate on or observe that the motion of the surface 272 is perpendicular to the cursor motion.

Motion of the user's finger in the translated direction -- the x-axis in the example of Fig. 10 -- tends to be more compelling. For example, as the user drags a finger in the x-direction to move a cursor from one displayed radio button to the next, the surface 272 may lead the user into the next button and can feel like a detent even though very small motions of the surface are being generated. A surface translation force opposing the direction of motion can be effective, e.g. if the user is moving left onto an icon, a translation force directed to the right feels crisp and natural. If haptic feedback is allowed in only one axis, the y-axis may be a better choice in some embodiments because there may be more vertically-oriented content on a GUI desktop and in applications.

A short, distinct pulse can provide excellent transitions when moving the cursor from one object to another, such as between graphical buttons. Vibrations can be conveyed to the user in surface translation embodiments by oscillating the actuator driving the surface, e.g. with a sine or other periodic wave, and thereby oscillating the translating surface in opposite directions.

The user also may naturally tend to take his or her finger off of the touchpad between motions that control the cursor, and an inherent spring centering of the motor and linkage can return the moving surface 252 or 272 to a neutral (origin) position, ready for the next interaction. The controlled cursor is not moved while the feedback apparatus has moved back to the neutral origin position, since only the surface above the touchpad moves and does not provide input to the computer through the touchpad like a user's finger.

Motion in a particular direction allows the surface translation embodiments to act in some embodiments as a relative pointing device with local pseudo-kinesthetic feedback. Tactile feedback is still the primary type of haptic feedback provided in such an embodiment, but the small displacements of the surface can be dramatically perceived as directed spring forces acting in such a way that they feel like detent "slopes" that force the user's finger in a direction, even though they are just pops.

The overall stiffness of the actuator can affect results. If the user presses too strongly on the moving surface, then the user may move the surface while dragging / pointing the finger and this can run the actuator out of its spring center. A preferred embodiment has a forceful but stiff actuator, one that the user can barely back-drive by pressing strongly.

Having particular amount of travel or compliance on the moving surface, e.g. about 2 mm, is desirable in some embodiments. There is a strong spring centering from the motor and linkage, and moving the cursor between two objects, such as buttons in a GUI, can be very realistic because the user may perceive true kinesthetic force feedback until finger pressure is decreased and the finger is moved quickly across the screen in a relative mode. The haptic effects which are output are simple tactile pops, and no actual kinesthetic springs are providing force in the X or Y directions. However, the user senses that his or her finger is being pulled into an adjacent object, e.g. the next button.

It should be noted that kinesthetic force feedback is possible in a different embodiment. For example, if the user keeps his or her finger in one place on the moving surface, and the moving surface has a large enough displacement, forces can be output in the degrees of freedom of motion of the moving surface, providing kinesthetic force feedback. The sensor of the touchpad can be used as the sensor indicating the position of the finger/moving surface for computation of the force, such as a spring force having a magnitude dependent on the distance that is moved from an origin of the spring. Thus, such an embodiment would be a dual mode haptic system, including both tactile and kinesthetic modes.

Some embodiments of the moving surface may allow sliding by the user, while others may be very stiff with little sliding. In many embodiments, if the maximum permitted movement of the surface is enough to allow traversal between two adjacent graphical targets, then the kinesthetic mode can be effective and user may not notice that he or she is moving the surface. Some embodiments can provide translation and forces in two axes (X and Y), allowing this kinesthetic directed feedback (real springs) in all directions of the touchpad.

Haptic effects may not feel the same if the user is not moving his or her finger or object on the touchpad. There is often content and value in the correspondence of touchpad motion with the haptic effect (e.g., a detent pop effect). For example, it is effective when the user finger is moving and receiving the pop effect when the finger translates the moving surface to the transition point between the icons or buttons.

Many of the advantages described above for separate translating surfaces are also applicable to translating the touchpad surface, described in detail below.

FIGURE 11 is a perspective view of another embodiment 290 of a separate translating surface and moving coil actuator. In this embodiment, a frame 292 is positioned over the touchpad 294 of the device. Frame 292 includes a thin surface portion 296 which is located directly above the touchpad 294 and is thin enough to allow the user's contact on the portion 296 to be detected by the touchpad 294 underneath. Frame 292 also includes an integrated voice coil 298 which is part of a voice coil actuator 300. The coil 298 can be wire traces that are molded into the frame 292, which can be a PCB. The other parts of the actuator 300 include a stationary two-pole magnet 302 positioned over the coil 298 and grounded to the laptop housing, and a backing plate 304 made of steel, positioned on the other side of frame 292 and grounded to the housing, and used for a flux return path. The steel subassembly can be attached to the touchpad PCB itself, for example.

Thus, the magnetic fields of the magnet 302 and the current flowing through coil 298 interact to cause a linear force on the frame 298, which causes the frame and portion 296 to move as indicated by arrow 306. This provides haptic sensations to the user similarly to the separate translating surface embodiments described above. The housing can surround the entire frame except for an opening surrounding the portion 296 of the frame 292. In some embodiments, wires from the coil 298 can be connected to the touchpad PCB using a separate flex circuit finger that branches off of the moving frame 292.

FIGURE 12 is a perspective view of another embodiment 310 of a separate translating surface. In this embodiment, a surface surrounding the touchpad is translated in x- and/or y-direction with respect to the touchpad surface. Thumb surface 312 is positioned at the bottom side of the touchpad 314 and is rigidly coupled to a link member 295. Link member 316 is coupled to a flexible link 318, which is coupled to the rotatable shaft of an actuator 320 that is grounded to the laptop housing. When the actuator 320 rotates the shaft, the flexible link 318 moves the link member 316 linearly as indicated by arrow 322, which moves the thumb surface 312 linearly along the x-axis. The thumb surface 312 is shown in sliding contact with a standard button (not shown) which is directly underneath the surface 312.

The user can rest his or her thumb, palm, or finger on the thumb surface 312 while operating the touchpad in order to feel the haptic sensations. To press the button located underneath the thumb surface 312, the user simply presses down on the surface 312. Overall, the sensations tend to be similar to the sensations for the other translating surfaces described above. In other embodiments, the link member 316 can be much longer to allow desired placement of the actuator 320 in the housing of the laptop or other device.

One disadvantage is that there is no feedback to the user unless the user has a thumb, finger, or palm on the thumb surface area. The user may have to reach for other buttons to type and then lose the haptic experience. A larger surface 312 or palm pad extension can be used in

embodiments in which it may be difficult to keep the user's thumb on the surface 312 while using the same hand to point with the touchpad.

Touch Device Translation

These embodiments translate the touchpad (or touchscreen) surface itself rather than moving a separate surface. The user feels the translating touchpad moving laterally, in shear with his or her skin, creating an immediate sensation. The touchpad can be moved relative to a fixed surround, such as a laptop housing.

FIGURE 13 is a perspective view of one embodiment 330 providing a translating touchpad surface. Touchpad 332 is moved relative to a housing 334, such as a laptop or PDA housing, by an actuator 336. In the described embodiment, the actuator 336 is a rotary actuator, such as a DC motor, having a rotating shaft 338 that is coupled to a linkage 340. The linkage 340 is coupled to a bracket 342 at its other end, where the bracket 342 is coupled to the underside of the touchpad 332 module. The linkage includes joints and/or flexibility/compliance to allow the rotational motion of the shaft 338 to be converted to linear force on the bracket 342, thereby causing the touchpad 332 to move laterally as shown by arrows 344. For example, the linkage can be made of polypropylene, similar to the linkages of the actuator assembly of Fig. 5. The laptop housing can serve as a constraining structure for the moving touchpad module.

For example, a standard DC motor can be used for actuator 336 and a polypropylene linkage assembly for linkage 340. In one embodiment, the haptic feedback components can reside where optional components for the laptop are normally placed, such as an optional disc drive.

In other embodiments, the actuator 338 can be located remotely from the touchpad 332, e.g., wherever space is available in the housing as opposed to directly underneath the touchpad as illustrated in Fig. 13. Linkages can be used to locate the actuator(s) remotely from the touchpad, as shown in Fig. 14 below.

Translating the entire touchpad in one or two axes may be one good overall haptics approach. Very small displacements ($0.2mm < x < 0.5mm$) of the touchpad are desired to provide useful haptics. The power consumption for this embodiment when evaluated within a practical magnitude range can be less than the consumption of currently available inertial mice interface devices, which can receive all needed power over the interface to the host computer, such as USB.

Some advantages are apparent in this type of embodiment. Feedback experience is direct, well correlated with pointing, and precise. Implementation can be flexible and

unobtrusive, and addition of haptic components does not alter how the touchpad is used. The translating surface has a small displacement requirement compared with inertial approaches – this can lead to reduced power consumption and manufacturing benefits. In some embodiments, the motion of the touchpad can be oriented at an angle in the x-y plane. Some disadvantages may include use of a DC motor, which are relatively large, a flexible linkage may need a lot of clearance and may cause friction, and power consumption may be relatively high.

FIGURE 14 illustrates a perspective view of another embodiment 350 of a moving touchpad, in which the touchpad may be moved in both X and Y directions. The touchpad 351 is directly coupled to a first linkage member 351, which is coupled to a rotating shaft of an actuator 353 by a flexible member 354, such as polypropelene. Actuator 353 is grounded to the laptop housing. When actuator 353 rotates its shaft, the flexible member 354 converts the rotary motion to linear motion and translates the linkage member 352 in the x-direction, which in turn translates the touchpad as indicated by arrow 355. At the distal end of the first linkage member 354, a second linkage member 356 is coupled, e.g. by a flexible coupling.

A second actuator 358, grounded to the laptop housing, is coupled to the other end of the second linkage member 356 by a flexible member 357, where the axis of rotation of the rotating shaft of the actuator 358 is substantially the same as the axis of rotation of the actuator 353. The rotary force output by the rotating shaft of the actuator 358 is converted to a linear force by the flexible member 357. This linear force causes the second linkage member 356 to move linearly along its length, which in turn causes the first linkage member 352 to pivot approximately about its end near actuator 353 along the y-axis and cause the touchpad 351 to move approximately along the y-axis. The actuators 353 and 358 can be, for example, DC motors or any other type of actuator, e.g. linear actuators can also be used, as described below in Figs. 15-17. The linkage members can be made of any suitable material, e.g. carbon fiber. Preferably, very little energy is absorbed by the grounded structure or by unwanted deformations in the linkage assembly.

Thus, the mechanism decouples the x- and y-motions; by activating actuator 353, x-axis motion is provided, and by activating actuator 358, y-axis motion is provided; both x- and y-axis motion can be provided by activating both motors simultaneously. Both actuators can be driven either together (common mode) or differentially (differential mode) to achieve pure X or Y movement without binding the linkage parts. Furthermore, any combination of drive current will produce a resultant force along any arbitrary axis with the same fidelity and lack of binding.

One embodiment may use firmware for rapid evaluation and output of X and Y forces, e.g. software running on a local controller such as a microprocessor, or running off the host CPU. In some embodiments, such firmware may be too complex, so that alternatively, a

mechanism with an electronic way of switching between the two principle feedback axes can be used. In one embodiment, the two DC motors can be connected in a series circuit with switch that reverses the current through one of the two motors.

In the embodiment of Fig. 14, the user may feel the difference between x- and y-directional forces when moving a finger or object on the touchpad in the x-direction. There is haptic value in having the correlation or alignment of tactile feedback with finger/cursor motion; in some cases, alignment can boost the haptic signal-to-noise ratio. For example, moving the cursor right to left over icons or buttons may feel better and more like real buttons to the user when the feedback is directed horizontally along the x-axis. Less power may be required overall if the feedback is aligned with the cursor direction instead of being omnidirectional or misaligned. In some cases, a weaker aligned haptic effect may be more meaningful than a stronger misaligned effect.

The touchpad surface with enhanced texture moves relative to a fixed surrounding surface with enhanced texture. The enhanced texture is more rough, corrugated, or otherwise textured, allowing a stronger user contact.

In some other embodiments, the touchpad surface can be comprised of interdigitated surface features that move relative to each other in x- and/or y- directions. For example, two halves of a touchpad can be driven by actuator(s) to move relative to each other.

In other embodiments, other actuators can be used to move the touchpad, touchscreen, or other touch device in the z-direction. For example, piezo-electric actuators, voice coil actuators, or moving magnet actuators can be directly coupled to the touchpad or touchscreen to provide direct motion of the touch surface. Also, the touchpad surface can be comprised of a fixed tactile surface and a reference surface, where the reference surface can displaced along the z-axis with respect to the fixed tactile surface.

FIGURES 15a and 15b are perspective views of the top side and bottom side, respectively, of a different embodiment of a novel "flat-E" actuator 360 for use in translating a touchpad. FIGURE 15c is a side view of the actuator 360. Actuator 360 is designed to be very flat and thus may be more appropriate to function within a flat assembly that can be inherently part of the touchpad, touchscreen, or other similar input device. "E-core" actuator topology provides an excellent actuator using minimal magnet material and delivers good force and bandwidth. One disadvantage of the moving magnet actuator is the large depth required ("E" core ferromagnetic piece width can be traded for height to some extent, perhaps reducing the overall depth of the actuator).

Actuator 360 presents a inventive embodiment of an "E" core that can be used to translate the touchpad (or alternatively to translate a separate surface, as in the embodiments of Figs. 9-14). A folded over, flat 3-D embodiment, shown in Figs. 15a-15b, that may behave substantially like a 2-D case, but with more leakage and non uniform flux at the poles.

Actuator 360 includes a ferromagnetic piece 362 shaped as an "E", which can be made of a metal such as a ferrous metal or carbon steel plate, and can be a single piece of metal or a lamination. A coil 364 of wire is wound about the central pole of the "E" of the ferromagnetic piece 362. A floating plastic cage 368 can be positioned on the ferromagnetic piece 362 and can include two or more rollers 370 positioned in apertures in the cage and oriented so that the rollers roll about axes parallel to the axis passing through the coil 364 about which the coil is wound. The cage can be plastic and is floating, i.e. unattached to other components, to allow the rollers to roll. A two-pole magnet 366 is positioned above the poles of the ferromagnetic piece 362 and cage 368 so that there is an air gap between magnet and ferromagnetic piece. The magnet 366 is coupled to the underside (in the orientation of the figures; other orientations are possible) of a backing steel piece 372 which is positioned on top of and contacting the rollers 370. The rollers thus set the nominal magnetic gap between the magnet and the ferromagnetic piece 362. The backing steel piece 372 can be rigidly coupled to the touchpad 373, as shown in FIGURE 15d, so that the touchpad, steel piece 372, and magnet 366 can translate relative to the ferromagnetic piece 362. For example, the magnet may in some embodiments be a two pole bonded neodymium wafer, and the steel parts may be stamped from single sheets about 1 mm thick. Additional rollers or foam can be used to support the end of the ferromagnetic piece opposite the magnet 366. The magnet, cage, and backing piece are located to the side of the "E" poles rather than at the front edge as in other E-core type actuators; this allows the actuator of the present invention to be made very flat for laptop and other portable device applications.

In operation, an electrical current is flowed through the coil 364, which causes magnetic flux to flow through the ferromagnetic piece in the direction of arrows 374. In reaction, the steel plate 372 moves in a direction along the axis indicated by arrow 376 (the direction is dependent on the direction of the current in the coil). The rollers 370 rotate to allow the steel plate 372 and magnet 366 to translate relative to the ferromagnetic piece 362. The floating cage 368 keeps the rollers from moving in undesired directions as they rotate. Also, the magnetic attractive normal forces which occur between ferromagnetic piece 362 and magnet 366 are reacted with the rollers 370. Other Flat-E related embodiments can include flexure and knife-edge suspensions to react (allow motion from) magnetic normal forces.

The flat E actuator embodiments described herein can be used to translate the touchpad (or touchscreen) or a separate surface member above or to the side of the touchpad. For

example, two flat E actuators can be used in a configuration similar to that of Fig. 9 to drive the touchpad or surface member in two axes, x and y.

The actuator 360 can be made very thin in comparison with other actuators, e.g. the assembly can be made approximately 3 or 4mm thick, less than half as thick as other "E" core actuators. The magnetics design can be iterated for optimal performance. Linearity and detent forces can be traded for thickness.

Advantages include a planar, thin geometry, which is suitable for laptops, PDA, and other portable devices. The moving magnet approach does not require a large air gap so it may be more attractive for laptop haptic feedback. An "E" core prototype was 10mm X 20mm X 8mm and is smaller than most DC motors with equivalent force and power consumption. Furthermore, it is a direct drive configuration, so no transmission is required between actuator and touchpad. Efficient, low cost, and easy to manufacture components allow the actuator to be produced cheaply. The actuator is simple to integrate with existing touchpad PCB's and modules. One disadvantage is that magnetic attractive normal forces exist, which may necessitate a suspension. Rollers and/or flexure and knife edge suspensions can be used in some embodiments to react magnetic normal forces.

The actuator 360 generally provides good bandwidth. Larger (e.g., > 1mm) displacements can be achieved. Those embodiments employing foam to support the opposite end of the ferromagnetic piece have a return spring having a low spring constant, mostly from the foam suspension operated in shear mode. Audible noise may also be reduced by using the foam and/or rollers. While the haptic performance is good, the displacement of the surface is small enough so that when the user is moving a finger over the touchpad to move the cursor over the desktop, the surface displacement does not noticeably affect the cursor motion.

FIGURES 16a and 16b are perspective views of the top side and bottom sides of another embodiment 380 of the "flat-E" actuator of Figs. 15a-15c. A ferromagnetic piece 382 (or a lamination, in other embodiments) includes an approximate "E" structure and has a coil 384 wound around the E center pole 385. A two-pole magnet 386 is positioned across the E center pole 385 such that a gap is provided between ferromagnetic piece 382 and magnet, similarly to the embodiment 360. A metal plate 388 (e.g., steel) is coupled to magnet 386 and is provided parallel to the ferromagnetic piece and magnet. A cage 390 can be provided as the middle layer, where rollers 389 (shown as dashed lines) can be positioned within apertures in the cage 390 and allow the plate 388 to slide laterally with respect to the ferromagnetic piece and magnet. A touchpad or touchscreen (not shown) can be rigidly coupled to the top of plate 388, with piece 382 grounded. In alternate embodiments, the touchpad or touch screen can be coupled to the piece 382 with plate 388 grounded.

Embodiment 380 also includes a flexible suspension, which can be coupled to the middle layer plastic cage 390 and can include two linkages 392 that are thus effectively coupled between the steel plate 388 and the ferromagnetic piece 382. The linkages 392 contact the steel plate 388 at ends 394 and are coupled to the cage layer 390 at ends 396 (or molded with the cage layer as a single plastic piece). Each linkage includes a thinner portion 398 and a thicker portion 400.

In operation, a current is flowed through coil 384 and the magnetic forces resulting from the current and magnet 386 cause the plate 388 (and the touchpad) to move as indicated by axis 402. The suspension including linkages 392 prevents the plate 388 from skewing due to magnetic normal forces and any other forces. Each linkage 392 flexes to accommodate the motion of the plate 388, where the thinner members 398 flex first, and the thicker members 400 flex if the limits of flex are reached for members 398. The thinner-thicker structure allows spring centering to operate until the thicker (stiffer) beams are engaged, which provide a softer feeling stop to motion. The final limit to motion is caused by either of the stops 404 hitting the inner edge of the plate 388.

The flexible suspension described above effectively allows lateral desired motion of the plate and touchpad, but prevent motion in any other direction. This creates a much more stable motion of the plate 388 and does not allow the plate 388 to drift in its position over time. Furthermore, the suspension provides a desirable spring centering force on the plate 388 and touchpad, allowing the touchpad to move to the center of its range of motion when the user stops touching and forcing the touchpad.

FIGURES 17a-17g are views illustrating another flat-E actuator touchpad embodiment 420 that miniaturizes this type of actuator and provides fabricated surface mount devices that take advantage of existing lead frame and over molding manufacturing technologies. Such small scale devices can be wave soldered onto the touchpad module and can work in parallel to provide suitable stroke and force for touchpad translation (or for z-axis forces in alternate embodiments).

Figures 17a-17c illustrate a top view of a PCB 422 which includes multiple Flat-E actuators 424. An actuator 424 can be positioned at each corner of the PCB 422 as shown. More or less actuators than shown can alternatively be placed in other configurations. The use of multiple actuators 422 can provide greater magnitude forces and allow each actuator 422 to have a lower force output and cost. In one embodiment, the PCB 422 is a separate PCB that is grounded to the housing of the laptop. The touchpad (e.g., including its own PCB different from PCB 422) is then coupled to the moving portions of the actuators, e.g., to the pads 426 shown in Fig. 17a. In another embodiment, the PCB 422 is the touchpad, and the moving portions of the actuators are coupled to a grounded surface in the laptop, such as the housing.

In such an embodiment, the actuators 424 can be hidden from the user by a lip of housing that extends around the perimeter of the touchpad, leaving the center area of the PCB 422 exposed to the user.

Fig. 17d is a side elevational view of one end of a PCB 422, separate from the touchpad, that includes the flat-E actuators 424. The touchpad/PCB member 428 is coupled to the moving portions 430 of the actuators 424.

Fig. 17e is a perspective view illustrating one embodiment of the underside of the PCB 422 shown in Fig. 17a, where the flat-E actuators 424 have been surface mounted to the underside of the PCB 422. This can be done as "hand-placed" components, or preferably using automatic surface mount technology placement equipment. The "E" ferromagnetic piece 432 can be grounded to the PCB 422 so that the magnet and steel backing plate of the actuator move.

Figs. 17f and 17g are perspective views illustrating top and bottom views, respectively, of the flat-E actuator 424 which has 3 poles and can operate similarly to the flat-E actuators described above. Ferromagnetic piece 432 is shaped like an "E" and has a coil 434 wrapped about the center pole. Flexures 436 allow the magnet 438 and steel backing plate 440 to move relative to the ferromagnetic piece 432 and coil 434. The touchpad (not shown) can be coupled to the steel backing piece 440 and the E-laminate piece 432/coil 434 can be grounded, as in the embodiments of Figs. 17a-17e. Alternatively, the backing piece 440 and magnet 438 can be grounded and the touchpad can be coupled to a moving ferromagnetic piece 432.

A flat-E actuator as described above can be used to translate touchpad modules or palm surfaces directly. In the described embodiments, the total thickness of the flat-E actuator can be about 3 mm or less. Flat-E magnetic assemblies that can be integrated into the an existing touchpad product line represent a preferred embodiment in terms of size, manufacturability and economy of scale.

In other embodiments, other moving magnet actuator designs, and other voice coil actuator designs, such as described in U.S. Patent Nos. 6,166,723 and 6,100,874, can be used.

In other embodiments, other types of input surfaces or display screens can be similarly translated using any of the actuators described herein. For example, a clear surface such as the input sensing device(s) covering a display screen of a personal digital assistant (PDA) or a touch screen on a monitor or CRT, can be similarly translated in the X and/or Y directions (parallel to the screen surface) to provide haptic feedback. One application for such clear screen translation is ATM machines, where the user typically inputs information on a touch screen. Haptic feedback can make such input more accessible and easy for people with below-

average vision. Haptic feedback can indicate when the user's finger is over a graphically-displayed button, or can identify particular displayed buttons with different haptic sensations. This can be useful in many ATM applications since there is not a cursor that is moved; haptic feedback can thus be useful to indicate to the user that a button has been pressed, e.g. a small vibration is output when a button is activated. Haptic feedback may also assist users in noisy environments, such as in areas with high vehicular traffic, where sound may not be easily heard by the user.

The embodiments described herein can also provide haptic feedback in an embodiment where the user is using a stylus or other object to input data on the touchpad, touch screen, or input area. The haptic sensations can be transmitted to the user from the touchpad (or other moving surface) and through the stylus or other object.

Other Features

A human factor issue related to haptic feedback in some embodiments may include force overload protection. Ideally, for non-inertial feedback actuators and transmission designs such as the translating surfaces and differential surfaces, it is desired for the actuator to produce large forces with fidelity regardless of the load on the actuator or the position within the actuator travel. Put another way, the finger or hand of the user should not move the actuator against a limit or reach an end of travel condition where half of a vibration cycle is attenuated. For this reason, it is desirable to design actuator and transmission mechanisms that are inherently decoupled from the user loading. An example of this would be an E-core actuator with very high spring centering provided by a stiff suspension, as in the embodiment of Fig. 16a-16b. A forceful actuator can overcome this spring force easily, and the forces of a finger dragging on a touchpad surface are a small percentage of full scale actuator output. A weaker actuator may require a more compliant suspension, and this would allow the user interaction to interfere with oscillations and create non-linear output.

Another human-factor-related issue with haptic feedback in some embodiments can be audibility. The use of palm rest surfaces and inertial actuator assemblies, for example, causes sound that is the unavoidable side effect of a haptic sounding board. Loaded surfaces, such as when the user is touching the housing or touchpad, radiate sound poorly, and still transmit forces quite well. Thus, in some embodiments, a load measuring device can be used to determine when the user's hands are present on moving surfaces to allow forces to be output only when such hands are present.

To save costs when providing haptic functionality to a laptop touchpad or other similar input device, the existing sound electronics within the laptop, PDA, or other device can be utilized in some embodiments. For example, the existing sound analog output (e.g. digital-to-

analog converter) and the sound power amplifiers can drive the actuator used for haptic feedback for the touchpad or other laptop component as described above, without having to add an additional microprocessor and/or additional power electronics. A notch filter or other pickoff from the sound signal can be used to provide the haptic feedback signal. For example, haptic effect control signals can be provided in the inaudible range of the sound spectrum and filtered so that these control signals can be provided to the haptic actuator, while the remainder of the signal in the audible range is routed to the audio speakers of the laptop. Or, dedicated signals that are outside the audible range and not included with audio signals can be filtered or routed to control the haptic feedback actuator(s).

Furthermore, existing software on many laptops tracks the battery power for the laptop to indicate power level, warn the user, or shutoff the laptop to conserve battery power. This tracking software can be tapped into for haptic feedback applications. For example, if battery power gets below a certain level, the haptic feedback software routines can scale down or even turn off the output forces to the user. This can be accomplished by dropping the magnitude of the forces, or by reducing the types or number of graphical objects in the GUI that have haptic effects associated with them. This can also be accomplished by shortening the duration of haptic effects, e.g. effects that are normally 50 ms can be reduced to 40 ms, etc. Also, a combination of such methods can be used. Finally, some laptop computers have different settings, such as high power, medium power, and low power, which a user can select according to his or her needs, e.g. lower power setting allows the batteries to last longer. The haptic feedback control can link into the setting and be governed by this setting as well. For example, if the user selects low power mode, the haptic feedback controller can adapt as described above to reduce power requirements of the haptic effects.

FIGURE 18 is a top elevational view of a touchpad 450 of the present invention. Touchpad 450 can in some embodiments be used simply as a positioning device, where the entire area of the touchpad provides cursor control. In other embodiments, different regions of the pad can be designated for different functions. In some of these region embodiments, each region can be provided with an actuator located under the region or otherwise physically associated with the region, while other region embodiments may use a single actuator that imparts forces on the entire touchpad 450. In the embodiment shown, a central cursor control region 452 can be used to position a cursor or viewpoint displayed by the laptop computer or other device.

The cursor control region of a touchpad can cause forces to be output on the touchpad based on interactions of the controlled cursor with the graphical environment and/or events in that environment. The user moves a finger or other object within region 452, for example, to correspondingly move the cursor 20. Forces are preferably associated with the interactions of

the cursor with displayed graphical objects. For example, a jolt or "pulse" sensation can be output, which is a single impulse of force that quickly rises to the desired magnitude and then is turned off or quickly decays back to zero or small magnitude. The touchpad 450 can be jolted in one direction or as an oscillation in the z-axis or other axis inertially in the inertial haptic feedback embodiments, or the touchpad can be translated in one direction or oscillated one or more times to provide the pulse. A vibration sensation can also be output, which is a time-varying force that is typically periodic. The vibration can cause the touchpad 450 or portions thereof to oscillate back and forth multiple times, and can be output by a host or local microprocessor to simulate a particular effect that is occurring in a host application.

Another type of force sensation that can be output on the touchpad is a texture force. This type of force is similar to a pulse force, but depends on the position of the user's finger on the area of the touchpad and/or on the location of the cursor in a graphical environment. Thus, texture bumps can be output depending on whether the cursor has moved over a location of a bump in a graphical environment. This type of force is spatially-dependent, i.e. a force is output depending on the location of the cursor as it moves over a designated textured area; when the cursor is positioned between "bumps" of the texture, no force is output, and when the cursor moves over a bump, a force is output. This can be achieved by the host sending the pulse signals as the cursor is dragged over the grating, or, a separate touchpad processor can be dedicated for haptic feedback with the touchpad, and the texture effect and be achieved using local control (e.g., the host sends a high level command with texture parameters and the sensation is directly controlled by the touchpad processor). In other cases a texture can be performed by presenting a vibration to a user, the vibration being dependent upon the current velocity of the user's finger (or other object) on the touchpad. When the finger is stationary, the vibration is deactivated; as the finger is moved faster, the frequency and magnitude of the vibration is increased. This sensation can be controlled by the touchpad processor (if present), or the host. Other spatial force sensations can also be output. In addition, any of the described force sensations herein can be output simultaneously or otherwise combined as desired.

Different types of graphical objects can be associated with haptic sensations. Haptic sensations can output on the touchpad based on interaction between a cursor and a window, menu, icon, web page link, etc. For example, a "bump" or pulse can be output on the touchpad to signal the user of the location of the cursor when the cursor is moved over a border of a window. In other related interactions, when a rate control or scrolling function is performed with the touchpad (through use of the cursor), sensations can be output related to the rate control functions. Furthermore, the magnitude of output forces on the touchpad can depend on the event or interaction in the graphical environment, including user-independent events. These force sensations can also be used in games or simulations. These and other haptic sensations are described in U.S. Patent No. 6,211,861. Other control devices or grips that can include a

touchpad of the present invention in its housing include a gamepad, mouse or trackball device for manipulating a cursor or other graphical objects in a computer-generated environment; or a pressure sphere or the like.

Some forms of touchpads and touchscreens allow the amount of pressure the user is exerting on the touchpad to be sensed. This allows a variety of haptic sensations to be determined based at least in part on the sensed pressure. For example, a periodic vibration can be output having a frequency that depends on the sensed pressure. Or, the gain (magnitude) of output haptic sensations can be adjusted based on the sensed pressure. Those users that always tend to use the touchpad with more pressure can be allowed to select an automatic magnitude increase that would be in effect constantly.

Other embodiments of touchpads and touchscreens allow the user to enter "gestures" or shortcuts by tracing a symbol on the cursor control region or other region, which is recognized as a command or data by a processor. Haptic sensations can be associated with or dependent on particular gestures. For example, a confirmation of modes can be conveyed haptically with a particular haptic sensation when a mode confirmation gesture is recognized. Characters recognized from gestures also may each have a particular haptic sensation associated with them. In most touchpad embodiments, a user can select a graphical object or menu item by "tapping" the touchpad. Some touchpads may recognize a "tap-and-a-half" or double tap, which is the user doing a tap and then again touching the pad and maintaining the finger or object on the pad while moving the finger. For example, such a gesture can provide a "drag" mode in which objects may be moved with the cursor. When the user is in such a drag mode, a vibration or other haptic sensation can be output to indicate to the user that this mode is active.

As stated above, the touchpad 450 can also be provided with different control regions that provide separate input from the main cursor control region 452. In some embodiments, the different regions can be physically marked with lines, borders, or textures on the surface of the touchpad 450 (and/or sounds from the computer 10) so that the user can visually, audibly, and/or or tactilely tell which region he or she is contacting on the touchpad.

For example, scroll or rate control regions 454a and 454b can be used to provide input to perform a rate control task, such as scrolling documents, adjusting a value (such as audio volume, speaker balance, monitor display brightness, etc.), or panning/tilting the view in a game or simulation. Region 454a can be used by placing a finger (or other object) within the region, where the upper portion of the region will increase the value, scroll up, etc., and the lower portion of the region will decrease the value, scroll down, etc. In embodiments that can read the amount of pressure placed on the touchpad, the amount of pressure can directly control the rate of adjustment; e.g., a greater pressure will cause a document to scroll faster. The region

454b can similarly be used for horizontal (left/right) scrolling or rate control adjustment of a different value, view, etc.

Particular haptic effects can be associated with the control regions 454a and 454b. For example, when using the rate control region 454a or 454b, a vibration of a particular frequency can be output on the touchpad. In those embodiments having multiple actuators, an actuator placed directly under the region 454a or 454b can be activated to provide a more localized tactile sensation for the "active" (currently used) region. As a portion of a region 454 is pressed for rate control, pulses can be output on the touchpad (or region of the touchpad) to indicate when a page has scroll by, a particular value has passed, etc. A vibration can also be continually output while the user contacts the region 454a or 454b.

Other regions 456 can also be positioned on the touchpad 450. For example, each of regions 456 can be a small rectangular area, like a button, which the user can point to in order to initiate a function associated with the pointed-to region. The regions 456 can initiate such computer functions as running a program, opening or closing a window, going "forward" or "back" in a queue of web pages in a web browser, powering the computer 10 or initiating a "sleep" mode, checking mail, firing a gun in a game, cutting or pasting data from a buffer, saving a file to a storage device, selecting a font, etc. The regions 456 can duplicate functions and buttons provided in an application program or provide new, different functions.

Similarly to regions 454, the regions 456 an each be associated with haptic sensations; for example, a region 456 can provide a pulse sensation when it has been selected by the user, providing instant feedback that the function has been selected. For example, a haptic sensation such as a pulse can be output when the user "taps" a finger or object on a region 456, 452, or 454 to make a selection. Similar to physical analog buttons that provide a range of output based on how far the button is pushed, one or more regions 456 can be an analog-like button by providing a proportional, stepped, or analog output based on the pressure the user is exerting on the touchpad.

Furthermore, the same types of regions can be associated with similar-feeling haptic sensations. For example, each word-processor related region 456 can, when pointed to, cause a pulse of a particular strength, while each game-related region 456 can provide a pulse of different strength or a vibration. Furthermore, when the user moves the pointing object from one region 454 or 456 to another, a haptic sensation (such as a pulse) can be output on the touchpad 450 to signify that a region border has been crossed. For example, a high frequency vibration which quickly decays to zero magnitude can be output when the pointing object enters a designated region. This can be valuable since it provides an indication of the borders to the regions 454 and 456 which the user would not otherwise know. This also allows region reconfiguration of size and/or location and allows the user to quickly learn the new layout

haptically. Regions can also be associated with "enclosures" which define areas in a graphical environment and the different haptic sensations which are output when the cursor enters, exits, and is moved within the enclosure and the particular borders having such haptic associations.

In addition, the regions are preferably programmable in size and shape as well as in the function with which they are associated. Thus, the functions for regions 456 can change based on an active application program in the graphical environment and/or based on user preferences input to and/or stored on the computer 10. Preferably, the size and location of each of the regions can be adjusted by the user or by an application program, and any or all of the regions can be completely removed if desired. Furthermore, the user is preferably able to assign particular haptic sensations to particular areas or types of areas based on types of functions associated with those areas, as desired. Different haptic sensations can be designed in a tool such as Immersion Studio™ available from Immersion Corp. of San Jose, CA.

It should be noted that the regions 454 and 456 need not be physical regions of the touchpad 450. That is, the entire touchpad surface need merely provide coordinates of user contact to the processor of the computer and software on the computer can designate where different regions are located. The computer can interpret the coordinates and, based on the location of the user contact, can interpret the touchpad input signal as a cursor control signal or a different type of signal, such as rate control, button function, etc. (e.g. a driver program can provide this interpreting function if desired). A touchpad microprocessor, if present, may alternatively interpret the function associated with the user contact location and report appropriate signal or data to the host processor (such as position coordinates or a button signal), thus keeping the host processor or software ignorant of the lower level processing. In other embodiments, the touchpad 450 can be physically designed to output different signals to the computer based on different regions physically marked on the touchpad surface that are contacted by the user; e.g. each region can be sensed by a different sensor or sensor array.

Any of those embodiments described herein which provide haptic feedback to the finger or object of the user that contacts the touchpad or touchscreen may be used with the regions of touchpad 450.

While this invention has been described in terms of several preferred embodiments, it is contemplated that alterations, permutations, and equivalents thereof will become apparent to those skilled in the art upon a reading of the specification and study of the drawings. For example, many of the features described in one embodiment can be used interchangeably with other embodiments. Furthermore, certain terminology has been used for the purposes of descriptive clarity, and not to limit the present invention.

What is claimed is:

CLAIMS

1. A haptic feedback touch control for inputting signals to a computer and for outputting forces to a user of the touch control, the touch control comprising:

a touch input device including an approximately planar touch surface operative to provide a position signal based on a location on said touch surface which said user contacts, said position signal representing said location in two dimensions; wherein said computer receives position information derived from said position signal; and

at least one actuator coupled to said touch input device, said actuator outputting a force on said touch input device to laterally move said touch input device approximately parallel to a surface of said touch input device to provide a haptic sensation to said user contacting said touch surface, wherein said actuator outputs said force based on force information output by said computer.

2. A haptic feedback touch control as recited in claim 1 wherein said computer positions a cursor in a graphical environment displayed on a display device based at least in part on said position signal.

3. A haptic feedback touch control as recited in claim 1 wherein said touch input device is a touchpad, said touchpad being separate from a display screen of said computer.

4. A haptic feedback touch control as recited in claim 1 wherein said touch input device is integrated in a housing of said computer.

5. A haptic feedback touch control as recited in claim 1 wherein said user contacts said touch surface with a finger of said user.

6. A haptic feedback touch control as recited in claim 1 wherein said user contacts said touch surface with a physical object held by said user.

7. A haptic feedback touch control as recited in claim 1 wherein said at least one actuator is a first actuator that outputs a first force in a first lateral direction approximately parallel to said surface of said touch input device, and further comprising a second actuator coupled to said touch input device and operative to output a second force on said touch input device in a second lateral direction approximately parallel to said surface and approximately perpendicular to said first lateral direction.

8. A haptic feedback touch control as recited in claim 1 wherein said actuator is a linear actuator that provides an output force in a linear degree of freedom, and wherein said actuator is coupled between said touchpad and a grounded housing.

9. A haptic feedback touch control as recited in claim 8 wherein said actuator is a rotary actuator that provides an output force in a rotary degree of freedom, said output force being converted to said linear force.

10. A haptic feedback touch control as recited in claim 8 wherein said actuator is an E-core actuator.

11. A haptic feedback touch control as recited in claim 10 wherein said actuator includes at least one roller allowing a backing plate of said actuator to slide relative to a magnet of said actuator.

12. A haptic feedback touch control as recited in claim 11 wherein said actuator includes a flexure providing a spring return force between said backing plate and said magnet.

13. A haptic feedback touch control as recited in claim 1 wherein said actuator oscillates said touch input device laterally.

14. A haptic feedback touch control as recited in claim 1 wherein said touch input device includes a plurality of different regions, wherein at least one of said regions provides said position signal and at least one other region provides a signal that is used by said computer to control a different function.

15. A haptic feedback touch control as recited in claim 14 wherein at least one of said regions is associated with a different haptic sensation output on said touch input device than another one of said regions.

16. A haptic feedback touch control as recited in claim 14 wherein a haptic sensation is output when said user moves a contacting object from one of said regions to another one of said regions.

17. A haptic feedback touch control as recited in claim 1 wherein said actuator is a first actuator, and further comprising at least one additional actuator coupled to said touch input device, wherein said actuators are E-core actuators that have been surface mounted to a printed circuit board.

18. A haptic feedback touch control for inputting signals to a computer and for outputting forces to a user of the touch control, the touch control comprising:

a touch input device including an approximately planar touch surface operative to provide a position signal based on a location on said touch surface which said user presses, said position signal representing said location in two dimensions, wherein said computer receives position information derived from said position signal;

a surface member located adjacent to said touch input device, wherein said user can contact said surface when pressing said touch input device; and

at least one actuator coupled to said surface member, said actuator outputting a force on said surface member to provide a haptic sensation to said user contacting said surface member, wherein said actuator outputs said force based on force information output by said computer.

19. A haptic feedback touch control as recited in claim 18 wherein said surface member is translated laterally, approximately in a plane parallel to said planar touch surface.

20. A haptic feedback touch control as recited in claim 19 wherein said surface member is positioned over said touch input device and at least approximately coextensive with said surface of said touch input device, such that said user presses said surface member to press said touch input device.

21. A haptic feedback touch control as recited in claim 20 wherein said actuator is a linear actuator.

22. A haptic feedback touch control as recited in claim 20 wherein said actuator is a rotary actuator, wherein a linkage converts a rotary output force to an approximately linear output force on said translated surface member.

23. A haptic feedback touch control as recited in claim 18 wherein said actuator is a voice coil actuator, wherein a wire coil is physically coupled to said surface member.

24. A haptic feedback touch control as recited in claim 18 wherein said surface member is positioned to a side of said touch input device such that said user touches said touch input device with one finger and touches said surface member with a different finger or palm.

25. A haptic feedback touch control as recited in claim 21 wherein said surface member is positioned over a physical button that is located adjacent to said touch input device.

26. A haptic feedback touch control as recited in claim 18 wherein said force on said surface member is a linear force output approximately perpendicularly to a surface of said surface member.

27. A haptic feedback touch control as recited in claim 26 wherein said linear force is an inertial force output by an actuator assembly that includes said actuator and moves an inertial

mass, wherein said inertial force is transmitted through said surface member to said user contacting said surface member.

28. A haptic feedback touch control as recited in claim 18 wherein said surface member is a palm surface coupled to a housing of said computer and located to the side of said touch input device.

29. A haptic feedback touch control as recited in claim 18 wherein sound electronics of said computer are used to drive said at least one actuator.

30. An actuator providing a linear force output, the actuator comprising:

a grounded ferromagnetic piece including a center pole located between two side poles;

a coil wrapped around said center pole;

a magnet positioned adjacent to said center pole and said side poles, wherein an air gap is provided between said magnet and said ferromagnetic piece; and

a backing plate coupled to said magnet, wherein said backing plate and said magnet move with respect to said grounded ferromagnetic piece when current is flowed in said coil.

31. An actuator as recited in claim 30 further comprising rollers positioned between said ferromagnetic piece and said backing plate to allow said relative motion between said backing plate and said ferromagnetic piece.

32. An actuator as recited in claim 31 wherein said rollers are constrained by a cage member.

33. An actuator as recited in claim 30 further comprising a flexure coupled between said backing plate and said ferromagnetic piece, said flexure reducing relative motion between said backing plate and said ferromagnetic piece in undesired directions and providing a spring centering force between said backing plate and said ferromagnetic piece.

34. An actuator as recited in claim 30 wherein an entire thickness of said actuator is approximately 4 millimeters or less.

35. A haptic touch device comprising:

a piezoelectric transducer coupled to a ground, said piezoelectric transducer including a metal diaphragm coupled to a ceramic element;

a planar sensing element operative to sense a location of a contact from a user on a surface of said planar sensing element and provide information representing said location to a computer controller;

a spacer provided between said piezoelectric transducer and said planar sensing element, wherein said metal diaphragm contacts said spacer; and

a spring element coupled between said planar sensing element and said ground, said spring element providing a spring restoring force to said planar sensing element.

36. A haptic touch device as recited in claim 35 wherein said piezoelectric transducer is driven with a signal approximately at a natural frequency of said haptic touch device.

37. A haptic touch device as recited in claim 35 wherein said natural frequency can be adjusted by adjusting a spring constant of said spring element or adjusting a mass of said spacer or said planar sensing element.

38. A method for providing haptic feedback to a touch input device that provides input to a computer device, said computer device implementing a graphical environment, the method comprising:

receiving a position signal from said touch input device, said position signal indicating a contact location on a surface of said touch input device where said user is pressing said surface;

determining in which of a plurality of regions said contact location is positioned, wherein said surface of said touch input device is divided into said plurality of regions; and

providing force information to cause at least one actuator to output a force to said user operating said touch input device, said force associated with said user moving an object on or over said surface of said touch input device.

39. A method as recited in claim 38 further comprising implementing a function associated with said region in which said contact location is positioned.

40. A method as recited in claim 39 wherein said function associated with said region includes a rate control function of a value.

41. A method as recited in claim 39 wherein said function associated with said region includes moving a displayed cursor to a screen position based on said position signal.

42. A method as recited in claim 39 wherein said function associated with said region includes a function that can also be initiated by selecting a graphical button displayed by an application program running on said computer device.

43. A method as recited in claim 38 wherein said force is output when said user moves said object over a boundary to said region in which said contact location is positioned from a different region of said touch input device.

44. A method as recited in claim 38 wherein said object moved on or over said surface of said touch input device includes a finger of said user or an object held by said user.

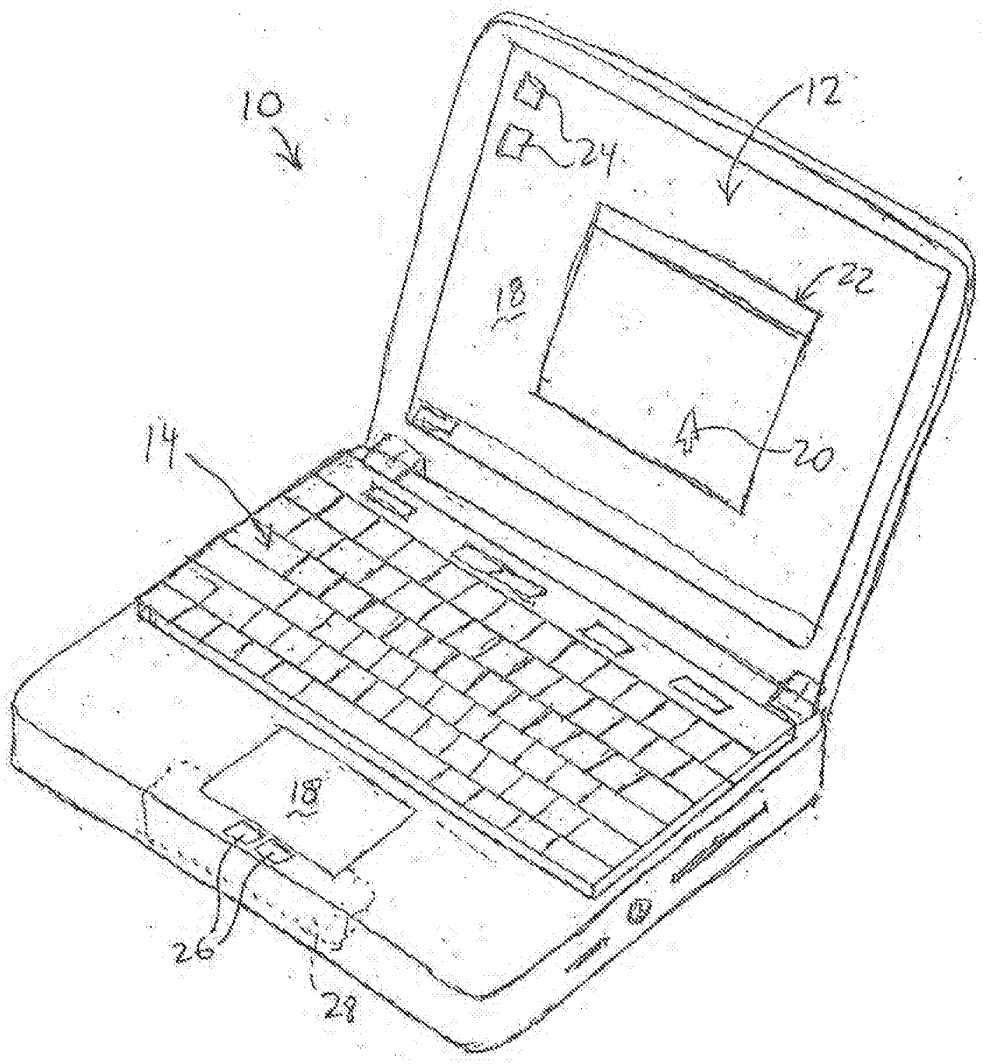


FIG. 1

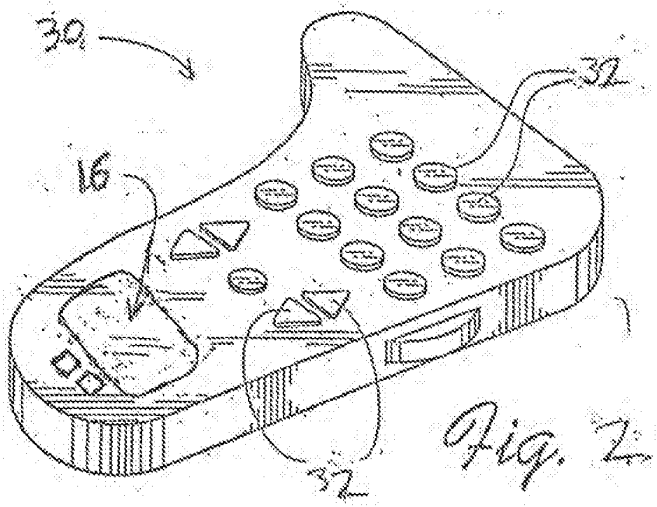


Fig. 2

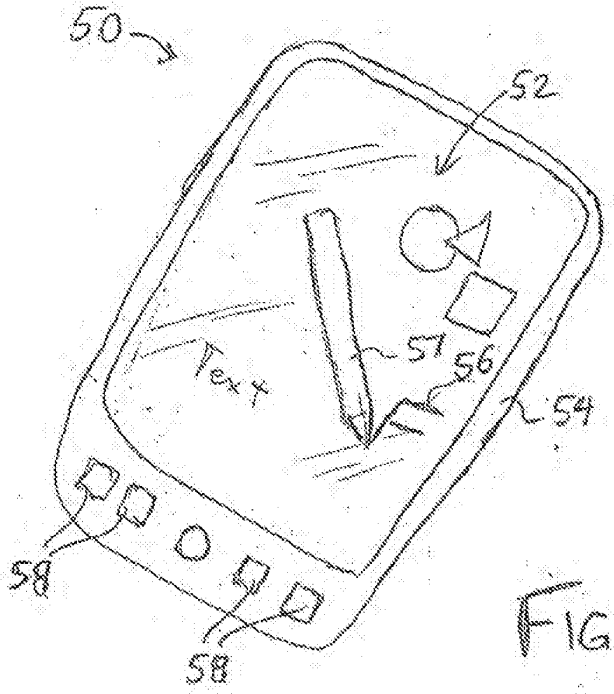


FIG. 3

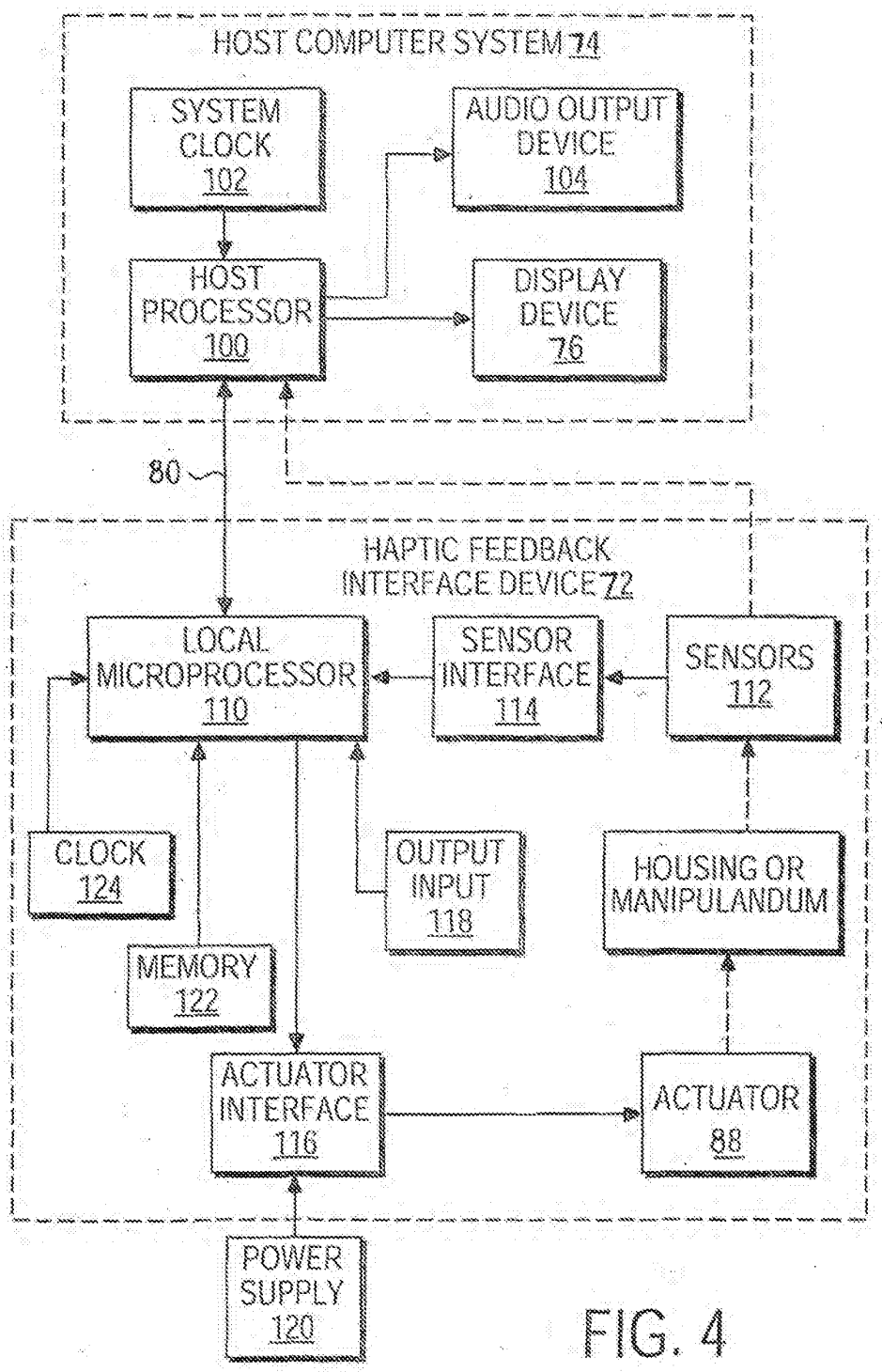

HOST COMPUTER SYSTEM 74
SYSTEM CLOCK 102
AUDIO OUTPUT DEVICE 104
HOST PROCESSOR 100
DISPLAY DEVICE 76
80
HAPTIC FEEDBACK INTERFACE DEVICE 72
LOCAL MICROPROCESSOR 110
SENSOR INTERFACE 114
SENSORS 112
CLOCK 124
OUTPUT INPUT 118
HOUSING OR MANIPULANDUM
MEMORY 122
ACTUATOR INTERFACE 116
ACTUATOR 88
POWER SUPPLY 120

FIG. 4

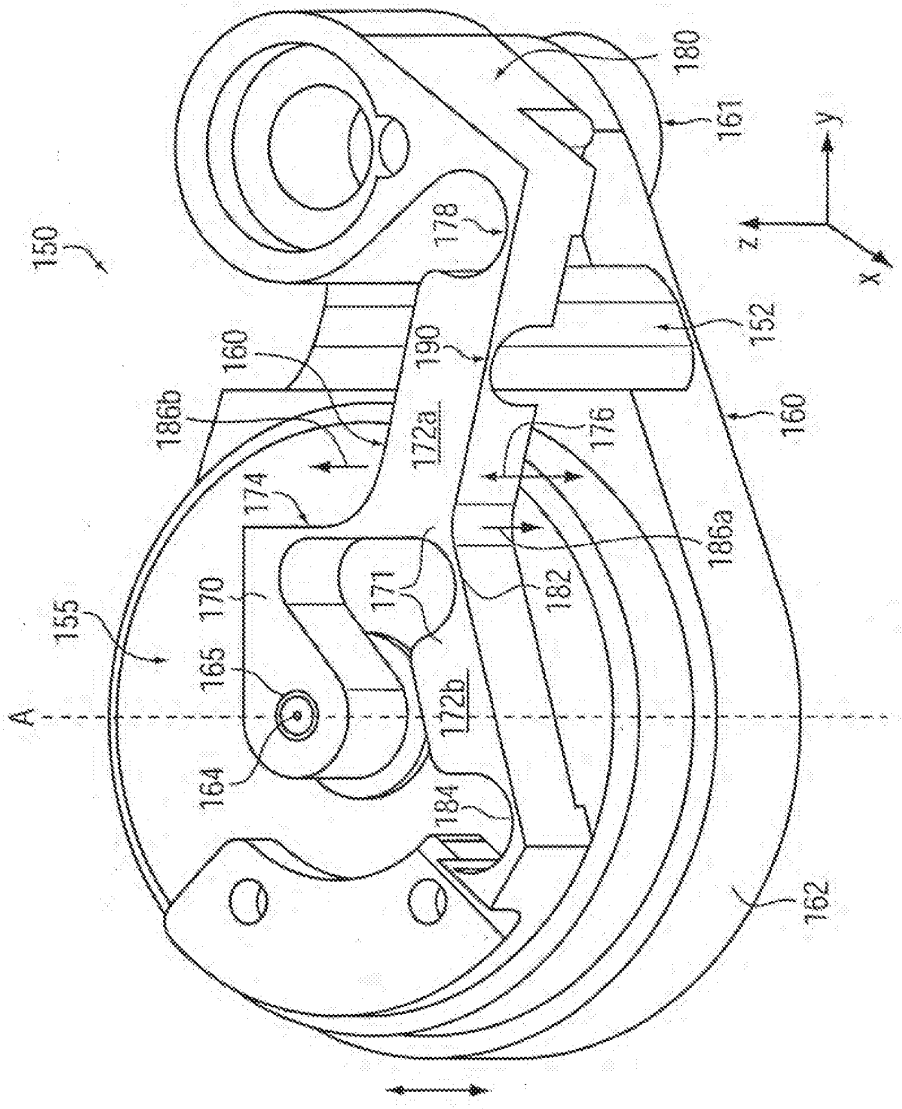


FIG. 5

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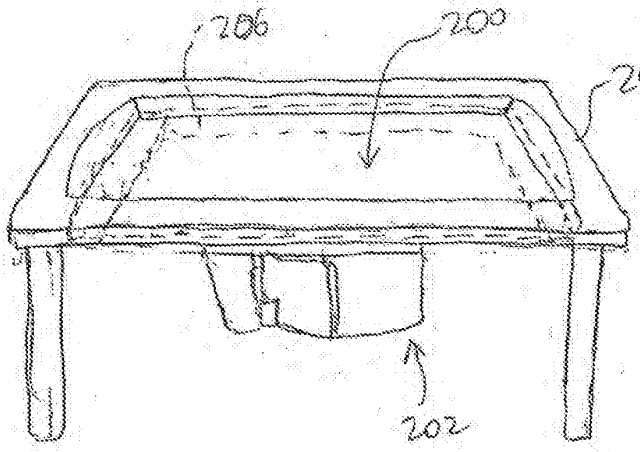
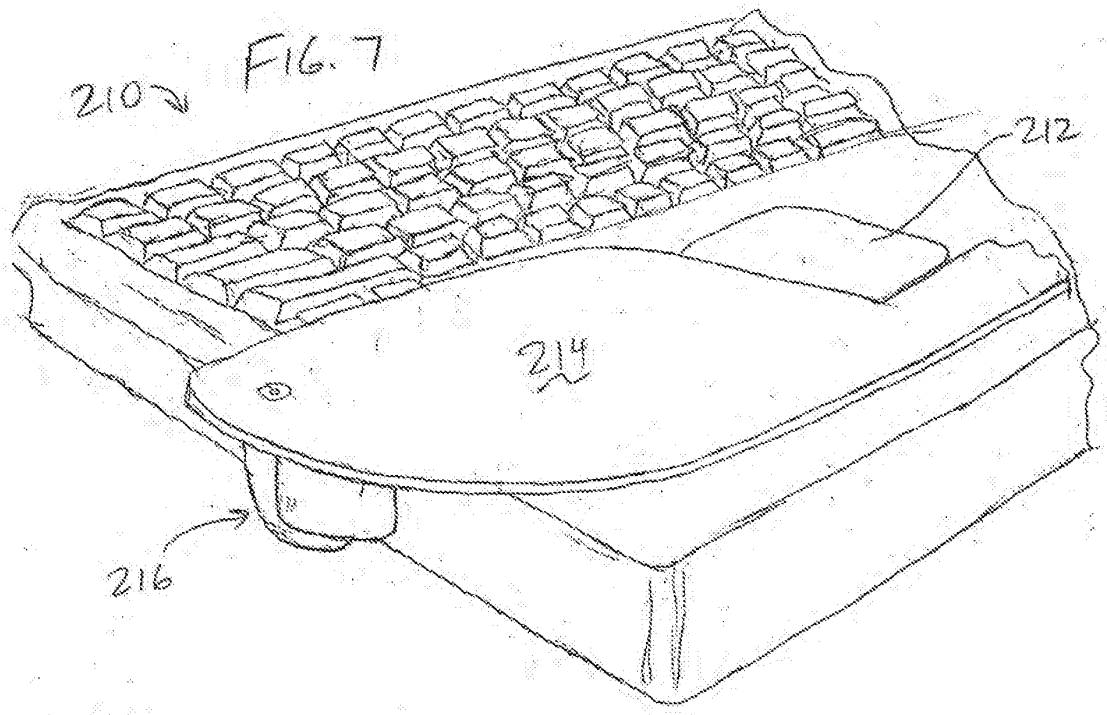


FIG. 6

FIG. 7



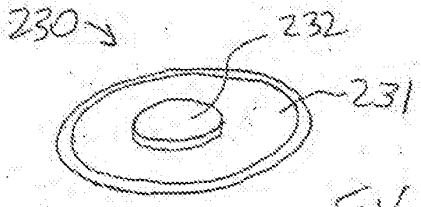


FIG. 8a

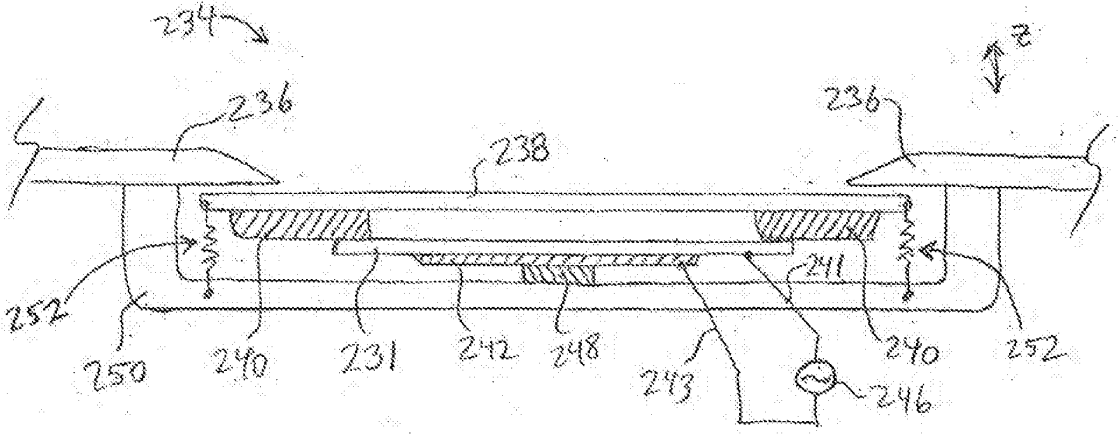


FIG. 8b

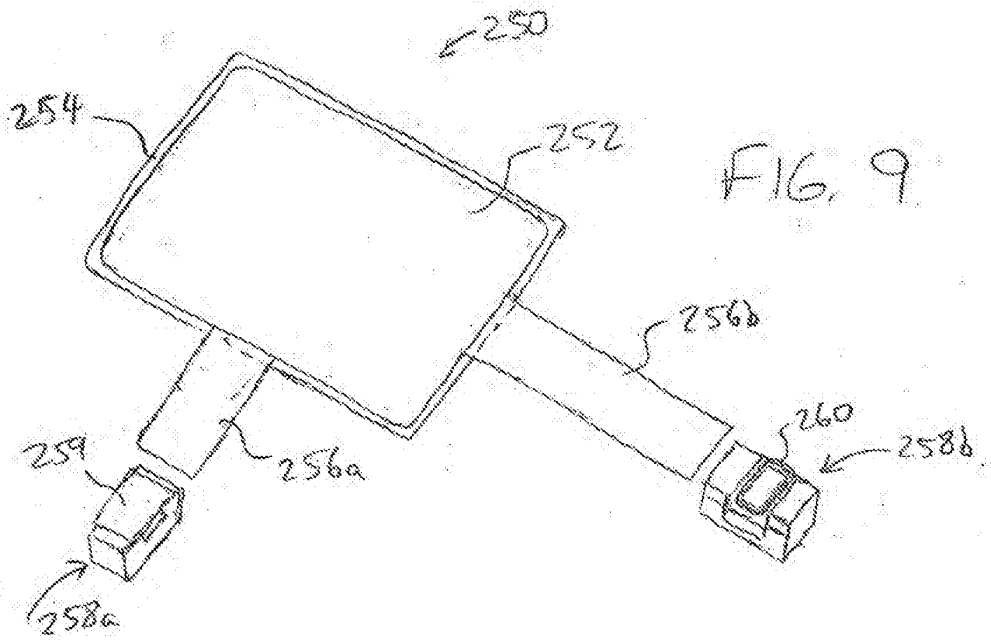

250
254
252
256b
260
258b
259
256a
258a

FIG. 9

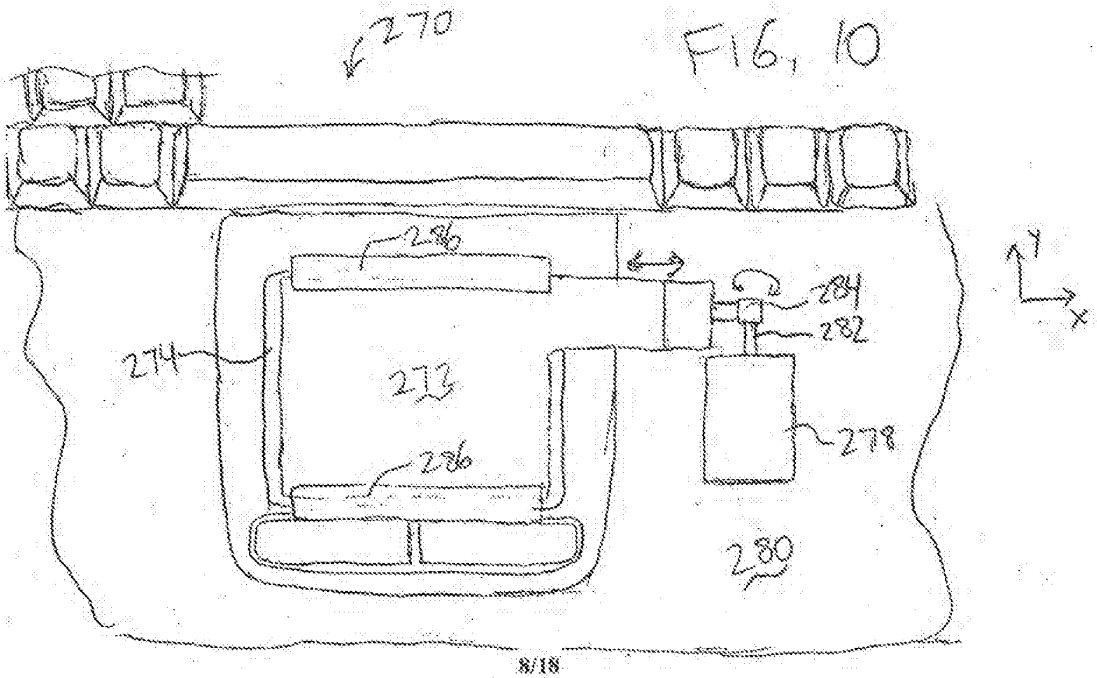
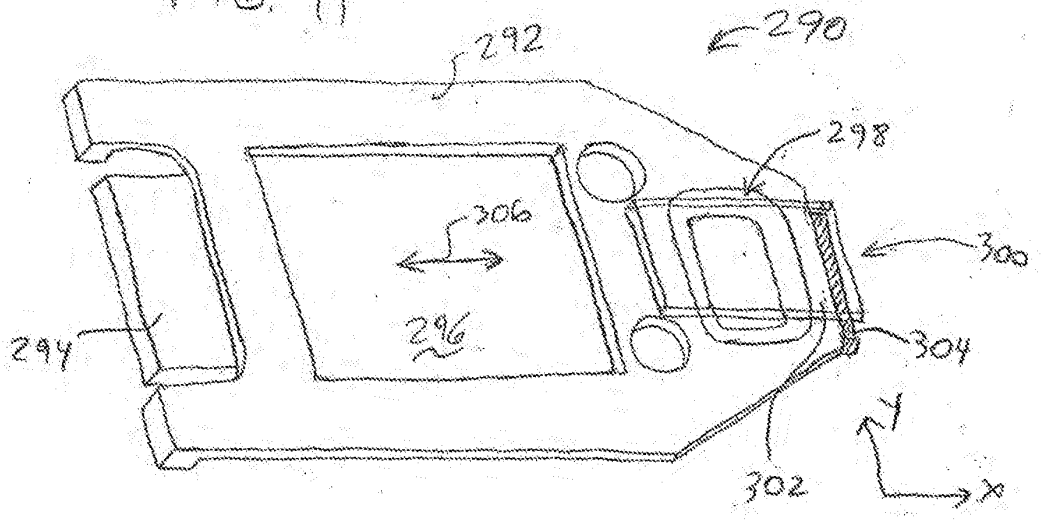

270
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284
282
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272
286
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Y
X

FIG. 10

FIG. 11



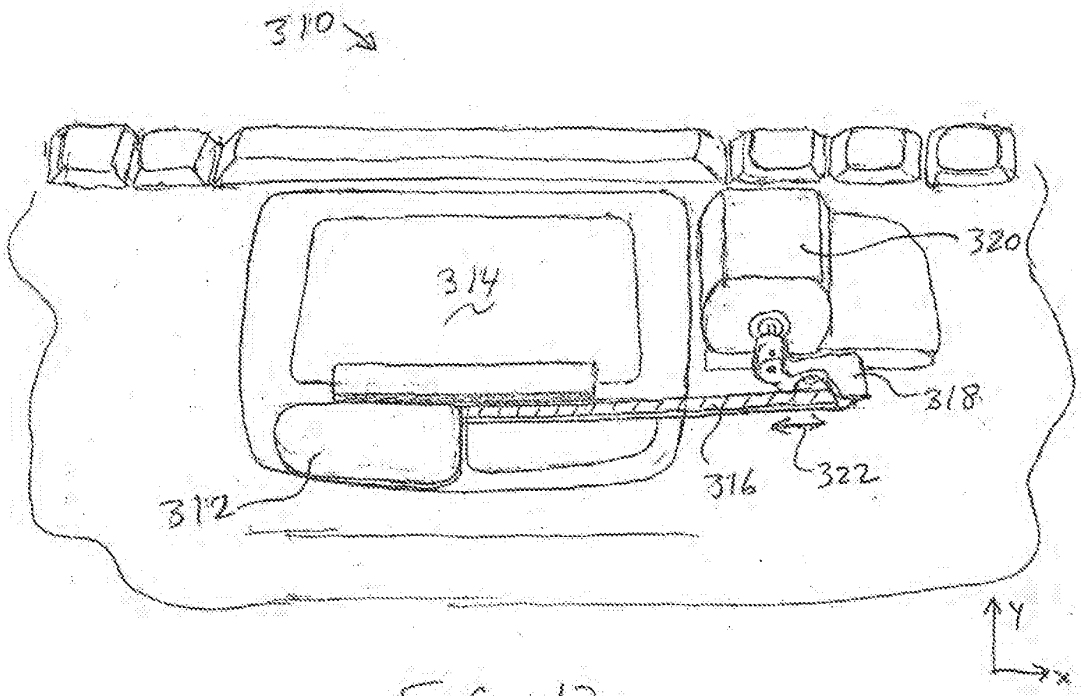


FIG. 12

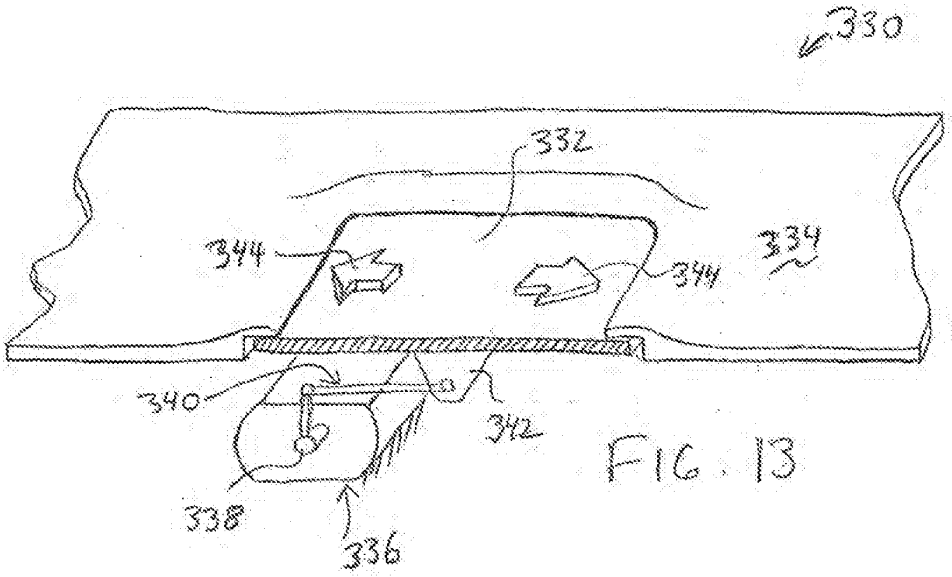

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FIG. 13

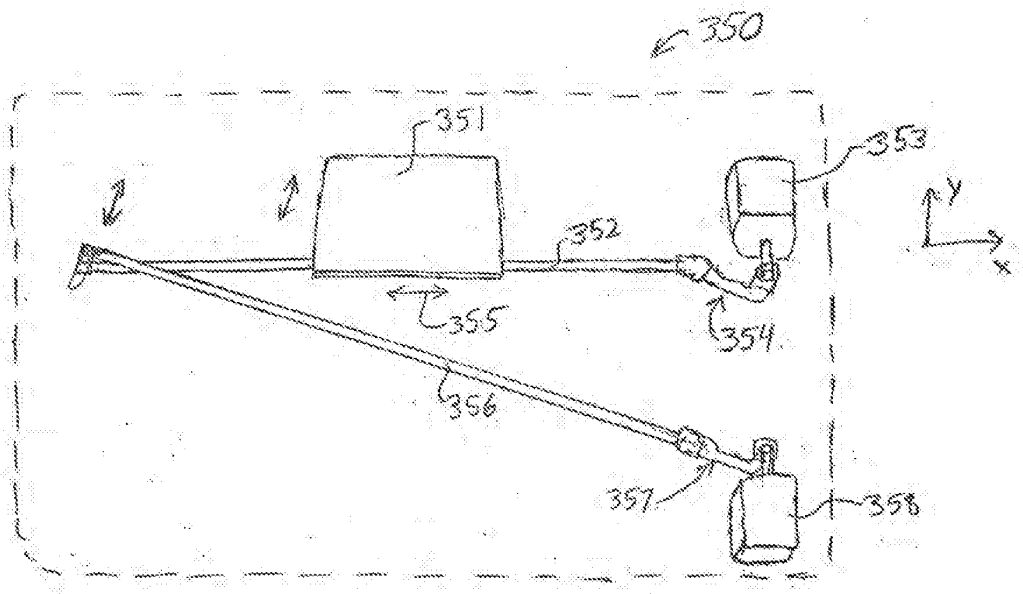
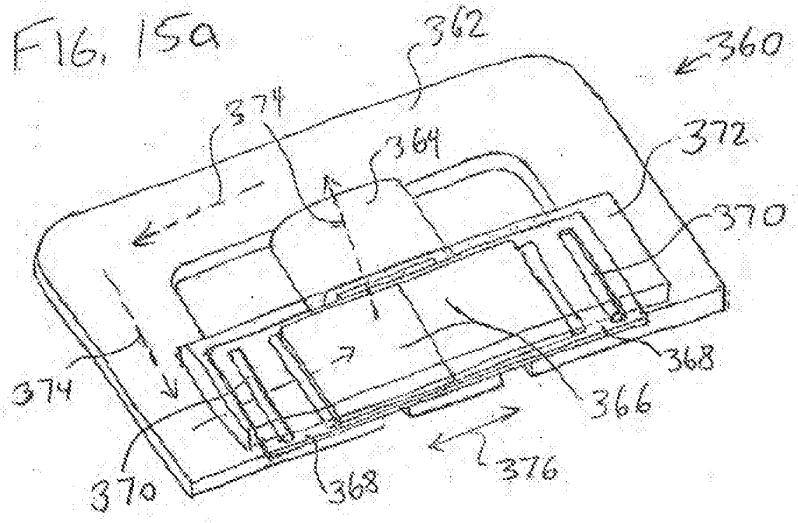

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x

FIG. 14

FIG. 15a



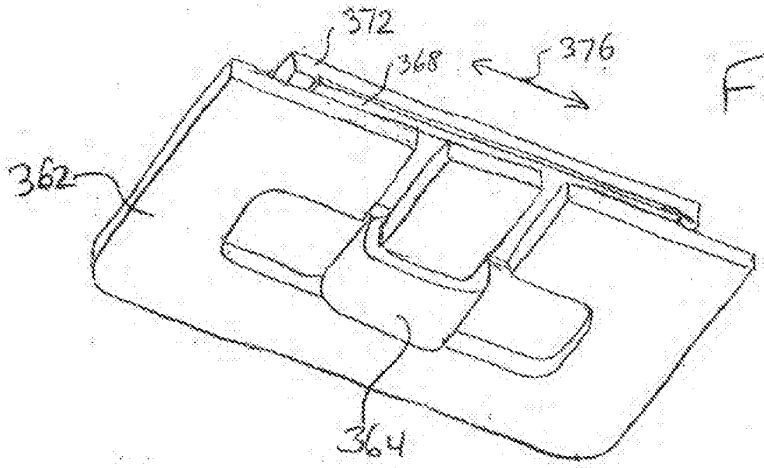
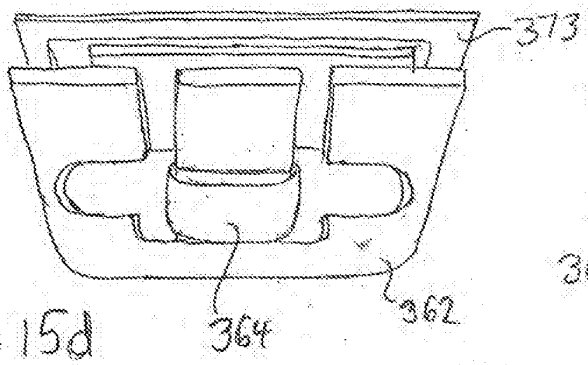


FIG. 15b



16. 15d

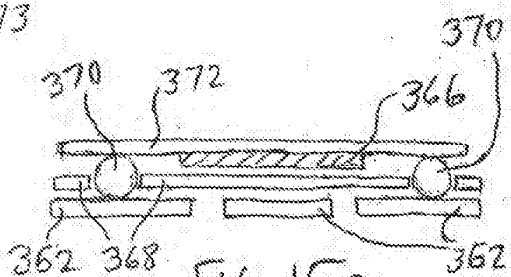
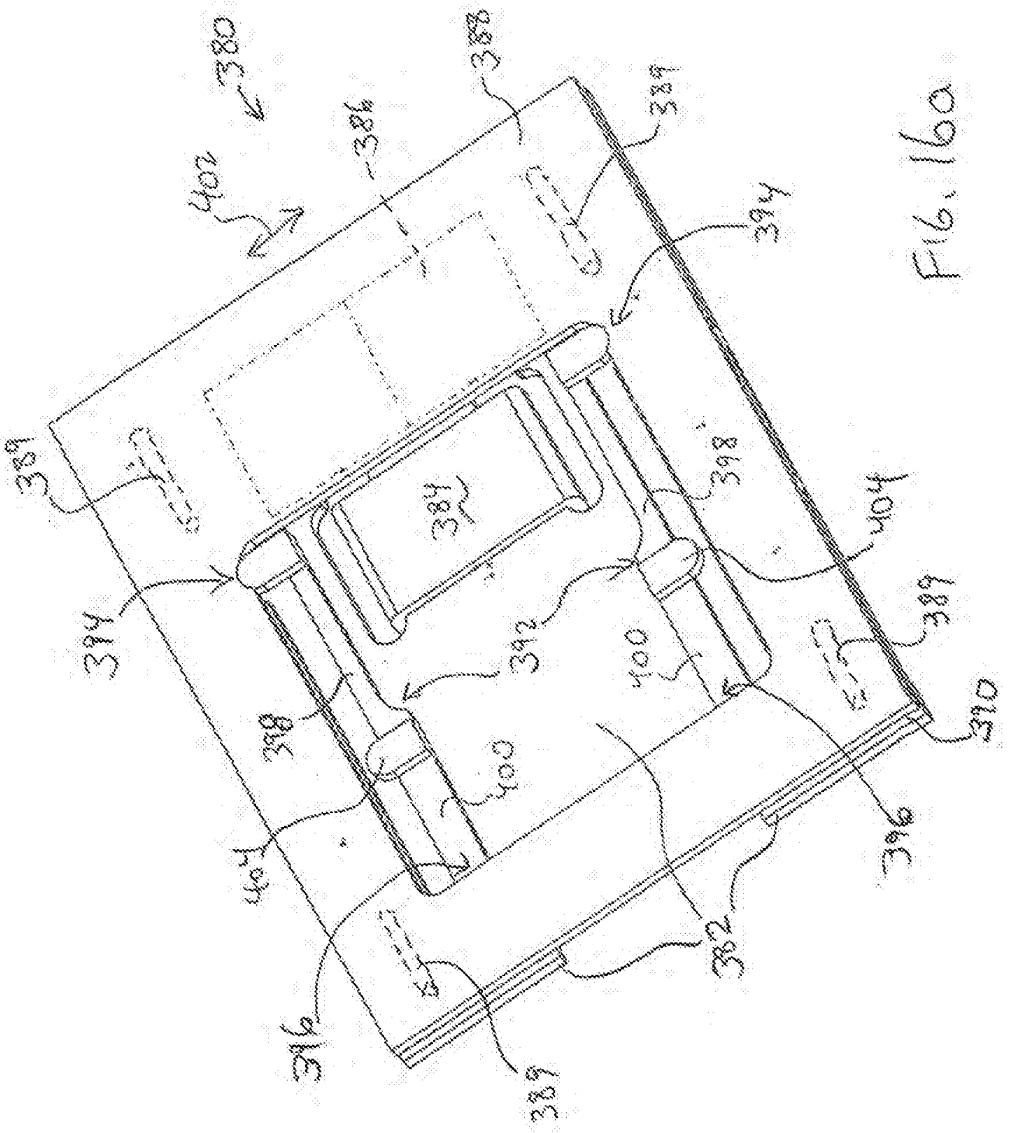


FIG. 15c


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FIG. 16a

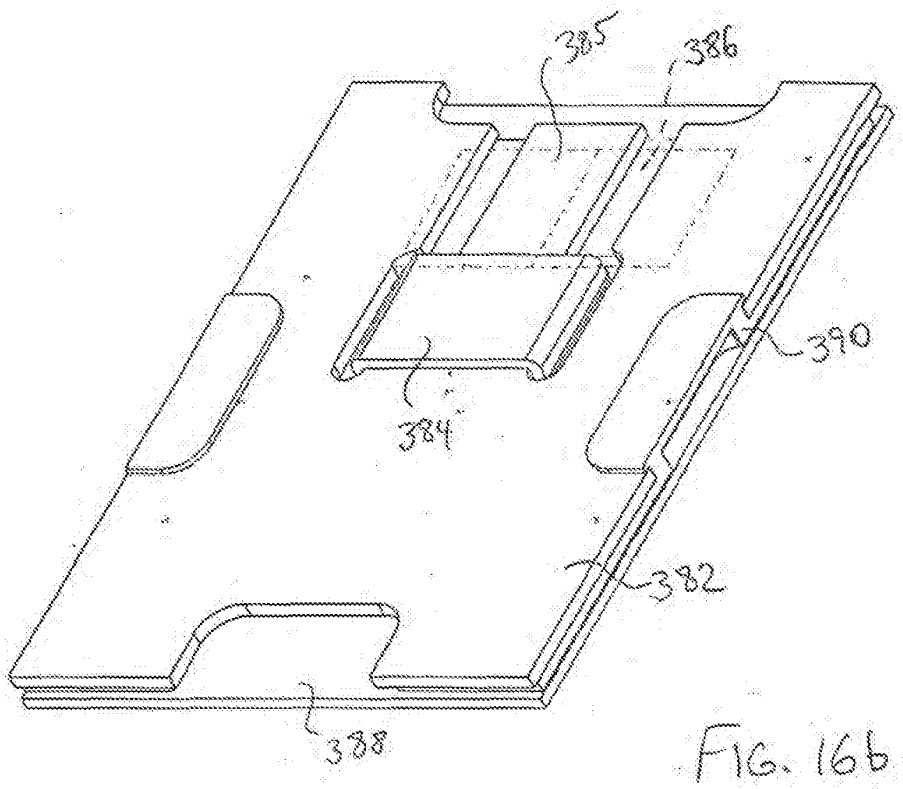


FIG. 16b

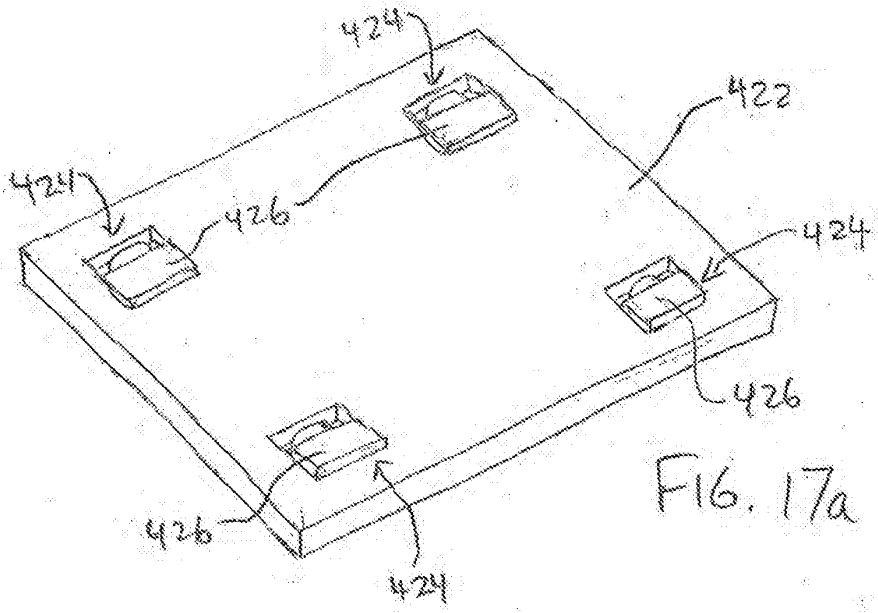


FIG. 17a

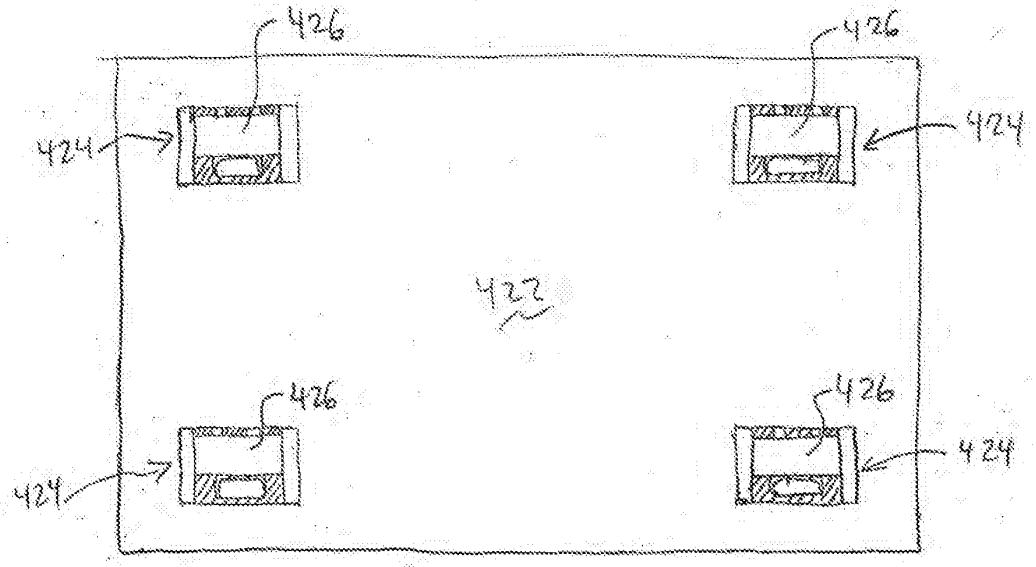


FIG. 17b

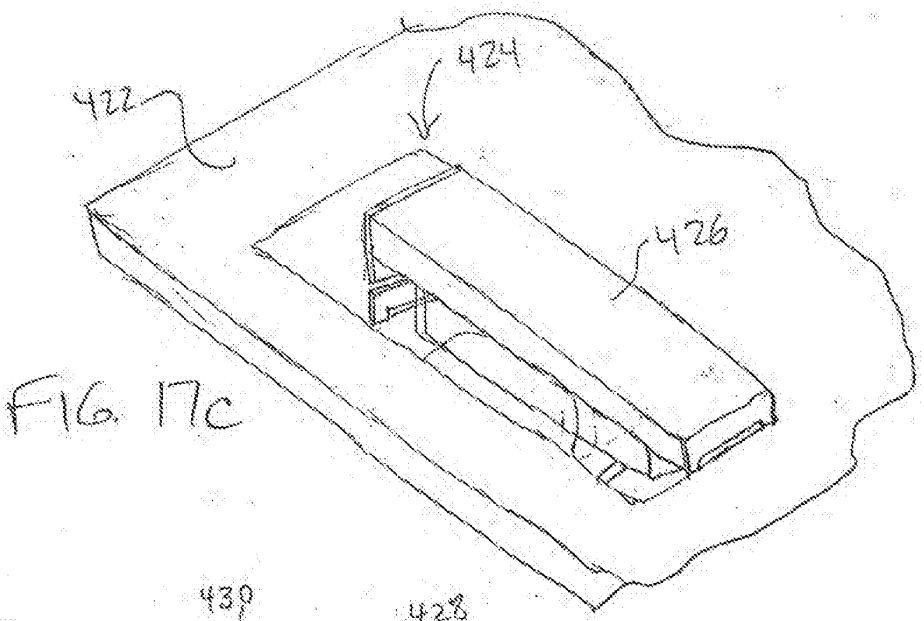


FIG. 17c

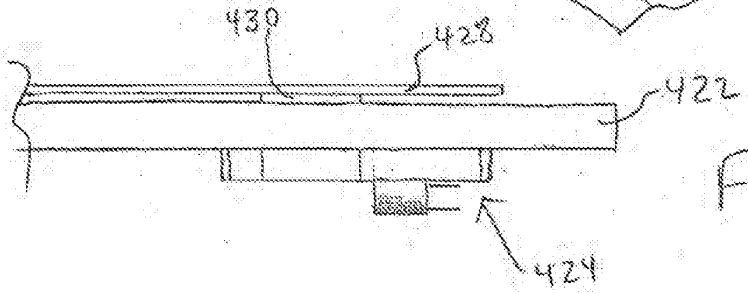


FIG. 17d

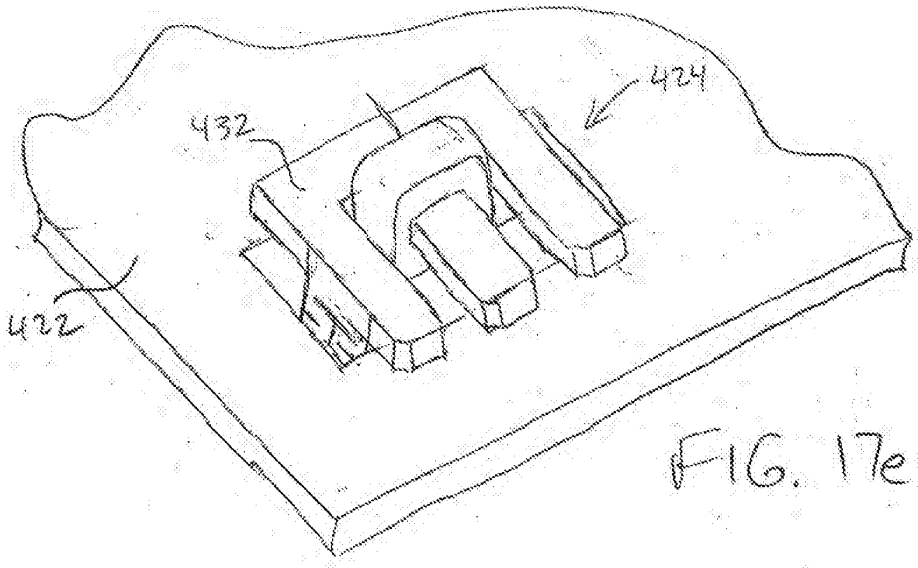
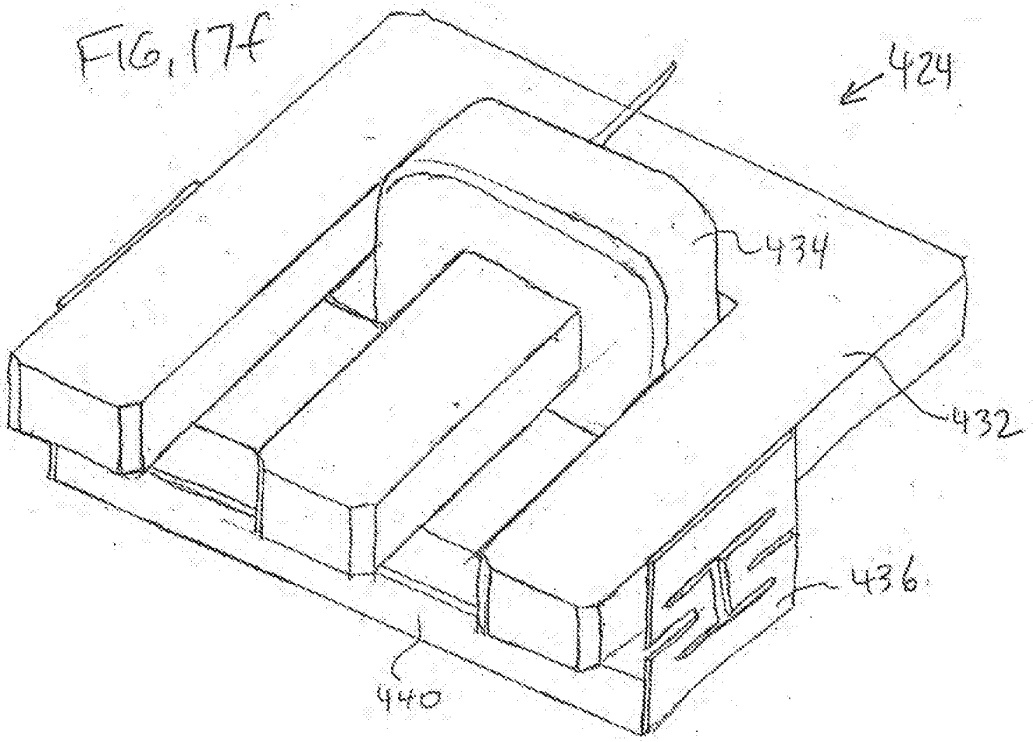


FIG. 17e

FIG. 17f



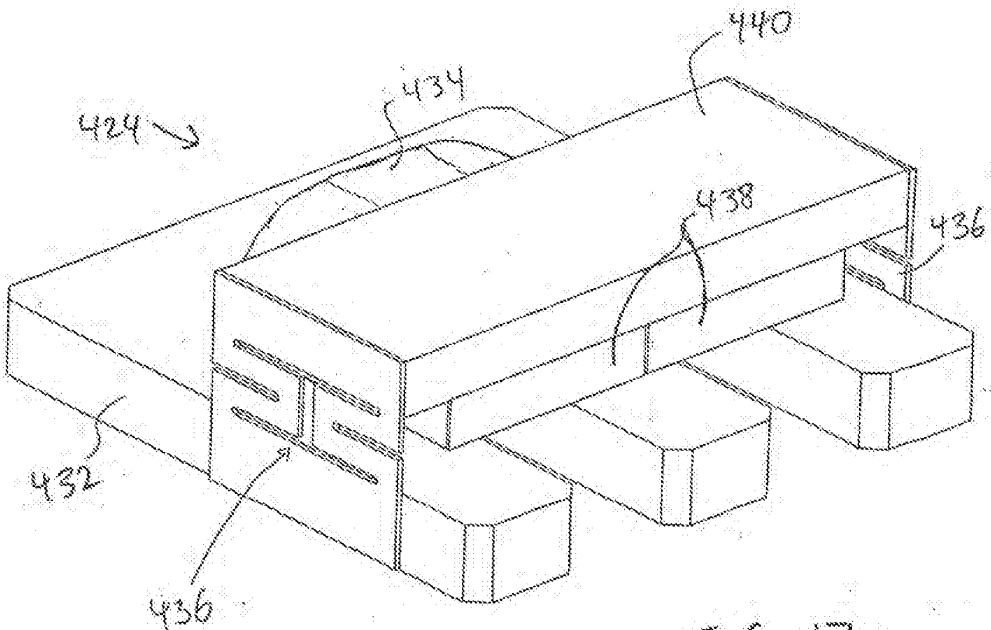


FIG. 17g

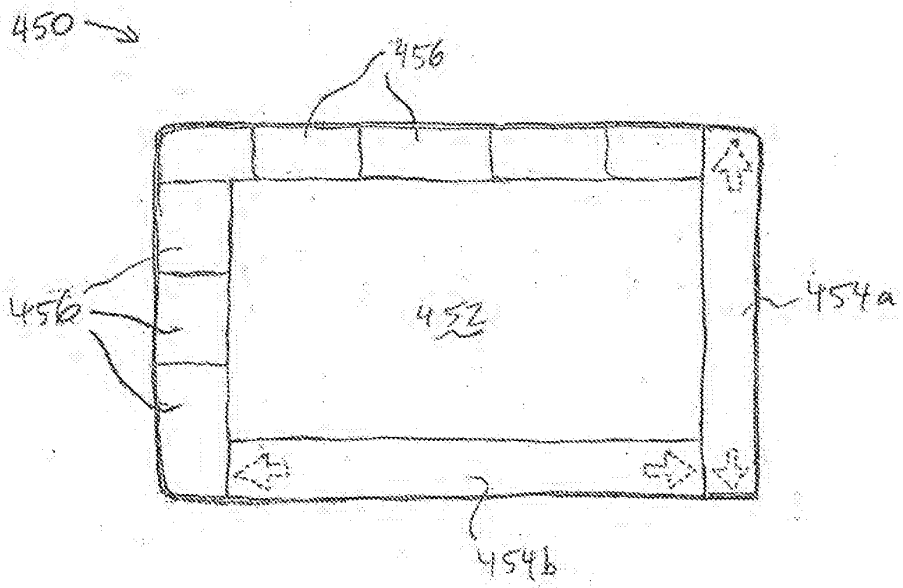


FIG. 18

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/07102

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G09G 5/00
US CL : 345/156, 157, 161, 169
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)
U.S. : 345/156, 157, 161, 169

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 practicable, search terms used)
WEST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5,988,902 A (HOLEHAN) 23 November 1999 (23.11.1999), see abstract.	1-44
A	US 5,887,995 A (HOLEHAN) 30 March 1999 (30.03.1999), see abstract.	1-44
A	US 4,692,756 A (CLARK) 08 September 1987 (08.09.1987), see column 3, lines 22-66.	1-44

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"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
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"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
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
09 May 2002 (09.05.2002)	12 JUN 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer: Ronald Laneau Telephone No. (703) 305-3975

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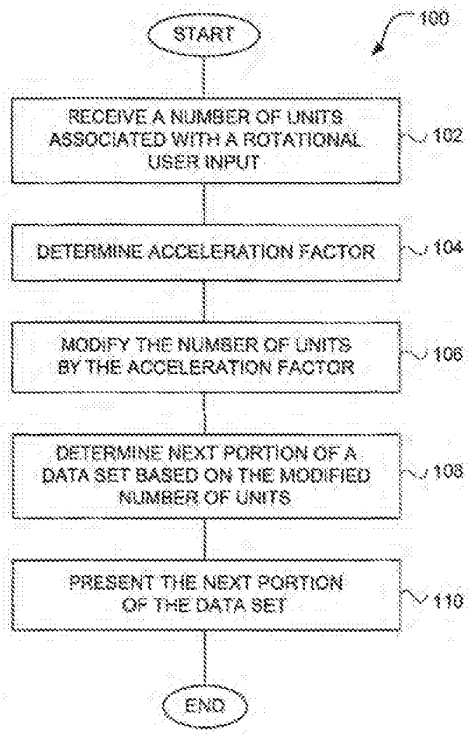
(74) Agent: OLYNICK, Mary, R.; Beyer Weaver & Thomas, LLP, P.O. Box 778, Berkeley, CA 94704-0778 (US).

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(54) Title: METHOD AND APPARATUS FOR ACCELERATED SCROLLING



(57) Abstract: Improved approaches for users to with graphical user interfaces of computing devices are disclosed. A rotational user action supplied by a user via a user input device can provide accelerated scrolling. The accelerated nature of the scrolling enables users to scroll or traverse a lengthy data set (e.g., list of items) faster and with greater ease. The amount of acceleration provided can be performed in successive stages, and/or performed based on the speed of the rotational user action. In one embodiment, the rotational user action is transformed into linear action with respect to a graphical user interface. The resulting acceleration effect causes the linear action to be enhanced such that a lengthy data set is able to be rapidly traversed.

WO 03/036457 A2

Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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.

Published:

— *without international search report and to be republished upon receipt of that report*

METHOD AND APPARATUS FOR ACCELERATED SCROLLING

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates generally to a computing device and, more particularly, to a handheld computing device having a rotational input unit.

Description of the Related Art

[0002] There exist today many styles of input devices for performing operations with respect to a consumer electronic device. The operations generally correspond to moving a cursor and making selections on a display screen. By way of example, the input devices may include buttons, switches, keyboards, mice, trackballs, touch pads, joy sticks, touch screens and the like. Each of these devices has advantages and disadvantages that are taken into consideration when designing the consumer electronic device. In handheld computing devices, the input devices are typically buttons and switches. Buttons and switches are generally mechanical in nature and provide limited control with regard to the movement of a cursor (or other selector) and the making of selections. For example, they are generally dedicated to moving the cursor in a specific direction (e.g., arrow keys) or to making specific selections (e.g., enter, delete, number, etc.). In the case of handheld personal digital assistants (PDAs), the input devices tend to utilize touch-sensitive display screens. When using a touch screen, a user makes a selection on the display screen by pointing directly to objects on the screen using a stylus or finger.

[0003] In portable computing devices such as laptop computers, the input devices are commonly touch pads. With a touch pad, the movement of an input pointer (i.e., cursor) corresponds to the relative movements of the user's

finger (or stylus) as the finger is moved along a surface of the touch pad. Touch pads can also make a selection on the display screen when one or more taps are detected on the surface of the touch pad. In some cases, any portion of the touch pad may be tapped, and in other cases, a dedicated portion of the touch pad may be tapped. In stationary devices such as desktop computers, the input devices are generally selected from keyboards, mice and trackballs. With a mouse, the movement of the input pointer corresponds to the relative movements of the mouse as the user moves the mouse along a surface. With a trackball, the movement of the input pointer corresponds to the relative movements of a ball as the user rotates the ball within a housing. Both mice and trackball devices generally include one or more buttons for making selections on the display screen.

[0004] In addition to allowing input pointer movements and selections with respect to a Graphical User Interface (GUI) presented on a display screen, the input devices may also allow a user to scroll across the display screen in the horizontal or vertical directions. For example, a mouse may include a scroll wheel that allows a user to simply roll the scroll wheel forward or backward to perform a scrolling action. In addition, touch pads may provide dedicated active areas that implement scrolling when the user passes his or her finger linearly across the active area in the x and y directions. Both devices may also implement scrolling via horizontal and vertical scroll bars that are displayed as part of the GUI. Using this technique, scrolling is implemented by positioning the input pointer over the desired scroll bar, selecting the desired scroll bar, and moving the scroll bar by moving the mouse or finger in the y direction (forwards and backwards) for vertical scrolling or in the x direction (left and right) for horizontal scrolling.

[0005] Further, consumer electronic products other than computers, such as cordless telephones, stereo receivers and compact-disc (CD) players, have used dials to enable users to select a phone number, a radio frequency and a specific CD, respectively. Here, typically, a limited-resolution display is used together with the dial. The display, at best, displays only a single item (number, frequency or label) in a low resolution manner using a character

generator LCD. In other words, these devices have used single line, low resolution LCD readouts.

[0006] Thus, there is always a need for improved user input devices that facilitate greater ease of use of computing devices.

SUMMARY OF THE INVENTION

[0007] The present invention relates to improved approaches for users of computing devices to interact with graphical user interfaces. A rotational user action supplied by a user via a user input device can provide accelerated scrolling. The accelerated nature of the scrolling enables users to scroll or traverse a lengthy data set (e.g., list of items) faster and with greater ease. The amount of acceleration provided can be performed in successive stages, and/or performed based on the speed of the rotational user action. In one embodiment, the rotational user action is transformed into linear action with respect to a graphical user interface. The resulting acceleration effect causes the linear action to be enhanced such that a lengthy data set is able to be rapidly traversed. Other aspects and features of the invention will become apparent below. Although the type of computing device can vary, the invention is particularly well-suited for use with a media player.

[0008] The invention can be implemented in numerous ways, including as a method, system, device, apparatus, graphical user interface, or computer readable medium. Several embodiments of the invention are discussed below.

[0009] As a method for scrolling through portions of a data set, one embodiment of the invention includes at least the acts of: receiving a number of units associated with a rotational user input; determining an acceleration factor pertaining to the rotational user input; modifying the number of units by the acceleration factor; determining a next portion of the data set based on the modified number of units; and presenting the next portion of the data set.

[0010] As a method for scrolling through portions of a data set associated with a handheld electronics device, one embodiment of the invention includes at least the acts of: receiving a rotational user input; determining an

acceleration value pertaining to the rotational user input; and scrolling to a next portion of the data set based on at least the acceleration value. The acceleration value specifies a degree of acceleration associated with the rate at which the scrolling through the portions of the data set is to be achieved.

[0011] As a method for scrolling through portions of a data set associated with a handheld electronics device, another embodiment of the invention includes at least the acts of: receiving a rotational user input; determining whether or not to provide acceleration with respect to the rotational user input; and scrolling to a next portion of the data set in either an accelerated manner when the determining determines that acceleration is to be provided, or in an unaccelerated manner when the determining determines that acceleration is not to be provided.

[0012] As a method for scrolling through portions of a file, one embodiment of the invention includes at least the acts of: receiving a number of units from a rotational input device; determining a speed of rotation for the rotational input device; applying acceleration when the speed of rotation is greater than a speed threshold; removing any acceleration being applied when the speed of rotation is less then the speed threshold; modifying the number of units in accordance with the acceleration, if any; determining a next portion of the file based on the modified number of units; and presenting the next portion of the file.

[0013] As a portable media player, one embodiment of the invention includes at least: a storage disk drive that stores media content for each of a plurality of media items; a display screen that displays a portion of the media items at a time; a user input device that enables a user of the portable media player to at least scroll through the plurality of media items using a rotational action with respect to the user input device; and a processor that determines a rate of scrolling and thus determines a next portion of the media items to be displayed

[0014] As a method for displaying a portion of a list of media items on a display of a media player, the media player having a rotational input device, one embodiment of the invention includes at least the acts of: determining a

rate of turn of the rotational input device; obtaining a length of the list of media items; determining a next portion of the list of media items to be displayed based on the rate of the turn of the rotational input device and the length of the list of media items; and displaying the next portion of the list of media items.

[0015] As a method for displaying a portion of a list of items on a display of a computing device, the computing device having a rotational input device, one embodiment of the invention includes at least the acts of: determining an indication of turning of the rotational input device; determining a next portion of the list of items to be displayed based on the indication of turning of the rotational input device; and displaying the next portion of the list of items.

[0016] As a consumer electronics product, one embodiment of the invention includes at least: a storage disk that stores a plurality of media items; a display for displaying a first portion of the plurality of media items; and a user input device that enables a user of the consumer electronics product to at least scroll through a list of the plurality of media items in accordance with a user-controlled scroll rate; and a processor. The processor determines an acceleration factor for use in scrolling through the list of the plurality of media items and causes the consumer electronics product to display a second portion of the plurality of media items. The location of second portion of the plurality of media items within the list of the plurality of media items is dependent on at least the user-controlled scroll rate and the acceleration factor.

[0017] Other aspects and advantages of the invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

FIG. 1 is a flow diagram of scroll processing according to one embodiment of the invention.

FIG. 2 is a flow diagram of list navigation processing according to another embodiment of the invention.

FIG. 3 is a flow diagram of acceleration amount processing according to one embodiment of the invention.

FIG. 4 is a flow diagram of acceleration amount processing according to another embodiment of the invention.

FIG. 5 is a representative acceleration state machine according to one embodiment of the invention.

FIG. 6 is a flow diagram of next portion determination processing according to one embodiment of the invention.

FIG. 7A is a perspective diagram of a computer system in accordance with one embodiment of the invention.

FIG. 7B is a perspective diagram of a media player in accordance with one embodiment of the present invention.

FIG. 8A is a block diagram of a media player according to one embodiment of the invention.

FIG. 8B is a block diagram of a computing system according to one embodiment of the invention.

FIG. 9 shows the media player of FIG. 7B being used by a user in accordance with one embodiment of the invention.

FIG. 10A is a flow diagram of user input processing according to one embodiment of the invention.

FIG. 10B is a flow diagram of user input processing according to another embodiment of the invention.

FIG. 11 is a flow diagram of user input processing according to another embodiment of the invention.

FIG. 12 is a block diagram of a rotary input display system in accordance with one embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

[0019] The present invention relates to improved approaches for users of computing devices to interact with graphical user interfaces. A rotational user action supplied by a user via a user input device can provide accelerated scrolling. The accelerated nature of the scrolling enables users to scroll or traverse a lengthy data set (e.g., list of items) faster and with greater ease. The amount of acceleration provided can be performed in successive stages, and/or performed based on the speed of the rotational user action. In one embodiment, the rotational user action is transformed into linear action with respect to a graphical user interface. The resulting acceleration effect causes the linear action to be enhanced such that a lengthy data set is able to be rapidly traversed. Other aspects and features of the invention will become apparent below. Although the type of computing device can vary, the invention is particularly well-suited for use with a media player.

[0020] Embodiments of the invention are discussed below with reference to FIGs. 1 - 12. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these figures is for explanatory purposes as the invention extends beyond these limited embodiments.

[0021] FIG. 1 is a flow diagram of scroll processing 100 according to one embodiment of the invention. The scroll processing 100 assists a user in scrolling through a data set. The scroll processing 100 initially receives 102 a number of units associated with a rotational user input. The number of units is an indication of an amount of rotational movement a user has invoked with respect to a rotational input device.

[0022] Next, an acceleration factor is determined 104. The acceleration factor is an indication of the degree of acceleration to be utilized with the scroll processing 100. After the acceleration factor is determined 104, the number of units that are associated with the rotational user input is modified 106 by the acceleration factor. In one embodiment, the number of units is modified by multiplication with the acceleration factor. In various other embodiments, the number of units can be modified in various other ways.

[0023] After the number of units has been modified 106, a next portion of the data set that is being scrolled through can be determined 108 based on the modified number of units. Once the next portion has been determined 108, the next portion of the data set can be presented 110. Typically, the next portion of the data set associated with the scroll processing 100 is presented 110 to the user that caused the rotational user input. In one embodiment, the next portion of the data set can be presented 110 to the user by displaying the next portion of the data set on a display device. In another embodiment of the invention, the next portion of the data set can be presented 110 to the user by displaying the next portion of the data set with at least one item distinctively or distinguishly displayed (e.g., highlighted) from the other items. In still another embodiment, the next portion of the data set can be presented 110 to the user by playing or executing a file. After the next portion of the data set has been presented 110, the scroll processing 100 is complete and ends. However, the scroll processing 100 will repeat for each rotational user input.

[0024] Here, the faster the rate of rotational user input, the further down a list the next item becomes. It should be noted that the rate of rotational user input can be relative or absolute in nature. Still further, the rate of rotational user input need not be an actual velocity value, but could be a count or other value that is proportional to or influenced by the rate of rotational user input.

[0025] A data set as used herein pertains to a set of data. As one example, the data set can be a list of items (e.g., a list of songs). As another example, the data set can be a media file (e.g., MP3 or other audio file, video file, or image file). In one embodiment, the data set can be considered a sequential data set because the data within the set is often sequential. For

example, the songs in a list are arranged sequentially and the data within an audio file are also arranged sequentially.

[0026] FIG. 2 is a flow diagram of list navigation processing 200 according to another embodiment of the invention. The list navigation processing 200 initially determines 202 a rate of rotational user input (e.g., dial turn). The rotational user input is provided through user interaction with a rotational input device. A list length is then obtained 204 and a current item in the list is identified. Typically, the current item is the item in the list that is being displayed. In one embodiment, the current item is highlighted such that it is distinctively displayed from other items of the list that are simultaneously displayed.

[0027] A next item in the list to be displayed is then determined 206 based on the rotational user input. The determination 206 of the next item in the list can also be dependent on the list length and the current item in the list. For example, the greater the rate of the rotational user input, the further apart the next item is from the current item in the list. The rate of the rotational user input and the length of the list can affect whether acceleration (e.g., acceleration factor) is provided for navigating the list. Thereafter, the list navigation processing 200 displays 208 a next item and one or more subsequent (or neighboring) items thereto. For example, the next item and the one or more subsequent items can be displayed 208 by a display screen produced by a display device. Additionally, the list navigation processing 200 can provide 210 an audio feedback. The audio feedback provides an audible sound that indicates feedback to the user as to the rate at which the items in the list are being traversed. The audible feedback can thus also be proportional to the rate of rotational user input.

[0028] FIG. 3 is a flow diagram of acceleration amount processing 300 according to one embodiment of the invention. The acceleration amount processing 300 is, for example, processing that can be performed to determine an acceleration factor. In one embodiment, the acceleration amount processing 300 is, for example, suitable for use as the operation 104 illustrated in FIG. 1. In another embodiment, the acceleration amount

processing 300 is, for example, suitable for use as a sub-operation for the operation 206 illustrated in FIG. 2.

[0029] The acceleration amount processing 300 initially determines 302 a speed of a rotational user input. As previously noted with respect to FIG. 1, the rotational user input is provided by a rotational input device that is interacted with by a user. In one embodiment, the speed of the rotational user input is determined 302 based on the number of rotational units identified by the rotational user input. More particularly, in another embodiment, the speed of the rotational user input is determined 302 based on the number of rotational units and an amount of time over which such rotational inputs were received. The speed of the rotational user input can, for example, be considered to be the speed of a user movement or the speed of rotation of a rotational input device.

[0030] After the speed of the rotational user input has been determined 302, a decision 304 determines whether the speed of the rotational user input is slow. The speed of the rotational user input can be determined or estimated, directly or indirectly, in a variety of ways. In one embodiment, a threshold is used to distinguish between slow and fast speeds of the rotational user input. The precise rate of rotation that is deemed to be the threshold between slow and fast can vary with application. The threshold can be determined experimentally based upon the particular application for which the acceleration amount processing 300 is utilized.

[0031] Once the decision 304 determines that the speed of the rotational user input is slow, then the acceleration factor (AF) is set 306 to zero (0). On the other hand, when the decision 304 determines that the speed of the rotational user input is not slow (i.e., the speed is fast), then a decision 308 determines whether an amount of time ($\Delta t1$) since the last time the acceleration was altered exceeds a first threshold (TH1). When the decision 308 determines that the amount of time ($\Delta t1$) since the last acceleration update is longer than the first threshold amount (TH1), then the acceleration factor is modified 310. In particular, in this embodiment, the modification 310 causes the acceleration factor to be doubled.

[0032] Following the operation 310, as well as following the operation 306, an acceleration change time is stored 312. The acceleration change time

reflects the time that the acceleration factor was last updated. The acceleration change time is stored such that the decision 308 understands the amount of time since the acceleration was last modified (i.e., $\Delta t1$). Following the operation 312, as well as directly following the decision 308 when the amount of time since the last acceleration update was made is less than the first threshold (TH1), the acceleration amount processing 300 is complete and ends.

[0033] Hence, according to the acceleration amount processing 300, when the speed of the rotational user input is deemed slow, the acceleration factor is reset to zero (0), which indicates that no acceleration effect is imposed. On the other hand, when the speed of the rotational user input indicates that the speed of such rotation is fast, then the acceleration effect being imposed is doubled. In effect, then, if the user interacts with the rotational input device such that the speed of rotation is slow, then no acceleration effect is provided. In such case, the user can scroll through a data set (e.g., list, audio file) with high resolution. On the other hand, when the user interacts with the rotational input device with a high speed of rotation, then the acceleration effect is step-wise increased (e.g., via doubling or other means). The acceleration effect provided by the invention enables a user to interact with a rotational input device in an efficient, user-friendly manner such that long or extensive data sets can be scrolled through in a rapid manner.

[0034] FIG. 4 is a flow diagram of acceleration amount processing 400 according to another embodiment of the invention. The acceleration amount processing 400 is generally similar to the acceleration amount processing 300 illustrated in FIG. 3. However, the acceleration amount processing 400 includes additional operations that can be optionally provided. More specifically, the acceleration amount processing 400 can utilize a decision 402 to determine whether a duration of time ($\Delta t2$) since the last rotational user input is greater than a second threshold (TH2). When the decision 402 determines that the duration of time ($\Delta t2$) since the last rotational user input exceeds the second threshold (TH2), then the acceleration factor is reset 306 to zero (0). Here, when the user has not provided a subsequent rotational user input for more than the duration of the second threshold (TH2), then the acceleration amount processing 400 is reset to no acceleration because it

assumes that the user is restarting a scrolling operation and thus would not want to continue with a previous accelerated rate of scrolling.

[0035] The rate at which the acceleration effect is doubled is restricted such that the doubling (i.e., operation 310) can only occur at a rate below a maximum rate. The acceleration amount processing 400 also includes a decision 404 that determines whether the acceleration factor (AF) has reached a maximum acceleration factor (AF_{MAX}). The decision 404 can be utilized to limit the maximum acceleration that can be imposed by the acceleration amount processing 400. For example, the acceleration factor (AF) could be limited to a factor of eight (8), representing that with maximum acceleration scrolling would occur at a rate eight (8) times faster than non-accelerated scrolling.

[0036] Still further, the acceleration amount processing 400 stores 406 a last input time. The last input time (t2) represents the time the last rotational user input was received (or processed). Note that the duration of time ($\Delta t2$) can be determined by the difference between a current time associated with an incoming rotational user input and the last input time (t2).

[0037] As previously noted, the acceleration amount processing 300, 400 is, for example, processing that can be performed to determine an acceleration factor. However, although not depicted in FIGs. 3 or 4, when the length of the data set (e.g., list) is short, then the acceleration can be set to zero (i.e., no acceleration) and the acceleration amount processing 300, 400 can be bypassed. For example, in one embodiment, where the data set is a list, if the display screen can display only five (5) entries at a time, then the list can be deemed short if it does not include more than twenty (20) items. Consequently, according to another embodiment of the invention, the acceleration effect imposed by the invention can be dependent on the length of the data set (e.g., list).

[0038] The accelerated scrolling can also be depicted as a state machine having states representing different acceleration levels or different rates of acceleration. The particulars of such a state machine will vary widely with implementation.

[0039] FIG. 5 is a representative acceleration state machine 500 according to one embodiment of the invention. The acceleration state machine 500 has

four states of acceleration. A first state 502 provides no acceleration. From the first state 502, when the speed of a next rotational user input is slow, the acceleration state machine 500 remains at the first state 502. Alternatively, when the speed of the rotational user input is fast, the acceleration state machine 500 transitions from a first state 502 to a second state 504. The second state 504 provides 2x acceleration, meaning that the resulting rate of scrolling would be twice that of the first state. When the acceleration state machine 500 is at the second state 504, when the speed of a next rotational user input is slow, the acceleration state machine 500 transitions back to the first state 502. Alternatively, when the speed of the next rotational user input is fast, the acceleration state machine 500 transitions from the second state 504 to a third state 506. The third state 506 provides 4x acceleration, meaning that the rate of scrolling would be four times that of the first state 502 or twice that of the second state 504. At the third state 506, when the speed of the next rotational user input is slow, the acceleration state machine 500 transitions from the third state 506 to the first state 502. Alternatively, when the speed of the next rotational user input is fast, the acceleration state machine 500 transitions from the third state 506 to a fourth state 508. At the fourth state 508, 8x acceleration is provided, meaning that the acceleration rate of scrolling is eight times that of the first state 502, four times that of the second state 504, or twice that of the third state 506. At the fourth state 508, when the speed of the next rotational user input is slow, the acceleration state machine 500 transitions from the fourth state 508 to the first state 502. Alternatively, when the speed of the next rotational user input is fast, the acceleration state machine 500 remains at the fourth state 508.

[0040] FIG. 6 is a flow diagram of next portion determination processing 600 according to one embodiment of the invention. The next portion determination processing 600 is, for example, processing performed by the operation 108 illustrated in FIG. 1

[0041] The next portion determination processing 600 receives 602 the modified number of the units. For example, at operation 106 of FIG. 1, the number of units was modified 106 by the acceleration factor to determine the modified number of units. A remainder value is then added 604 to the modified number of units. The remainder value pertains to a previously

determined remainder value as discussed below. Next, the modified number of units is divided 606 by a chunking value to view a next portion. The next portion is a subset of the data set that is eventually presented on a display device. For example, the next portion can pertain to one or more items in a list when the data set pertains to a list of items. In another example, the next portion can pertain to a segment or position in a audio file when the data set pertains to an audio file. In any case, the remainder value from the operation 606 is then saved 608 for subsequent usage in computing a subsequent next portion. Following the operation 608, the next portion determination processing 600 is complete and ends. Although the use of the remainder value is not necessary, the scrolling provided by the invention may be smoother to the user when the remainder is carried forward as described above.

[0042] As one example of the scroll processing according to the invention, consider the following exemplary case. Assume that the number of units associated with a rotational user input is 51 units. Also assume that an acceleration factor was determined to be 2. Hence, the modified number of units, according to one embodiment, would then be 102 units (51 * 2). In one implementation, a previous remainder value (if not stale) can be added to the modified number of units. Assume that the previous remainder value was 3, then the modified number of units becomes 105 (102 + 3). Thereafter, to determine the next portion of the data set, the modified number of units (105) is then divided by a chunking value (e.g., 5). Hence, the resulting value 20 indicates that the next portion of the data set is to be presented (i.e., displayed on a display device) would be 20 items down (up) in the list from the current item.

[0043] The scroll, list navigation or acceleration amount processing discussed above can be utilized with respect to an audio player having a screen that displays a list of songs, or that provides a scroll bar indicating position of playing within an audio file. Typically, such an audio player typically displays different screens on the display. Each such screen can be individually scrolled through using separate position and acceleration values. Alternatively, the acceleration values can be shared across multiple different screens. Each such screen could be associated with a different list that is

partially displayed on the screen, a portion of which is displayed on the screen at a time and, through scrolling, the portion can be altered in an accelerated manner. The file can be a list or represent a scroll bar reflecting play position in a song. Additional details of screens suitable for use with an audio player are described in U.S. Provisional Patent Application No. 60/399,806, filed on July 30, 2002, which is hereby incorporated herein by reference.

[0044] FIG. 7A is a perspective diagram of a computer system 650 in accordance with one embodiment of the invention. The computer system 650 includes a base housing 652 that encloses electronic circuitry that performs the computing operations for the computing system 650. Typically, the electronic circuitry includes a microprocessor, memory, I/O controller, graphics controller, etc. The housing 652 also provides a removable computer readable medium drive 654 in which a removable computer readable medium can be placed so as to electronically or optically read data therefrom. The computer housing 652 is also coupled to a display device 656 on which a screen display can be presented for a user of the computer system 650 to view. Still further, the computer system 650 includes a keyboard apparatus 658. The keyboard apparatus 658 allows a user to interact with a computer program (application program or operating system) performed by the computer system 650. In this regard, the keyboard apparatus 658 includes a plurality of keys 660 and a rotational input unit 662. The rotational input unit 662 allows a user to perform a rotational movement with respect to the rotational input unit 662. The rotational movement (rotational user input) can then be processed by the electronic circuitry of the computer system 650 and used to manipulate navigation or selection actions with respect to a graphical user interface being presented to the user on the display device 656. The keyboard apparatus 658 can also include a button 664 associated with the rotational input unit 662. As shown in FIG. 7A, the button 664 can be provided at a center region of the rotational input unit 662. However, the button 664 is not required and, if provided, can be placed elsewhere, such as outside the periphery of the rotational input unit 662.

[0045] FIG. 7B is a perspective diagram of a media player 700 in accordance with one embodiment of the present invention. The term "media

player" generally refers to computing devices that are dedicated to processing media such as audio, video or other images. In one implementation, the media player is a portable computing device. Examples of media players include music players, game players, video players, video recorders, cameras and the like. These computing devices are generally portable so as to allow a user to listen to music, play games or video, record video or take pictures wherever the user travels. In one embodiment, the media player is a handheld device that is sized for placement into a pocket of the user (i.e., pocket-sized). By being pocket-sized, the user does not have to directly carry the device and therefore the device can be taken almost anywhere the user travels (e.g., the user is not limited by carrying a large, bulky and often heavy device, as in a portable computer). For example, in the case of a music player (e.g., MP3 player), a user may use the device while working out at the gym. In the case of a camera, a user may use the device while mountain climbing. Furthermore, the device may be operated by the user's hands, no reference surface such as a desktop is needed. In one implementation, the music player can be pocket-sized and rather lightweight (e.g., dimensions of 2.43 by 4.02 by 0.78 inches and a weight of 6.5 ounces) for true portability.

[0046] The media player 700 typically has connection capabilities that allow a user to upload and download data to and from a host device such as a general purpose computer (e.g., desktop computer or portable computer). For example, in the case of a camera, photo images may be downloaded to the general purpose computer for further processing (e.g., printing). With regard to music players, songs and playlists stored on the general purpose computer may be downloaded into the music player. In one embodiment, the media player 700 can be a pocket-sized handheld MP3 music player that allows a user to store a large collection of music.

[0047] As shown in FIG. 7B, the media player 700 includes a housing 702 that encloses various electrical components (including integrated circuit chips and other circuitry) to provide computing capabilities for the media player 700. The integrated circuit chips and other circuitry may include a microprocessor, memory (e.g., ROM or RAM), a power source (e.g., a battery), a circuit board, a hard drive, and various input/output (I/O) support circuitry. In the case of

music players, the electrical components may include components for outputting music such as an amplifier and a digital signal processor (DSP). In the case of video recorders or cameras, the electrical components may include components for capturing images such as image sensors (e.g., charge-coupled device (CCD) or complimentary oxide semiconductor (CMOS)) or optics (e.g., lenses, splitters, filters). The housing may also define the shape or form of the media player. That is, the contour of the housing 702 may embody the outward physical appearance of the media player 700.

[0048] The media player 700 also includes a display screen 704. The display screen 704 is used to display a Graphical User Interface (GUI) as well as other information to the user (e.g., text, objects, graphics). By way of example, the display screen 704 may be a liquid crystal display (LCD). In one particular embodiment, the display screen corresponds to a high-resolution display with a white LED backlight to give clear visibility in daylight as well as in low-light conditions. Additionally, according to one embodiment, the display screen 704 can be about 2 inches (measured diagonally) and provide a 160-by-128 pixel resolution. The display screen 704 can also operate to simultaneously display characters of multiple languages. As shown in FIG. 7B, the display screen 704 is visible to a user of the media player 700 through an opening 705 in the housing 702, and through a transparent wall 706 that is disposed over the opening 705. Although transparent, the transparent wall 706 may be considered part of the housing 702 since it helps to define the shape or form of the media player 700.

[0049] The media player 700 includes a rotational input device 710. The rotational input device 710 receives a rotational input action from a user of the media player 700. The rotational input action is used to control one or more control functions for controlling or interacting with the media player 700 (or application operating thereon). In one embodiment, the control function corresponds to a scrolling feature. The direction of scrolling can vary depending on implementation. For example, scrolling may be implemented vertically (up or down) or horizontally (left or right). For example, in the case of a music player, the moving finger may initiate a control function for scrolling

through a song menu displayed on the display screen 704. The term "scrolling" as used herein generally pertains to moving displayed data (e.g., text or graphics) across a viewing area on a display screen 704 so that at least one new item of data (e.g., line of text or graphics) is brought into view in the viewing area. In essence, the scrolling function allows a user to view sets of data currently outside of the viewing area. The viewing area may be the entire viewing area of the display screen 704 or it may be only a portion of the display screen 704 (e.g., a window frame).

[0080] By way of example, in the case of a music player (e.g., MP3 player), the scrolling feature may be used to help browse through songs stored in the music player. To elaborate, the display screen 704, during operation, may display a list of media items (e.g., songs). A user of the media player 700 is able to linearly scroll through the list of media items by providing a rotational input action using the rotational input device 710. The displayed items from the list of media items are varied commensurate with the rotational input action such that the user is able to effectively scroll through the list of media items. However, since the list of media items can be rather lengthy, the invention provides the ability for the user to rapidly traverse (or scroll) through the list of media items. In effect, the user is able to accelerate their traversal of the list of media items by providing the rotational input action at greater speeds. The direction of the rotational input action may be arranged to control the direction of scrolling.

[0081] In addition to above, the media player 700 may also include one or more buttons 712. The buttons 712 are configured to provide one or more dedicated control functions for making selections or issuing commands associated with operating the media player 700. By way of example, in the case of a music player, the button functions may be associated with opening a menu, playing a song, fast forwarding a song, seeking through a menu and the like. In most cases, the button functions are implemented via a mechanical clicking action. The position of the buttons 712 relative to the rotational input device 710 may be widely varied. For example, they may be adjacent to one another or spaced apart. In the illustrated embodiment, the buttons 712 are configured to surround the inner and outer perimeter of the

rotational input device 710. In this manner, the buttons 712 may provide tangible surfaces that define the outer boundaries of the rotational input device 710. As shown, there are four buttons 712A that surround the outer perimeter and one button 712B disposed in the center or middle of the rotational input device 710. By way of example, the plurality of buttons 712 may consist of a menu button, play/stop button, forward seek button, reverse seek button, and the like.

[0052] Moreover, the media player 700 may also include a power switch 714, a headphone jack 716 and a data port 718. The power switch 714 is configured to turn the media device 700 on and off. The headphone jack 716 is capable of receiving a headphone connector associated with headphones configured for listening to sound being outputted by the media device 700. The data port 718 is capable of receiving a data connector/cable assembly configured for transmitting and receiving data to and from a host device, such as a general purpose computer. By way of example, the data port 718 may be used to upload or download songs to and from the media device 700. The data port 718 may be widely varied. For example, the data port may be a PS/2 port, a serial port, a parallel port, a USB port, a FireWire port, and the like. In some cases, the data port 718 may be a radio frequency (RF) link or optical infrared (IR) link to eliminate the need for a cable. Although not shown in FIG. 7B, the media player 700 may also include a power port that receives a power connector/cable assembly configured for delivering power to the media player 700. In some cases, the data port 718 may serve as both a data and a power port.

[0053] FIG. 8A is a block diagram of a media player 800 according to one embodiment of the invention. The media player 800 can, for example, represent internal components of the media player 700.

[0054] The media player 800 includes a processor 802 that pertains to a microprocessor or controller for controlling the overall operation of the media player 800. The media player 800 stores media data pertaining to media items in a file system 804 and a cache 806. The file system 804 is, typically, a storage disk or a plurality of disks. The file system typically provides high capacity storage capability for the media player 800. However, since the

access time to the file system 804 is relatively slow, the media player 800 also includes a cache 806. The cache 806 is, for example, Random-Access Memory (RAM) provided by semiconductor memory. The relative access time to the cache 806 is substantially shorter than for the file system 804. However, the cache 806 does not have the large storage capacity of the file system 804. Further, the file system 804, when active, consumes more power than does the cache 806. The power consumption is particularly important when the media player 800 is a portable media player that is powered by a battery (not shown).

[0055] The media player 800 also includes a user input device 808 that allows a user of the media player 800 to interact with the media player 800. For example, the user input device 808 can take a variety of forms, such as a button, keypad, dial, etc. Still further, the media player 800 includes a display 810 (screen display) that can be controlled by the processor 802 to display information to the user. A data bus 811 can facilitate data transfer between at least the file system 804, the cache 806, the processor 802, and the coder/decoder (CODEC) 812. The media player 800 can also include an audio feedback unit (not shown) to provide audio feedback for user interactions (such as with the user input device 808).

[0056] In one embodiment, the media player 800 serves to store a plurality of media items (e.g., songs) in the file system 804. When a user desires to have the media player play a particular media item, a list of available media items is displayed on the display 810. Then, using the user input device 808, a user can select one of the available media items. The processor 802, upon receiving a selection of a particular media item, supplies the media data (e.g., audio file) for the particular media item to a coder/decoder (CODEC) 812. The CODEC 812 then produces analog output signals for a speaker 814. The speaker 814 can be a speaker internal to the media player 800 or external to the media player 800. For example, headphones or earphones that connect to the media player 800 would be considered an external speaker.

[0057] FIG. 8B is a block diagram of a computing system 850 according to one embodiment of the invention. The computing system 850 can, for example, represent a portion of any of the computer system 650 shown in

FIG. 7A, the media player 700 shown in FIG. 7B, or the media player 800 shown in FIG. 8A.

[0058] The computing system 850 includes a housing 852 that exposes a rotational input device 854. The housing 852 can be a computer's housing or an input/output device's housing. The rotational input device 854 permits a user to interact with the computing system 850 through a rotational action. The rotational action results from either rotation of the rotational input device 854 itself or by rotation of a stylus or user's finger about the rotational input device 854. As examples, the rotational input device 854 can be a rotary dial (including, e.g., a navigational wheel or a scroll wheel) capable of being rotated or a touch pad capable of rotational sensing. In one embodiment, the touch pad has a circular shape. A rotation pickup unit 856 couples to the rotational input device 854 to sense the rotational action. For example, the rotational pickup unit 856 can be optically or electrically coupled to the rotational input device 854.

[0059] The computing system 850 further includes a processor 858, a display 860 and an audio feedback unit 862. Signals pertaining to the rotational action are supplied to the processor 858. The processor 858 not only performs processing operations for application programs hosted by the computing system 850 but also can control the display 860 and the audio feedback unit 862. Alternatively, a specialized controller or other circuitry can support the processor 858 in controlling the display 860 or the audio feedback unit 862.

[0060] The processor 858 causes a display screen to be produced on the display 860. In one implementation, the display screen includes a selectable list of items (e.g., media items) from which a user may select one or more of the items. By the user providing a rotational action with respect to the rotational input device 854, the list can be scrolled through. The processor 858 receives the signals pertaining to the rotational action from the rotation pickup unit 856. The processor 858 then determines the next items of the list that are to be presented on a display screen by the display 860. In making this determination, the processor 858 can take into consideration the length of the list. Typically, the processor 858 will determine the rate of the rotational

action such that the transitioning to different items in the media list can be performed at a rate proportional to the rate of the rotational action.

[0061] The processor 858 can also control the audio feedback unit 862 to provide audio feedback to a user. The audio feedback can, for example, be a clicking sound produced by the audio feedback unit 862. In one embodiment, the audio feedback unit 862 is a piezoelectric buzzer. As the rate of transitioning through the list of items increases, the frequency of the clicking sounds can increase. Alternatively, when the rate that the rotational input device 854 is turned slows, the rate of transitioning through the list of items decreases, and thus the frequency of the clicking sounds correspondingly slows. Hence, the clicking sounds provide audio feedback to the user as to the rate in which the items within the list of items are being traversed.

[0062] FIG. 9 shows the media player 700 of FIG. 7B being used by a user 920 in accordance with one embodiment of the invention. In this embodiment, the user 920 is linearly scrolling (as shown by arrow 924) through a list of songs 922 displayed on the display screen 904 via a slider bar 923. As shown, the media device 900 is comfortably held in one hand 926 while being comfortably addressed by the other hand 928. This configuration generally allows the user 920 to easily actuate the rotational input device 910 with one or more fingers. For example, the thumb 930 and right-most fingers 931 (or left-most fingers if left handed) of the first hand 926 are used to grip the sides of the media player 900 while a finger 932 of the opposite hand 928 is used to actuate the rotational input device 910.

[0063] Referring to FIG. 9, and in accordance with one embodiment of the invention, the rotational input device 910 can be continuously actuated by a circular motion of the finger 932 as shown by arrow 934. For example, the finger may rotate relative to an imaginary axis. In particular, the finger can be rotated through 360 degrees of rotation without stopping. This form of motion may produce incremental or accelerated scrolling through the list of songs 922 being displayed on the display screen 904.

[0064] FIG. 10A is a flow diagram of user input processing 1000 according to one embodiment of the invention. The user input processing 1000 is, for

example, performed with respect to the computer system 650 illustrated in FIG. 7A or the media player 700 illustrated in FIG. 7B.

[0065] The user input processing 1000 displays 1002 a graphical user interface. Then, a rotational movement associated with a user input action is received 1004. Here, the user input action is generally angular, as opposed to linear, and thus pertains to a rotational movement. As discussed in more detail below, the rotational movement can be provided by the user input action. In one example, the rotational movement can be caused by a user acting to rotate a navigational wheel through a user input action. In another example, the rotational movement can be caused by a user's finger or a stylist being moved in a rotational manner through a user input action with respect to a touch pad. After the rotational movement has been received 1004, the rotational movement is converted 1006 into a linear movement. The linear movement is then applied 1008 to at least one object of the graphical user interface. For example, the object of the graphical user interface can be a list, menu or other object having a plurality of selectable items. The linear movement can effect a scroll type action with respect to the object (e.g., list or menu). Alternatively, the linear movement can effect a level adjustment (e.g., volume adjustment) or position adjustment (e.g., slider bar position). After the linear movement has been applied 1008, the user input processing 1000 is complete and ends.

[0066] FIG. 10B is a flow diagram of user input processing 1050 according to another embodiment of the invention. The user input processing 1050 is, for example, performed with respect to the computer system 650 illustrated in FIG. 7A or the media player 700 illustrated in FIG. 7B.

[0067] The operations 1052-1060 performed by the user input processing 1050 are similar to those like operations performed by the user input processing 1000 illustrated in FIG. 10A. Additionally, the user input processing 1050 operates to provide 1056 audible feedback corresponding to the rotational movements. In other words, as the rotational movement associated with user input action is received 1054, audible feedback corresponding to the rotational movement is provided 1056. Such audible feedback provides the user with feedback concerning the extent to which

rotational movement has been input. In one embodiment, the rotational movement associated with user input action is converted into linear movement and applied to an object of a graphical user interface. For example, when the object of the graphical user interface is a multi-item list that is displayed for user scrolling and selection actions, the rotational movement associated with the user input action represents a distance traversed in the multi-item list. When acceleration is applied, the distance traversed is increased (e.g., multiplied). In one embodiment, the audible feedback is provided through a piezoelectric buzzer that is controlled by a processor (or other circuitry). For example, the audio feedback unit 862 shown in FIG. 8B can be a piezoelectric buzzer. The controller for the piezoelectric buzzer can, for example, be a processor of the computer system 650 or the media player 700, or some other circuitry coupled to the piezoelectric buzzer.

[0068] FIG. 11 is a flow diagram of user input processing 1100 according to another embodiment of the invention. The user input processing 1100 is, for example, performed by a computing device, such as the computer system 650 illustrated in FIG. 7A or the media player 700 illustrated in FIG. 7B.

[0069] The user input processing 1100 begins by the display 1102 of a portion of a list of items together with a select bar. The select bar typically points to or highlights one or more of the items of the list of items. In general, the select bar can be associated with any sort of visual indication specifying one or more of the items of the list of items. Hence, the select bar is one type of visual indicator. Next, a decision 1104 determines whether a rotational movement input has been received. When the decision 1104 determines that a rotational movement input has not yet been received, then a decision 1106 determines whether another input has been received. Here, the inputs are provided by a user of the computing device performing or associated with the user input processing 1100. When the decision 1106 determines that another input has been received, then other processing is performed 1108 to perform any operations or actions caused by the other input. Following the operation 1108, the user input processing 1100 is complete and ends. On the other hand, when the decision 1106 determines that no other input has been

received, then the user input processing 1100 returns to repeat the decision 1104.

[0070] Once the decision 1104 determines that a rotational movement input has been received, then the rotational movement is converted 1110 to a linear movement. Then, a next portion of the list of items (and placement of the select bar over one of the items) is determined 1112. Thereafter, the next portion of the list of items is displayed 1114. The linear movement operates to move the select bar (or other visual identifier) within the list. In other words, the select bar is scrolled upwards or downwards (in an accelerated or unaccelerated manner) by the user in accordance with the linear motion. As the scrolling occurs, the portion of the list being displayed changes. Following the operation 1114, the user input processing 1100 is complete and ends. However, if desired, the user input processing 1100 can continue following operation 1114 by returning to the decision 1104 such that subsequent rotational movement inputs can be processed to view other portions of the list items in a similar manner.

[0071] FIG. 12 is a block diagram of a rotary input display system 1200 in accordance with one embodiment of the invention. By way of example, the rotary input display system 1200 can be performed by a computing device, such as the computer system 650 illustrated in FIG. 7A or the media player 700 illustrated in FIG. 7B. The rotary input display system 1200 utilizes a rotational input device 1202 and a display screen 1204. The rotational input device 1202 is configured to transform a rotational motion 1206 by a user input action (e.g., a swirling or whirling motion) into translational or linear motion 1208 on the display screen 1204. In one embodiment, the rotational input device 1402 is arranged to continuously determine either the angular position of the rotational input device 1202 or the angular position of an object relative to a planar surface 1209 of the rotational input device 1202. This allows a user to linearly scroll through a media list 1211 on the display screen 1204 by inducing the rotational motion 1206 with respect to the rotational input device 1202.

[0072] The rotary input display system 1200 also includes a control assembly 1212 that is coupled to the rotational input device 1202. The control

assembly 1212 is configured to acquire the position signals from the sensors and to supply the acquired signals to a processor 1214 of the system. By way of example, the control assembly 1212 may include an application-specific integrated circuit (ASIC) that is configured to monitor the signals from the sensors to compute the angular location and direction (and optionally speed and acceleration) from the monitored signals and to report this information to the processor 1214.

[0073] The processor 1214 is coupled between the control assembly 1212 and the display screen 1204. The processor 1214 is configured to control display of information on the display screen 1204. In one sequence, the processor 1214 receives angular motion information from the control assembly 1212 and then determines the next items of the media list 1211 that are to be presented on the display screen 1204. In making this determination, the processor 1214 can take into consideration the length of the media list 1211. Typically, the processor 1214 will determine the rate of movement such that the transitioning to different items in the media list 1211 can be performed faster or in an accelerated manner when moved at non-slow speeds or proportional with greater speeds. In effect, to the user, rapid rotational motion causes faster transitioning through the list of media items 1211. Alternatively, the control assembly 1212 and processor 1214 may be combined in some embodiments.

[0074] Although not shown, the processor 1214 can also control a buzzer to provide audio feedback to a user. The audio feedback can, for example, be a clicking sound produced by a buzzer 1216. In one embodiment, the buzzer 1216 is a piezoelectric buzzer. As the rate of transitioning through the list of media items increases, the frequency of the clicking sounds increases. Alternatively, when the rate of transitioning slows, the frequency of the clicking sounds correspondingly slows. Hence, the clicking sounds provide audio feedback to the user as to the rate in which the media items within the list of media items are being traversed.

[0075] The various aspects, features or embodiments of the invention described above can be used alone or in various combinations. The invention is preferably implemented by a combination of hardware and software, but

can also be implemented in hardware or software. The invention can also be embodied as computer readable code on a computer readable medium. The computer readable medium is any data storage device that can store data which can thereafter be read by a computer system. Examples of the computer readable medium include read-only memory, random-access memory, CD-ROMs, DVDs, magnetic tape, optical data storage devices, and carrier waves. The computer readable medium can also be distributed over network-coupled computer systems so that the computer readable code is stored and executed in a distributed fashion.

[0076] The advantages of the invention are numerous. Different embodiments or implementations may yield one or more of the following advantages. It should be noted that this is not an exhaustive list and there may be other advantages which are not described herein. One advantage of the invention is that a user is able to traverse through a displayed list of items using a rotational user input action. Another advantage of the invention is that a user is able to easily and rapidly traverse a lengthy list of items. Still another advantage of the invention is the rate of traversal of the list of media items can be dependent on the rate of rotation of a dial (or navigation wheel). Yet still another advantage of the invention is that audible sounds are produced to provide feedback to users of their rate of traversal of the list of media items.

[0077] The many features and advantages of the present invention are apparent from the written description, and thus, it is intended by the appended claims to cover all such features and advantages of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation as illustrated and described. Hence, all suitable modifications and equivalents may be resorted to as falling within the scope of the invention.

What is claimed is:

1. A method for scrolling through portions of a data set, said method comprising:

receiving a number of units associated with a rotational user input;

determining an acceleration factor pertaining to the rotational user input;

modifying the number of units by the acceleration factor;

determining a next portion of the data set based on the modified number of units; and

presenting the next portion of the data set.

2. A method as recited in claim 1, wherein the data set pertains to a list of items, and the portions of the data set include one or more of the items.

3. A method as recited in claim 1, wherein the data set pertains to a media file, and the portions of the data set pertain to one or more sections of the media file.

4. A method as recited in claim 3, wherein the media file is an audio file.

5. A method as recited in claim 1, wherein the rotational user input is provided via a rotational input device.

6. A method as recited in claim 5, wherein the rotational input device is a circular touch pad or a rotary dial.

7. A method as recited in claim 1, wherein the acceleration factor is dependent upon a rate of speed for the rotational user input.

8. A method as recited in claim 1, wherein the acceleration factor provides a range of acceleration.

9. A method as recited in claim 1, wherein the acceleration factor can successively increase to provided successively greater levels of acceleration.

10. A method as recited in claim 1, wherein said determining of the next data portion comprises:

converting the modified number of units into the next portion based on a predetermined value.

11. A method as recited in claim 1, wherein said determining of the next data portion comprises:

dividing the modified number of units by a chunking value.

12. A method as recited in claim 1, wherein said determining of the next data portion comprises:

adding a prior remainder value to the modified number of units; and

converting the modified number of units into the next portion.

13. In a handheld, electronics device, a method for scrolling through portions of a data set, said method comprising:

receiving a rotational user input;

determining an acceleration value pertaining to the rotational user input; and

scrolling to a next portion of the data set based on at least the acceleration value,

whereby the acceleration value specifies a degree of acceleration associated with the rate at which said scrolling through the portions of the data set is to be achieved.

14. A method as recited in claim 13, wherein said handheld, electronics device is a portable media player.

15. In a handheld, electronics device, a method for scrolling through portions of a data set, said method comprising:

receiving a rotational user input;

determining whether or not to provide acceleration with respect to the rotational user input; and

scrolling to a next portion of the data set in either an accelerated manner when said determining determines that acceleration is to be provided, or in an unaccelerated manner when said determining determines that acceleration is not to be provided.

16. A method as recited in claim 15, wherein the data set pertains to a list of items, and the portions of the data set include one or more of the items.

17. A method as recited in claim 15, wherein the data set pertains to a media file, and the portions of the data set pertain to one or more sections of the media file.

18. A method as recited in claim 17, wherein the media file is an audio file.

19. A method for scrolling through portions of a file, said method comprising:

(a) receiving a number of units from a rotational input device;

(b) determining a speed of rotation for the rotational input device;

(c) applying acceleration when the speed of rotation is greater than a speed threshold;

(d) removing any acceleration being applied when the speed of rotation is less then the speed threshold;

(e) modifying the number of units in accordance with the acceleration, if any;

(f) determining a next portion of the file based on the modified number of units; and

(g) presenting the next portion of the file.

20. A method as recited in claim 19, wherein said applying (c) of the acceleration successively increases an amount of acceleration being applied.

21. A method as recited in claim 20, wherein said applying (c) comprises:

(c1) obtaining a current acceleration amount being applied for a previous number of units from the rotational input device; and

(c2) determining an increased acceleration amount to be applied to a current number of units from the rotational input device.

22. A method as recited in claim 21, wherein the increased acceleration amount is an integer multiple of the current acceleration amount.

23. A method as recited in claim 21, wherein said applying (c) further comprises:

(c3) determining whether the time since the acceleration was last changed is greater than a duration threshold; and

(c4) preventing said applying of the acceleration or the increased acceleration amount when the time since the acceleration was last changed is not greater than the duration threshold.

24. A method as recited in claim 19, wherein said applying (c) comprises:

(c1) determining whether the time since the acceleration was last changed is greater than a duration threshold; and

(c2) preventing said applying of the acceleration when the time since the acceleration was last changed is not greater than the duration threshold.

25. A method as recited in claim 19, wherein said determining (f) of the next data portion comprises:

(f1) converting the modified number of units into the next portion based on a predetermined value.

26. A method as recited in claim 19, wherein said determining (f) of the next data portion comprises:

(f1) dividing the modified number of units by a chunking value.

27. A method as recited in claim 19, wherein said determining (f) of the next data portion comprises:

(f1) adding a prior remainder value to the modified number of units; and

(f2) converting the modified number of units into the next portion.

28. A portable media player, comprising:

a storage disk drive that stores media content for each of a plurality of media items;

a display screen that displays a portion of the media items at a time;

a user input device that enables a user of said portable media player to at least scroll through the plurality of media items using a rotational action with respect to said user input device; and

a processor operatively connected to said storage disk drive and said user input device, said processor determining a rate of scrolling and thus determining a next portion of the media items to be displayed

29. A portable media player as recited in claim 28, wherein said portable media player is battery-operated.

30. A portable media player as recited in claim 29, wherein said portable media player is pocket-sized.

31. A portable media player as recited in claims 28, wherein the rate of scrolling is automatically increased to provide an acceleration effect with respect to scrolling through the list of media items.

32. A portable media player as recited in claim 28, wherein said portable media player comprises an audio player, and wherein the media content for the media items includes at least audio files of songs.

33. A portable media player as recited in claim 28, wherein said portable media player comprises a video player, and wherein the media content for the media items includes at least video files of videos.

34. A portable media player as recited in claim 28, wherein said portable media player comprises an image viewer, and wherein the media content for the media items includes at least image files of images.

35. A portable media player as recited in claim 28, wherein said portable media player further comprises: