keypad of a cellular phone, or into a display of a personal electronic device in the manner disclosed in reference to Figures 45 and 46 hereinbelow. Remaining components of the fingerprint sensor 10 (such as power supply, driver module, controller, etc.) are then located within the computer or the cellular phone.

In alternative embodiments the fingerprint sensor 10 may be implemented as a portable, autonomous identification and/or authentication apparatus that includes the components and software to perform the matching procedure and to output the result of the matching procedure. For example, the fingerprint sensor 10 may be implemented within a smart or chip card, or a communications module designed in accordance with a specification defined by the Personal Computer Memory Card International Association (PCMCIA). The communications module is, thus, often referred to as a PCMCIA card.

In certain embodiments, the fingerprint sensor 10 has a flat, generally rectangular shape, with a thickness of approximately 1-2 mm, a contact surface 32 which receives the fingertip 40 of the user, and an effective area of approximately 6 cm^2. In other embodiments, the fingerprint sensor 10 may have a circular-, oval-, square-like-, or any other shape of sufficient size to contact a sufficiently large portion of the fingertip 40 of the user. Persons skilled in the art can select an appropriate configuration and shape for the fingerprint sensor 10 compatible with the present invention.

In the following description and figures, the fingerprint sensor 10 has a generally horizontal orientation. Terms such as "top," "bottom," "above," "below," "underneath," or the like, are used with reference to the generally horizontal orientation of the fingerprint sensor 10 to describe the relative orientation of the various components of the fingerprint sensor 10. Persons skilled in the art appreciate that the fingerprint sensor 10 may have other orientations and that the relational terms then apply correspondingly.

The first material 22 of the substrate 20 of the fingerprint sensor 10 is substantially transparent to light with wavelengths within a first range of wavelengths. As used herein, the term "light" corresponds to electromagnetic radiation which may or may not be within the visible spectrum. In addition, as used herein, a material is substantially transparent to light with a given wavelength if the transmittance of the material to the light is greater than or equal to 40%. In certain embodiments, the first range of wavelengths substantially transmitted by the first material 22 preferably range from approximately 400 nm to approximately 600 nm, more preferable from approximately 400 nm to approximately 550 nm, and most preferably from approximately 400 nm to approximately 500 nm. In certain embodiments, the first range of wavelengths corresponds to green light, while in other embodiments the first range corresponds to non-red light. In still other embodiments, the first range of wavelengths corresponds to wavelengths which are not substantially transmitted by the fingertip. The first range of wavelengths includes at least a portion of the emission spectra of the light source 50, described below. In certain embodiments, the first material 22 can also substantially transmit light with wavelengths outside the first range of wavelengths. In addition, the index of refraction of the first material 22 in certain embodiments approximates the index of refraction of the fingertip 40. Examples of first materials 22 compatible with the present invention include, but are not limited to, glass, plastic, or any transparent substrate, such as quartz.

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As illustrated in Figure 23, certain embodiments of the fingerprint sensor 10 comprise a color filter layer 30 comprising a second material 34. In certain embodiments, the color filter layer 30 comprises multiple layers of materials with different optical or mechanical properties. In the embodiment illustrated in Figure 23, the color filter layer 30 comprises a second material 34 and a hardcoat layer 35 which provides protection to the underlying portions of the color filter layer 30. In this embodiment, the contact surface 32 is the top surface of the hardcoat layer 35. When receiving the fingertip 40 of a user, the contact surface 32 is in contact with the ridges of the fingertip 40. In addition, the index of refraction of the hardcoat layer 35 in certain embodiments approximates the index of refraction of the fingertip 40. An exemplary hardcoat layer 35 comprises a 3 m-thick film of EXP98024, which is available from Brewer Science, Inc. of Rolla, Missouri, and can be applied using standard screen printing processes. Such a hardcoat layer 35 provides resistance to scratching and to chemicals, including various solvents. Persons skilled in the art can select an appropriate material and method of fabrication for the hardcoat layer 35 compatible with the present invention.

In the embodiment schematically illustrated in Figure 23, the color filter layer 30 overlies a top coat layer 36 which covers the optical detectors 60. This top coat layer 36 provides protection for the optical detectors 60, as well as planarization for subsequent layers. Potential materials for the top coat layer 36 include, but are not limited to, epoxy and acrylic. One exemplary embodiment of the top coat layer 36 comprises a "Philips top-coat" obtainable from Philips Electronics North America, New York, NY and which comprises a 1.5 m epoxy, followed by a 4 m acrylic.

In certain embodiments, the fingerprint sensor 10 also comprises an opaque material 37 which covers a portion of the contact surface 32. The portion of the contact surface 32 not covered by the opaque material thereby defines an active area 38. Figure 24 schematically illustrates such an embodiment with an opaque material 37 defining an oval-shaped active area 38. During operation of the fingerprint sensor 10, the fingertip 40 is placed onto the active area 38 so that the active area 38 is completely covered by the fingertip 40. As described more fully below, in this way, only a portion of the ambient light is able to propagate to the optical detectors 60 below through the fingertip 40. As seen in Figure 25, which schematically illustrates the transmittance spectrum of a human finger, the portion of ambient light substantially transmitted through the fingertip 40 has wavelengths larger than approximately 600 nm, with a peak at approximately 700 nm.

In certain embodiments, the second material 34 is substantially transparent to light with a range of wavelengths which approximates the first range of wavelengths substantially transmitted by the first material 22. Alternatively, in other embodiments, the second material 34 is substantially transparent to light with a range of wavelengths which is a subset of the first range of wavelengths. For example, in certain embodiments, the second material 34 is substantially transparent to light within only a subrange of the first range of wavelengths, while in still other embodiments, the second material 34 is substantially transparent to light within a range of wavelengths which only overlaps a portion of the first range of wavelengths. In certain embodiments, the color filter 30 is substantially transparent to green light, while in other embodiments, the color filter 30 is substantially transparent to non-red light.

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In still other embodiments, the color filter 30 is substantially transparent to light which is not substantially transmitted by the fingertip 40.

The second material 34 is also substantially opaque to light within a second range of wavelengths. As used herein, a material is substantially opaque to light with a given wavelength if the transmittance of the material to the light is less than 20%. In certain embodiments, the second range of wavelengths not substantially transmitted by the second material 34 preferably range from approximately 600 nm to approximately 800 nm, more preferable from approximately 600 nm to approximately 750 nm, and most preferably from approximately 600 nm to approximately 700 nm. In certain embodiments, the second range of wavelengths is characterized as red light, while in other embodiments, the second range of wavelengths is characterized as non-green light. In still other embodiments, the second range of wavelengths is characterized as the portion of ambient light that is substantially transmitted by the fingertip 40. As illustrated in Figure 25, the portion of ambient light that is substantially transmitted through the fingertip 40 is primarily red light. In certain embodiments, the second material 34 is also substantially opaque to light which is outside both the second range of wavelengths and the first range of wavelengths. In addition, the index of refraction of the second material 34 in certain embodiments approximates the index of refraction of the fingertip 40.

Numerous second materials 34 and techniques for fabricating the color filter layer 30 which are compatible with the present invention are described in "Liquid Crystal Flat Panel Displays," by William C. O'Mara, pp. 118-126, published by Van Nostrand Reinhold, New York 1993 which is incorporated by reference herein. Examples of second materials 34 include, but are not limited to glass or polyimide with dissolved colorants (e.g., dyes, pigments). In certain embodiments, the color filter comprises an organic material, while in other embodiments, the color filter comprises an inorganic material. One exemplary second material 34 is "Green 02," which is available from Brewer Science, Inc. of Rolla, Missouri, and can be applied using standard screen printing processes. Figure 25 schematically illustrates a transmittance spectrum for "Green 02," which is substantially transparent to light with wavelengths between approximately 490 nm and 560 nm, and is substantially opaque to light with wavelengths above approximately 580 nm. In addition, "Green 02" is substantially opaque to light with wavelengths below approximately 480 nm. Similarly, in other embodiments, the second material 34 comprises "Blue 02," also available from Brewer Science, Inc. of Rolla, Missouri. A transmittance spectrum for "Blue 02" is schematically illustrated in Figure 25. "Blue 02" is substantially transparent to light with wavelengths between approximately 390 nm and 520 nm, and is substantially opaque to light with wavelengths above approximately 530 nm.

Examples of techniques for fabricating the color filter layer 30 include, but are not limited to, dyeing, offset printing, pigment dispersion, spin-coating, electro-deposition, or electromist and may include photolithography techniques. Using an exemplary fabrication technique, the second material 34 of the embodiment schematically illustrated in Figure 23 can be formed by applying an adhesion promoter to a substrate 20 with optical detectors 60 on its top surface, spin-coating the second material 34 onto the substrate 20, and curing the second material 34 by heating to an elevated temperature. The thickness of the second material 34 in the embodiment illustrated in Figure 23 is preferably between approximately 1.0 to approximately 3.0 m, more preferably between approximately 1.5 to

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approximately 3.0 m, and most preferably between approximately 2.5 to 3.0 m. Other embodiments may include other processing steps, such as photolithography techniques, to pattern the second material 34. Persons skilled in the art can select appropriate second materials 34 and techniques for fabricating the color filter layer 30 compatible with the present invention.

At least one light source 50 is coupled to the substrate 20. As used herein, the term "light source" encompasses single or multiple light sources or light source panels which may have a variety of configurations. In the embodiment illustrated in Figure 23, the light source 50 is positioned below the substrate 20 and extends across the substrate 20 and illuminates the substrate 20 evenly. As described more fully below, other embodiments may utilize other configurations of light sources 50, such as multiple individual light sources 50 below the substrate 20, or utilize a light source 50 comprising a waveguide, such as an acrylic light pipe, which is coupled to the substrate 20 and to a light generator which is displaced from the substrate 20. Other embodiments include multiple individual light sources 50 located to evenly cover and illuminate the substrate 20, an array emitter including pixelized light sources, or a light source panel such as an electroluminescent panel.

In the embodiment illustrated in Figure 23, when the light source 50 is activated, light propagates in an upward direction through the substrate 20, past the optical detectors 60, to be reflected by the contact surface 32 and fingertip 40. In this embodiment, the light source 50 functions as a backlight for the contact surface 32 of the fingerprint sensor 10. Persons skilled in the art can select an alternative configuration for the light source 50 which is compatible with the present invention.

The light source 50 generates light with at least one wavelength within the first range of wavelengths so that the generated light can propagate with minimal attenuation through the substrate 20 to the fingertip 40 positioned on the contact surface 32. In certain embodiments, the wavelengths of the generated light can be characterized as being visible light in the green or blue portion of the spectrum. In other embodiments, the light generated by the light source 50 is characterized as non-red light. Examples of light sources 50 compatible with the present invention include, but are not limited to, electroluminescent light sources, one or more inorganic or organic light-emitting diodes (LEDs), laser diodes, a backlight device, for example, as used for a liquid crystal display (LCD), or any other light source 50 suitable to illuminate the contact surface 32 of the fingerprint sensor 10.

As explained below, one exemplary light source 50 comprises a backlight panel with a microlens array and a green LED positioned to one side of the backlight panel. The light from the green LED is reflected towards the contact surface 32 and onto the fingertip 40 by the microlens array positioned along the backlight panel. Figure 26 schematically illustrates an emission spectrum for such an exemplary backlight panel, the emission being peaked at approximately 524 nm with a full-width-at-half-maximum of approximately 40 nm. Similar backlight panels are available from Lumitex, Inc. of Strongsville, Ohio.

Other embodiments can utilize light sources 50 with different emission spectra, e.g., blue LEDs, when used in conjunction with an appropriate color filter layer 30. However, light sources 50 which emit green light are more preferable since their emission spectra are a closer match to the sensitivity spectra of the optical detectors 60

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described below. In addition, standard second materials 34 for the color filter layer 30 which substantially transmit blue light also transmit a significant fraction of red light, thereby reducing their effectiveness as filters of the ambient light transmitted through the fingertip 40. Also, LEDs which emit blue light are more expensive than LEDs which transmit green light, making green LEDs more preferable as the light source 50, e.g. Nichia Superbright LED, part number NSCG215, manufactured by Nichia America Corporation, Mountville, PA. As described in U.S. Utility Patent and U.S. Provisional Patent Applications Numbers 60/188,273, entitled "System and Method for Lighting a Biometric Sensor" filed March 10, 2000; 60/188,280 entitled "Biometric Sensor using Organic Light Emiting Diode Technology" filed March 10, 2000, 60/201,905 entitled "System and Method for Lighting a Biometric Sensor" filed May 4, 2000; 60/214,155 entitled "System and Method for Lighting a Biometric Sensor" filed June 26, 2000; 60/234,635 entitled "System and Method for Lighting a Biometric Sensor" filed September 22, 2000; and 09/477,943, which are incorporated by reference herein, the fingerprint sensor 10 also includes various other components to operate the light sources 50 including any electrodes and power supplies.

For certain embodiments, the light source 50 comprises an electroluminescent light source based on inorganic or organic materials. An organic electroluminescent material includes, for example, thin sublimed molecular films such as tris(8-quinolinolato) aluminum (III) commonly known as Alq or light emitting polymers having specialized structures which provide positive and negative charge carriers having high mobilities. The light-emitting polymers include polyphenylene vinylene (PPV), soluble polythiophene derivatives, and polyanilene which may be applied by known coating techniques such as spin or doctor-blade coating. Further details about organic electroluminescent materials are described in J.C. Sturm et al., "Integrated Organic Light Emitting Diode Structures Using Doped Polymers," *Proceedings of SID*, 1997, pages F11-F18.

An inorganic electroluminescent material includes a phosphor material in combination with material such as zinc sulfide:manganese (ZnS:Mn), zinc silicate (Zn_2SiO_4), or zinc gallate ($ZnGaO_4$). In one embodiment, the phosphor, ZnS:Mn material may be dispersed in an insulating dielectric material such as barium titanate ($BaTiO_3$). Other dielectric materials include yttrium oxide, silicon nitride, and silicon oxy-nitride. In another embodiment, the light source 50 includes an electroluminescent (EL) panel. Such an EL panel is, for example, manufactured by Durel Corporation of Chandler, Arizona, and designated as part number DB5-615B.

A plurality of optical detectors 60 are disposed from the contact surface 32, with at least a portion of the second material 34 disposed between the optical detectors 60 and the contact surface 32. In the embodiment schematically illustrated in Figure 23, the optical detectors 60 are positioned on top of the substrate 20 and are below the color filter layer 30 which has the second material 34 generally uniformly distributed throughout. In this way, the optical detectors 60 are positioned to receive light which is generated by the light sources 50 and reflected by the fingertip 40 at the contact surface 32. In such an embodiment, the optical detectors 60 are not responsive to directly impinging light from below the optical detectors 60. The optical detectors 60 generate electrical signals in response to the received light, thereby providing an electronic representation of a fingerprint corresponding to the fingertip.

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In certain embodiments, the optical detectors 60 include a plurality of individual, spaced-apart picture elements or pixels 61. As schematically illustrated in Figure 27, the optical detectors 60 comprise an optical planar array 58 of pixels 61 arranged in M rows and N columns in generally orthogonal columns and rows. In one embodiment, the array 58 has M=315 rows and N=240 columns of pixels 61 with each pixel 61 occupying an area of approxmiately 63 square microns. Each pixel 61 includes a photodetector and a charge-storing mechanism, for example, an inherent (parasitic) capacitance or a capacitor electrically coupled to the photodetector. Each pixel 61, hence each photodetector, can be selected through an address line L_M (row) and a data line L_N (column) which are connected to a driver module. In such embodiments, the optical detector 60 comprises an active matrix sensor array.

In the exemplary embodiment schematically illustrated in Figure 28, each pixel 61 comprises a photodiode 62 and a switching diode 63, both deposited directly on the substrate 20 using photolithographic techniques. In one embodiment, a rigid material such as glass forms the substrate 20, with the glass having a thickness of approximately 1 mm. The photodiode 62 and switching diode 63 each comprise a p-i-n diode implemented above a chromium (Cr) electrode 64. The p-i-n photodiode 62 comprises a photoactive p-layer 65, an intrinsic (i)-layer 66, and an n-layer 67. The n-layer 67 is formed by a layer of amorphous silicon doped to be of n-type silicon (n^+ a-Si:H), and the p-layer 65 is formed by a layer of amorphous silicon doped to be of p-type silicon (p^- a-Si:H). Between the p- and n-layers 65, 67, a layer of undoped amorphous silicon forms the i-layer 66 (i a-Si:H). The p-layer 65 of the photodiode 62 is covered by a transparent conducting layer 68. In this embodiment, the transparent conducting layer 68 comprises indium-tin oxide (ITO). The transparent conducting layer 68 is covered by a passivation layer 69, and is in contact with an electrode 70 which extends through the passivation layer 69.

In the illustrated embodiment, the switching diode 63 is also a p-i-n diode and has generally the same structure as the p-i-n photodiode 62. The p-layer 65 of the switching diode 63 is covered by the bus line 71a. The electrodes 64, 70 and bus lines 71a, 71b are, for example, thin layers of chromium or a combination of chromium and aluminum. It is contemplated that other conducting materials, such as Mo or W, may be used to form the electrodes 64, 70 and the bus lines 71a, 71b. In one embodiment, the bus lines 71a are part of the data lines L_N, L_{N-1}, and the bus lines 71b are part of the address lines L_M, L_{M-1}. The bus lines 71a and the bus lines 71b are separated through the passivation layer 69, which comprises an insulating material such as amorphous silicon nitride (a-SiN_x:H). Various configurations of optical detectors 60 and methods of manufacture which are compatible with the present invention are described in U.S. Patent Application No. 09/477,943 which is incorporated by reference herein.

In one embodiment, the plurality of optical detectors 60 are positioned approximately 3-4 microns below the contact surface 32. In this embodiment, the optical detectors 60 are arranged in the array 58 comprising 240 by 317 pixels 61. In this embodiment, the plurality of optical detectors 60 occupies an area of approximately 19.2 mm by 14.2 mm wherein each pixel 61 occupies approximately 63 um^2. In one embodiment, a photodiode 62 and switching diode 63 have an area of approximately 40 um^2 and are spaced apart from other photodiodes 62 and switching diodes 63 by approximately 12 um.

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Figure 29 schematically illustrates the optical responsivity of a p-i-n photodiode 62, such as the photodiode 62 illustrated in Figure 28, as a function of the wavelength of the incident light. As can be seen from Figure 29, the photodiode 62 is substantially responsive to wavelengths between approximately 450 nm and 650 nm. For the photodiode 62 to be responsive to light which is substantially transmitted through the substrate 20 and the color filter layer 30, the first range of wavelengths overlaps at least a portion of the range of optical responsivity of the photodiode 62.

Figure 30 is a flowchart of one embodiment of a method 100 of sensing a fingerprint comprising a pattern of ridges 42 and valleys 44 of a fingertip 40 of a user. In a procedural block 110, the fingertip 40 is received on a fingerprint sensor 10. The ridges 42 of the fingertip 40 make contact with a contact surface 32 of the fingerprint sensor 10. In embodiments of the fingerprint sensor 10 which comprise an opaque layer 37 which defines an active area 38, the fingertip 40 is placed so that the active area 38 is completely covered by the fingertip 40.

In a procedural block 120, a first light 80 is received and substantially transmitted through the fingertip 40 to the contact surface 32. The first light 80 is generated by ambient light sources, which can include, but are not limited to, fluorescent room lights or sunlight. In embodiments in which the fingertip 40 completely covers an active area 38, only the portion of the first light which propagates through the tissue of the fingertip 40 reaches the contact surface 32. As is evident from Figure 25, the fingertip 40 substantially filters out wavelengths shorter than approximately 600 nm, thereby leaving only the red portion of the ambient light spectrum as the first light 80.

In a procedural block 130, a second light 82 is generated and substantially transmitted to the fingertip 40 from the contact surface 32. In embodiments using the fingerprint sensor 10 schematically illustrated in Figure 23, the second light 82 is generated below the substrate 20 by the light source 50 and is substantially transmitted through the substrate 20, past the optical detectors 60, through the top coat layer 36 and color filter layer 30, and reaching the contact surface 32. In order for the second light 82 to be substantially transmitted in this manner, the optical transmittance spectra of the substrate 20, top coat layer 36, and color filter layer 30 substantially transmit at least one wavelength of the light generated by the light source 50.

In a procedural block 140, a portion of the second light 82 is reflected from the fingertip 40. The ridges 42 of the fingertip 40 exhibit a first reflectivity and the valleys 44 of the fingertip 40 exhibit a second reflectivity. Because the ridges 42 are generally in contact with the contact surface 32, the fractions of the second light 82 which undergo total internal reflection from the contact surface 32 are different at the ridges 42 from the valleys 44, thereby contributing to the difference in reflectivity between the ridges 42 and the valleys 44. In certain embodiments, the indices of refraction for the various layers of the fingerprint sensor 10 are selected to approximate the index of refraction of the fingertip 40 to utilize the total internal reflection phenomenon to provide contrast between the ridges 42 and valleys 44. In addition, the ridges 42 provide relatively flat surfaces from which the second light 82 can be reflected back down from the contact surface 32, while the valleys 44 provide relatively curved surfaces from which the second light 82 is reflected in various directions, thereby further contributing to the difference in reflectivity between the ridges 42 and the valleys 44.

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In a procedural block 150, the first light 80, substantially transmitted through the contact surface 32, is filtered from the second light 82 reflected from the fingertip 40. In embodiments using the fingerprint sensor 10 schematically illustrated in Figure 23, the filtering is performed by the color filter layer 30 which is substantially opaque to the first light 80 which was substantially transmitted through the fingertip 40 and substantially transparent to the second light 82 produced by the light source 50. The first light 80 is inhibited from propagating to the plurality of optical detectors 60 while a portion of the second light 82 is permitted to propagate to the plurality of optical detectors 60. In this way, any influence of the ambient light on the sensed fingerprint is effectively removed by the fingertip 40 (which is substantially opaque to light with wavelengths below 600 nm) combined with the color filter layer 30 (which is substantially opaque to light with wavelengths above 580 nm). The combined filtering of the fingertip 40 and the color filter layer 30 allow the fingerprint sensor 10 to operate even in environments with high levels of ambient light, and avoids potentially cumbersome enclosures for the fingerprint sensor 10 to shield it from the influences of ambient light.

In a procedural block 160, the second light 82 reflected from the fingertip 40 is detected, thereby imaging the fingerprint of the fingertip 40. In embodiments using the fingerprint sensor 10 schematically illustrated in Figure 23, the second light 82 is detected by the plurality of optical detectors 60 after propagating through the color filter layer 30 and the top coat layer 36. The plurality of optical detectors 60 then generates an electronic representation of the fingerprint, which can be used for identification of the user.

In an alternative embodiment, schematically illustrated in Figure 31A, the color filter layer 30 with the second material 34 is applied directly onto the substrate 20 and the plurality of optical detectors 60. This embodiment either includes a top coat layer 36 which comprises the second material 34, or does not include a top coat layer 36 at all. Similarly, in the embodiment schematically illustrated in Figure 31B, the second material 34 is applied directly onto the plurality of optical detectors 60, but the areas between the optical detectors 60 are free of the second material 34. The color filter 30 is patterned such that the color filter 30 does not substantially cover the region between the optical detectors 60. This embodiment avoids attenuation of the light from the light source 50 which may occur in the embodiments of Figures 23 and 31A as the light propagates through the color filter layer 30 toward the contact surface 32. In the embodiments of Figures 31A and 31C the color filter 30 substantially covers the plurality of optical detectors 60.

In still another alternative embodiment, schematically illustrated in Figure 31C, the color filter layer 30 can be incorporated within the passivation layer 69 just above the photodiode 62 of the optical detectors 60. In such an embodiment, the passivation layer 69 is insulating, substantially transparent to light with wavelengths within the first range of wavelengths, and substantially opaque to light with wavelengths within the second range of wavelengths. An exemplary example of a passivation layer 69 compatible with this embodiment is a multilayer structure of a-SiN_x/a-SiO_x/a-SiN_xO_y. Persons skilled in the art can select other materials and configurations which are compatible with this embodiment. In such embodiments, the optical detectors 60 are substantially responsive to light that is generated by

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the light source 50 and not substantially response to the portion of ambient light substantially transmitted through the fingertip 40.

In alternative embodiments, the fingerprint sensor 10 does not have the opaque layer 37 of the embodiments of Figures 23, 31A, and 31B. Instead, the optical detectors 60 comprise an opaque matrix 90 which substantially bounds each optical detector 60 thereby separating the optical detectors 60 from one another, as schematically illustrated in Figure 32A. Similarly, the opaque matrix 90 can substantially bound portions of the color filter 30, thereby separating the portions of the color filter 30 from one another. In still other embodiments, as shown in Figure 32A, the opaque matrix 90 substantially bounds each optical detector 60 with an associated portion of the color filter 30. The walls of the opaque matrix 90 extend across a substantial portion of the thickness of the top coat layer 36. In this way, when the fingertip 40 is placed on the contact surface 32, ambient light not substantially transmitted through the fingertip 40 is blocked from reaching any pixels 61 directly below the fingertip 40. An exemplary material for the opaque matrix 90 is DARC 400, a resin material available from Brewer Science, Inc. of Rolla, Missouri. The opaque matrix 90 can be fabricated by spin-coating and patterning using photolithographic techniques.

In yet another embodiment of the present invention, the light sources 50 and the optical detectors 60 can be fabricated in generally the same layer of the fingerprint sensor 10, such that the optical detectors 60 are substantially co-planar with the light sources 50. As schematically illustrated in Figure 32B, the light generated by the light sources 50 is reflected from the fingertip 40 and detected by the optical detectors 60 which are incorporated with the color filter layer 30. The substrate 20 of this embodiment provides structural support for the other elements of the fingerprint sensor 10, and since the light does not propagate through the substrate 20, there are no constraints on the optical characteristics of the substrate 20.

In still other embodiments of the present invention, a color filter layer 30 may be omitted where the sensitivity spectrum of the optical detectors 60 are less sensitive to light which is substantially transmitted through the fingertip 40, i.e., in the red portion of the visible spectrum. By utilizing a light source 50 which emits light in the range of higher sensitivity of the optical detectors 60, e.g., green visible light, the filtering of the ambient light by the fingertip 40 reduces the sensitivity of the fingerprint sensor 10 to ambient light. Persons skilled in the art can select appropriate light sources 50 and optical detectors 60 to practice this embodiment of the present invention.

In another embodiment, as illustrated schematically in Figure 32C, the fingerprint sensor 10 comprises an opaque material layer 37, a color filter layer 30 comprising a hardcoat layer 35 and a second material 34, a top coat layer 36, an active matrix sensor array 60, and a substrate 20 comprising a first material 22. The fingerprint sensor 10 also comprises a light source 50 comprising a green LED 84, a microlens array 86, and a reflector 88. In addition, the fingerprint sensor 10 further comprises a light shield 89.

The microlens array 86 and the reflector 88 are positioned below the active matrix sensor array 60, and the green LED 84 is positioned to one side of the microlens array 86. The green LED 84 illuminates the microlens array 86 and reflector 88, and the light from the green LED 84 is reflected towards the fingertip 40. The microlens array 86 comprises a plurality of reflective surfaces which direct the reflected light upward towards the fingertip 40. In

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certain embodiments, the reflective surfaces can be curved while in alternative embodiments the reflective surfaces can be angled, patterned, or generally rough in shape or form. Typically, the microlens array 86 comprises a molded acrylic material, and microlens arrays 86 compatible with this embodiment are available from Lumitex, Inc, of Strongsville, Ohio. To provide a more uniformly distributed illumination of the fingertip 40, the light shield 89 comprises an opaque material and is positioned to block light from the green LED 84 from directly illuminating the fingertip 40 without reflecting from the microlens array 86.

Note that not all of the components listed and described in Figures 23, 31A, 31B, 31C, 32A, 32B, and 32C are required to practice the present invention, since these figures merely illustrate particular embodiments of the fingerprint sensor 10. Other embodiments compatible with the present invention can eliminate some or all of these components, or can include additional components. It will be further appreciated that the color filter layer 30 as herein described with respect to the sensor 10 is compatible with the sensor 1003 and optical modules 1200, 1300, 1400, and 1500 previously described and the sensors 200, 300, 330, 370, 420, 450, 468, and 500 to be described in greater detail below and could be readily adapted by one of skill in the art without detracting from the spirit of the present invention.

In another aspect, the present invention comprises a fingerprint sensor 200 wherein the light source 50 is positioned substantially adjacent to the fingerprint sensor 200 wherein the light emitted from the light source 50 is directed towards a relief object through a substrate material to improve the image quality and resolution. Furthermore, the system and method presented herein have the ability to harvest ambient light in such a way that it may be used for improving image contrast while at the same time eliminating the need for employing a shield to prevent ambient light from entering the sensor device.

Still other aspects of the present invention will now be discussed which may utilize the aforementioned methods for rendering the fingerprint image. Additionally, these embodiments will disclose other features of the fingerprint sensor which demonstrate other methods and structures for detecting and imaging the fingerprint surface. In one aspect, the following methods and structures increase the accuracy or ease of reentering, as well as, desirably add other functionalities to the fingerprint sensor 200.

Figure 33A illustrates a simplified cross sectional diagram of the fingerprint sensor 200 attached to a printed circuit board (PCB) 201 with a latch or harness 203. In one aspect, the light source 50 of the fingerprint sensor 200 comprises a side injected light source 202 for illuminating the fingertip 40. In one embodiment, the side injected light source 202 is positioned substantially adjacent to the fingerprint sensor 200 wherein light 211 is directed from the side injected light source 202 into the fingerprint sensor 200. A plurality of reflective surfaces 206 may further be positioned along the sides and bottom of the fingerprint sensor 200 to increase the amount of light 211 which is directed towards the fingertip 40 to be subsequently reflected and detected by a plurality of optical detectors 60.

In one aspect the reflective surfaces 206 will comprise a metal, glass, acrylic or plastic material having light reflective properties. Additionally, the reflective surfaces 206 may comprise one of the aforementioned materials used in conjunction with a light reflective layer or coating to produce the desired light reflective surfaces 206. The

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reflective surfaces 206 improve the illumination of the fingertip 40 by redirecting light, which might not otherwise reach the fingertip 40, in a direction which results in the light being transmitted towards the fingertip 40. Thus, the path of the light may be altered by the reflective surfaces 206 so as to increase the quantity of light which is directed towards the fingertip 40 as compared to that of the light which travels along paths that will not reach the fingertip 40. For example, a side reflective surface 206 may be positioned along the side opposite of the side injected light source 202 to reflect light 211 that would otherwise pass through the fingerprint sensor 200 without striking the fingertip 40.

Additionally, a reflective surface base may be positioned along the underside of the fingerprint sensor 200 to desirably reflect light 211 in the direction of the fingertip 40. The reflective surfaces 206 may desirably be used individually or in combination so as to reduce the amount of light 211 lost along undesirable paths and to increase the amount of light 211 directed towards the fingertip 40. In one embodiment, the reflective surfaces will comprise a metal or metal alloy coated or layered on the reflective surfaces 206 to yield a material which desirably possesses the aforementioned light-reflective properties.

In one aspect, light 211 emitted by the side-injected light source 202 propagates along a path which does not intersect with the fingertip 40. Unless reflected, this quantity of light 211 would be lost, for example, by transmission through the sides or base of the fingerprint sensor 200. By positioning the reflective surfaces 206 along areas of the sensor 200 where light would otherwise escape (such as the base or side walls of the sensor 200), the light can be desirably reflected back into the sensor 200 and furthermore redirected towards the fingerprint surface 40 to desirably increase the intensity of illumination produced by the light source 202.

Figure 33B illustrates the side injected light source 202 coupled to a light conductive material 210 used to direct the emitted light 211 through a conduit 809 until the light 211 reaches a side surface 213 of the fingerprint sensor 200. Use of the light conductive material 210 desirably permits the side injected light source 202 to be displaced from the fingerprint sensor 200 while maintaining sufficient illumination of the fingertip 40. In one aspect, the light conductive material 210 comprises an acrylic, glass, or plastic light pipe or fiber optic material which efficiently internally conducts light 211 with minimal loss of light intensity. The light conductive material 210 may further be coupled to, or surrounded by, a conduit reflector 215 which desirably increases the amount of light 211 transmitted into the fingerprint sensor 200 by reducing the amount of stray light which might otherwise exit the light conductive material 210 in positions other than that of the desired position into the fingerprint sensor 200.

The aforementioned fingerprint sensors 200, shown in Figures 33A and 33B, may be advantageously used to detect a plurality of ridges 42 and valleys 44 formed along the fingertip 40 by using light 211 directed through an interior region 212 of the fingerprint sensor 200 to an upper surface 214 of the fingerprint sensor 200. In one aspect, the reflective surfaces 206 will desirably be positioned along the sides or edges of the sensor 200 to prevent light 211 from escaping from the sensor without intersecting with the fingerprint surface 40. At least a portion of the light 211 is reflected at the upper surface 214 where the valleys 44 of the finger 805 are positioned and is subsequently

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detected by an array 58 of optical detectors 60, such as those described above in reference to Figure 28, to reconstruct an electronic image of the fingertip 40 in a manner that will be discussed in greater detail hereinbelow.

In one aspect, the reflective surfaces 206 advantageously reflect or redirect the light 211 at an angle which desirably increases the light's reflectivity when it interacts with the fingertip 40. As a result, the light-sensing photodetectors 60 of the fingerprint sensor 200 may receive and process the fingertip surface or relief information more readily with an increase in the efficiency of light utilization. Thus, the reflective surfaces 206 contribute to increased sensor sensitivity and require a light source with lower illumination intensity as compared to a sensor apparatus which does not employ reflective surface illumination.

The use of a light conductive material 211, such as the aforementioned light pipe, advantageously permits the light source 202 to be displace from the sensor 200 while still providing sufficient light transmission into the sensor 200 to permit the illumination of the fingertip 40. This conveys a manufacturing or fabrication advantage to the sensor 200 by permitting more flexible placement of the light source 202 and may be important in instances where the light source 202 generates heat which might interfere with the sensor 200 operation.

Figure 34A illustrates a method for illuminating a relief object, such as a fingertip 40, to be subsequently resolved using a fingerprint sensor 200. The interior region 212 of the fingerprint sensor 200 may be formed from substantially light conductive material 210, such as glass or plastic. In one aspect, the fingerprint sensor 200, comprises a rectangular region with dimensions of approximately 14mm by 19mm and provides a sufficient surface to position at least a portion of the fingertip 40 upon to permit the electronic resolution of the ridges 42 and valleys 44 of the fingertip 40.

The light conductive material 210 of the fingerprint sensor 200 serves as a support base and light conductivity medium for the array 58 of optical detectors 60. The array 58 is additionally formed on or near the surface of the fingerprint sensor 200 and is covered or encased in a substantially transparent protective top-coat 36. The top-coat 36 desirably possess a refractive index close to that of the fingertip 40 to improve the selective light reflecting properties associated when passing light over the ridges 42 and valleys 44 of the fingertip 40. Furthermore, the optical detectors 60 are spaced between approximately 5 microns and 20 microns apart to permit sufficient light to pass between adjacent optical detectors 60. In other embodiments, the fingerprint sensor 200 may contain additional components and layers such as, for example, layers and components associated with an LCD or CRT display or screen. These additional layers and components desirably do not substantially interfere with the operation of the fingerprint sensor 200 and may be used to enhance the functionality of the fingerprint sensor 200 or permit integration into other devices.

In one embodiment, ambient light 220 is utilized in conjunction with another illumination method such as the aforementioned side injected light source 202, to improve the resolution and contrast of the fingerprint sensor 200 as is illustrated in Figure 34A. During operation of the fingerprint sensor 200, ambient light 220 enters the fingerprint sensor 200 through an open region 219 which is not covered by the fingertip 40. Typically, the ambient light 220 enters the fingerprint sensor 200 from many different angles depending on the source of ambient light 220 present in

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the vicinity of the fingerprint sensor 200. A light reflective surface 221 is positioned substantially below or integrated into the base of the fingerprint sensor 200 and reflects 222 the incoming ambient light 220 towards the fingertip 40. The light reflective surface 221 is further configured in such a manner so as to reflect 222 the ambient light 221 at an angle which results in the ambient light 220 being transmitted from the open region 219 alongside the fingertip 40 to the underside 225 of the fingertip 40 wherein the ridges 42 and valleys 44 of the fingertip 40 can be identified.

The light reflective surface 221 used for reflecting ambient light 220 may be formed from numerous materials including an optical diffraction grating, a holography grating, a micro lens structure, a micro-prism device, or similar components possessing the necessary properties to reflect 222 the ambient light 220 which enters the fingerprint sensor 200. In one aspect, the light reflective surface 221 will further posses properties for selectively reflecting light at a particular angle or with a particular wavelength to improve the contrast or quality of the sensed fingertip 40. Selective light reflection may further comprise absorbing or reflecting undesirable ambient light 220 of a particular angle or wavelength away from the fingertip 40 to selectively illuminate the fingertip 40 with ambient light 220 of a particular wavelength and/or at a specific desired angle of incidence.

Figure 34B further illustrates the fingerprint sensor 200 and light reflecting surface 221 used in conjunction with a side injected light source 202. In one aspect, the side injected light source 202 emits light 211 to illuminate the underside 225 of the fingertip 40 in a uniform manner. The emitted light 211 may additionally pass through a directivity enhancement element 227 interposed between the side injected light source 202 and the side surface 213 of the fingerprint sensor 200. The directivity enhancement element 227 serves to direct the light 211 along a desirable angular vector to increase the uniformity of the illumination of the fingertip 40. In one aspect, the directivity enhancement element 227 comprises a substantially transparent plastic, glass, or acrylic component with light bending properties.

Improved illumination and relief feature recognition is accomplished by passing the light from the light source 202 into the directivity enhancement element 227 in a first direction wherein at least a portion of the light is redirected of bent in a second direction to result in a projection of light along an angular vector which desirably enhances the amount of light which illuminates the fingertip region 40. Additionally, the directivity enhancement element 227 may further bend or redirect the light in such a manner so as to create an angle of incidence which improves the reflection of light off of the valleys 818 of the fingertip or increases the proportion of light which undergoes total internal reflection at the interface between the underside 225 of the fingertip and the top surface of the fingerprint sensor 200 in a manner that will be discussed in greater detail hereinbelow.

During operation of the fingerprint sensor 200, the side injected light 211 enters the side surface 213 of the fingerprint sensor 200 and cooperates with the reflected ambient light 220 to desirably illuminate the fingertip 40 with greater contrast than by using either light components 211 or 220 alone. One reason for the improved contrast results from the combination of light 211, 220 which have different angular components or angles of incidence and desirably enhance the quality of the electronic image obtained when reflected light is sensed by the array 58 of optical detectors 60 as described in greater detail hereinbelow.

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Figure 35 further illustrates one embodiment of the present invention comprising a selective reflection method used to better discern between the ridges 42 and valleys 44 of the fingertip 40. The side injected light source 202 comprises a lighting apparatus such as an organic LED, a inorganic LED, a electro-luminescent component, or other light generating device which emits light 211 along the side of the fingerprint sensor 200 as previously described. The directivity enhancement element 227 and/or light conduit 209 may further be interposed between the side injected light source 202 and the side surface 213 of the fingerprint sensor 200 to improve the uniformity of the lighting of the fingertip 40 as previously described. In one aspect, the directivity enhancement element 227 may comprise a color filter, such as the color filter layer 30, used to selectively enhance a particular wavelength of side injected light 211 which is found to be most beneficial in obtaining a resolvable fingerprint image. Alternatively, the directivity enhancement element 227 may comprise a polarizing element or diffraction grating which directs the light 211 entering from the side surface 213 of the fingerprint sensor 200 along a particular plane or angle of incidence to improve the quality of the fingerprint image. Additionally, ambient light 220 may be reflected towards the fingertip 40 using the reflective grating 221 to increase the illumination of the fingertip 40 as previously discussed. The side injected light source 202 and ambient light 220 may be used in conjunction with one another to improve the overall contrast of the fingertip 40 to desirably obtain increased contrast and improved accuracy when electronically imaging the fingerprint.

A benefit obtained from using ambient light 220 in conjunction with the side light source 202 is that the need for a shield or sensor cover is eliminated and the flexibility of the fingerprint sensor 200 is improved. Additionally, the resulting electronic image may more accurately represent individual fingerprints when using combined light sources and results in increased accuracy in discriminating between similar but not identical fingerprints.

It will be appreciated by those of skill in the art that the combination of ambient light 220 and side injected light 211 is not necessarily required for electronically generating a representation of the fingerprint pattern of the fingertip 40. In certain embodiments, a single light source or method of illumination may be used to illuminate the fingertip 40. For example, the side injected light source 202 may be exclusively used for illuminating the fingertip 40 and ambient light 220 may be inhibited from either entering or reflecting off of the surfaces of the fingerprint sensor 200 by positioning light absorptive layers 207 along the fingerprint sensors 200 in positions where ambient light 220 interacts with the fingerprint sensor 200 to absorb or block ambient light 220. Furthermore, other lighting methods and types of light emitting devices exist that may sufficiently illuminate the fingertip 40 and may be used in conjunction with the aforementioned components of the fingerprint sensor 200 and thus represent additional embodiments of the fingerprint sensing device 200.

Figure 35 further illustrates one aspect of fingerprint detection wherein the relief features of the fingerprint are detected by selective reflection of light using the property of total internal reflection. More specifically, the fingertip 40 is resolved by the passage of light through the substantially transparent light conductive material 210 of the fingerprint sensor 200 to the upper surface 214 of the light conductive material 210. A sufficient amount of incoming light 229 is further passed between the photodetector elements 220 and through the top-coat layer 36 to

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the interface 233 between the top-coat layer 36 and the fingertip 40 where the light 211 is either reflected, refracted, or absorbed by the surface of the fingertip 40 as discussed in previous sections.

When the portion of the fingertip 40 comprising the valleys 44 rests over the surface of the top-coat material 36, incoming light 211 in this area is substantially reflected towards the array 58 of optical detectors 60 in accordance with the principles of total internal reflection. In a more detailed sense, the selective reflection of light 211 along the valleys 44 of the fingertip 40 results from an optical density differential wherein the top-coat material 36 comprises a medium with a greater optical density than the space under the valleys 44 of the fingertip 40. Furthermore, light 211 is not substantially reflected in the areas where the ridges 42 of the fingertip 40 are positioned due to the optical density of the top-coat material 36 being fashioned to have a substantially identical optical density as compared to that of the fingertip 40.

As light 211 propagates through the top-coat material 36 the light 211 reaches the interface between the surface of the top-coat material 36 and the underside 225 of the fingertip 40. Light 211 with a sufficient angle of incidence undergoes total internal reflection under the areas where the valleys 44 of the fingertip 40 are positioned resulting from the light 211 traveling through a material with a greater optical density and interacting with a material with a lesser optical density. The array 58 embedded within the top coat layer 36 then registers the reflected light 235 wherein the plurality of optical detectors 60 are triggered by light 211 which has undergone total internal reflection.

Light 211 which propagates through the top-coat material 36 into areas where ridges 42 are positioned do not experience a substantial change in optical density when passing through the top-coat material into the underside 225 of the fingertip 40. As a result, the light 211 interacting with the areas where ridges 42 are present is transmitted into the fingertip 40 without undergoing appreciable total internal reflection.

Thus, a selective reflectivity of light 211 is observed between light 211 which interacts with the ridges 42 and valleys 44 of the fingertip 40 to provide a method for identifying the relief features of the fingertip 40. Furthermore, the selective reflection and transmittance of a sufficient amount of incoming light, selective triggers the array 58 of optical detectors 60 and results in the rendering of an electronic image which is representative of the reconstructed fingerprint pattern of the fingertip 40.

Figures 36A-C illustrate different modes by which the side injected lighting source 202 may be oriented to improve illumination of the ridges 42 and valleys 44 of the fingertip 40. As shown in Figure 36A, the side injected light source 202 is positioned substantially adjacent to the directivity enhancement element 227 which in turn is positioned substantially adjacent to the side surface 213 of the fingerprint sensor 200. Light 211 generated by the side injected light source 202 is typically dispersed in many directions and is desirably filtered and oriented using the directivity enhancement element 227. In one aspect, the directivity enhancement element 227 bends or polarizes the light 211 along an angular path which provides increased illumination of the underside 225 of the fingertip 40. Reorientation or bending of the light 211 further improves the illumination of the fingertip 40 by uniformly spreading at least a portion of the light 211 across the fingertip 40 while at the same time reducing or eliminating undesirable

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angles or wavelengths of light which might otherwise reduce the contrast or quality or the resulting electronic image of the fingerprint.

Figure 36B illustrates an alternative positioning of the side injected light source 202 and directivity enhancement element 227. In one aspect, the side injected light source 202 and directivity enhancement element 227 are vertically displaced or offset from the side surface 213 of the fingerprint sensor 200. Though offset from the fingerprint sensor 200, the directivity enhancement element 227 polarizes or bends light 211 emitted from the side injected light source 202 in a manner that permits the light 211 to be transmitted into the fingerprint sensor 200. The offset or displacement of the side injected light source 202 and directivity enhancement element 227 further permits at least a portion of the light 211 to enter the bottom surface 236 of the fingerprint sensor 200. As a result, improved uniformity of light 211 distribution across the fingertip 40 is thereby accomplished.

Figure 36C illustrates the fingerprint sensor 200 wherein the side injected light source 202 and directivity enhancement element 227 reside substantially adjacent to the fingerprint sensor 200 but are angularly displaced from the major axis of the fingerprint sensor 200. Additionally, the side surface 213 of the fingerprint sensor 200 may be formed to coincide with the angular displacement of the side injected light source 202 and directivity enhancement element 227. This structure serves to direct the emitted light 211 with a desirable angle of incidence which may improve the illumination of the fingertip 40. Additionally, the side surface 213 may be formed in such a manner so as to enhance the bending or refracting of the light 211 wherein a prismatic effect is displayed by the light conductive material 210 of the interior region 212 of the fingerprint sensor 200. As with previous embodiments shown in Figures 36A-B, the configuration of the fingerprint sensor 200, side injected light source 202, and directivity enhancement element 227 may desirably enhance the illumination of the fingerprint region and improve the uniformity of light intensity distributed across the fingertip 40.

The embodiments of the fingerprint sensor 200 shown in Figures 36A-C may additionally comprise a light conduit 209, as previously discussed, to permit alternative placement of the side injected light source 202 in positions other than those indicated in the illustrated embodiments. Furthermore, the light conduit 209 may be interposed between the fingerprint sensor 200 and the directivity enhancement element 227, or alternatively, the light conduit 209 may be interposed between the side injected light source 202 and the directivity enhancement element 227. In both cases, the combination of the side injected light source 202, directivity enhancement element 227, and light conduit 209 may be configured to direct light 211 into the fingerprint sensor 200 in the indicated directions and orientations.

In addition to the aforementioned advantage of uniform light distribution, variations in the positioning of the side injected light source 202 and directivity enhancement element 227 may be beneficially used to accommodate different configurations of electronics which may be present in the area surrounding the fingerprint sensor 200. This feature becomes increasingly important in embodiments of the fingerprint sensor 200 where space is limited and results in an increase in the flexibility of design options which may incorporate the fingerprint sensor 200 and side injected light source 202.

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Figure 37A illustrates another embodiment of the fingerprint sensor 200 wherein a bottom injected light method is utilized to illuminate the fingertip 40. In one aspect, bottom injected lighting is accomplished by coupling a side injected light source 202 with a diffuser component 240. The side injected light source 202 may be positioned adjacent to the diffuser component 240 wherein light 211 is conducted directly into the diffuser 240. Alternatively a light conduit 209 (not shown) may be interposed between the side injected light source 202 and the diffuser 240 to improve the light injection into the diffuser 240. Additionally, as previously mentioned, a directivity enhancement element 227 may also be interposed between the side injected light source 202 and the diffuser 240 to improve the lighting characteristics used to illuminate the fingertip 40.

The diffuser 240 further comprises a light conductive material, such as glass or plastic, which receives the light 211 from the side injected light source 202 and distributes and bends the light 211 in such a manner so as to direct the light 211 towards the fingertip 40. In one aspect, the diffuser 240 is further coupled to a micro-prism or micro-lens array apparatus 241 which receives at least a portion of the light 211 transmitted through the diffuser 240 and directs the light 211 towards the fingertip 40. One advantage realized by using the bottom injected light apparatus resides in the more uniform distribution of light 211 over a larger area compared to other conventional fingerprint illumination methods. Furthermore, the coupling of the micro prism apparatus 241 to the diffuser 240 further increases the quantity of light 211 which is directed along a desirable angle of incidence to improve the effect of total internal reflection by the valleys 44 of the fingertip 40 while maintaining an absorptive or refractive effect from the ridges 42 of the fingertip 40.

Figure 37B illustrates another embodiment of the diffuser 240 and micro prism apparatus 241 wherein a backlight source 242 is used to provide light 211 for illuminating the fingertip 40. In this embodiment, light 211 is directed from a backlight source 242 into the diffuser 240 to uniformly illuminate the bottom surface 244 of the diffuser 240. In one aspect, the backlight source 242 comprises an LED array, electroluminescent panel or other lighting source with substantially the same area and/or surface dimensions as the bottom surface 244 of the diffuser 240. One advantage of this configuration is the backlight source 242 provides uniform luminosity across the region of the diffuser 240 and, as a result, improves the uniform distribution of light 211 over the underside 225 of the fingertip 40.

It will be appreciated by those of skill in the art that the aforementioned embodiments of the lighting apparatus, including the ambient lighting method, side lighting method, and backlighting method, may be used individually or in combination to improve the contrast and resolution of the fingerprint and improve the accuracy in discriminating between fingerprint patterns. Likewise, the components of the lighting apparatus may be modified or arranged in such a manner so as to improve the selective reflective effect resulting from the passage of light 211 over the fingertip 40. It will be further appreciated that the light sources 50, 202, 220, and 220 herein described can be used individually or in combination with the sensors 10 and 1003 and optical modules 1200, 1300, 1400, and 1500 previously described and the sensors 200, 300, 330, 370, 420, 450, 468, and 500 to be described in greater detail below without detracting from the spirit of the present invention.

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Figures 38A-C illustrate a contact triggered or tactile fingerprint sensor 300 used to electronically sense and image the fingertip 40. As schematically shown in Figure 38A, a surface 301 of the fingerprint sensor 300 comprises a plurality of external contact electrodes 302 arranged about the surface 301 upon which the fingertip 40 is positioned. The arrangement of the external contact electrodes 302 forms a sensing array 304 with approximately 315 x 240 external electrodes 302 arranged in an area of between approximately 1.4 cm x 1.8 cm and 1.6 cm x 2.2 cm wherein the spacing between individual external electrodes 302 is between approximately 20 m and 30 m apart. A ground contact 305 is further formed on the surface 301 of the fingerprint sensor 300 and is positioned adjacent to the sensing array 304. The ground contact 305 forms a substantially rectangular region with approximate dimensions of 0.5 cm in width by 1.5 cm in length.

The sensing array 304 and ground contact or surface 305 are positioned on the substantially planar surface 301 of the fingerprint sensor 300 to allow the fingertip 40 to be positioned in such a manner so as to permit selective contact between the ridges 42 of the fingertip 40 and the external electrodes 302 of the sensing array 304. Furthermore, at least a portion of the fingertip 40 is desirably positioned to rest on the ground contact 305 in a manner that with be described in greater detail hereinbelow.

As shown in the cross-sectional view of Figure 38B, the tactile fingerprint sensor 300 further comprises a plurality of substrate layers 306 that form a conductive medium through which electronic and light impulses may travel. In one aspect, a plurality of internal contact electrodes 308 are positioned adjacent to and in continuous contact with the external contact electrodes 302. A passivation layer 310 is further formed about the internal contact electrodes 308 to electrically isolate each external electrode 302 / internal electrode 308 pair. The passivation layer 310 serves as a protective barrier or coating for the tactile fingerprint sensor 300 wherein the underlying components and layers 306 within the sensor 300 are shielded from damage by external or environmental factors. The passivation layer 310 is desirably formed from a non-conductive plastic or acrylic material and has a thickness of approximately 2.0 m to form the surface 301 of the fingerprint sensor 300.

The substrate layers 306 below the internal electrode 308 / passivation layer 310 form a region comprising an organic light emitting diode (OLED) cell 311 comprising an electron transportation layer (ETL) 312, an organic polymer layer (OPL) 314, a hole transportation layer (HTL) 316, a transparent conducting oxide (TCO) layer 318, and a substrate or contact imager layer 320. The OLED cell 311 is formed substantially below the plurality of internal contact electrodes 308 such that a least a portion of the bottom surface of each internal electrode 308 is in direct contact with a portion of the electron transport layer 312 of the OLED cell 311.

A power source 315 is further connected between the TCO layer 318 and the ground contact 305 such that, when the ground contact 305 is conductively joined to any external electrode 302, a conductive path is formed and a voltage is applied to the OLED cell 311. When the appropriate voltage is applied to the OLED cell 311, light emission is produced within the OLED cell 311 and is registered by a plurality of optical detectors 60 in a manner that will be described in greater detail hereinbelow.

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In the OLED cell 311, each internal electrode 308 forms a cathode to the OLED cell 311 with the TCO layer 318 forming an anode layer. As described above, when a voltage is applied between to one or more of the plurality of internal electrodes 308 and the TCO layer 318, positive and negative charges 322 are injected into the OPL 314. The underlying ETL 312 and HTL 316 act as the sources for the positive and negative charges 322, as is known in the art of OLED design and manufacture, and these charges 322 recombine in the OPL 314 to produce OLED light 303 in the form of electroluminescence.

The fingerprint sensor 300 utilizes at least a portion of the emitted OLED light 303 which passes through the HTL 316 and TCO 318 layers to be subsequently captured by the optical detectors 60. In one aspect, the HTL 316 and TCO 318 are at least partially transparent so as to permit the transmission of the OLED light 303 into the substrate layer 320. As OLED light 303 enters the substrate layer 320, the plurality of optical detectors 60, arranged substantially below each internal electrode 308, detect and register the OLED light 303 produced as a result of the triggering of the OLED cell 311.

Based on the aforementioned principles of operation of the OLED cell 311, a fingertip 40 may be rendered by a plurality of triggering events which occur when a least a portion of the fingertip 40 is placed in contact with the tactile fingerprint sensor 300. The placement of the fingertip 40 conductively joins the ground contact 305 and one of more of the external electrodes 302 to thereby create a path of conductivity wherein a voltage may be made to pass through the layers 306 of a discrete section of the fingerprint sensor 300 comprising the OLED cell 311.

In one aspect, the tactile fingerprint sensor 300 produces discrete OLED light 303 in response to the individual triggering of external electrodes 302 by the ridges 42 of the fingertip 40. As shown in Figure 38C, the fingertip 40 is desirably placed over the sensor array 304 wherein a portion of the fingertip 40 covers a number of individual external electrodes 302. When the fingertip 40 makes contact with the ground surface 305, a path of conductivity is created wherein a voltage is applied to the external electrodes 302 that are in contact with the ridges 42 of the fingertip 40. The applied voltage is conducted through the external electrode 302 to the internal electrode 308 and subsequently into the OLED cell 311 where the resulting applied voltage selectively triggers OLED light 303 in the OPL 314.

The aforementioned light triggering events are localized to the regions between the external electrode 302, to which the voltage was applied, and the area of the OPL 314 substantially below the external electrode 302. External electrodes 302 that are positioned under valleys 44 of the fingertip 40 do not receive an applied voltage as the fingertip 40 does not make contact with the external electrodes 302 in these positions. As a result, the relief structure of the fingertip 40 may be used to selectively illuminate OLED regions 319 of the OPL 314 that can be resolved to map the fingertip 40 and yield an electronic image of the fingerprint.

Crosstalk or light scatter resulting from light reflected by the valleys 44 or the surface of the sensor 200 underlying the valley 44 onto optical detectors 60 adjacent to the desired optical detector 60 is reduced by minimizing the path length of light travel between the reflecting surface and the optical detector 60. In one aspect, the path length is between approximately 3 microns and 5 microns with the optical detector 60 having dimensions of

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approximately 40 microns in width by 40 microns in length. Furthermore, the optical detectors 60 are spaced approximately 12 microns apart to permit light 211 to pass between the optical detectors 60 and illuminate the surface of the fingertip 40.

In one aspect, an image of the fingertip 40 is obtained by combining the results of the plurality of optical detectors 60 to reveal the areas in which the ridges 42 of the fingerprint are positioned relative to the valleys 44. As will be described in greater detail below, a controller 490 may be desirably integrated into the fingerprint sensor 300 to accumulate and process the signals generated by the optical detectors 60 to render the fingerprint image.

It will be appreciated that the tactile fingerprint sensor 300 need not depend on an externally positioned light source to illuminate the fingertip 40. The sensor 300 is compatible with the light sources 50, 202, 220, 242, and 311 previously described and 303 to be described in greater detail below as will be understood by one of skill in the art. As a result, the tactile fingerprint sensor 300 is not significantly affected by the presence of ambient light 220 and does not require side or back lighting devices. Another benefit of the tactile fingerprint sensor 300 resides in its ability to utilize a high-density sensor array 304. The high-density sensor array 304 possesses a greater number of contact points 302 compared to conventional fingerprint sensors and improves the quality and resolution of the fingerprint image resulting in increased sensitivity and accuracy in fingerprint rendering.

Figure 39 illustrates another embodiment of the tactile fingerprint sensor 300 wherein the OLED cell 311 is represented as a plurality of photodiodes 323 coupled to discrete electrodes or contact points 325 to form the sensor array 304 upon which the fingertip 40 rests. The fingertip 40 is desirably positioned over the surface 301 of the sensor array 304 in contact with the ground electrode 305 and at least a portion of the discrete electrodes or contact points 325. The ridges 42 of the fingertip 40 selectively trigger the emission of discrete quantities of OLED light 303 which can then be identified to determine the relative position of the ridges 42 and valleys 44 of the fingerprint.

Identification of the emitted OLED light 303 is accomplished using a plurality of photodetectors 324 positioned in the substrate layer 320. Alternatively, the plurality of photodetectors 324 may be positioned in the upper surface 301 of the tactile fingerprint sensor 300 wherein incoming OLED light 303 is registered from the lower layers of the fingerprint sensor 300. When positioned in this manner, the photodetectors 322 may be further interposed between the electrodes 325 to capture emitted OLED light 303.

Figure 40A illustrates one embodiment of a fingerprint sensor 330 used in conjunction with a multifunction OLED screen 331 that has a touch panel function. In one aspect, the OLED screen 331 comprises a plurality of discrete pixels 333 and is used to selectively emit OLED light 303 for display purposes. Additionally, a plurality of photodetectors 324 may be integrated into the multifunction screen 331 to sense the presence of a touch pen or stylus 334 when positioned over the multifunction screen 331.

As is known in the art of touch panel design, the presence of the stylus 334 may be detected when the stylus 334 is positioned over a region of pixels 333 wherein the photodetectors 324 detect a change in ambient light conditions. When the stylus 334 is brought into close proximity to the multifunction screen 331, the photodetectors 324 residing under the stylus 334 sense a reduction in the ambient lighting resulting from the stylus 334 blocking at

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least a portion of the light to prevent the light from interacting with the multifunction screen 331. The darkened area under the stylus 334 can then be identified relative to other areas of the multifunctional screen 331 that do not sense a change in ambient lighting to yield a method by which the position of the stylus 334 can be determined.

The multifunction OLED screen 331 / fingerprint sensor 330 adds functionality for detecting and rendering the fingertip 40 using the pixels 333 as a source of OLED light 303 to illuminate the fingertip 40. When a fingertip 40 is positioned over the sensor 330, reflected light 335, which is reflected by the fingertip 40 and directed into the multifunction screen 331 where the photodetectors 324 are, is used to sense the reflected light 335. As with certain embodiments of the invention to be described in greater detail below, a controller 490 may be used to compile the triggering state of the photodetectors 324 and render an electronic image of the fingertip 40 in a manner that will be described in greater detail hereinbelow.

An enlarged cross-sectional view of the multifunctional display screen 331 as shown in Figure 40A is shown in Figure 40B to further illustrate the operation of the fingerprint sensor 330. A plurality of pixel elements 333 are positioned in close proximity to form the multifunctional OLED screen 331. In one aspect, each pixel element 333 comprises a red 336, green 338, and blue 340 color component that can be individually engaged to provide illumination of a specific wavelength or color. The color components 336, 338, 340 are formed in a layered stack comprising alternating layers of color OLED cells 311 corresponding to a red cell, a green cell, and a blue cell.

Each of the color OLED cells 311 further comprise a corresponding transparent conducting oxide (TCO) layer 341 and a corresponding electrode 346. When current is passed between a specific TCO layer 341 and the corresponding electrode 346, the OLED cell 311 associated with the TCO layer 341 and corresponding electrode 346 is selectively illuminated to produce OLED light 303 of a desired color or wavelength. At least a portion of the OLED light 303 generated by the OLED cells 311 is directed through the upper surface 350 of the display screen 331 to provide the illumination functionality of the multifunction screen 331. It will be appreciated by those of skill in the art, that the arrangement of OLED cells 311 may be accomplished using a transparent OLED (TOLED) configuration or a stacked OLED (SOLED) configuration, both of which are suitable for use in integration with the fingerprint sensor 330 into the touchscreen/display apparatus.

When the fingertip 40 covers the fingerprint sensor 330 and the multifunction screen illuminated 331, reflected light 335 may be reflected by the fingertip 40, as described previously, to be subsequently detected by the photodetector 324 positioned in close proximity to the pixel elements 333. In one aspect, the photodetector 324 comprises a thin film transistor (TFT) which is formed in a planarization layer 351 comprising a plastic, acrylic, or glass substrate located along the lower surface of the fingerprint sensor 330 / multifunctional OLED screen 331.

A plurality of black matrix areas 352 are additionally formed on each side of the pixel element 333. The black matrix areas 352 block OLED light 303 from escaping from the sides of the pixel element 333 and thus illuminating the photodetector 324 directly. The black matrix areas 352 may further be formed from plastic or acrylic materials and are desirably opaque in nature to absorb or reflect OLED light 303 which is directed towards them. In the illustrated embodiment, each photodetector 324 is positioned between two adjacent pixel elements 333 with

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black matrix areas 352 extending about the sides of the photodetector 324. This arrangement blocks incoming paths of light aside from the path directly over the photodetector 324. When positioned in this manner, the photodetectors 324 may receive only reflected light 335 reflected by the fingertip 40 from an adjacent pixel element 333 thus reducing stray light detection and improving sensitivity of the fingerprint sensor 330.

The surface of the fingerprint sensor 330 is formed by a second planarization layer 353 extending about the pixel elements 333 and serves as an oxygen and moisture barrier to protect the embedded electronic components. The fingerprint sensor 330 may be further coated with a transparent topcoat layer 36 to provide added protection and resistance to damage from exterior elements such as the stylus 334 and fingertip 40.

Figure 41 illustrates another embodiment of fingerprint sensor 330 integrated into the multifunction OLED screen 331. In the illustrated embodiment, the OLED screen 331 has a directional functionality wherein in a first direction 360 the OLED screen 331 functions as a display apparatus and touchscreen. In the first direction 360, OLED light 303 is emitted from the plurality of color OLED cells 311 through a substrate/planarization layer 355 and topcoat layer 36 of the screen 331. Subsequent detection of the presence of the stylus 334 can be made, as previously described, by the plurality of photodetectors 324 interposed between the OLED cells 311.

The OLED screen 331 may additionally possess a second, substantially transparent substrate/planarization layer 355 and topcoat layer 36 positioned along the opposing side of the OLED screen 331 to permit a least a portion of the OLED light 303 emitted by the OLED cells 311 to be transmitted through the opposing side of the screen 331 in a second direction 361. This side of the screen 331 is configured to function as a fingerprint sensor 330 wherein a least a portion of the OLED light 303 is reflected 335 towards the photodetectors 324 when the fingertip 40 is appropriately positioned along the second surface 350 of the OLED screen 331.

The directional functionality of the OLED screen 331 / fingerprint sensor 330 may be advantageously used to reduce the accumulation of dirt, oils, residues and other contaminants on the display side 360 of the screen 331. These accumulations may occur when the fingerprint sensor 330 is repeatedly used and results in reduced display quality. In a single direction integrated display and fingerprint sensing device, repeated cleaning of the screen may be necessary to remove the smudges and residues left behind by the fingertip 40. Confining finger sensing activities to a side other than the display side 360 of the screen 331 beneficially reduces the problems associated with the accumulation of these contaminants. Furthermore, by using the light 303 emitted from the OLED cells 311 in opposing directions, the fingerprint sensing apparatus 330 desirably saves space and reduces the number of electronic components which are needed to fabricate a display device with the plurality of functionalities described above.

Figure 42A-B illustrates an OLED fingerprint sensor 370 with an integrated color filter. As previously discussed, color filters may be advantageously used to select colors or wavelengths of light that yield improved contrast and resolution when imaging the fingertip 40. Figure 42A illustrates a portion of the OLED display 331 comprising a plurality of pixel elements 333. Each pixel element 333 comprises three OLED color cells 311 corresponding to a red cell, a green cell, and a blue cell and may be selectively engaged to provide a large number of possible color combinations and wavelengths. The pixel elements 333 further comprise an integrated photodetector

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324 and color filter 371 which are used to identify reflected light 335 when a fingertip 40 is positioned over the fingerprint sensor 370 in a manner that will be discussed in greater detail hereinbelow.

The cross-sectional detail of the pixel elements 333 shown in Figure 42B, further illustrates the arrangement of the OLED fingerprint sensor 370 wherein the OLED color cells 311 are positioned on the substrate 355 with interposing color filter-protected photodetectors 324. Black matrix structures 352 are further positioned between each OLED cell 311 and its corresponding photodetector 324 to prevent emitted OLED light 303 from undesirably triggering the adjacent photodetectors 324 without first interacting with the fingertip 40. A substantially transparent hardcoat layer 35 may additionally be formed on the surface of the color filter 371 and OLED cells 311 and serves as a protective and planarization layer. The resulting surface of the fingerprint sensor 370 is then coated with a first protective layer 502. In this embodiment, the first protective layer 502 is a substantially transparent conductive material, such as indium-tin-oxide adapted to protect the fingerprint sensor 370 from damage due to electrostatic discharge in a manner that will be described in greater detail below.

Rendering of the fingertip 40 is accomplished by illuminating at least one of the OLED cells 311 so as to direct OLED light 303 towards the fingertip 40. Reflected light 335 is then redirected into the fingerprint sensor 370 where the color filter 371 permits the selective illumination of the underlying photodetector 324. In one aspect, each color filter 371 is matched to the color of the OLED cell 311 to which it is adjacently positioned to permit transmission of the reflected light 335 produced by the corresponding OLED cell 311. Reflected light 334 comprising light of an undesirable wavelength or color are excluded by the color filter 371 and prevented from triggering the underlying photodetector 324.

One advantage obtained by using this configuration of OLED fingerprint sensor 370 is that the fingertip 40 can be simultaneously illuminated with more than one color or wavelength of light 373. Each color or wavelength of light 373 can then be used to resolve an independent image of the fingertip 40 and the results combined by the controller 490 to yield an improved image or rending of the fingertip 40. The use of integrated color filters 371 additionally prevents undesirable ambient or reflected light from triggering the photodetector 324 without blocking the desirable color or wavelength of light 373 produced by the OLED cells 311.

Thus, the aforementioned OLED fingerprint sensor 370 may be integrated into a display apparatus or monitor without affecting the quality or tint of a displayed image while simultaneously providing a method for selecting optimized color or wavelength of light 373 to be used in resolving the fingerprint. Additionally, the OLED fingerprint sensor 370 may be manufactured with a thickness between approximately 2.0 m and 3.0 m thus making it highly suitable for integration into electronic devices where size and weight are a significant consideration.

Figures 43A-B illustrate the OLED fingerprint sensor 330 comprising an OLED emitting layer 380. As shown in Figure 43A, the OLED emitting layer 380 is formed on a sealant layer 381 which serves as a protective or insulating base for the fingerprint sensor 330. The OLED emitting layer 380 further comprises a plurality of functional layers which are arranged, as previously discussed, to inject electrical charges into the organic polymer layer 314 so as to induce light emissions in the form of electroluminescence.

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In one aspect, the sealant layer 381 may be desirably formed from a rigid material such as glass, metal, or plastic with a thickness between approximately 0.3 mm and 1.1 mm. In applications where the overall thickness of the fingerprint sensor 380 is desirably minimized, a thin film of Vitex® may be used to form the sealant layer 381 wherein the Vitex® film forms a layer of approximately 1 micrometer.

A conductive layer 357 comprising aluminum, lithium fluoride or other suitable metal or metal alloy is interposed between the OLED emitting layer 380 and the sealant layer 381 and forms a first of the two electrode layers through which a voltage may be applied to induce the OLED emitting layer 380 to luminesce. In one embodiment, the second electrode comprises a transparent conductive oxide 382 which in this embodiment comprises a layer of indium tin oxide formed on the opposing side of the OLED emitting layer 380.

A substantially transparent substrate layer 383 is further formed on the surface of the transparent conductive oxide 382 to transmit emitted OLED light 303 towards the fingertip 40. The substrate layer 383 additionally serves a base for an upper sensor layer comprising one of the aforementioned fingerprint sensing layer 379, such as the active matrix sensor array or LCD sensor array. The sensor layer 379 is positioned in close proximity to the surface of the fingerprint sensor 330 to capture light reflected from the fingertip 40 and render the fingerprint image as discussed in previous sections.

As with other embodiments of the fingerprint sensor, upper protective layers 358 may be formed on the surface of the sensor layer 379 to provide necessary planarization and protection of the underlying sensor layer 379. These upper protective layers 358 comprise the first protective layer 502, the hardcoat layer 35, and a top-coat layer 36. Additionally, a color filter 385 may be interposed between these layers 502, 35, 36 to selectively permit light of a particular color or wavelength to enter the fingerprint sensor 330. The color filter 385 also permits the emitted OLED light 303 of the OLED emitting layer 380 to be transmitted through the fingerprint sensor 330 to improve the illumination of the fingertip 40.

Figure 43B illustrates the OLED fingerprint sensor 330 with the integrated OLED backlight 242 wherein the upper protective layers 358 comprising the hardcoat layer 35, topcoat layer 36, first protective layer 502, and color filter 383 are desirably formed from a single multifunctional or composite layer 387 to serve substantially the same purpose as the aforementioned individual layers 502, 35, 36, and 383. The composite layer 387 in this embodiment simplifies the manufacturing steps required to produce the fingerprint sensor 330 and may advantageously require less material with a reduced overall thickness.

In one aspect, the overall thickness of the fingerprint sensor 330 is less than 2.1 millimeters with the composite layer 387 having a thickness of approximately 7 micrometers, the substrate surface having a thickness of approximately 1.1 millimeters and the backlight apparatus 242 having a thickness of approximately 0.5 micrometers. These relatively small dimensioned requirements contribute to the increased flexibility in integrating the fingerprint sensor 330 into electronic devices without unduly increasing the overall size of the device to accommodate the fingerprint sensor 330.

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Figure 44 A-B illustrates another application of the OLED fingerprint sensor device 330 wherein an identification card 388 contains an embedded fingerprint sensor 330 and controller 490. The identification card 388 is desirably used in conjunction with an imaging device 389 (Figure 44B) wherein the identification card 388 is placed on a receiving face 390 of the imaging device 389. The imaging device 389 contains an opening 391 which is positioned under the fingerprint sensor 330 when the identification card 388 is properly positioned over the imaging device 389 so as to permit light to enter an interior compartment 392 of the imaging device 389.

During operation of the imaging device 389 the fingertip 40 is placed in contact with the embedded fingerprint sensor 330 on the identification card 388 and a pixilated OLED layer 394 generates light 395 which is directed towards the fingertip 40. As described in previous sections, at least a portion of the light 395 is reflected by the ridges 42 and/or valleys 44 of the fingertip 40 back into the sensor 330. The reflected light 395 passes through substantially transparent layers 396 of the identification card 388 and enters the interior compartment 392 of the imaging device 389.

Within the imaging device 389, a lens assembly 393 is positioned so as to direct and/or focus at least a portion of the light 395 onto an imager 399 such as a charge-coupled device (CCD) imager or Complementary Metal-Oxide-Silicon (CMOS) imager. The imager 399 captures the light 395 to reconstruct an image of the fingertip 40 and subsequently uses this information for verification of the identity of the individual whose fingertip 40 has been placed on imaging device 389.

In one aspect, the lens assembly 393 may further comprise a color filter to block undesirable reflected light of an inappropriate wavelength, reduce ambient light entering the imager, or to improve the quality and contrast of the image of the fingertip 40 to be rendered by the imager 399. It will be further appreciated that other components may be used in conjunction with, or substituted for, the lens apparatus 393 such as a polarizing filter, a diffraction grating, other components which can be used to improve the quality and resolution of the resulting fingerprint.

Figure 45 illustrates a laptop-computing device 400, wherein an optical image sensor system is employed for user identification and verification by fingerprint detection, capture, and analysis. The optical image sensor system, in one embodiment as a fingerprint sensor, may be integrated into a non-display area 401, such as a touchpad or a pointing device, a viewing display area 402, or a housing area 403 of the computing device 400. The non-display area 401 may be modified to comprise a dual functionality, wherein, in one embodiment, a first function comprises a fingerprint image sensor for user identification and verification and a second function comprises a touch sensitive pointing device. It will be appreciated by one of skill in the art that any of the sensors 10, 200, 300, 330, 370 previously described can be adapted to cooperate with the devices 331, 400, 410 as well as the sensors 420, 450, 468, and 500 to be described in greater detail below without detracting from the spirit of the present invention.

For example, in a normal operation embodiment, the non-display area 401 may function as a conventional pressure sensitive pointing device controller, but to login or gain access to the computing device 400, the non-display area 401 may function as an optical fingerprint sensor for user identification and verification. In which case, a transparent layer may replace the conventional upper opaque layer of the non-display area 401 for the optical image

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sensing of a fingerprint. The viewing display area 402 utilizes imaging techniques further discussed below with reference to Figures 47 and 48. Furthermore, the fingerprint sensor integration and application into the housing area 403 also utilizes imaging techniques further discussed below with reference to Figure 49.

The benefit to integrating a fingerprint sensor into the computing device 400 is that the overall reduced bulk of the computing device 400 increases convenience and manageability of the computing device 400. In portable situations, the overall size and weight of the computing device 400 is a concern, which deters the employment of a discrete fingerprint sensor. With the application of an integrated fingerprint sensor, it may be appreciated that the need of an external connection port for the attachment of a fingerprint sensor is reduced and is no longer required by the sensor, which increases the user identification and verification procedural efficiency and convenience thereof.

In Figure 46, an optical image sensor system, in one alternative embodiment, may be integrated into a Personal Digital Assistant (PDA) device 410. The placement of the optical image sensor system, in various embodiments, may be integrated into a non-display area 411, a display apparatus area 412, or the display casing area 413 of the PDA device 410. The non-display area 411 refers to a stylus sensitive region that can be modified to comprise a dual functionality, wherein, in one embodiment, a first function comprises an optical fingerprint image sensor for user identification and verification, and a second function comprises a stylus sensor. The display apparatus area 412 utilizes imaging techniques further discussed below in Figures 47 and 48. The fingerprint sensor integration and application into the display housing area 413 also utilizes imaging techniques further discussed below in Figure 49.

Handheld computing devices and sub-compact electronic devices exemplify convenience and portability. The "ease of use" concept is inherent to the marketability of such small personal electronic computing devices. Many of these devices do not have peripheral connection ports for the attachment of external devices, such as a discrete fingerprint sensor. From this conceptualization, it may be appreciated that an integrated fingerprint sensor into the small personal electronic device would better serve the user, wherein portability, flexibility, convenience, and manageability are of high concern. The assimilation of an embedded fingerprint image sensor into the PDA 410 would seek to maintain the inherent value and nature of the small PDA 410 by preserving the size, weight, and portability of the PDA 410.

Many electronic computing devices, including personal devices or otherwise, integrate liquid crystal display imaging for viewing digital information. As is known in the art, many LCD devices comprise an array of microscopic partitions (pixels), preferably rectangular in form, wherein information is displayed through the internal manipulation of externally reflected or projected light. The liquid crystals themselves are typically classified as non-emissive display elements that generally do not generate their own light, but, alternatively, an LCD apparatus either passes or blocks reflected or projected light that is emitted from an external lighting source, wherein the reflected or projected light is supplied by a back or side active lighting source. LCD devices that are generally projective in nature tend to employ an active lighting source to illuminate and display electronic or digital information to a user via a display apparatus.

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Figure 47, illustrates one embodiment of fingerprint sensor system 420 integrated into a passive matrix liquid crystal display (LCD) 425, wherein the image sensed is a fingerprint. The fingerprint sensor system 420, in one embodiment, comprises a relief object sense layer 430, the passive matrix LCD 425, and an active back light source 423, wherein the sense layer 430 is formed on the upper surface of the LCD 425.

The relief object sense layer 430 of the fingerprint sensor system 420, in one embodiment, comprises an array 58 of light-sensing optical detectors 60 encapsulated in a transparent glass substrate 427 material, wherein the relief object sense layer 430 is formed on the upper surface of LCD 425. In one embodiment, the glass substrate 427 has an index of refraction close to that of a fingertip 40. In addition, the optical detectors 60 are spaced approximately between 50 and 60 m apart to permit sufficient light to pass between adjacent optical detectors 60. The optical detectors 60, may be formed of a semiconductor based materials in the manners previously described.

When the fingertip 40 is placed onto the upper surface of the relief object sense layer 430, the ridges 42 are in contact with the upper surface of the relief object sense layer 430, while the valleys 44 form air-filled pockets or regions above the relief object sense layer 430. By illuminating the fingertip 40 and positioning an array of optical detectors 60 within the substrate layer 427, light 422 is able to pass between the fingertip 40 and the relief object sense layer 430 and is then reflected from the air filled valleys 44 and projected onto the array 58 of optical detectors 60. In this way, the ridges 42 can be visually distinguished from the valleys 44 to form an optical image of the fingertip 40. Thus, an optical image of the fingertip 40, in one embodiment, can be sensed, captured, and rendered electronically for future use, such as user identification and verification.

Integrating the fingerprint sensor system 420 into an LCD 425 offers many benefits to the user including convenience and ease of access to the fingerprint sensor system 420. An embedded fingerprint sensor system 420 integrated into the substrate layer 427 provides a surface for placement of the user's fingertip 40. In addition, the backlight apparatus 423 provides ample light for fingerprint detection, and the user does not have to worry about attaching a discrete fingerprint sensor device to a peripheral port. Thus, the integrated fingerprint sensor system 420 increases overall efficiency, convenience, and manageability of a personal electronic device equipped therewith.

In one aspect, the passive matrix LCD 425 comprises an incoming glass substrate layer 437 and an outgoing glass substrate layer 441 with a liquid crystal element layer 429 interposed between the two surface treated transparent glass substrate layers, 437 and 441. The two glass substrate layers, 437 and 441, are approximately 1100 microns thick, and the liquid crystal element layer is approximately 5 microns thick. The functionality of liquid crystals and the passive matrix LCD 425 will be further discussed below.

The incoming glass substrate layer 437 further comprises a polarized filter layer 426 formed on a first surface 408 of the substrate 437 and a first series of contiguous electrode traces 428 patterned and etched, in a manner well known in the art, into a series of rows formed on a second surface 404 of the substrate 437. The polarized filter layers 426 are approximately 60 um thick, and are usually formed of iodine material in a manner known in the art.

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A voltage applied to the electrode traces 428 induces an electrical field across the liquid crystal element 429, which enables or disables the ability of reflected or projected light to internally traverse the liquid crystal element 429. The electrode traces 428, in one embodiment, are formed of Indium Tin Oxide (ITO), which is a transparent conductive material, wherein the electrode layer is approximately 0.15 microns thick, and are formed by a sputter deposition technique known in the art. Furthermore, the electrode traces 428 are patterned to form the rows and columns of a passive matrix display or the individual pixels of an active matrix display. The active matrix display embodiment will be further discussed herein below.

The polarized filter layers 426 is preferably polarized in a first fixed direction, whereby light can only pass through if it is oriented in the same first fixed direction of the polarized filter layers 426. Conversely, the orientation of the second direction is preferably a 90-degree rotational offset of the orientation of the first direction. The orthogonal polarized filters, 426 and 432, act as a medium that only passes light if the plane of the light is oriented in a specific pre-determined direction, wherein incoming light is oriented in a first direction and outgoing light is oriented in a second direction.

As is known in the art, liquid crystals exhibit properties of a liquid, defined by the ability of molecules to freely move about within a material, and the properties of a solid, defined by the ability of molecules within a material to orient in one common direction. In one embodiment, nematic liquid crystals exhibit this phenomenon with a definite molecular order or pattern, whereby liquid crystal molecules are oriented in distinct parallel lines. As a result, exemplary ordered liquid crystal molecules, known as Twisted Nematic (TN) liquid crystals, are capable of performing a highly uniform twist in the absence of an electric field. Conversely, in the presence of an electric field, TN liquid crystal molecules untwist causing polarized light passing through the untwisted liquid crystal molecules to substantially diffuse most of the incoming light, which produces a darkened pixel image. Therefore, an exemplary type of LCD device is the Twisted Nematic display, wherein the TN display comprises a nematic liquid crystal element interposed between two transparent glass substrate layers.

For example, the absence of an applied electric field across a liquid crystal element causes the liquid crystal molecules to twist which rotates the incoming plane of light 90-degrees, wherein the outgoing rotated plane of light can pass through the plane of the second polarized filter. Conversely, in the presence of an electric field, the liquid crystal molecules untwist, which results in an un-rotated incoming plane of light, wherein an un-rotated outgoing plane of light diffuses and cannot fully penetrate the plane of the second polarized filter.

The outgoing glass substrate layer 441 comprises a second series of contiguous electrode traces 407 patterned and etched, in a manner well known in the art, into a series of columns, orthogonal to the electrode rows , formed on a first surface 405 of the substrate 441 and a second polarized filter layer 432 formed on a second surface 406 of the substrate 441. The electrode trace layers, 407 and 428, are approximately 0.15 microns thick, and are formed by a deposition technique in a manner known in the art. The second polarized filter layer 432 is preferably polarized in a second fixed direction, which is orthogonal to the first fixed direction of the polarized filter layer 426, wherein light can only pass through if it is oriented in the same second fixed direction of the polarized filter layer 432.

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When, in one embodiment, the two glass substrates, 437 and 441, are assembled into the LCD 425, the orthogonal intersection of electrode traces 428 and 407 forms a pixel 409, whereby the pixel 409 is addressed by the electrode traces 428 and 407. For example, in one embodiment, when a pulse is sent down one electrode trace 407 and the corresponding addressed electrode trace 428 is grounded, the induced electric field across the pixel 409 can alter the visual appearance of the liquid crystal element 429, which is referenced by the specifically addressed pixel 409. The resultant electric field across a liquid crystal element 429 rotates the polarized plane of light from an active light source 414, which alters the visual appearance of the addressed pixel 409. In addition, if the pixel 409 is not addressed, then the visual appearance of the pixel 409 remains unaltered. By addressing and non-addressing multiple pixels 409 at one time, a preferred image can be visualized on the LCD 425.

The back light apparatus 423 is formed, in various embodiments, with an array of tightly packed LEDs, multiple fluorescent tubes, or an array of miniature light bulbs in a manner known in the art. The back light apparatus 423 provides the LCD 425 and the sense layer 430 with a constant projection of light 422, wherein the intensity of the light 422 is sufficient for proper LCD 425 and fingerprint sensor system 420 functionality. The back light apparatus 423 comprises the active light source 414 and a back light reflector 415, wherein the light 422 is substantially projected towards the LCD device 425. The back light reflector 415, in one embodiment, comprises a material with a known reflective coating, whereby the back light reflector 415 substantially redirects any diverging light 422 from the back light apparatus 423 towards the LCD device 425.

For proper functionality, it is desired to reduce external ambient light from impinging upon the optical detectors 60 by completely covering the active optical image sense region with fingertip 40. Ambient light can have the effect of reducing the contrast resolution between the ridges 42 and the valleys 44 of the fingerprint image by providing unwanted conduits for light encroaching onto the optical detectors 60. Moreover, during the fingerprint image capture mode, the LCD device 425 must allow the light 422 to pass through for image reflection of the ridges 42 and the valleys 44 of the fingertip 40. As a result, an electric field should not be present across the LCD device 425 during the fingerprint image capture mode due to the diffusion of light 422 when an electric field is applied across the LCD device 425.

Figure 48 illustrates another embodiment of a fingerprint sensor system 450 integrated into an active matrix LCD 451, wherein the image sensed is a fingerprint. The fingerprint sensor system 450, in one embodiment, comprises the relief object sense layer 430, the active matrix LCD 451, and the active back light 423, wherein the relief object sense layer 430 is formed on the upper surface of the active matrix LCD 451. The relief object sense layer 430 of the fingerprint sensor system 450, in this embodiment, is utilized in the same manner as in the fingerprint sensor system 420 as previously described. The active back light 423 provides the active matrix LCD 451 and the sense layer 430 with a constant projection of light 422, wherein the operation and formation are incorporated in the same manner as in the fingerprint sensor system 420.

In one aspect, the active matrix LCD 451 comprises an incoming glass substrate layer 452 and an outgoing glass substrate layer 453 with the liquid crystal element layer 454 interposed between the two glass substrate

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layers, 452 and 453. The two glass substrate layers, 452 and 453, are approximately 1100 microns thick, and the liquid crystal element layer 454 is approximately 5 microns thick. The functionality of the active matrix LCD 451 will be further discussed below.

The incoming glass substrate layer 452 comprises the polarized filter layer 426 formed on a first surface 455 of the substrate 452 and the electrode trace 428 patterned and etched, in a manner well known in the art, into an array of individual partitions 456 formed on a second surface 457 of the substrate 452. The polarized filter layer 426 is preferably polarized in a first fixed direction, whereby light 422 can only pass through if the light 422 is oriented in the same first fixed direction of the polarized filter layer 426.

The outgoing glass substrate layer 453 comprises the electrode trace 407 formed on a first surface 458 of the substrate 453 and a second polarized filter layer 432 formed on a second surface 459 of the substrate 453. The electrode trace layers, 428 and 407, are approximately 0.15 microns thick. The second polarized filter layer 432 is preferably polarized in a second fixed direction, which is orthogonal to the first fixed direction of the first polarized layer 426, wherein light 422 can only pass through if it is oriented in the same second fixed direction of the polarized filter layer 432.

When, in this embodiment, the two glass substrates, 452 and 453, are assembled into the active LCD 451, the intersection of the electrode trace 426 and the patterned electrode partition 456 forms a pixel 409. Individual electrode partitions 456 comprise a hydrogenated amorphous silicon (a-Si:H) type Thin Film Transistor (TFT) 460 that indirectly addresses individual pixels 409, wherein the a-Si:H TFT 460 characterizes a pixel switch. The a-Si:H TFT 460 devices are formed by a sputtering deposition technique in a manner known in the art. The pixel 409 is addressed by applying a current to the a-Si:H TFT 460 gate terminal, which switches the a-Si:H TFT 460 "on" and permits a charge to transfer from the a-Si:H TFT 460 source terminal onto the electrode partition 456. The resultant electric field across the liquid crystal element layer 454 rotates the plane of light from the light source 414, which alters the visual appearance of the addressed pixel 409. Once the pixel 409 has been addressed, the a-Si:H TFT 460 gate terminal is reversed biased to insure that no charge can pass into an adjacent pixel 409.

By addressing multiple pixels 409 at one time, a preferred image can be visualized on the active LCD 451. To insure proper charge storage for a single display cycle and to carefully control the charge state of the pixel 409, electrode partition 456 incorporates a capacitor 461 in conjunction with the TFT 460, wherein the capacitor 461 provides a continuous refresh of charge to the TFT 460. Thus, the pixel 409 warrants the ability to provide a continuous visual appearance. Conversely, if TFT 460 is switched "off" by not applying a current to the TFT 460 gate terminal, then the visual appearance of the addressed pixel 409 remains unaltered. By addressing and non-addressing multiple pixel 409 at one time, a preferred image can be visualized on the active LCD 451.

Liquid crystal displays employ a light source , such as the lighting apparatus 423 represented in Figures 47, 48, and 49. Liquid crystal displays can utilize an ambient lighting source and further employ a reflective surface mounted behind the LCD device. Reflective displays have limited brightness capabilities due to the fact that light passes through multiple polarized filter layers, which significantly diminishes the overall intensity of the reflected light.

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An exemplary method for providing light to both passive and active LCD devices is through an active projected lighting source.

A back or side projected lighting system reliably increases overall light intensity to the LCD device, wherein the light source, mounted behind or at the edges of the LCD device, reduces the need for reflected ambient light. Active matrix displays commonly utilize back or side lighting systems to increase light intensity, and, in most cases, passive matrix displays also incorporate back and side lighting systems to improve overall light intensity. Moreover, the array of photo-detectors 60 in the relief object sense layer 430 reduces the intensity of light seen by the user, wherein the appearance comprises a reduced brightness over the optical image sensor system region. To combat this potential problem, the light source should project a higher intensity of light 422 through the optical image sensor system region, which results in a balanced visual appearance for the user over the entire viewing display area of the display apparatus.

Figure 49 illustrates a cross-sectional view of an LCD system 465, wherein the LCD system 465 comprises an electronic device housing substrate 466, an LCD 467, and a fingerprint sensor 468.

The LCD 467 comprises a back light reflector 469, an active back lighting source 470, and a transparent protective screen 471, wherein the LCD 467 is attached to the housing substrate 466. The active back lighting source 470 emits and provides light 422 to the LCD 467, and, in addition, the back light reflector 469 reflects light 422 from the active back lighting source 470 and any external ambient light towards the LCD 467. The fingerprint sensor 468 is embedded and integrated into the housing substrate 466, wherein the back light reflector 469 does not prevent the active back lighting source 470 from emitting and providing light 422 to the fingerprint sensor 468. Furthermore, the active back lighting source 470 simultaneously emits and provides light 422 to the LCD 467 and to the fingerprint sensor 468.

The fingerprint sensor 468, in one embodiment, comprises the array 58 of optical detectors 60 encapsulated in a transparent glass substrate 472, wherein the fingerprint sensor 468 is formed on the active back lighting source 470 and embedded and integrated into the housing substrate 466. In one embodiment, the glass substrate 472 material has an index of refraction close to that of a fingertip 40.

When the fingertip 40 is placed onto the glass substrate 472, the fingertip ridges 42 are in contact with the glass substrate 472, while the fingerprint valleys 44 form air-filled pockets or regions above the substrate 472. By illuminating the fingertip 40 and positioning an array of optical detectors 60 within the glass substrate 472, the light 422 is able to pass between the fingertip 40 and the glass substrate 472 and is then reflected from the air filled valleys 44 and projected onto the array 58 of optical detectors. In this way, the ridges 42 can be visually distinguished from the valleys 44 to form an optical image of the fingertip 40. Thus, an optical image of the fingertip 40 can be detected, captured, and saved for future use, such as user identification and verification.

The advantage to integrating an embedded fingerprint image sensor into the housing substrate of an electronic device is that the overall reduced bulk of a portable electronic device increases overall flexibility, convenience, and manageability of the portable electronic device. In portable situations, the overall size and weight of

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the personal electronic device is a concern, which deters the employment of a discrete, standalone fingerprint sensor device. In addition, with the application of an integrated fingerprint sensor into a personal computing electronic device, it may be appreciated that the need of an external connection port for the attachment of a fingerprint sensor is significantly diminished. Therefore, the fingerprint image sensor no longer requires an external peripheral connection port, and, as a result, the user identification and verification procedural efficiency and convenience are considerably increased.

For proper functionality, it is desired to reduce external ambient light from impinging the optical detectors 60 by completely covering the active optical image sense region with the fingertip 40. Ambient light can have the effect of reducing the contrast resolution between the ridges 42 and the valleys 44 of the fingerprint image by providing unwanted conduits for light encroaching onto the optical detectors 60.

Figure 50 schematically illustrates, in one embodiment, a functional procedure 480 for the fingerprint sensor system 420 and 450, whereby the fingerprint comprises a pattern of the ridges 42 and the valleys 44 of the fingertip 40 of a user. The functional procedure 480 begins with the procedural block 481, wherein the fingertip 40 is placed on the relief object sense layer 430 of the fingerprint sensor 420 and 450. The ridges 42 of the fingertip 40 make contact with the upper surface of the sense layer 430, and the valleys 44 of the fingertip 40 do not make contact with the upper surface of the sense layer 430. In various embodiments, finger print sensor 420 and 450 define an active area 402, whereby the fingertip 40 is positioned over the active area 402 defined by the placement of the finger print sensor 420 and 450.

In procedural block 482, the next step is to disable the electric fields in the LCD 425 and 451 where the fingerprint sensor is formed. Disabling the electric field across the LCD 524, 451 allows light 422 to traverse through the LCD 425, 451.

In procedural block 483, an active back light source 470 projects the light 422, which is emitted and projected towards the LCD device 425 and 615. Any diverging light 721 is reflected from the reflector 613 towards the LCD 425, 451.

In procedural block 484, the projected light 422 from the back light source 470 and the reflector 469 traverses the LCD 425, 451, whereby traversed light 422 illuminates the fingertip 40 placed on the upper surface of the sense layer 430. At this time, an electric field applied across the liquid crystal element layers, 429, would inhibit traversing light 422 from penetrating the LCD 425, 451 and reaching the fingertip 40.

In procedural block 485, traversed light 422 is reflected off of the ridges 42 and the valleys 44 of the fingertip 40. In one embodiment, the glass substrate material 430 has an index of refraction close to that of a fingertip 40. By illuminating the fingertip 40 and positioning an array of optical detectors 60 within the substrate layer 427, the light 422 is able to pass between the fingertip 40 and the substrate 430 and is then reflected from the air filled valleys and projected onto the array 58 of optical detectors 60.

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In procedural block 485, the reflected light is detected by the array 58 of optical detectors 60, and the resolved fingerprint image is captured for user identification and verification. Once the fingerprint image is captured, the functional procedure ends.

Figure 51 schematically illustrates a personal electronic device 486, which, in one embodiment, comprises a controller 490, an input peripheral device 492, a display apparatus 494, and a fingerprint sensor 496 integrated into the display apparatus 494. The input device 486 permits a user to input information. The display apparatus 494 projects light from a back or side lighting apparatus and provides a method for displaying electronic images on the viewing area of the display apparatus. The controller 490 receives electronic signals from the input device 492 and provides signals to the display 494. The controller 490 also receives electronic signals from the fingerprint sensor 496. The fingerprint sensor 496 is integrated into the display device 494 such that light projected from the display is reflected off of a fingertip, which is positioned on the fingerprint sensor 496 surface, and captured by the fingerprint sensor 496. The fingerprint sensor 496 sends signals to the controller indicative of the optical image captured by the fingerprint sensor 496, wherein the fingerprint image sensed is an electronic representation of the fingerprint.

When utilizing an integrated fingerprint sensor, in various personal electronic devices, it may be appreciated that increased flexibility and manageability of the personal electronic device is achieved, whereby an increased sense of workspace organization results from the assimilation of an integrated fingerprint sensor into an electronic device. Discrete standalone fingerprint sensors can be cumbersome, but an integrated fingerprint sensor increases convenience by reducing the need for exchanging external connection ports for the use of a fingerprint image sensor device. Furthermore, integrated fingerprint sensors preserve portability, size, and weight of the personal electronic device, whereby the footprint of the device as a whole is maintained. As a result, it may be appreciated that an integrated fingerprint sensor satisfies the needs of a user by increasing the flexibility, manageability, convenience, and portability of the personal electronic device.

Figure 52 is a top view of a fingerprint sensor 500 comprising a first protective layer 502 adapted for protecting the fingerprint sensor 500 against electrostatic discharge (ESD) and for improving the resolution of the fingerprint sensor 500 in a manner that will be described in greater detail below. The fingerprint sensor 500 senses, renders, and validates fingerprint patterns placed adjacent the fingerprint sensor 500 in the manner previously described with respect to the fingerprint sensors 10,200, 300, 330, 370, 420, 450, 468.

In this embodiment, the fingerprint sensor 500 is embodied as a separate assembly, such as a PCMCIA card as previously described and attached to a system 575, such as a PDA, laptop computer, and the like. However, it will be appreciated by one of skill in the art that the inventive features of the finger print sensor 500 as described in this embodiment can also be adapted for use with the fingerprint sensors 10, 200, 300, 330, 370, 420, 450, 468 as previously described without departing from the spirit of the invention.

The first protective layer 502 of this embodiment is an electrically conductive, optically transparent material. In one embodiment, the first protective layer 502 comprises a layer of indium-tin oxide (ITO) with a composition of approximately 90% In_2O_3 and 10% SnO_2. The first protective layer 502 is applied with a known

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sputtering technique to a thickness of approximately 1500Å. In this embodiment, the SnO_2 component of the first protective layer 502 acts as an n-type dopant providing donor carriers to improve the electrical conductivity of the first protective layer 502.

In one embodiment, the hardcoat layer 35 is interposed between the first protective layer 502 and underlying optical detectors 60 so as to form a second protective layer 520 (Figures 58A and 58B). The second protective layer 520, comprising the hardcoat layer 35, protects underlying structures, including the optical detectors 60, from damage due to physical contact such as scratching, erosion, etc. In alternative embodiments, the second protective layer 520 comprises the top-coat layer 36. In another embodiment, the second protective hardcoat layer 520 is placed over the first protective layer 502 to improve the resistance of the finger print sensor 500 to physical contact damage.

The first protective layer 502 is electrically connected to an analog circuit ground 504 via a planar conductor 506. The analog circuit ground 504 provides a circuit reference node in a known manner. The planar conductor 506 of this embodiment is a paint or tracing of Silver (Ag) approximately 50 m thick and 1 mm wide deposited on a substrate 576 with a conductive trace deposition, sputtering, soldering, wire-bonding, or other known method of forming conductive structures. The planar conductor 506 has the advantage of being low profile and minimally affecting the overall planarity of the fingerprint sensor 500, thereby maintaining optimal convenience for the user. The planar nature of the fingerprint sensor 500 also facilitates integration of the fingerprint sensor 500 into other devices as previously described with respect to the fingerprint sensors 10, 200, 300, 330, 370, 420, 450, 468.

A user of the fingerprint sensor 500 typically carries at least some electrostatic charge 510 in their body and clothing. The electrostatic charge 510 can be of either positive or negative polarity and can have a kilovolt potential. As the user touches the fingerprint sensor 500, the potential of the electrostatic charge 510 contained in the user's finger can be different than the potential of the fingerprint sensor 500. The potential difference will tend to equalize by a discharge of the electrostatic charge 510 with the direction of current flow depending on the particular potential difference according to known electrical principles.

Current induced by the electrostatic charge 510 will be distributed throughout the first protective layer 502 and will further flow from or to the analog circuit ground 504 depending on the direction of potential difference. Thus, the electrostatic charge 510 carried by the user will be shunted to the analog circuit ground 504 through the first protective layer 502 and the planar conductor 506 so as to equalize potential difference therebetween. As the first protective layer 502 overlies and is electrically isolated from the optical detectors 60 (Figures 58A and 58B), the electrostatic charge 510 is inhibited from discharging through the optical detectors 60, thereby minimizing the potential for damage to the optical detectors 60 due to ESD.

The fingerprint sensor 500 also comprises a plurality of diode rings 578. The diode rings 578 are in electrical communication with a connector 579. The connector 579 interconnects the fingerprint sensor 500 and the system 575 in a known manner. The diode rings are adapted to shunt ESD that may be picked up on the conductors of the connector 579 to the analog ground 504.

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An additional advantage of the fingerprint sensor 500 of this embodiment is that shunting the electrostatic charge 510 in the manner previously described also helps to maintain image resolution. In particular, if the electrostatic charge 510 were not shunted away from the optical detectors 60, the discharge of the electrostatic charge 510 could create false signals to be read from individual optical detectors 60. The individual optical detectors 60 could unintentionally interpret localized ESD as impinging light reflected from the fingertip 40. Thus, the fingerprint sensor 500 could mistakenly interpret ESD as light reflected off of ridges 42 and valleys 44 of a user's fingertip 40 thereby corrupting the data and reducing the accuracy of the fingerprint sensor 500. The invention of this embodiment offers the particular advantage of offering protection both from damage from discharge of the electrostatic charge 510 as well as maintaining the resolution of the images sensed by the fingerprint sensor 500 from being corrupted by ESD in a single structure. This reduces the overall size and cost of the fingerprint sensor 500.

Figure 53 is a top view of an alternative embodiment of a fingerprint sensor 500. In this embodiment, the fingerprint sensor 500 also comprises a metal layer 512. In this embodiment, the metal layer 512 comprises a layer of copper foil approximately 0.1 mm thick. The metal layer 512 also defines an opening. The metal layer 512 overlies the first protective layer 502 such that the opening in the metal layer 512 defines an active area 514. The active area 514 is generally oval and conforms generally to the contact profile of a finger. The active area 514 is that region of the first protective area 502 not occluded by the opaque metal layer 512. The contour of the active area 514 provides a pictograph suggesting to a user the appropriate place to position their finger to effect sensing and rendering by the fingerprint sensor 500. The pictorial suggestion of the contour of the active area 514 is advantageous in that it is non-verbal and thus non-language specific. This offers increased utility to the fingerprint sensor 500 in multi-national markets.

The metal layer 514 is connected to the analog circuit ground 504 via a planar conductor 516. The planar conductor 516 of this embodiment is substantially similar to the planar conductor 506, however, in alternative embodiments, the planar conductor 506, 516 can comprise other conductive material such as copper, aluminum, and conductive oxides or silicides. The planar conductor 516 is formed by soldering, deposition, wire-bonding, sputtering, or other known methods of forming conductive structures. As will be understood by one of skill in the art, the planar conductor 516 is electrically isolated from other conductive structures such as the connector 579 by placement of insulative material, such as plastic or silicon dioxide, between the planar conductor 516 and other structures in manner well understood in the art.

The metal layer 514, as connected to the analog circuit ground 504 via the planar conductor 516, is adapted to shunt the electrostatic charge 510 so as to equalize electrical potential in the manner previously described. An advantage of the metal layer 514 is that it offers a secondary path for current travel thus increasing the capacity for discharging electrostatic charge 510 of the fingerprint sensor 500 of this embodiment.

The improvement in image resolution provided by the first protective layer 502 is illustrated in Figures 54A and 54B. In particular, it should be noted that the image sensed with a fingerprint sensor 500 with the first protective layer 502 as illustrated in Figure 54B is less grainy or pixilated than a contrasting image sensed by a fingerprint

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sensor without the presence of the first protective layer 502 as illustrated in Figure 54A. It will be appreciated by one of skill in the art, that a less grainy or pixilated image provides a more accurate image of the actual fingerprint pattern of the user and facilitates an improved rendering of the fingerprint sensor 500, thereby increasing the sensitivity, accuracy and convenience and utility of the fingerprint sensor 500.

Figure 55 is a circuit diagram of an additional aspect of the present invention. Figure 55 illustrates a live finger detection system 530. The live finger detection system 530 detects and discriminates the presence or absence of a live finger surface in contact with the fingerprint sensor 500. The live finger detection system 530 performs the function of powering the fingerprint sensor 500 only when a living finger is in contact with the fingerprint sensor 500. This function of the live finger detection system 530 enables power-saving for the fingerprint sensor 500 as power is only supplied and consumed when the fingerprint sensor 500 is actually in the process of imaging a fingerprint. Thus, the fingerprint sensor 500 of this embodiment draws less energy from a limited power source, such as a battery, in battery powered applications such as PDAs or laptop computers.

The live finger detection system 530 also provides fraud protection for the fingerprint sensor 500. In particular, the live finger detection system 530 is adapted to only engage the fingerprint sensor 500 when a living finger is in contact with the fingerprint sensor 500 in a manner that will be described in greater detail below. In this manner, the live finger detection system 530 inhibits a fraudulent user from employing an artifice imitating a finger print, such as a rubber or dead finger to activate the fingerprint sensor 500 and render or validate a fingerprint image from the artifice.

The live finger detection system 530 comprises a time varying voltage source 532, a finger contact 534, and a sensing circuit 536. The time varying voltage source 532 provides a voltage of approximately 10 V_{pp} at a frequency from 10 Hz to 10MHz. In one embodiment, the time varying voltage source 532 provides a voltage of 10 V_{pp} at 1 KHz. In alternative embodiments, the time varying voltage source 532 provides voltages at different frequencies. The time varying voltage source 532 is constructed in a known manner.

The finger contact 534 provides a contact that is normally open and is selectively bridged by a finger surface as a user places their finger in contact with the fingerprint sensor 500. Several embodiments of the finger contact 534 are illustrated in Figures 57, 58A, and 58B and will be described in greater detail below with reference to these Figures. When a user's finger is in contact with the finger contact 534, this condition will be referred to as finger present 540 in the description to follow.

The sensing circuit 536 of this embodiment, comprises three resistors, R1 542, R2 544, R3 546, an Op Amp 550, an analog-to-digital converter (A/D) 552, and a comparator 554. R1 542 and R2 544 are connected in series between the time varying voltage source 532 and analog ground 504. R1 542 and R2 544 are also connected as a voltage divider with the node between R1 542 and R2 544 being connected to the non-inverting input of the Op Amp 550. The finger contact 534 and R3 546 are also connected as a voltage divider with the node between the finger contact 534 and R3 546 being connected to the inverting input of the Op Amp 550.

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The output of the Op amp 550 is connected to the A/D 552 and the output of the A/D 552 is fed to the comparator 554 such that input signals to the inverting and non-inverting inputs of the Op Amp 550 generate signals to the comparator 554 in a known manner. The output of the comparator 554 is connected to the light source 50, 202, 242, 380, 414, 423, 470. The parameters of the sensing circuit 536 are selected such that presence of a living finger with an impedance in the range of 5 KOhms to 70 KOhms at 1 KHz will generate a logic "1" output from the comparator 554 so as to enable the light source 50, 202, 242, 380, 414, 423, 470. In a complementary manner, absence of a living finger or an artifice without the correct finger impedance 556 will generate a logic "0" output from the comparator 554 and inhibit the activation of the fingerprint sensor 500. Thus, the voltage dividers of R1 542 and R2 544 and the finger contact 534 and R3 546 as connected to the time varying voltage source 532, generate inputs to the Op Amp 550. If a living finger is not present or an artifice without the appropriate finger impedance 556 is present, the fingerprint sensor 500 will not be enabled.

Figure 56 is a circuit diagram of an alternative embodiment of a live finger detection system 530. In this embodiment, the live finger detection system 530 comprises a sensing circuit comprising resistors R4 562 and R5 564, a time varying voltage source 566, and the finger contact 534. In this embodiment, R4 562 has a resistance of approximately 75 and R5 564 has a resistance of approximately 1k . The time varying voltage source generates a voltage of 20V peak-to-peak at a frequency between 100Hz and 1MHz.

R4 562 and R5 564 are connected in series with the finger contact 534 so as to form a voltage divider. In this embodiment, the fingerprint sensor 500 monitors the voltage developed across the finger contact 534 due to the finger impedance 556 in a known manner. In a similar manner to that previously described, if the finger impedance 556 is not within the range of 5K to 70K at 1 KHz, thereby indicating the absence of a finger or the presence of something other than a live finger, the voltage read across the finger contact 534 will not be within the indicated range and the fingerprint sensor 500 will not be enabled.

In certain embodiments of the live finger detection system 530, a first measurement of the finger impedance 556 is taken or sampled at a time varying voltage source 532, 566 of 10 V_{pp} V (rms or P-P) and a frequency of 1KHz. Then, at least a second measurement is taken at 10 V_{pp} V and 5 KHz. In this manner, taking at least two measurements better discriminates the capacitance of the finger thereby improving the live finger detection system's 530 ability to discriminate the presence of a live finger.

These embodiments of the present invention offer the advantage of additional convenience to the user. In particular, the user would need to place their finger on the fingerprint sensor 500 anyway and doing so enables the fingerprint sensor 500 and simultaneously authenticates that a living finger is in place. In addition, once the finger is removed, power is also disengaged from the optical detectors 60 and the light source 50, 202, 242, 380, 414, 423, 470 of the fingerprint sensor 500, thereby only powering the fingerprint sensor 500 when a finger is in contact with the fingerprint sensor 500. In one embodiment, the fingerprint sensor 500 can be adapted to power down when the authentication procedure is completed regardless of whether a finger is still in contact with the fingerprint sensor 500.

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Figure 57 is a detailed, top view of one embodiment of the finger contact 534. In this embodiment, the finger contact 534 comprises the first protective layer 502 and the metal layer 512. In this embodiment, the first protective layer 502 and the metal layer 512 are electrically insulated from each other by a insulator layer 570 such that a closed electrical circuit between the first protective layer 502 and the metal layer 512 is not formed unless an object, such as a finger, bridges the gap between the first protective layer 502 and the metal layer 512. It will be appreciated that in the embodiment of the finger contact 534 illustrated in Figure 57, the region of the insulative layer 570 wherein the metal layer 512 does not overlie the first protective layer 502 can comprise a solid insulator such as SiO_2 or an air gap.

Figure 58A is a side, section view of an alternative embodiment of the finger contact 534. In this embodiment, the finger contact 534 comprises the first protective layer 502, the metal layer 512, and the insulator layer 570. In this embodiment, the metal layer 512 partially overlies the first protective layer 502 about the periphery of the active area 514. Figure 58B illustrates an embodiment of the finger contact 534 comprising the first protective layer 502, the metal layer 512, and the insulator layer 570 wherein the metal layer 512 does not overlie the first protective layer 502. It can be seen in Figure 58A and 58B that the active area 514 overlies the plurality of optical detectors 60.

Figure 59 is a flow chart illustrating certain aspects of one embodiment of the method of operation of the present invention. In particular, a user places their finger on the active area 514 of the fingerprint sensor 500 in state 580. The user's finger has a finger impedance 556 and the live finger detection system 530 will generate a signal corresponding to the voltage developed across the finger in the manners previously described in state 582. The fingerprint sensor 500 then determines in decision state 584 whether the signal generated in state 582 corresponds to a live finger, i.e. to finger present 540. As previously described, in certain embodiments of the present invention, multiple measurements of the finger impedance 556 may be made to better discriminate finger present 540. Designing and implementing an appropriate decision logic for determining the presence of a live finger with multiple measurements is well within the skill of one of ordinary skill in this art and will not be described in detail here.

If the fingerprint sensor 500 determines in state 584 that a live finger is present, the fingerprint sensor 500 enables the optical detectors 60 and the light source 50, 202, 242, 380, 414, 423, 470 in state 586. The fingerprint sensor 500 then senses and authenticates the fingerprint in the manner previously described. When the fingerprint sensor 500 determines that the sensing is complete in state 590, the fingerprint sensor proceeds to disable the optical sensors 60 and the light source 50, 202, 242, 380, 414, 423, 470 in state 592. It should be appreciated that, in decision state 590, wherein a determination is made if the fingerprint sensing is complete, can comprise actually completing the sensing as previously described or removing the finger from the fingerprint sensor 500.

Although the foregoing description of the invention has shown, described and pointed out novel features of the invention, it will be understood that various omissions, substitutions, and changes in the form of the detail of the apparatus as illustrated, as well as the uses thereof, may be made by those skilled in the art without departing from

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the spirit of the present invention. Consequently the scope of the invention should not be limited to the foregoing discussion but should be defined by the appended claims.

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WHAT IS CLAIMED IS:

1. A fingerprint sensor wherein a finger placed on the sensor is illuminated by both a light source and by ambient light, the fingerprint sensor having a color filter that filters out a portion of the ambient light, the fingerprint sensor comprising:

a contact surface which receives a fingertip of a user;

at least one light source which generates at least green light that is reflected by the fingertip;

a color filter which is substantially transparent to the green light and substantially opaque to a portion of ambient light that is substantially transmitted through the fingertip; and

a plurality of optical detectors disposed from the contact surface with at least a portion of the color filter disposed between the optical detectors and the contact surface, the optical detectors positioned to receive the green light reflected by the fingertip, the optical detectors generating electrical signals in response to the received light, thereby providing an electronic representation of a fingerprint corresponding to the fingertip.

2. The fingerprint sensor of Claim 1, wherein the portion of ambient light that is substantially transmitted through the fingertip is primarily red light.

3. The fingerprint sensor of Claim 1, wherein the light source comprises a green light-emitting diode.

4. The fingerprint sensor of Claim 1, wherein the color filter comprises a polyimide material with dissolved colorants.

5. The fingerprint sensor of Claim 1, wherein the color filter comprises an organic material.

6. The fingerprint sensor of Claim 1, wherein the color filter comprises an inorganic material.

7. The fingerprint sensor of Claim 6, wherein the color filter comprises a multilayer structure of a-SiN_x/a-SiO_x/a-SiN_xO_y.

8. The fingerprint sensor of Claim 1, wherein the color filter has a thickness between approximately 1.0 um to approximately 3.0 um.

9. The fingerprint sensor of Claim 1, wherein the color filter substantially covers the plurality of optical detectors.

10. The fingerprint sensor of Claim 1, wherein the plurality of optical detectors are separated from one another, thereby defining a region between the optical detectors, and the color filter is patterned such that the color filter does not substantially cover the region between the optical detectors.

11. The fingerprint sensor of Claim 1, wherein the plurality of optical detectors comprise a planar array of pixels.

12. The fingerprint sensor of Claim 11, wherein the planar array of pixels is arranged in generally orthogonal columns and rows.

13. The fingerprint sensor of Claim 1, wherein each optical detector comprises a switching diode and a photodiode.

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14. The fingerprint sensor of Claim 1, wherein the plurality of optical detectors comprises an opaque matrix which substantially bounds each optical detector, thereby separating the optical detectors from one another.

15. The fingerprint sensor of Claim 1, further comprising an opaque matrix which substantially bounds portions of the color filter, thereby separating the portions of the color filter from one another.

16. The fingerprint sensor of Claim 1, further comprising an opaque matrix which substantially bounds each optical detector with an associated portion of the color filter.

17. The fingerprint sensor of Claim 1, wherein the plurality of optical detectors and the light source are substantially co-planar.

18. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip;

a color filter which is substantially transparent to green light and substantially opaque to non-green light; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the green light reflected by the fingertip.

19. A fingerprint sensor comprising:

a contact surface which receives a fingertip of a user, the fingertip comprising a pattern of ridges and valleys, the contact surface in contact with the ridges of the fingertip;

at least one light source which generates light that is reflected from the contact surface;

a color filter which is substantially transparent to green light and substantially opaque to non-green light; and

at least one optical detector disposed from the contact surface with at least a portion of the color filter disposed between the optical detector and the contact surface, the optical detector positioned to receive the green light reflected from the contact surface.

20. A fingerprint sensor comprising:

a substrate which is substantially transparent to green light;

at least one light source coupled to the substrate, the light source generating light that propagates through the substrate and is reflected by a fingertip;

a color filter which is substantially transparent to green light and substantially opaque to non-green light; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the green light reflected by the fingertip.

21. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip;

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a color filter which is substantially transparent to green light and substantially opaque to non-green light; and

an optical detector layer disposed from the fingertip with at least a portion of the color filter disposed between the optical detector layer and the fingertip, the optical detector layer positioned to receive the green light reflected by the fingertip.

22. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip;

a color filter which is substantially transparent to non-red light and substantially opaque to red light; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the non-red light reflected by the fingertip.

23. A fingerprint sensor comprising:

a contact surface which receives a fingertip of a user, the fingertip comprising a pattern of ridges and valleys, the contact surface in contact with the ridges of the fingertip;

at least one light source which generates light that is reflected from the contact surface;

a color filter which is substantially transparent to non-red light and substantially opaque to red light; and

at least one optical detector disposed from the contact surface with at least a portion of the color filter disposed between the optical detector and the contact surface, the optical detector positioned to receive the non-red light reflected from the contact surface.

24. A fingerprint sensor comprising:

a substrate which is substantially transparent to non-red light;

at least one light source coupled to the substrate, the light source generating light that propagates through the substrate and is reflected by a fingertip;

a color filter which is substantially transparent to non-red light and substantially opaque to red light; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the non-red light reflected by the fingertip.

25. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip;

a color filter which is substantially transparent to non-red light and substantially opaque to red light; and

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an optical detector layer disposed from the fingertip with at least a portion of the color filter disposed between the optical detector layer and the fingertip, the optical detector layer positioned to receive the non-red light reflected by the fingertip.

26. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip;

a color filter which is substantially opaque to a portion of ambient light that passes through the fingertip; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive a portion of the light that reflects from the fingertip and passes through the color filter.

27. A fingerprint sensor comprising:

a contact surface which receives a fingertip of a user, the fingertip comprising a pattern of ridges and valleys, the contact surface in contact with the ridges of the fingertip;

at least one light source which generates light that is reflected from the contact surface;

a color filter which is substantially opaque to a portion of ambient light that passes through the fingertip; and

at least one optical detector disposed from the contact surface with at least a portion of the color filter disposed between the optical detector and the contact surface, the optical detector positioned to receive a portion of the light that reflects from the contact surface and passes through the color filter.

28. A fingerprint sensor comprising:

at least one light source coupled to a substrate, the light source generating light that propagates through the substrate and is reflected by a fingertip, the substrate being substantially transparent to the light generated by the light source;

a color filter which is substantially opaque to a portion of ambient light that passes through the fingertip; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive a portion of the light that reflects from the fingertip.

29. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip;

a color filter which is substantially opaque to a portion of ambient light that passes through the fingertip; and

an optical detector layer disposed from the fingertip with at least a portion of the color filter disposed between the optical detector layer and the fingertip, the optical detector layer positioned to receive a portion of the light that reflects from the fingertip.

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30. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip; and

at least one optical detector disposed from the fingertip, the optical detector positioned to receive the light generated by the light source and reflected by the fingertip, the optical detector comprising a color filter which is substantially transparent to the light that is generated by the light source and reflected by the fingertip and substantially opaque to a portion of ambient light substantially transmitted through the fingertip, whereby the optical detector is substantially responsive to the light that is generated by the light source and reflected by the fingertip and is not substantially responsive to the portion of ambient light substantially transmitted through the fingertip.

31. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip; and

a plurality of optical detectors disposed from the fingertip, the optical detectors positioned to receive the light generated by the light source and reflected by the fingertip, the optical detectors each comprising:

a switching diode;

a photodiode comprising a photoactive p-layer, an intrinsic layer, and an n-layer; and

a color filter layer covering the photoactive p-layer, the color filter layer substantially transparent to the light generated by the light source and reflected by the fingertip and substantially opaque to a portion of ambient light substantially transmitted through the fingertip,

whereby the optical detectors are substantially responsive to light that is generated by the light source and not substantially responsive to the portion of ambient light substantially transmitted through the fingertip.

32. A fingerprint sensor wherein a finger placed on the sensor is illuminated by both a light source and by ambient light, the fingerprint sensor having a color filter that filters a portion of the ambient light, the fingerprint sensor comprising:

a substrate comprising a first material which is substantially transparent to light with wavelengths within a first range of wavelengths;

a contact surface which receives a fingertip of a user;

a color filter layer comprising a second material which is substantially transparent to light with wavelengths within the first range of wavelengths and substantially opaque to a portion of ambient light with wavelengths within a second range of wavelengths, the portion of ambient light propagating through the fingertip;

at least one light source coupled to the substrate, the light source generating light with at least one wavelength within the first range of wavelengths, the light propagating through the substrate to the fingertip; and

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a plurality of optical detectors disposed from the contact surface with at least a portion of the second material disposed between the optical detectors and the contact surface, the optical detectors positioned to receive light generated by the light source and reflected by the fingertip, the optical detectors generating electrical signals in response to the received light, thereby providing an electronic representation of a fingerprint corresponding to the fingertip.

33. A method of sensing a fingerprint comprising a pattern of ridges and valleys of a fingertip of a user, the method comprising:

receiving the fingertip on a fingerprint sensor;

receiving a first light substantially transmitted through the fingertip to a contact surface, whereby the first light is generated by ambient light sources;

generating a second light and substantially transmitting the second light to the fingertip from the contact surface;

reflecting a portion of the second light from the fingertip;

filtering the first light substantially transmitted through the contact surface from the second light reflected from the fingertip; and

detecting the second light reflected from the fingertip, thereby imaging the fingerprint of the fingertip.

34. The method of Claim 33, wherein receiving the fingertip on the fingerprint sensor comprises contacting a contact surface of the fingerprint sensor with the ridges of the fingertip.

35. The method of Claim 33, wherein reflecting a portion of the second light from the fingertip comprises reflecting from the ridges of the fingertip with a first reflectivity and reflecting from the valleys of the fingertip with a second reflectivity.

36. The method of Claim 33, wherein receiving the first light substantially transmitted through the fingertip comprises receiving primarily red light.

37. The method of Claim 33, wherein generating the second light is performed using a light source comprising a green light-emitting diode.

38. The method of Claim 33, wherein filtering the first light comprises using a color filter comprising a polyimide material with dissolved colorants.

39. The method of Claim 33, wherein filtering the first light is filtered comprises using a color filter having a thickness between approximately 1.0 um to approximately 3.0 um.

40. The method of Claim 33, wherein detecting the second light comprises using a plurality of optical detectors comprising a planar array of pixels.

41. The method of Claim 40, further comprising arranging the planar array of pixels in generally orthogonal columns and rows.

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42. The method of Claim 33, wherein detecting the second light comprises using a plurality of optical detectors comprising an opaque matrix which substantially bounds each optical detector, thereby separating the optical detectors from one another.

43. The method of Claim 33, wherein filtering the first light comprises using an opaque matrix which substantially bounds portions of the color filter, thereby separating the portions of the color filter from one another.

44. The method of Claim 33, wherein filtering the first light comprises using an opaque matrix which substantially bounds each optical detector with an associated portion of the color filter.

45. The method of Claim 33, wherein detecting the second light comprises using a plurality of optical detectors which is substantially co-planar with a light source which generates the second light.

46. A fingerprint sensor comprising:

at least one light source which generates green light that is reflected by a fingertip;

a color filter which is substantially transparent to the green light generated by the light source and reflected by the fingertip, and which is substantially opaque to non-green light; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the green light generated by the light source and reflected by the fingertip.

47. The fingerprint sensor of Claim 46, wherein the light source comprises a green light-emitting diode.

48. The fingerprint sensor of Claim 46, wherein the light source comprises a microlens array.

49. The fingerprint sensor of Claim 46, wherein the optical detector comprises an active matrix sensor array.

50. A fingerprint sensor comprising:

at least one light source comprising a green light-emitting diode which generates green light that is reflected by a fingertip;

a color filter which is substantially transparent to the green light generated by the green light-emitting diode and reflected by the fingertip, and which is substantially opaque to non-green light; and

at least one optical detector comprising an active matrix sensor array disposed from the fingertip with at least a portion of the color filter disposed between the active matrix sensor array and the fingertip, the active matrix sensor array positioned to receive the green light generated by the green light-emitting diode and reflected by the fingertip.

51. The fingerprint sensor of Claim 50, further comprising a microlens array that reflects the green light onto the fingertip.

52. The fingerprint sensor of Claim 51, wherein the microlens array is positioned below the active matrix sensor array.

53. The fingerprint sensor of Claim 51, wherein the microlens array comprises a plurality of reflective, curved surfaces.

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54. The fingerprint sensor of Claim 51, wherein the fingerprint sensor further comprises a light shield positioned to block light from the green light-emitting diode from directly illuminating the fingertip without reflecting from the microlens array.

55. A fingerprint sensor comprising:

at least one light source comprising a microlens array and a green light-emitting diode which generates green light that is reflected by a fingertip;

a color filter which is substantially transparent to the green light generated by the light source and reflected by the fingertip, and which is substantially opaque to non-green light; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the green light generated by the light source and reflected by the fingertip.

56. A fingerprint sensor comprising:

at least one light source comprising a microlens array and a green light-emitting diode which generates green light that is reflected by a fingertip;

a color filter which is substantially transparent to the green light generated by the light source and reflected by the fingertip, and which is substantially opaque to non-green light; and

at least one optical detector comprising an active matrix sensor array disposed from the fingertip with at least a portion of the color filter disposed between the active matrix sensor array and the fingertip, the active matrix sensor array positioned to receive the green light generated by the green light-emitting diode and reflected by the fingertip.

57. A fingerprint sensor comprising:

at least one light source which generates non-red light that is reflected by a fingertip;

a color filter which is substantially transparent to the non-red light generated by the light source and reflected by the fingertip, and which is substantially opaque to red light; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the non-red light generated by the light source and reflected by the fingertip.

58. The fingerprint sensor of Claim 57, wherein the light source comprises a green light-emitting diode.

59. The fingerprint sensor of Claim 57, wherein the light source comprises a microlens array.

60. The fingerprint sensor of Claim 57, wherein the optical detector comprises an active matrix sensor array.

61. A fingerprint sensor comprising:

at least one light source which generates light that is reflected by a fingertip, the light having a wavelength which is not substantially transmitted through the fingertip;

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a color filter which is substantially opaque to a portion of ambient light that passes through the fingertip, and which is substantially transparent to the light generated by the light source and reflected by the fingertip; and

at least one optical detector disposed from the fingertip with at least a portion of the color filter disposed between the optical detector and the fingertip, the optical detector positioned to receive the light generated by the light source and reflected by the fingertip.

62. A personal electronic device comprising:

an input device;

a display for displaying information to a user, wherein the display includes a light source;

a controller that receives signals from the input device and provides signals to the display;

a fingerprint sensor positioned so as to receive light from the display, the fingerprint sensor having a surface upon which a user's finger is positioned and also having a plurality of detectors that detect light from the display that is reflected off of the finger when the user's finger is positioned on the sensor wherein the plurality of detectors produce a signal indicative of the reflected light that is provided to the controller so that the controller can thereby determine whether the user is an authorized user of the personal electronic device.

63. The device of Claim 62, wherein the device comprises a personal computer and the input device comprises a keyboard.

64. The device of Claim 62, wherein the device comprises a personal digital assistant (PDA) and the input device comprises a touch screen that is integrated into the display.

65. The device of Claim 62, wherein the display comprises an LCD display that incorporates a first light source.

66. The device of Claim 65, wherein the LCD display comprises a passive matrix LCD display.

67. The device of Claim 65, further comprising a housing that defines a first opening in which the LCD display is positioned, and wherein the housing defines a second opening in which the fingerprint sensor is positioned so as to receive light produced by the LCD display.

68. The device of Claim 67, wherein the housing has a front side, which defines the first opening and a back side which defines the second opening.

69. The device of Claim 68, wherein the fingerprint sensor includes a light transmissive member positioned within the body defining the surface upon which a user's finger is positioned, and the plurality of detectors is interposed between the LCD display and the surface of the light transmissive member.

70. The device of Claim 62, wherein the detectors of the fingerprint sensor are distributed in a first region of the display.

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71. The device of Claim 70, wherein a supplemental light source is positioned adjacent the first region of the display so as to increase the light that is being output by the display in the first region to thereby offset the decrease in light output occurring as a result of positioning the plurality of detectors in the first region of the display.

72. The device of Claim 70, wherein the LCD display has an outer polarizing layer and a top coat layer positioned on the outer polarizing layers and wherein the plurality of detectors are positioned within the top coat layer.

73. The device of Claim 62, wherein the surface of the fingerprint sensor comprises a transparent material having an index of refraction that is correlated to the index of refraction of the user's finger such that when ridges of the user's finger is positioned on the surface the light is transmitted into the ridges but is reflected back to the plurality of detectors from positions of the surface adjacent valleys of the finger between the ridges as a result of total internal reflection.

74. The device of Claim 62, wherein the plurality of detectors comprise a plurality of PIN diodes that provide an electrical signal upon receiving reflected light from the user's finger that exceeds a pre-selected threshold.

75. The device of Claim 62, wherein the plurality of detectors comprise a plurality of detectors arranged into an array of pixels.

76. The device of Claim 75, wherein the array of pixels comprise an array that is approximately 240 by 317 pixels.

77. The device of Claim 76, wherein the plurality of detectors occupy an area that is approximately 19.2mm by 14.2mm.

78. The device of Claim 77, wherein each pixel has an area that is approximately 63 square microns.

79. The device of Claim 78, wherein each pixel includes a sensor diode and a switching diode and wherein the sensor diodes and the switching diodes have an area that is approximately 40 square microns and are spaced apart by a distance that is approximately 12 microns.

80. The device of Claim 79, wherein the plurality of detectors are positioned underneath the surface an approximate distance of 3 – 4 microns.

81. The device of Claim 62, further comprising a color filter interposed between the surface that receives the user's finger and the plurality of detectors that is selected so as to permit transmission of a wavelength of light so as to enhance the responsiveness of the plurality of detectors.

82. The device of Claim 62, wherein the display includes an organic light emitting diode (OLED) as a light source.

83. An LCD display incorporating a fingerprint sensor, the display comprising:

a light source that produces light;

an LCD element that has a first and a second surface, wherein the LCD element is positioned to receive the light via the first surface and selectively transmit the light therethrough to the second surface so as to selectively produce images;

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a top coat member formed on the second surface of the LCD element wherein the top coat member is formed of a light transmissive material wherein the top coat material defines an outer surface where a user's finger is positioned to obtain a representation of the user's fingerprint; and

a plurality of detectors mounted so as to be interposed between the LCD display and the outer surface such that light from the light source is reflected off of the user's fingerprint when the user's fingerprint is positioned on the outer surface and is then detected by the plurality of detectors so that the plurality of detectors generate a signal representative of the user's fingerprint.

84. The device of Claim 83, wherein the LCD device comprises a passive matrix LCD device.

85. The device of Claim 83, wherein the LCD device comprises an active matrix LCD device.

86. The device of Claim 83, wherein the light source comprises an organic light emitting diode (OLED) source.

87. The device of Claim 83, further comprising a supplemental light source that is positioned so as to increase the amount of light emitted from the LCD device in the region of the plurality of detectors so as to offset the occlusion of the light in the region of the plurality of detectors to thereby result in a more uniform display of light from the LCD display.

88. The device of Claim 83, wherein the surface of the top coat member comprises a transparent material having an index of refraction that is correlated to the index of refraction of the user's finger such that when ridges of the user's finger is positioned on the surface the light is transmitted into the ridges but is reflected back to the plurality of detectors from positions of the surface adjacent valleys of the finger between the ridges as a result of total internal reflection.

89. The device of Claim 83, wherein the plurality of detectors comprise a plurality of PIN diodes that provide an electrical signal upon receiving reflected light from the user's finger that exceeds a pre-selected threshold.

90. The device of Claim 83, further comprising a color filter interposed between the surface that receives the user's finger and the plurality of detectors that is selected so as to permit transmission of a wavelength of light so as to enhance the responsiveness of the plurality of detectors.

91. A personal electronic device comprising:

a housing having a first, second and third apertures;

an input device positioned within the first aperture of the housing;

a display positioned within the second aperture, for displaying information to a user, wherein the display includes a light source that provides light to the second aperture and also provides light to the third aperture;

a controller positioned within the housing that receives signals from the input device and provides signals to the display;

a fingerprint sensor positioned within the third aperture so as to receive light from the display, wherein the fingerprint sensor has a surface upon which a user's finger is positioned and also has a plurality

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of detectors that receive light from the display that is reflected off of the finger when the user's finger is positioned on the surface, wherein the plurality of detectors provides an signal indicative of the reflected light, wherein the signal is provided to the controller so that the controller can thereby determine whether the user is an authorized user of the personal electronic device.

92. The device of Claim 91, wherein the device comprises a personal computer and the input device comprises a keyboard.

93. The device of Claim 91, wherein the device comprises a personal digital assistant (PDA) and the input device comprises a touch screen that is integrated into the display.

94. The device of Claim 91, wherein the display comprises an LCD display that incorporates a first light source.

95. The device of Claim 94, wherein the LCD display comprises a passive matrix LCD display.

96. The device of Claim 94, wherein the LCD display comprises an active matrix LCD display.

97. The device of Claim 94, wherein second and third apertures are positioned on opposite sides of the housing such that the light source for the LCD display is interposed between the LCD display and the fingerprint sensor.

98. The device of Claim 91, wherein the surface of the fingerprint sensor comprises a transparent material having an index of refraction that is correlated to the index of refraction of the user's finger such that when ridges of the user's finger is positioned on the surface the light is transmitted into the ridges but is reflected back to the plurality of detectors from positions of the surface adjacent valleys of the finger between the ridges as a result of total internal reflection.

99. The device of Claim 91, wherein the plurality of detectors comprise a plurality of PIN diodes that provide an electrical signal upon receiving reflected light from the user's finger that exceeds a pre-selected threshold.

100. The device of Claim 91, wherein the plurality of detectors comprise a plurality of detectors arranged into an array of pixels.

101. The device of Claim 100, wherein the array of pixels comprise an array that is approximately 240 by 317 pixels.

102. The device of Claim 101, wherein the plurality of detectors occupy an area that is approximately 19.2mm by 14.2mm.

103. The device of Claim 102, wherein each pixel has an area that is approximately 63 square microns.

104. The device of Claim 103, wherein each pixel includes a sensor diode and a switching diode and wherein the sensor diodes and the switching diodes have an area that is approximately 40 square microns and are spaced apart by a distance that is approximately 12 microns.

105. The device of Claim 104, wherein the plurality of detectors are positioned underneath the surface an approximate distance of 3 – 4 microns.

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106.The device of Claim 105, further comprising a color filter interposed between the surface that receives the user's finger and the plurality of detectors that is selected so as to permit transmission of a wavelength of light so as to enhance the responsiveness of the plurality of detectors.

107.A touch screen assembly for a personal electronic device, the touch screen comprising:

a light source;

a touch screen surface that receives light from the light source; and

a plurality of detectors wherein the plurality of detectors detect changes in the ambient light so as to determine the presence and location of a stylus on the touch screen and wherein the plurality of detectors further detect light that is reflected off of a user's finger that is positioned on the touch screen so as to produce a signal indicative of the user's fingerprint for identification purposes.

108.The assembly of Claim 107, wherein the plurality of detectors comprise a plurality of PIN diodes that provide an electronic signal upon receiving light reflected off of the fingerprint that has an intensity greater than a pre-selected threshold.

109.The assembly of Claim 108, wherein the plurality of detectors comprise a plurality of detectors arranged into an array of pixels.

110.The assembly of Claim 109, wherein the array of pixels comprise an array that is approximately 240 by 317 pixels.

111.The assembly of Claim 110, wherein the plurality of detectors occupy an area that is approximately 19.2mm by 14.2mm.

112.The assembly of Claim 111, wherein each pixel has an area that is approximately 63 square microns.

113.The assembly of Claim 112, wherein each pixel includes a sensor diode and a switching diode and wherein the sensor diodes and the switching diodes have an area that is approximately 40 square microns and are spaced apart by a distance that is approximately 12 microns.

114.The assembly of Claim 113, wherein the plurality of detectors are positioned underneath the touch screen surface an approximate distance of 3 – 4 microns.

115.The assembly of Claim 107, wherein the plurality of detectors comprise a first plurality of detectors of a first density and a second plurality of detectors of a second density greater than the first density wherein the second plurality of detectors are used to produce a signal indicative of the user's fingerprint for identification purposes.

116.The assembly of claim 107, further comprising color filter interposed between the surface that receives the user's finger and the plurality of detectors that is selected so as to permit transmission of a wavelength of light so as to enhance the responsiveness of the plurality of detectors.

117.The assembly of Claim 107, wherein the surface of the fingerprint member comprises a transparent material having an index of refraction that is correlated to the index of refraction of the user's finger such that when ridges of the user's finger is positioned on the surface the light is transmitted into the ridges but is reflected back to

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the plurality of detectors from positions of the surface adjacent valleys of the finger between the ridges as a result of total internal reflection.

118.The assembly of Claim 117, wherein the light source is an OLED light source.

119.The assembly of Claim 117, wherein the OLED light source produced red, green and blue light.

120.A touch screen for a personal electronic device, the touch screen comprising:

a light source;

a touch screen surface that is light transmissive and receives light from the light source; and

a first plurality of detectors wherein the first plurality of detectors detect changes in the ambient light so as to determine the presence and location of a stylus on the touch screen;

a finger print surface that is formed of a light transmissive material so as to transmit light from the light source therethrough;

a second plurality of detectors of detectors that detect light from the light source that is reflected off of a user's finger that is positioned on the fingerprint surface so as to produce a signal indicative of the user's fingerprint for identification purposes.

121.The touch screen of Claim 120, wherein the plurality of detectors comprise a plurality of PIN diodes that provide an electronic signal upon receiving light reflected off of the fingerprint that has an intensity greater than a pre-selected threshold.

122.The touch screen of Claim 121, wherein the plurality of detectors comprise a plurality of detectors arranged into an array of pixels.

123.The touch screen of Claim 122, wherein the array of pixels comprise an array that is approximately 240 by 317 pixels.

124.The touch screen of Claim 123, wherein the plurality of detectors occupy an area that is approximately 19.2mm by 14.2mm.

125.The touch screen of Claim 124, wherein each pixel has an area that is approximately 63 square microns.

126.The touch screen of Claim 125, wherein each pixel includes a sensor diode and a switching diode and wherein the sensor diodes and the switching diodes have an area that is approximately 40 square microns and are spaced apart by a distance that is approximately 12 microns.

127.The touch screen of Claim 126, wherein the plurality of detectors are positioned underneath the touch screen surface an approximate distance of 3 – 4 microns.

128.The touch screen of claim 120, further comprising a color filter interposed between the surface that receives the user's finger and the second plurality of detectors that is selected so as to permit transmission of a wavelength of light so as to enhance the responsiveness of the plurality of detectors.

129.The touch screen of Claim 120, wherein the surface of the fingerprint member comprises a transparent material having an index of refraction that is correlated to the index of refraction of the user's finger such that when

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ridges of the user's finger are positioned on the surface the light is transmitted into the ridges but is reflected back to the plurality of detectors from positions of the surface adjacent valleys of the finger between the ridges as a result of total internal reflection.

130. The touch screen of Claim 120, wherein the light source is an OLED light source.

131. The touch screen of Claim 130, wherein the OLED light source produces red, green and blue light.

132. The touch screen of Claim 120, further comprising a housing wherein the light source is positioned within the housing and the finger print surface and the touch screen surface are mounted adjacent each other on a first surface of the housing.

133. The touch screen of Claim 120, further comprising a housing wherein the light source is positioned within the housing and the finger print surface and the touch screen surface are mounted on a first and a second surface of the housing with the light source interposed therebetween.

134. A fingerprint detector comprising:

a substrate having a first surface;

a plurality of contacts that are geographically distributed about a region of the first surface wherein each of the plurality of contacts extend upward from the first surface a first height to an upper surface that has a first linear dimension wherein the first height and the first linear dimension is selected so that when a user's finger is placed on the first surface of the substrate in a first orientation, the ridges of the user's finger positioned adjacent a first set of the upper surfaces of the plurality of contacts physically contact the first set of the plurality of contacts and the grooves of the user's finger positioned adjacent the upper surfaces of a second set of the plurality of contacts are spaced from the upper surfaces of the second set of the plurality of contacts;

a distributed light emitting element positioned adjacent the plurality of contacts so as to be electrically connected to each of the plurality of contacts such that when the user's finger is positioned on the region of the first surface in the first orientation, light is emitted from regions of the light emitting element positioned adjacent the first set of the plurality of contacts;

a plurality of light detectors positioned within the substrate at locations corresponding to the locations of the plurality of contacts such that a first set of the plurality of light detectors produce electrical signals that correspond to the first set of the plurality of contacts such that an electrical signal indicative of the user's fingerprint is produced.

135. The fingerprint detector of Claim 134, further comprising a ground element positioned on the first surface and connected to an electrical source wherein the electrical source is further connected to an electrode layer conductively joined to the distributed light emitting element.

136. The fingerprint detector of Claim 135, wherein when the user's finger is placed on the first surface of the substrate at least a portion of the user's finger physically contacts the ground element in addition to the first set of the plurality of contacts such that the physical contact of the of the user's finger with the ground element and the

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first set of the plurality of contacts results in the passage of an electrical impulse through the distributed light emitting element.

137.The fingerprint detector of Claim 136, wherein when the electrical impluse is passed into the distributed light emitting element discrete quantities of light are produced which are subsequently detected by the light detectors.

138.The fingerprint detector of Claim 137, wherein the distributed light emitting element comprises an organic light emitting diode layer which is selectively illuminated by the passage of electrical impulses resulting from the placement of the user's finger on the plurality of contacts and the ground element.

139.The fingerprint detector of Claim 134, wherein the plurality of contacts comprise conductive metal or metal alloy.

140.The fingerprint detector of Claim 134, wherein the plurality of contacts have dimensions of approximately 40 um in width by 40 um in length.

141.The fingerprint detector of Claim 134, wherein the distributed light emitting element comprises a layer of electroluminecent material.

142.The fingerprint detector of Claim 134, wherein the distributed light emitting element comprises a plurality of discrete light emitting devices coupled to the plurality of contacts.

143.A fingerprint detector comprising:

a substrate having a first surface;

a plurality of contacts that are geographically distributed about a region of the first surface wherein each of the plurality of contacts extend upward from the first surface a first height to an upper surface that has a first linear dimension wherein the first height and the first linear dimension is selected so that when a user's finger is placed on the first surface of the substrate in a first orientation, the ridges of the user's finger positioned adjacent a first set of the upper surfaces of the plurality of contacts physically contact the first set of the plurality of contacts and the grooves of the user's finger positioned adjacent the upper surfaces of a second set of the plurality of contacts are spaced from the upper surfaces of the second set of the plurality of contacts;

an organic light emitting diode layer positioned adjacent the plurality of contacts so as to be electrically connected to each of the plurality of contacts such that when the user's finger is positioned on the region of the first surface in the first orientation, light is emitted from regions of the light emitting element positioned adjacent the first set of the plurality of contacts;

a plurality of light detectors positioned within the substrate at locations corresponding to the locations of the plurality of contacts such that a first set of the plurality of light detectors produce electrical signals that correspond to the first set of the plurality of contacts such that an electrical signal indicative of the user's fingerprint is produced.

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144.The fingerprint detector of Claim 142, further comprising a ground element positioned on the first surface and connected to an electrical source wherein the electrical source is further connected to an electrode layer conductively joined to the organic light emitting diode layer.

145.The fingerprint detector of Claim 144, wherein when the user's finger is placed on the first surface of the substrate at least a portion of the user's finger physically contacts the ground element in addition to the first set of the plurality of contacts such that the physical contact of the of the user's finger with the ground element and the first set of the plurality of contacts results in the passage of an electrical impulse through the organic light emitting diode layer.

146.The fingerprint detector of Claim 145, wherein when the electrical impluse are passed into the organic light emittting element discrete quantities of light are produced which are subsequently detected by the light detectors.

147.The fingerprint detector of Claim 143, wherein the plurality of contacts comprise at least one of conductive metal and metal alloy.

148.The fingerprint detector of Claim 143, wherein the plurality of contacts have dimensions of approximately40 um in width by 40 um in length.

149.A fingerprint sensor comprising:

a substrate defining a first surface that is adapted to receive a user's finger wherein the substrate is formed at least partially of a light transmitting material;

a light source positioned with respect to the substrate so as to permit light to travel therethrough;

a plurality of detectors positioned with respect to the substrate so as to receive a reflected light pattern emanating through the substrate when the user's finger is positioned on the first surface and wherein the plurality of detectors produce an electrical signal indicative of the reflected light pattern; and

a grounding mechanism coupled to the first surface of the substrate such that electrical potential arising from electrostatic charge differences between the first surface and the user as a result of the user's finger being positioned on the first surface is reduced to thereby reduce the influence of the electrostatic charge on the plurality of detectors.

150.The sensor of Claim 149, wherein the light source comprises an OLED.

151.The sensor of Claim 149, wherein the light source comprises ambient light.

152.The sensor of Claim 149, wherein the light source comprises a side injected light source.

153.The sensor of Claim 149, wherein the light source comprises a backlighting source.

154.The sensor of Claim 149, wherein the sensor employs total internal reflection at the first surface of the substrate to further distinguish relief features of the finger.

155.The sensor of Claim 149, further comprising a finger characteristic detector that is engaged with the first surface of the substrate that obtains at least one characteristic of the user's finger when the user's finger is

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positioned on the first surface and compares the at least one characteristic to a pre-determined criteria to thereby determine whether the user's finger is a live finger to thereby hinder fraudulent access to the sensor.

156.The sensor of Claim 155, wherein the finger characteristic is impedance.

157.The sensor of Claim 149, further comprising a color filter layer interposed between the first surface and the plurality of detectors wherein the color filter layer permits transmission of selected wavelengths of light so as to improve the responsiveness of the detectors.

158.The sensor of Claim 149, wherein the substrate comprises at least one protective layer.

159.The sensor of Claim 158, wherein the at least one protective layer is positioned to coincide with the first surface.

160.The sensor of Claim 158, wherein the at least one protective layer comprises a conductive transparent oxide.

161.The sensor of Claim 160, wherein the conductive transparent oxide comprises indium-tin-oxide.

162.The sensor of Claim 161, wherein the indium-tin-oxide comprises approximately 10% by weight tin oxide and 90% by weight indium oxide.

163.A fingerprint sensor coupled to a system such that the fingerprint sensor permits access to the system to authorized users, the fingerprint sensor comprising:

a substrate defining a first surface that is adapted to receive a user's finger wherein the substrate is at least partially formed of a light transmitting material;

a light source positioned with respect to the substrate so as to permit light to travel therethrough;

a plurality of detectors positioned with respect to the substrate so as to receive a reflected light pattern emanating through the substrate when the user's finger is positioned on the first surface and wherein the plurality of detectors produce an electrical signal indicative of the reflected light pattern; and

a finger characteristic detector that is engaged with the first surface of the substrate that obtains at least one characteristic of the user's finger when the user's finger is positioned on the first surface and compares the at least one characteristic to a pre-determined criteria to thereby determine whether the user's finger is a live finger to thereby hinder fraudulent access to the system.

164.The sensor of Claim 163, wherein the finger characteristic is impedance.

165.The sensor of Claim 163, wherein the finger characteristic detector comprises:

a time varying voltage source;

at least one resistor;

a first contact surface adapted to receive the finger;

a second contact surface adapted to receive the finger and electrically isolated from the first contact surface; and

a voltage monitor adapted to measure the voltage developed between the first and second contact surfaces wherein a closed electrical circuit is formed by the time varying voltage source, the at least one

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resistor, the first and second contact surfaces, and a finger in contact with both the first and second contact surfaces.

166.The sensor of Claim 163, wherein the finger characteristic detector comprises:

a time varying voltage source;

a first and second contact surfaces adapted to each receive a finger wherein the first and second contact surfaces are electrically isolated from each other;

a plurality of resistors;

an Op Amp wherein the time varying voltage source, the plurality of resistors, and the first and second contact surfaces are connected as voltage dividers to the inputs of the Op Amp;

an analog/digital converter connected to the output of the Op Amp; and

a comparator connected to the output of the analog/digital converter wherein the comparator generates an enable signal when a finger is in contact with the first and second contact surfaces.

167.The sensor of Claim 163, wherein the light source comprises an OLED.

168.The sensor of Claim 163, wherein the light source comprises ambient light.

169.The sensor of Claim 163, wherein the light source comprises a side injected light source.

170.The sensor of Claim 163, wherein the light source comprises a backlighting source.

171.The sensor of Claim 163, wherein the sensor employs total internal reflection at the first surface of the substrate to further distinguish relief features of the finger.

172.The sensor of Claim 163, further comprising a color filter layer interposed between the first surface and the plurality of detectors wherein the color filter layer permits transmission of selected wavelengths of light so as to improve the responsiveness of the detectors.

173.The sensor of Claim 163, wherein the substrate comprises at least one protective layer.

174.The sensor of Claim 173, wherein the at least one protective layer is positioned to coincide with the first surface.

175.The sensor of Claim 173, wherein the at least one protective layer comprises a conductive transparent oxide.

176.The sensor of Claim 175, wherein the conductive transparent oxide comprises indium-tin-oxide.

177.The sensor of Claim 176, wherein the indium-tin-oxide comprises approximately 10% by weight tin oxide and 90% by weight indium oxide.

178.The sensor of Claim 163, further comprising a common ground in electrical communication with the first surface of the substrate and the plurality of detectors so as to equalize electrical potential between the user and the sensor.

179.The device of Claim 163, wherein the plurality of detectors comprise a plurality of detectors arranged into an array of pixels.

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180.The device of Claim 179, wherein the array of pixels comprise an array that is approximately 240 by 317 pixels.

181.The device of Claim 180, wherein the plurality of detectors occupy an area that is approximately 19.2mm by 14.2mm.

182.The device of Claim 179, wherein each pixel has an area that is approximately 63 square microns.

183.The device of Claim 182, wherein each pixel includes a sensor diode and a switching diode and wherein the sensor diodes and the switching diodes have an area that is approximately 40 square microns and are spaced apart by a distance that is approximately 12 microns.

184.The device of Claim 183, wherein the plurality of detectors are positioned underneath the first surface an approximate distance of 3 – 4 microns.

185.A fingerprint sensor coupled to a system such that the fingerprint sensor permits access to the system to authorized users, the fingerprint sensor comprising:

a substrate defining a first surface that is adapted to receive a user's finger wherein the substrate is at least partially formed of a light transmitting material;

a light source positioned with respect to the substrate so as to permit light to travel therethrough;

a plurality of detectors positioned with respect to the substrate so as to receive a reflected light pattern emanating through the substrate when the user's finger is positioned on the first surface and wherein the plurality of detectors produce an electrical signal indicative of the reflected light pattern;

an impedance measurement circuit coupled to the first surface such that when the user positions their finger on the first surface, the impedance of the finger is measured and a signal indicative thereof is produced;

an evaluation device that receives the impedance measurement signal from the impedance measurement circuit wherein the evaluation device determines whether the impedance measurement signal is indicative of a live finger and provides an evaluation signal indicative thereof such that the system can use the evaluation signal to limit access to inhibit unauthorized access to the system.

186.The sensor of Claim 185, wherein the light source comprises an OLED.

187.The sensor of Claim 185, wherein the light source comprises ambient light.

188.The sensor of Claim 185, wherein the light source comprises a side injected light source.

189.The sensor of Claim 185, wherein the light source comprises a backlighting source.

190.The sensor of Claim 185, wherein the sensor employs total internal reflection at the first surface of the substrate to further distinguish relief features of the finger.

191.The sensor of Claim 185, further comprising a color filter layer interposed between the first surface and the plurality of detectors wherein the color filter layer permits transmission of selected wavelengths of light so as to improve the responsiveness of the detectors.

192.The sensor of Claim 185, wherein the substrate comprises at least one protective layer.

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193.The sensor of Claim 192, wherein the at least one protective layer is positioned to coincide with the first surface.

194.The sensor of Claim 193, wherein the at least one protective layer comprises a conductive transparent oxide.

195.The sensor of Claim 194, wherein the conductive transparent oxide comprises indium-tin-oxide.

196.The sensor of Claim 195, wherein the indium-tin-oxide comprises approximately 10% by weight tin oxide and 90% by weight indium oxide.

197.The sensor of Claim 185, further comprising a common ground in electrical communication with the first surface of the substrate and the plurality of detectors so as to equalize electrical potential between the user and the sensor.

198.A fingerprint sensor comprising:

a substrate defining a first surface that is adapted to receive a user's finger wherein the substrate is formed at least partially of a light transmitting material;

a light source positioned with respect to the substrate so as to permit light to travel therethrough;

a plurality of detectors positioned with respect to the substrate so as to receive a reflected light pattern emanating through the substrate when the user's finger is positioned on the first surface and wherein the plurality of detectors produce an electrical signal indicative of the reflected light pattern; and

a grounding mechanism coupled to the first surface of the substrate such that electrical potential arising from electrostatic charge differences between the first surface and the user as a result of the user's finger being positioned on the first surface is reduced to thereby reduce the influence of the electrostatic charge on the plurality of detectors.

199.The sensor of Claim 198, wherein the light source comprises an OLED.

200.The sensor of Claim 198, wherein the light source comprises ambient light.

201.The sensor of Claim 198, wherein the light source comprises a side injected light source.

202.The sensor of Claim 198, wherein the light source comprises a backlighting source.

203.The sensor of Claim 198, wherein the sensor employs total internal reflection at the first surface of the substrate to further distinguish relief features of the finger.

204.The sensor of Claim 198, further comprising a finger characteristic detector that is engaged with the first surface of the substrate that obtains at least one characteristic of the user's finger when the user's finger is positioned on the first surface and compares the at least one characteristic to a pre-determined criteria to thereby determine whether the user's finger is a live finger to thereby hinder fraudulent access to the sensor.

205.The sensor of Claim 204, wherein the finger characteristic is impedance.

206.The sensor of Claim 198, further comprising a color filter layer interposed between the first surface and the plurality of detectors wherein the color filter layer permits transmission of selected wavelengths of light so as to improve the responsiveness of the detectors.

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207. The sensor of Claim 198, wherein the substrate comprises at least one protective layer.

208. The sensor of Claim 207, wherein the at least one protective layer is positioned to coincide with the first surface.

209. The sensor of Claim 207, wherein the at least one protective layer comprises a conductive transparent oxide.

210. The sensor of Claim 209, wherein the conductive transparent oxide comprises indium-tin-oxide.

211. The sensor of Claim 210, wherein the indium-tin-oxide comprises approximately 10% by weight tin oxide and 90% by weight indium oxide.

212. A fingerprint sensor coupled to a system such that the fingerprint sensor permits access to the system to authorized users, the fingerprint sensor comprising:

a substrate defining a first surface that is adapted to receive a user's finger wherein the substrate is at least partially formed of a light transmitting material;

a light source positioned with respect to the substrate so as to permit light to travel therethrough;

a plurality of detectors positioned with respect to the substrate so as to receive a reflected light pattern emanating through the substrate when the user's finger is positioned on the first surface and wherein the plurality of detectors produce an electrical signal indicative of the reflected light pattern; and

a finger characteristic detector that is engaged with the first surface of the substrate that obtains at least one characteristic of the user's finger when the user's finger is positioned on the first surface and compares the at least one characteristic to a pre-determined criteria to thereby determine whether the user's finger is a live finger to thereby hinder fraudulent access to the system.

213. The sensor of Claim 212, wherein the finger characteristic is impedance.

214. The sensor of Claim 212, wherein the finger characteristic detector comprises:

a time varying voltage source,

at least one resistor,

a first contact surface adapted to receive the finger;

a second contact surface adapted to receive the finger and electrically isolated from the first contact surface; and

a voltage monitor adapted to measure the voltage developed between the first and second contact surfaces wherein a closed electrical circuit is formed by the time varying voltage source, the at least one resistor, the first and second contact surfaces, and a finger in contact with both the first and second contact surfaces.

215. The sensor of Claim 212, wherein the finger characteristic detector comprises:

a time varying voltage source;

a first and second contact surfaces adapted to each receive a finger wherein the first and second contact surfaces are electrically isolated from each other;

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a plurality of resistors;

an Op Amp wherein the time varying voltage source, the plurality of resistors, and the first and second contact surfaces are connected as voltage dividers to the inputs of the Op Amp;

an analog/digital converter connected to the output of the Op Amp; and

a comparator connected to the output of the analog/digital converter wherein the comparator generates an enable signal when a finger is in contact with the first and second contact surfaces.

216.The sensor of Claim 212, wherein the light source comprises an OLED.

217.The sensor of Claim 212, wherein the light source comprises ambient light.

218.The sensor of Claim 212, wherein the light source comprises a side injected light source.

219.The sensor of Claim 212, wherein the light source comprises a backlighting source.

220.The sensor of Claim 212, wherein the sensor employs total internal reflection at the first surface of the substrate to further distinguish relief features of the finger.

221.The sensor of Claim 212, further comprising a color filter layer interposed between the first surface and the plurality of detectors wherein the color filter layer permits transmission of selected wavelengths of light so as to improve the responsiveness of the detectors.

222.The sensor of Claim 212, wherein the substrate comprises a first protective layer.

223.The sensor of Claim 222, wherein the first protective layer is positioned to coincide with the first surface.

224.The sensor of Claim 222, wherein the at least one protective layer comprises a conductive transparent oxide.

225.The sensor of Claim 224, wherein the conductive transparent oxide comprises indium-tin-oxide.

226.The sensor of Claim 225, wherein the indium-tin-oxide comprises approximately 10% by weight tin oxide and 90% by weight indium oxide.

227.The sensor of Claim 212, further comprising a common ground in electrical communication with the first surface of the substrate and the plurality of detectors so as to equalize electrical potential between the user and the sensor.

228.The device of Claim 212, wherein the plurality of detectors comprise a plurality of detectors arranged into an array of pixels.

229.The device of Claim 228, wherein the array of pixels comprise an array that is approximately 240 by 317 pixels.

230.The device of Claim 229, wherein the plurality of detectors occupy an area that is approximately 19.2mm by 14.2mm.

231.The device of Claim 228, wherein each pixel has an area that is approximately 63 square microns.

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232.The device of Claim 231, wherein each pixel includes a sensor diode and a switching diode and wherein the sensor diodes and the switching diodes have an area that is approximately 40 square microns and are spaced apart by a distance that is approximately 12 microns.

233.The device of Claim 232, wherein the plurality of detectors are positioned underneath the first surface an approximate distance of 3 – 4 microns.

234.A fingerprint sensor coupled to a system such that the fingerprint sensor permits access to the system to authorized users, the fingerprint sensor comprising:

a substrate defining a first surface that is adapted to receive a user's finger wherein the substrate is at least partially formed of a light transmitting material;

a light source positioned with respect to the substrate so as to permit light to travel therethrough;

a plurality of detectors positioned with respect to the substrate so as to receive a reflected light pattern emanating through the substrate when the user's finger is positioned on the first surface and wherein the plurality of detectors produce an electrical signal indicative of the reflected light pattern;

an impedance measurement circuit coupled to the first surface such that when the user positions their finger on the first surface, the impedance of the finger is measured and a signal indicative thereof is produced;

an evaluation device that receives the impedance measurement signal from the impedance measurement circuit wherein the evaluation device determines whether the impedance measurement signal is indicative of a live finger and provides an evaluation signal indicative thereof such that the system can use the evaluation signal to limit access to inhibit unauthorized access to the system.

235.The sensor of Claim 234, wherein the light source comprises an OLED.

236.The sensor of Claim 234, wherein the light source comprises ambient light.

237.The sensor of 234, wherein the light source comprises a side injected light source.

238.The sensor of Claim 234, wherein the light source comprises a backlighting source.

239.The sensor of Claim 234, wherein the sensor employs total internal reflection at the first surface of the substrate to further distinguish relief features of the finger.

240.The sensor of Claim 234, further comprising a color filter layer interposed between the first surface and the plurality of detectors wherein the color filter layer permits transmission of selected wavelengths of light so as to improve the responsiveness of the detectors.

241.The sensor of Claim 234, wherein the substrate comprises at least one protective layer.

242.The sensor of Claim 241, wherein the at least one protective layer is positioned to coincide with the first surface.

243.The sensor of Claim 241, wherein the at least one protective layer comprises a conductive transparent oxide.

244.The sensor of Claim 243, wherein the conductive transparent oxide comprises indium-tin-oxide.

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245.The sensor of Claim 244, wherein the indium-tin-oxide comprises approximately 10% by weight tin oxide and 90% by weight indium oxide.

246.The sensor of Claim 234, further comprising a common ground in electrical communication with the first surface of the substrate and the plurality of detectors so as to equalize electrical potential between the user and the sensor.

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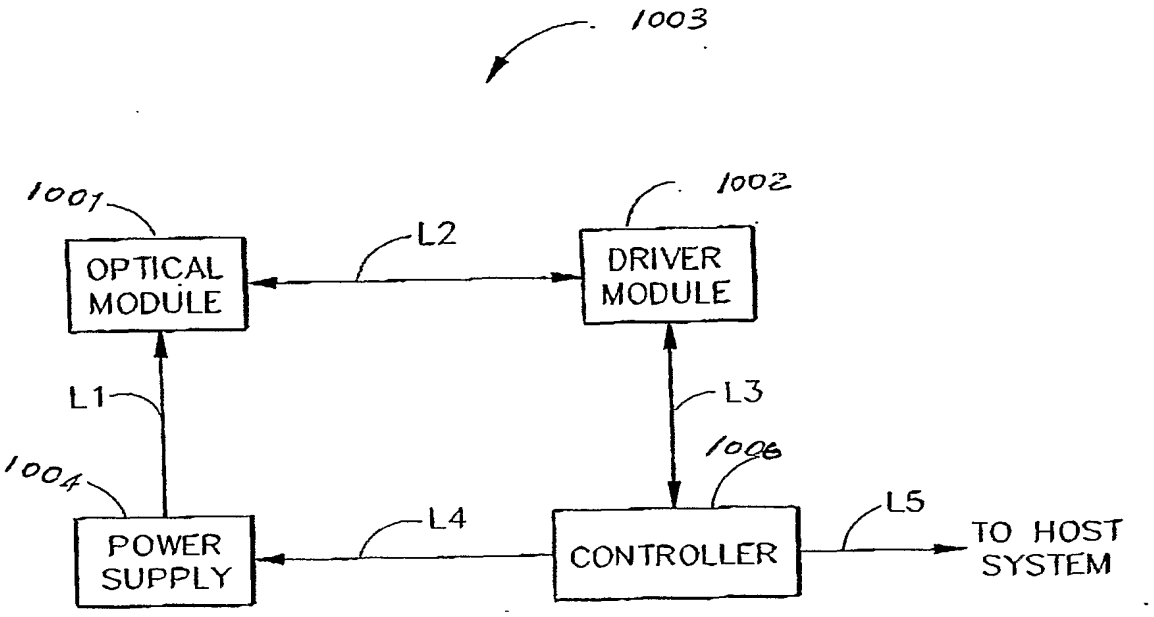

1003
1001
OPTICAL MODULE
L2
1002
DRIVER MODULE
L1
L3
1004
1006
POWER SUPPLY
L4
CONTROLLER
L5
TO HOST SYSTEM

FIG. 1

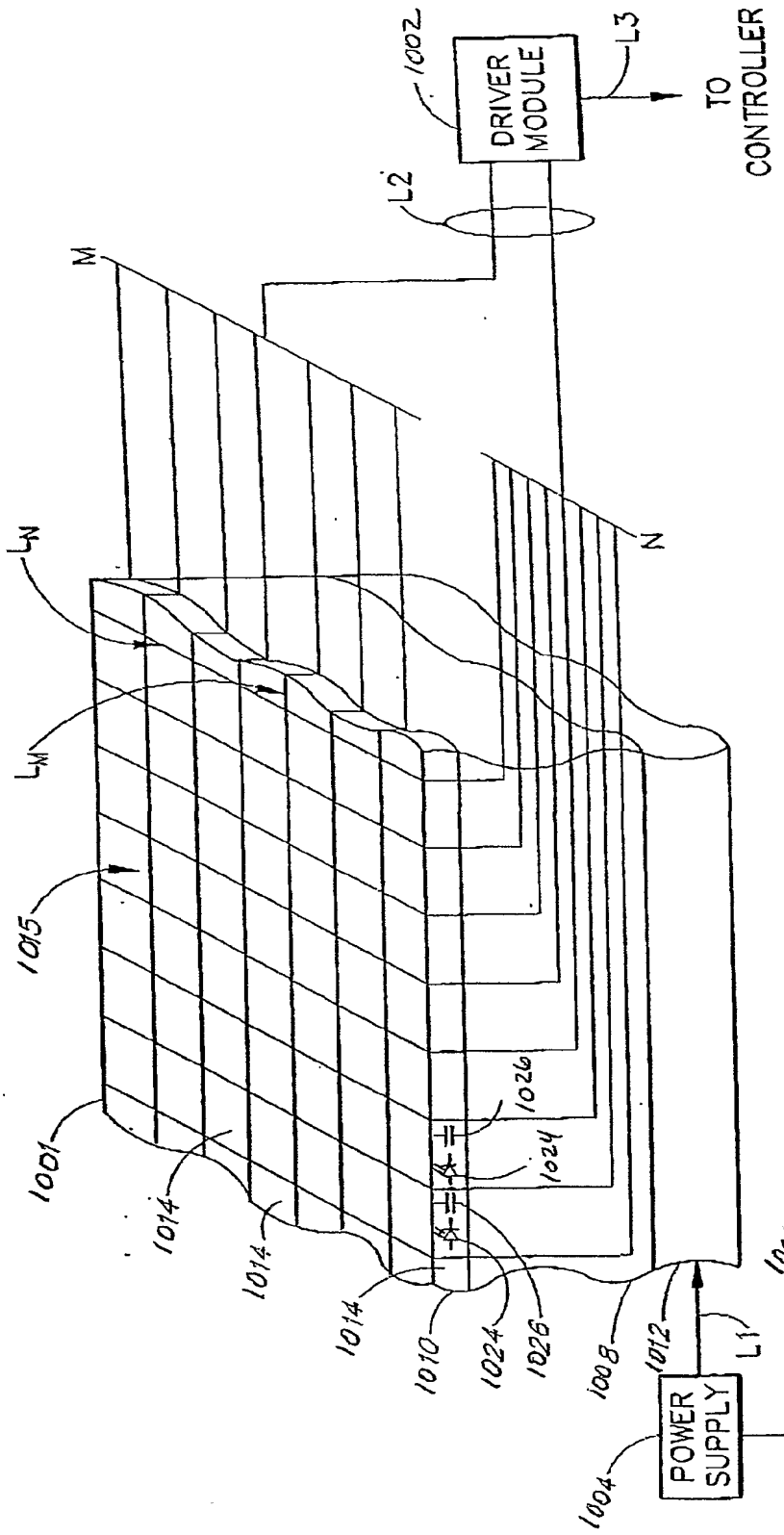

1002
DRIVER MODULE
L3
TO CONTROLLER
L2
M
N
L_N
L_M
1005
1001
1014
1014
1014
1010
1024
1026
1024
1026
1008
1012
L1
1006
TO CONTROLLER
POWER SUPPLY
1004
L4

FIG. 2

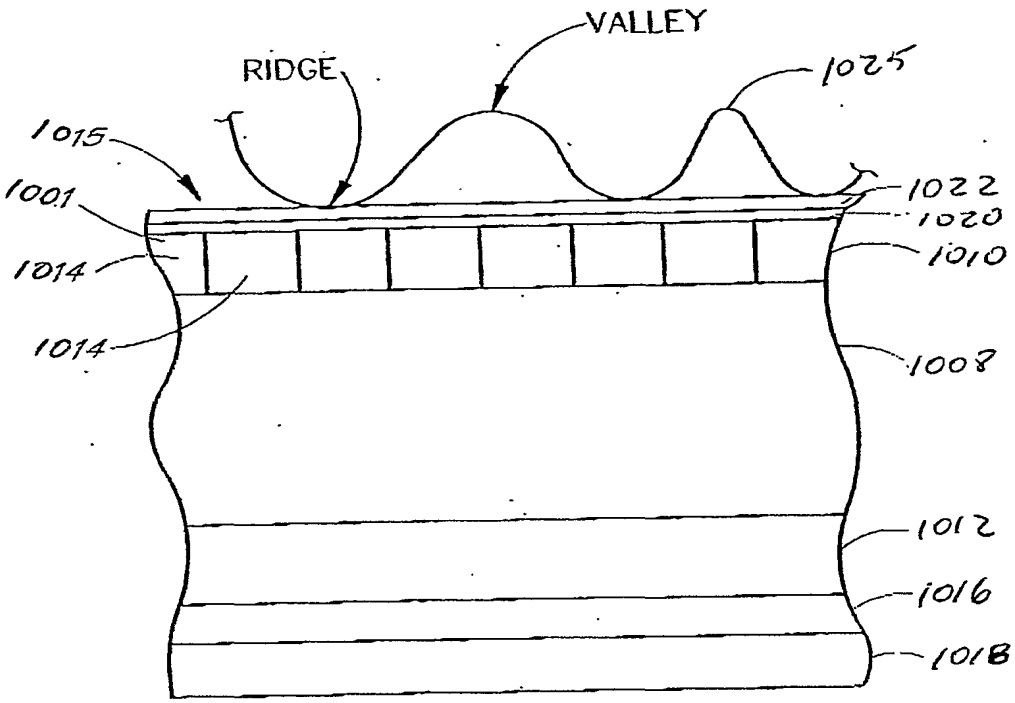

VALLEY
RIDGE
1025
1015
1001
1022
1020
1014
1010
1014
1008
1012
1016
1018

FIG. 3A

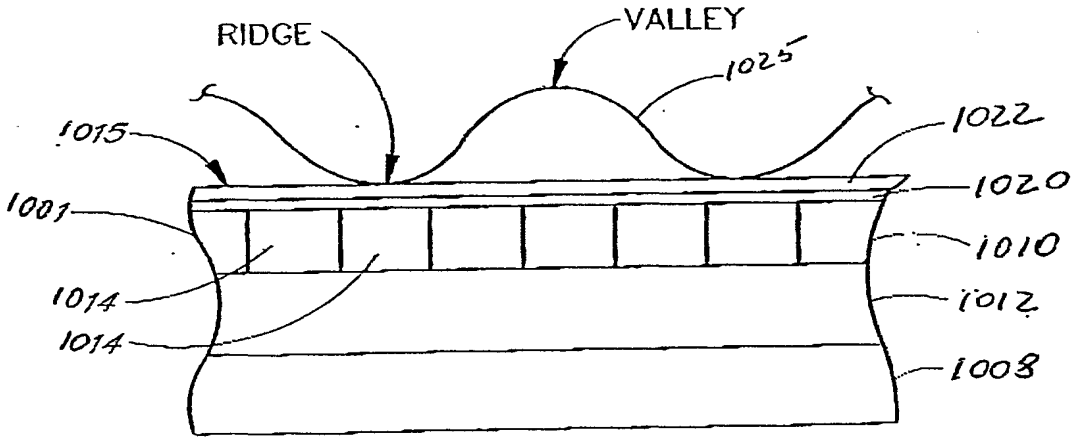

RIDGE
VALLEY
1025
1015
1022
1020
1001
1010
1014
1012
1014
1008

FIG. 3B

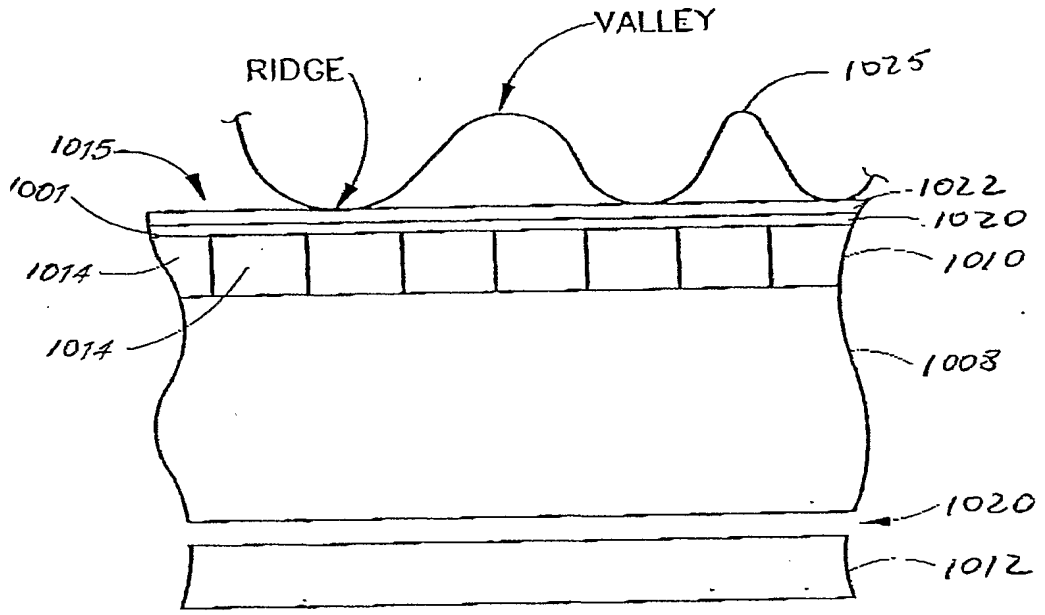

VALLEY
RIDGE
1025
1015
1001
1022
1020
1010
1014
1014
1008
1020
1012

FIG. 4

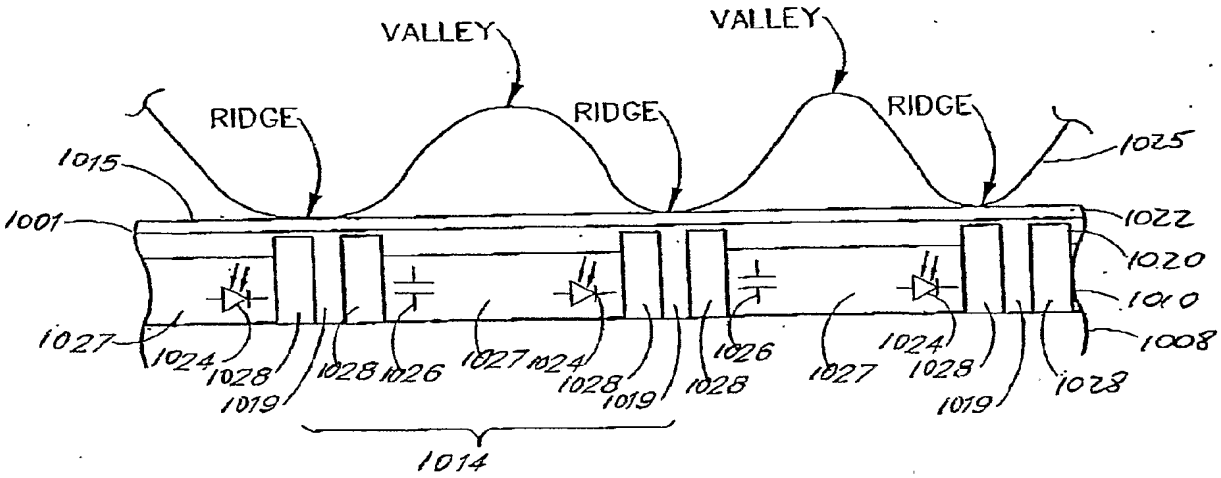

VALLEY
VALLEY
RIDGE
RIDGE
RIDGE
1015
1001
1025
1022
1020
1010
1008
1027
1024
1028
1026
1019
1014

FIG. 5

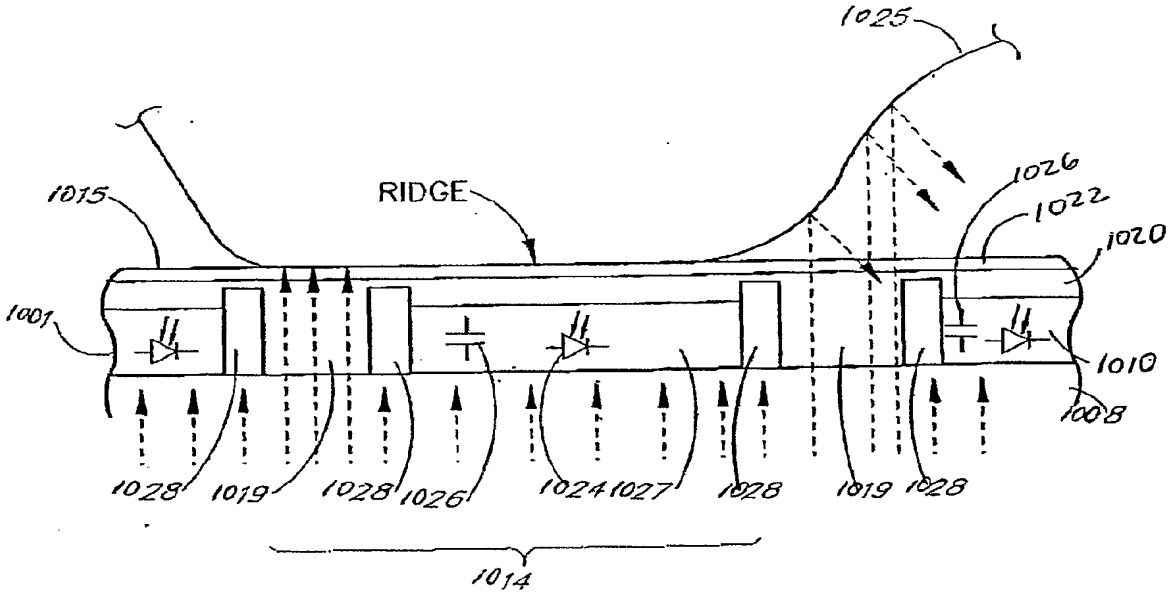

1025
RIDGE
1015
1026
1022
1020
1001
1010
1008
1028
1019
1024
1027
1014

FIG. 6

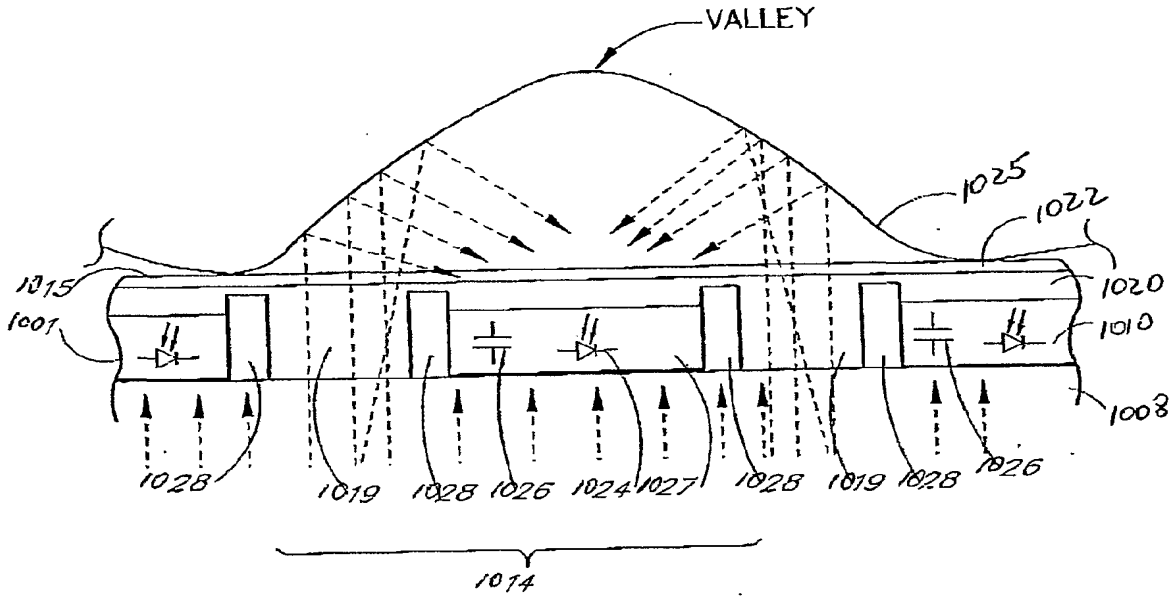

VALLEY
1025
1022
1015
1020
1001
1010
1008
1028
1019
1028
1026
1024
1027
1028
1019
1028
1026
1014

FIG. 7

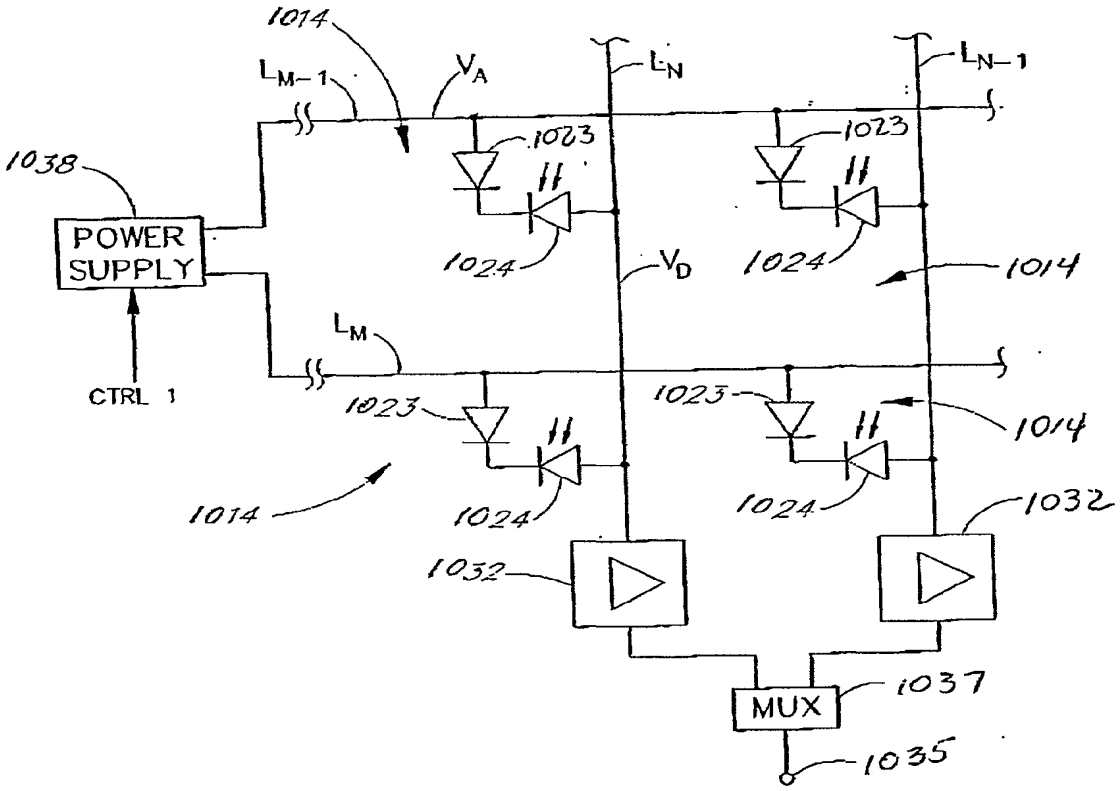

1014
L_{M-1}
V_A
L_N
L_{N-1}
1023
1023
1038
POWER SUPPLY
1024
V_D
1024
1014
L_M
CTRL 1
1023
1023
1014
1014
1024
1024
1032
1032
MUX
1037
1035

FIG. 8

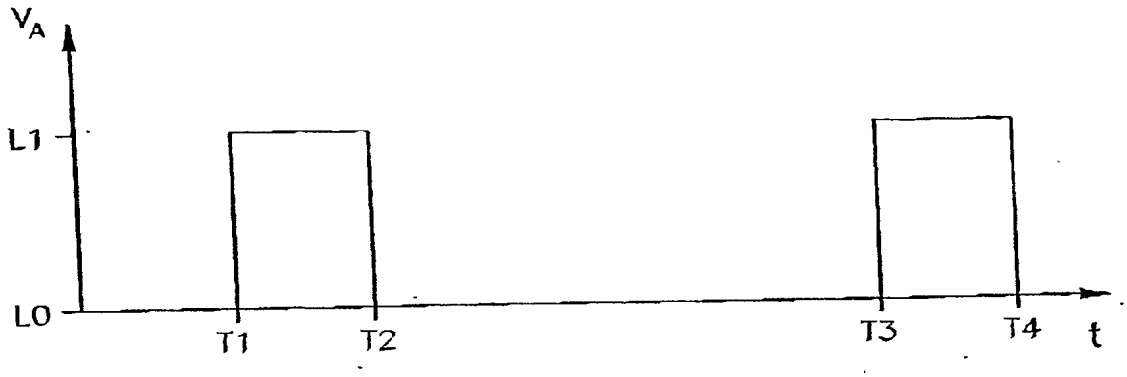


FIG. 8A

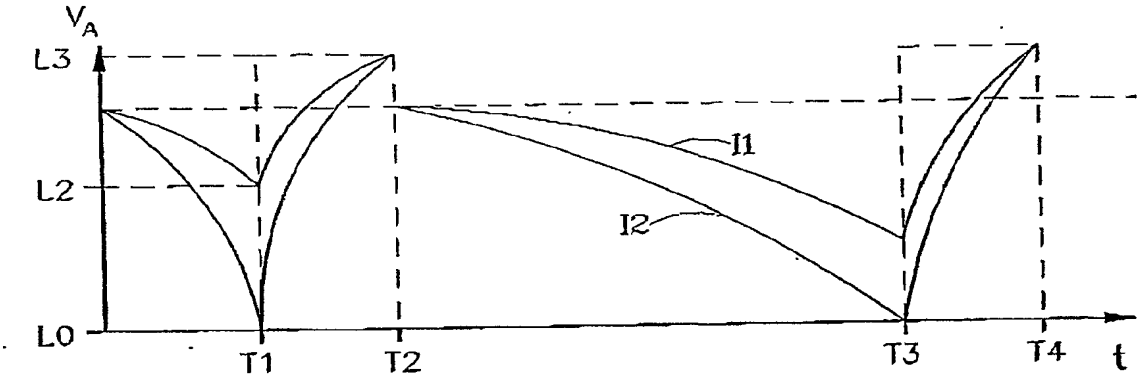


FIG. 8B

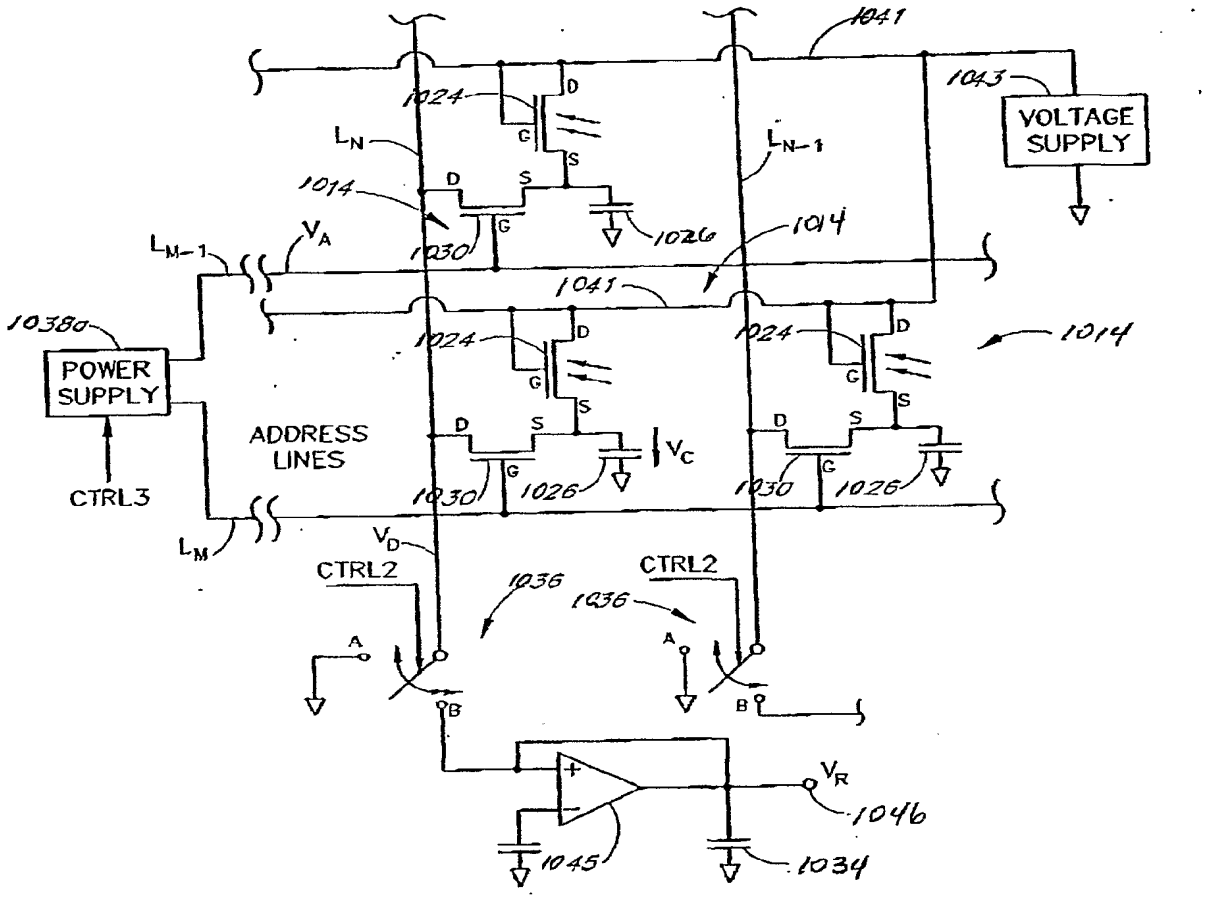

1041
1043
VOLTAGE SUPPLY
1024
D
G
S
L_N
L_{N-1}
1014
1026
1030
L_{M-1}
V_A
10380
POWER SUPPLY
ADDRESS LINES
CTRL3
L_M
V_C
V_D
CTRL2
1036
A
B
V_R
1046
1045
1034

FIG. 9

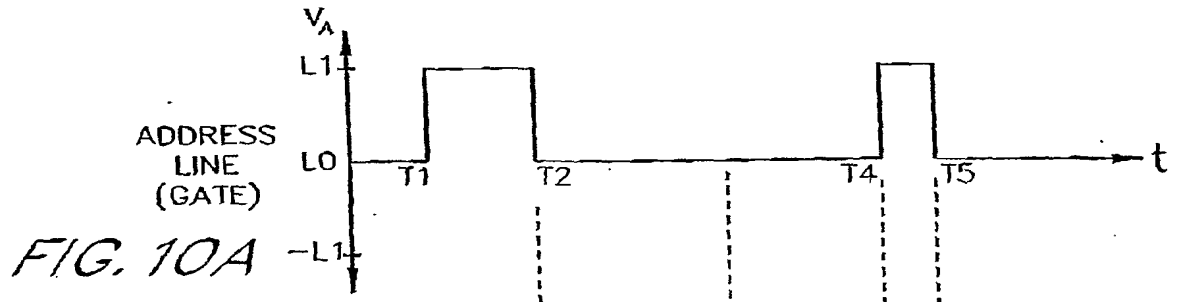


FIG. 10A

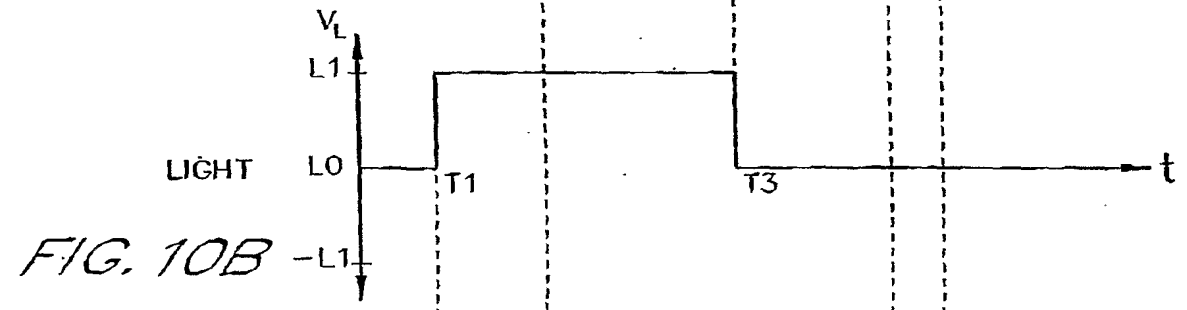


FIG. 10B

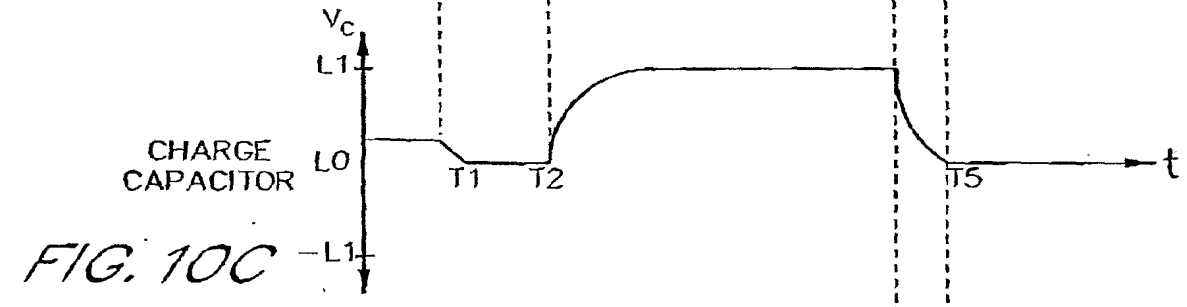


FIG. 10C

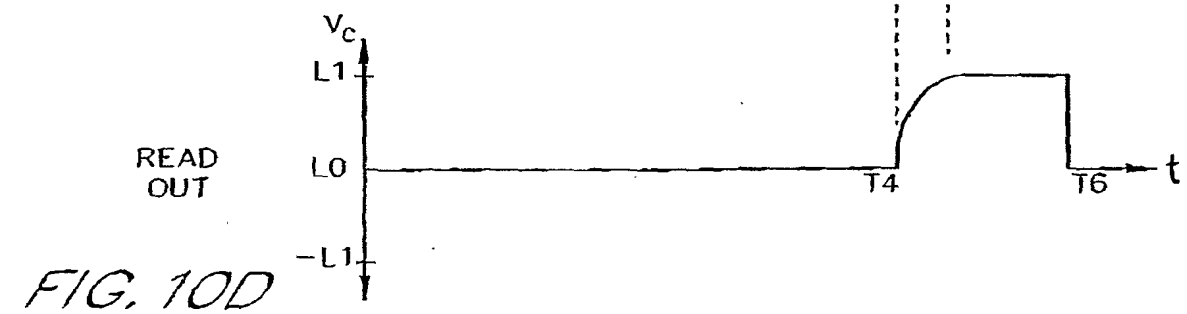


FIG. 10D

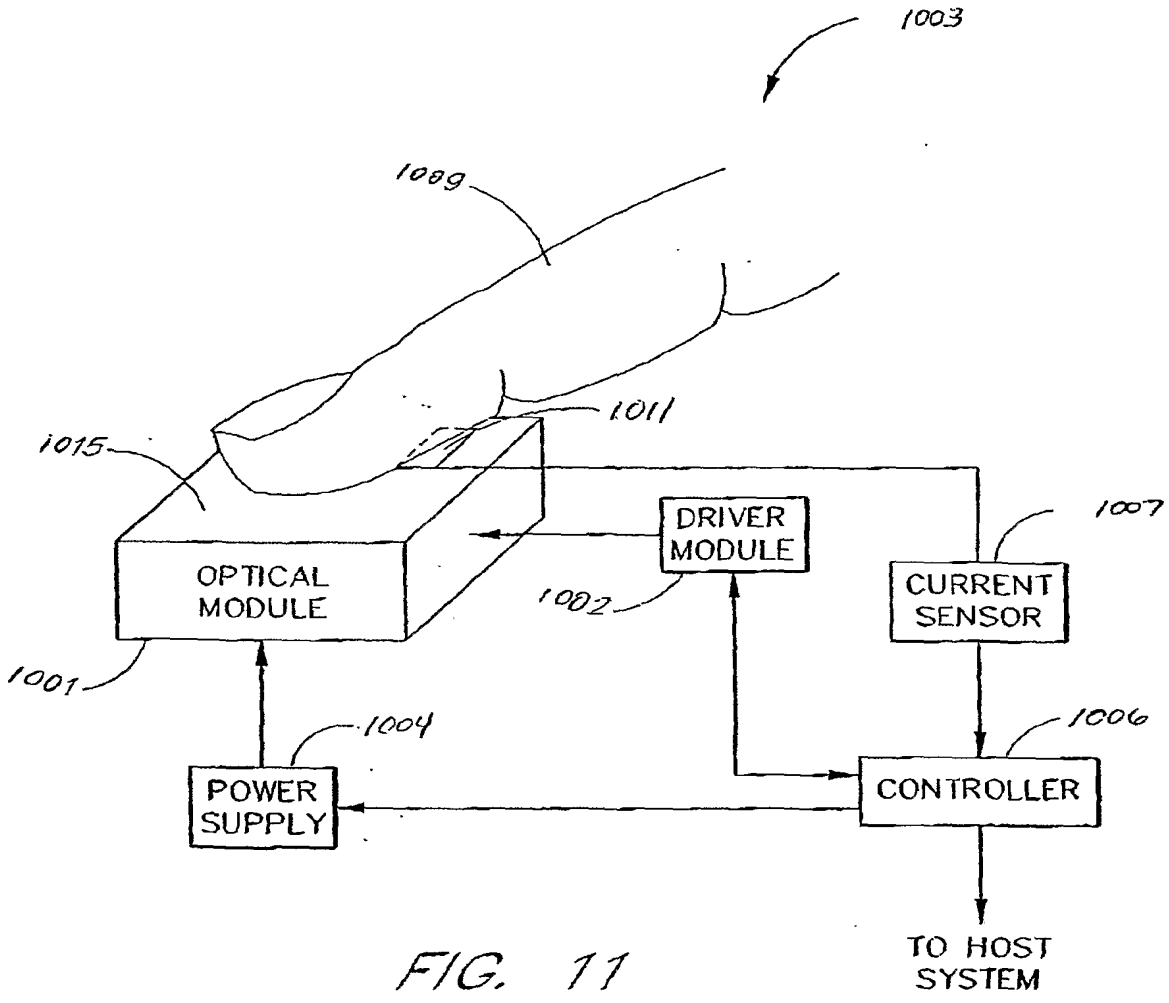

1003
1009
1011
1015
OPTICAL MODULE
1001
DRIVER MODULE
1002
1007
CURRENT SENSOR
1004
POWER SUPPLY
1006
CONTROLLER
TO HOST SYSTEM

FIG. 11

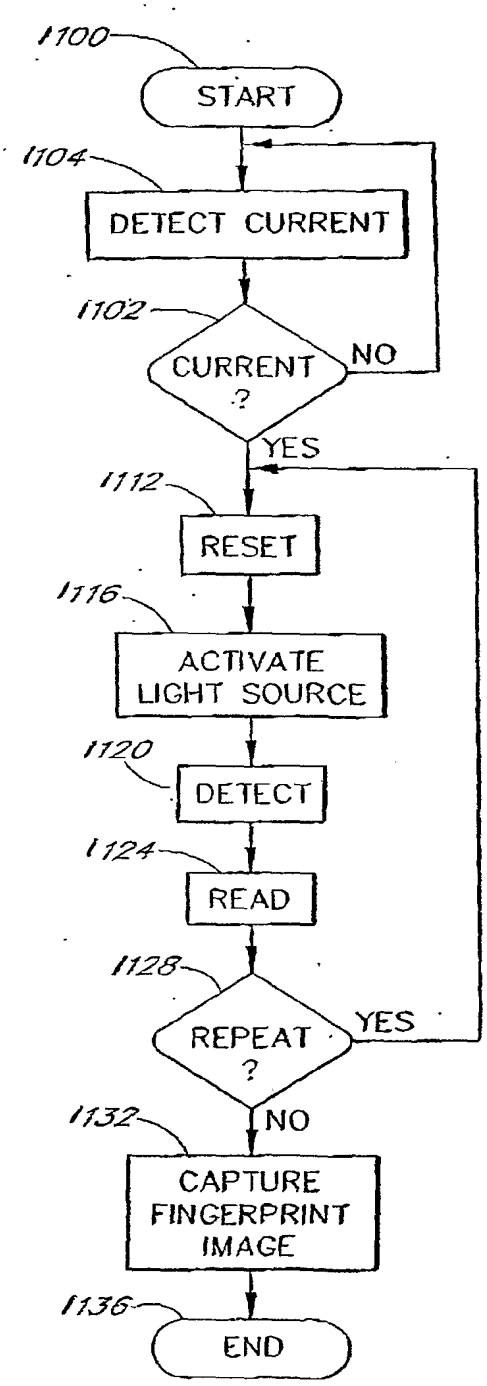

1100
START
1104
DETECT CURRENT
1102
CURRENT ?
NO
YES
1112
RESET
1116
ACTIVATE LIGHT SOURCE
1120
DETECT
1124
READ
1128
REPEAT ?
YES
NO
1132
CAPTURE FINGERPRINT IMAGE
1136
END

FIG. 12

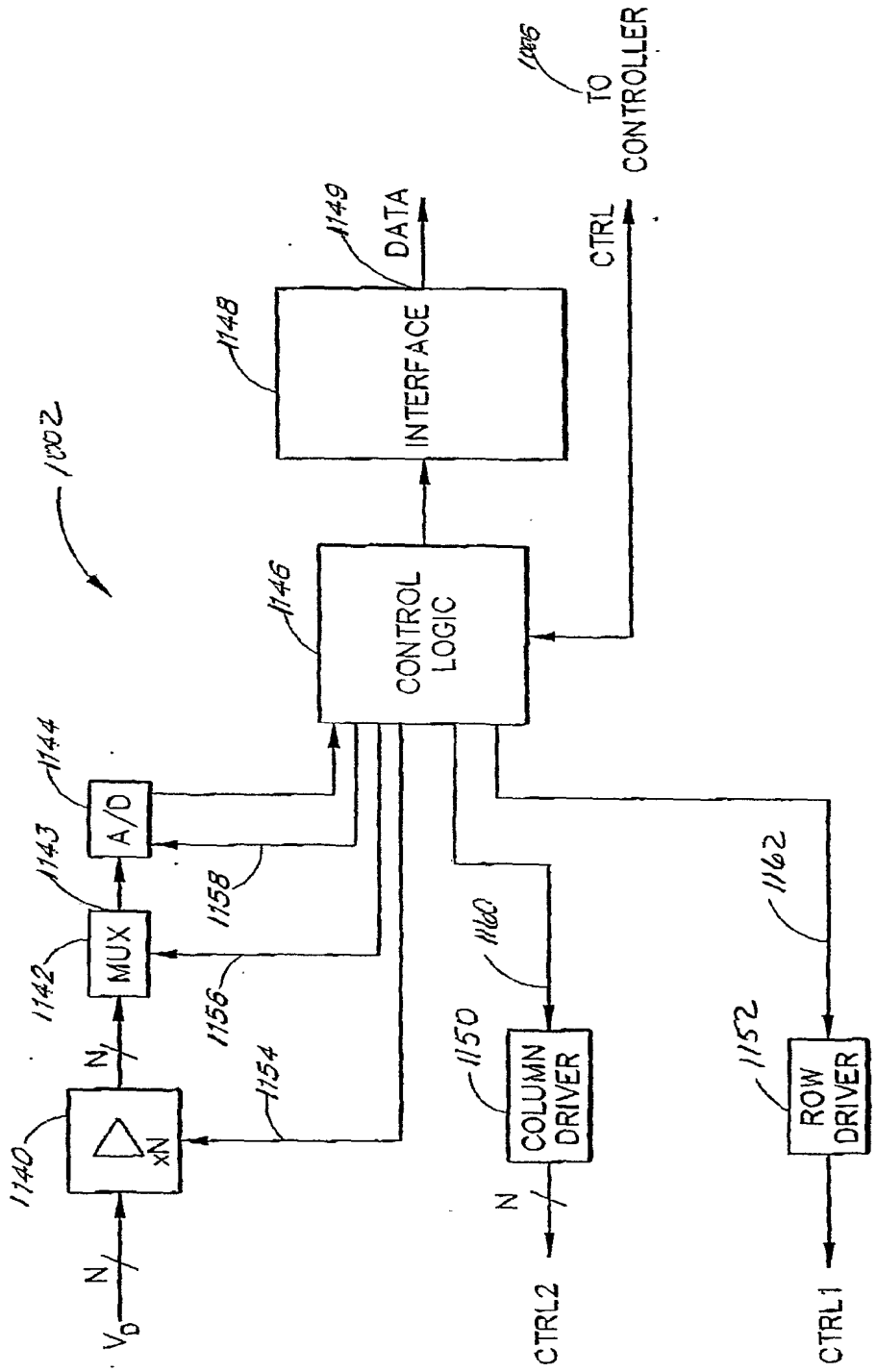

1002
1140
xN
N
V_D
1142
MUX
1143
1144
A/D
1158
1156
1154
1146
CONTROL LOGIC
1148
INTERFACE
1149
DATA
CTRL
1006
TO CONTROLLER
1150
COLUMN DRIVER
1160
N
CTRL2
1152
ROW DRIVER
1162
CTRL1

FIG. 13

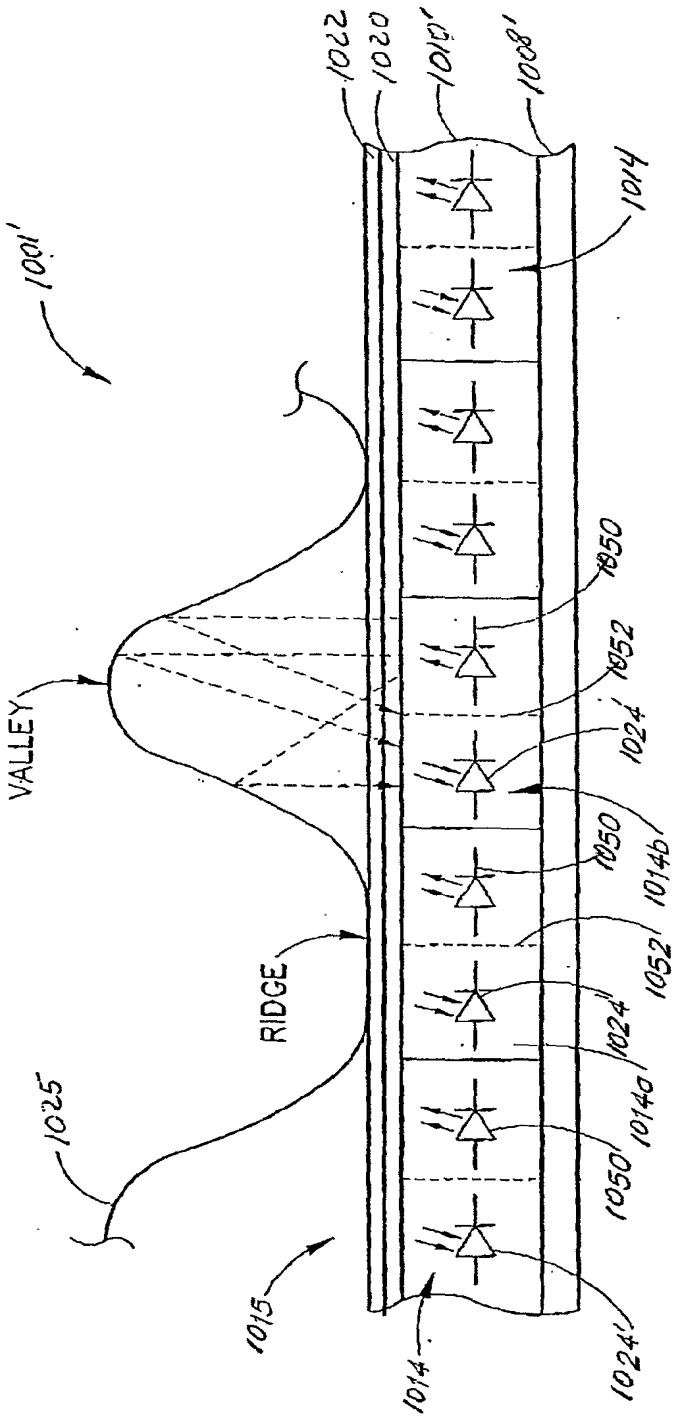

1001'
VALLEY
RIDGE
1025
1015
1014
1022
1020
1018'
1008'
1014
1050
1052
1024'
1050
1014b
1052
1024"
1014a
1050
1024'

FIG. 14

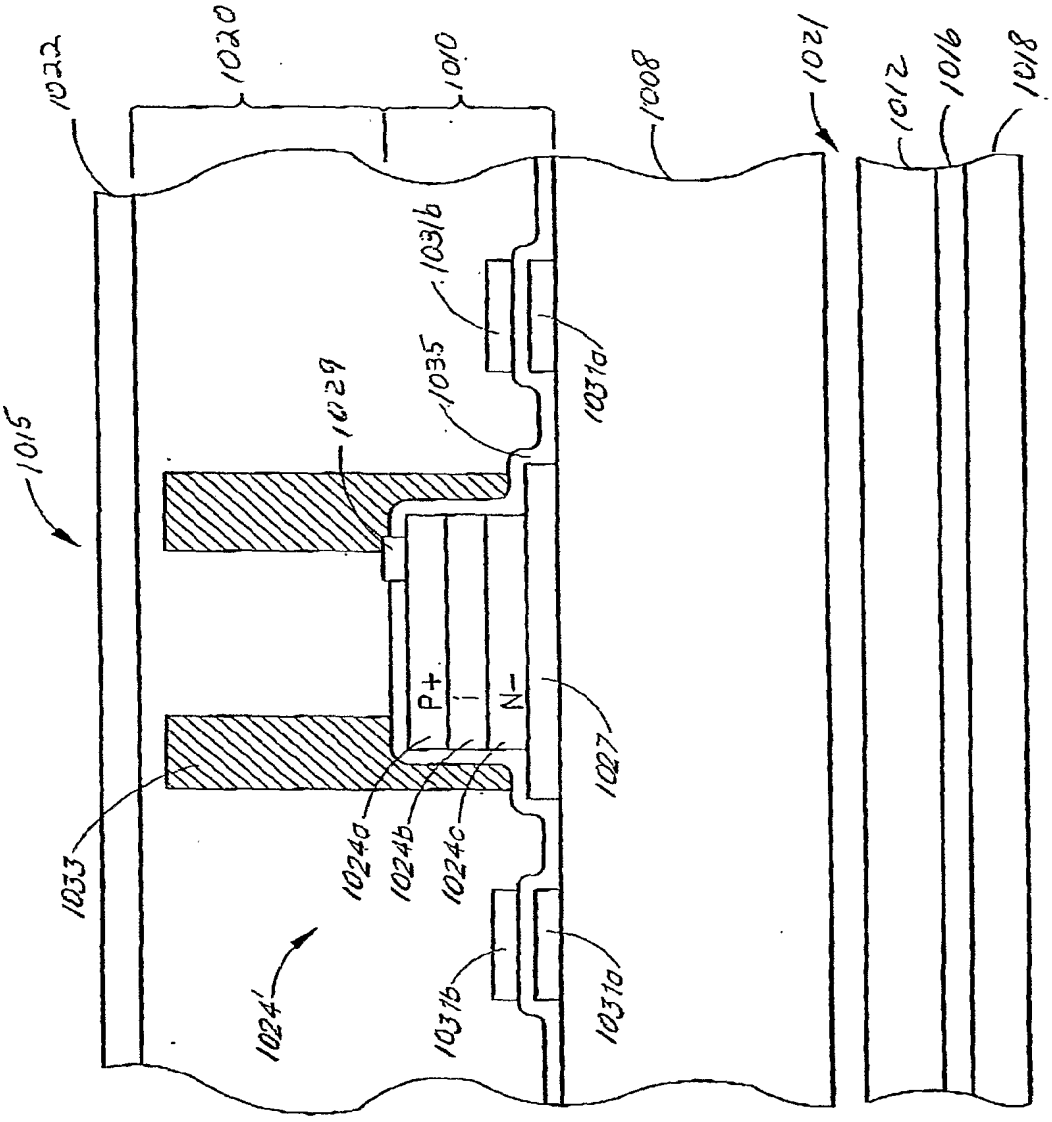

1022
1020
1010
1008
1021
1012
1016
1018
1031b
1035
1031a
1029
1015
P+
I
N-
1027
1033
1024a
1024b
1024c
1024'
1031b
1031a

FIG. 15

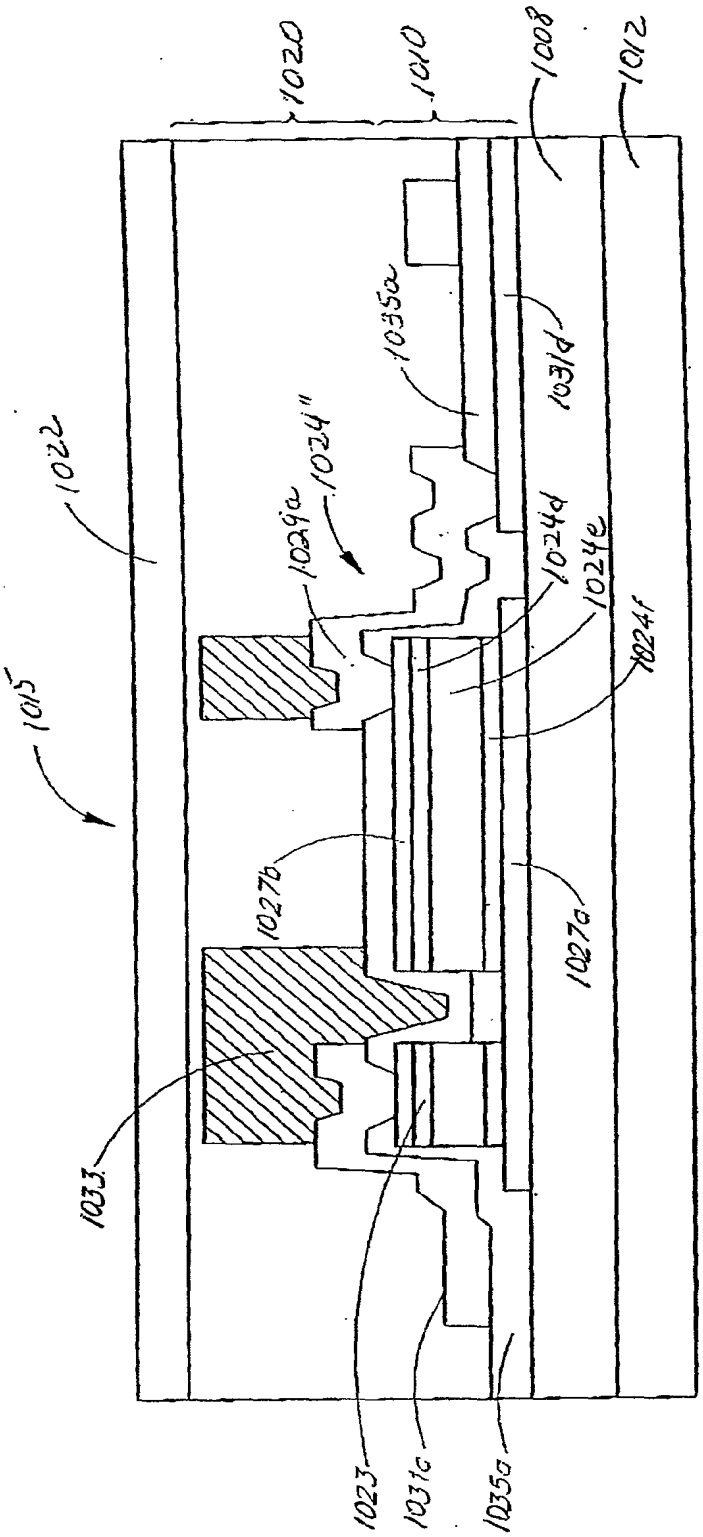

1020
1010
1008
1012
1022
1015
1035a
1031d
1034"
1029a
1024d
1024e
1024f
1027b
1027a
1033
1023
1031c
1035c

FIG. 15A

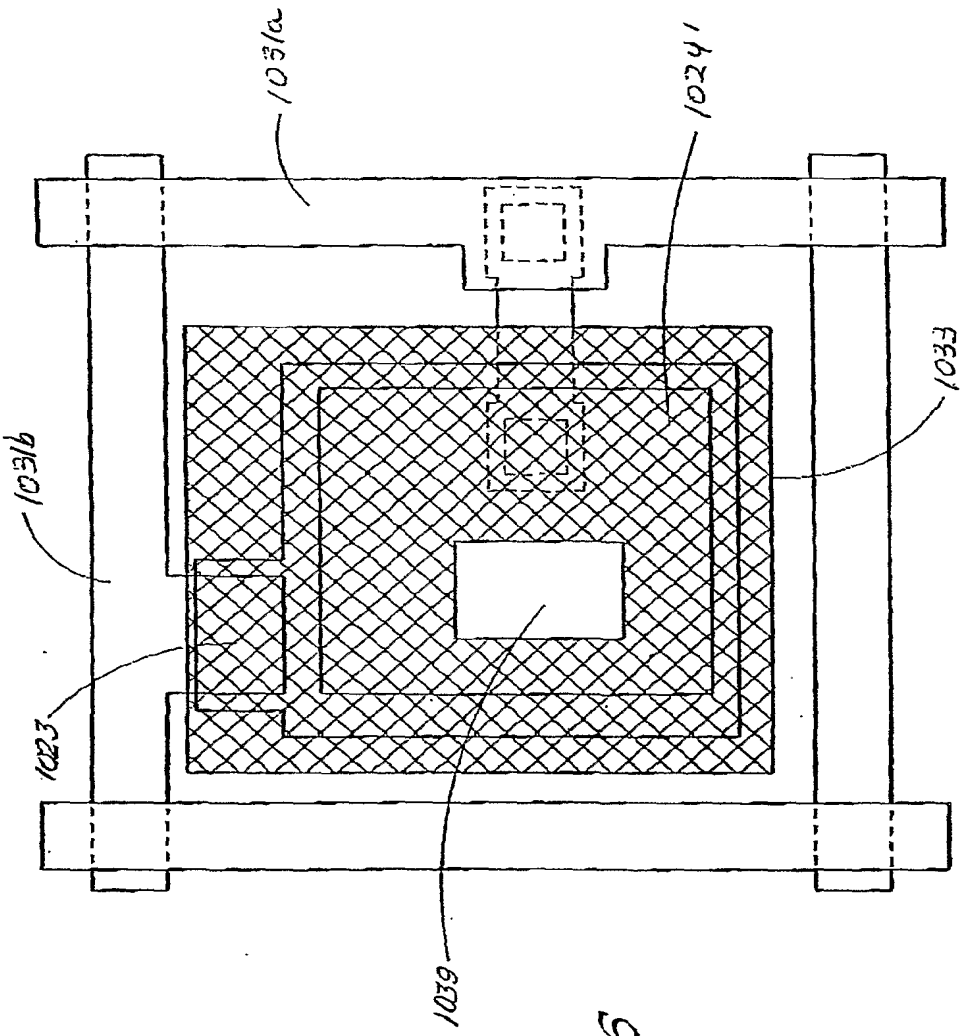


FIG. 16

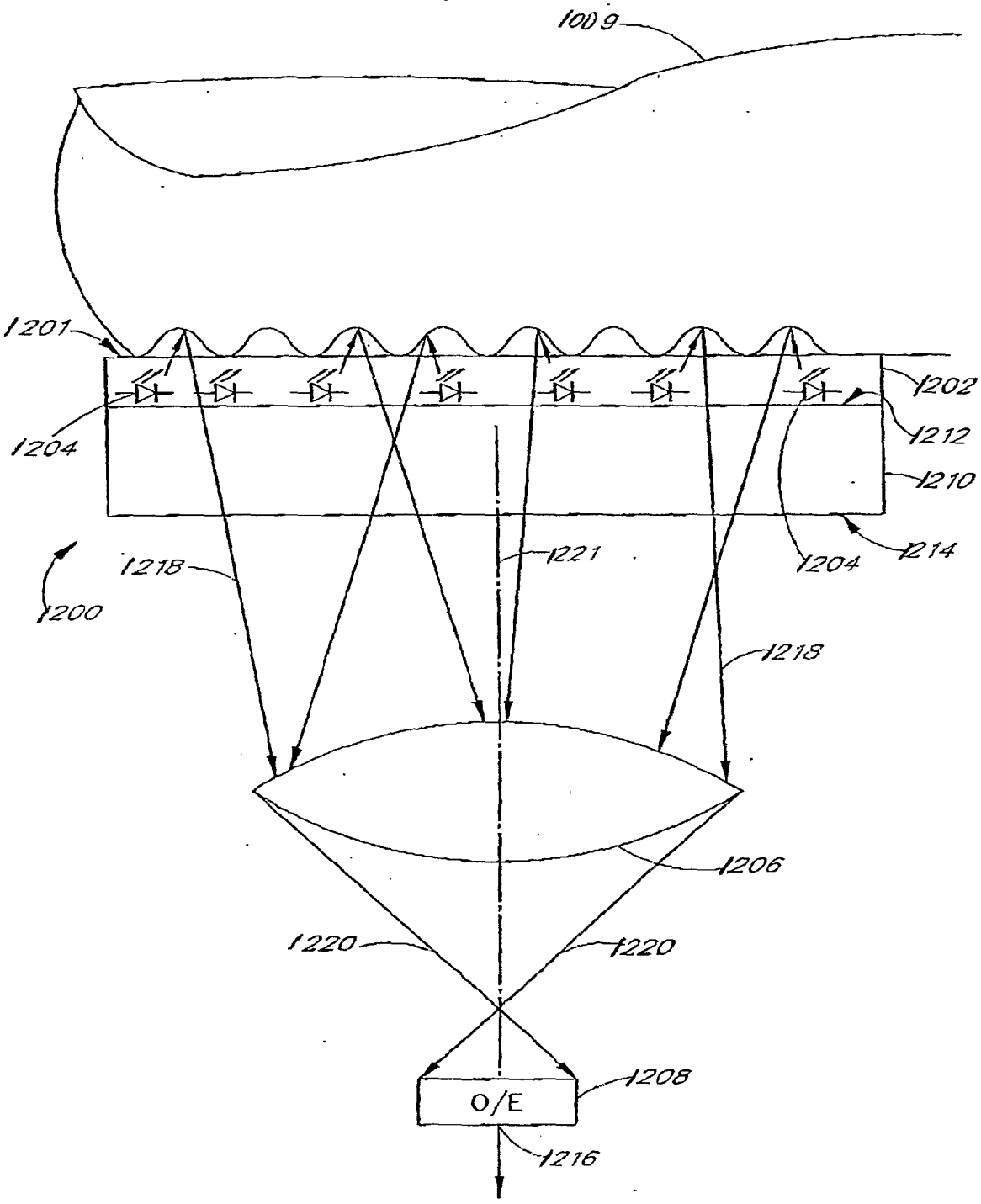

1009
1201
1202
1204
1212
1210
1214
1204
1218
1221
1200
1218
1206
1220
1220
1208
O/E
1216

FIG. 17

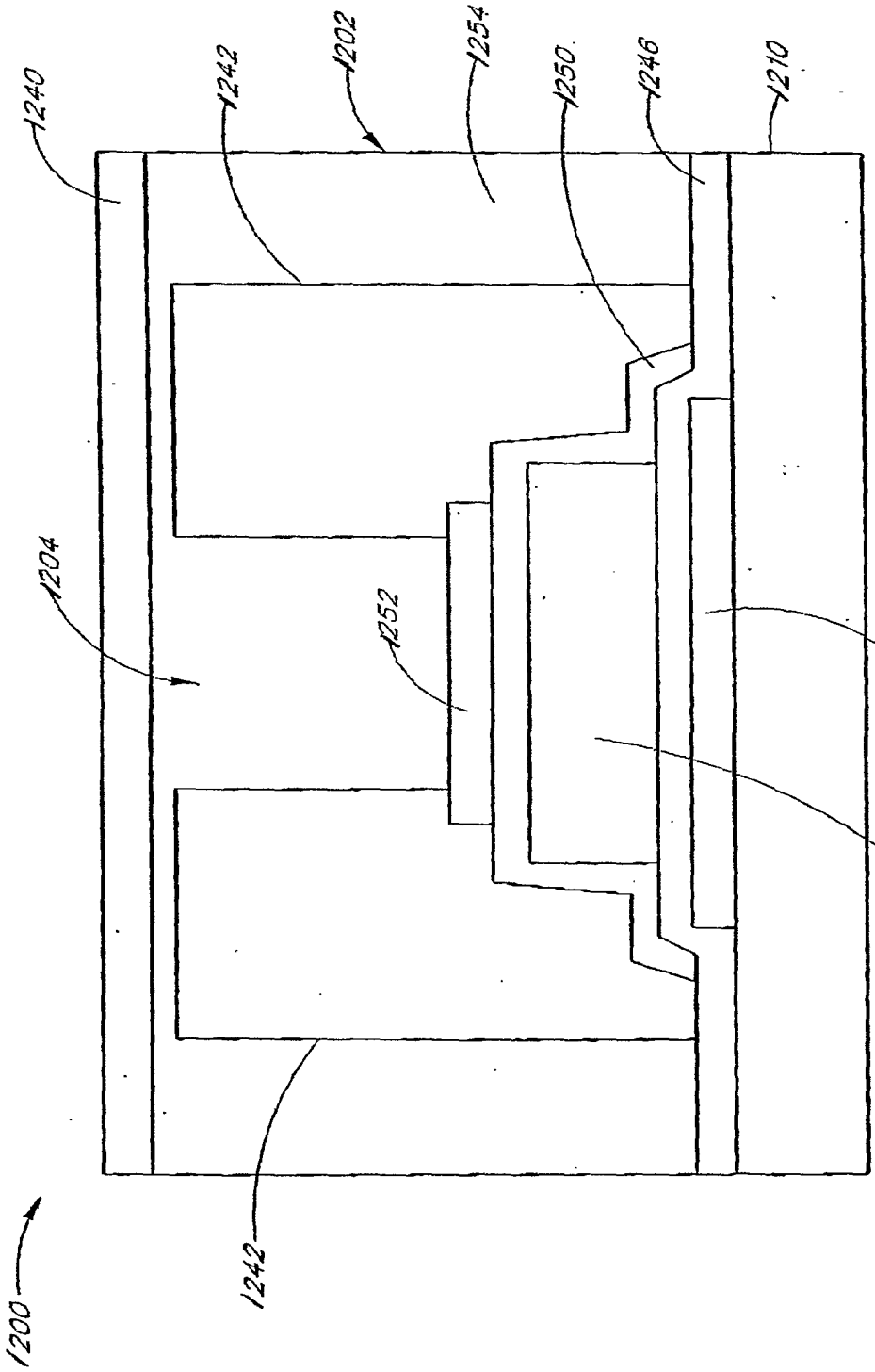

1240
1242
1202
1254
1250
1246
1210
1204
1252
1244
1248
1242
1200

FIG. 17A

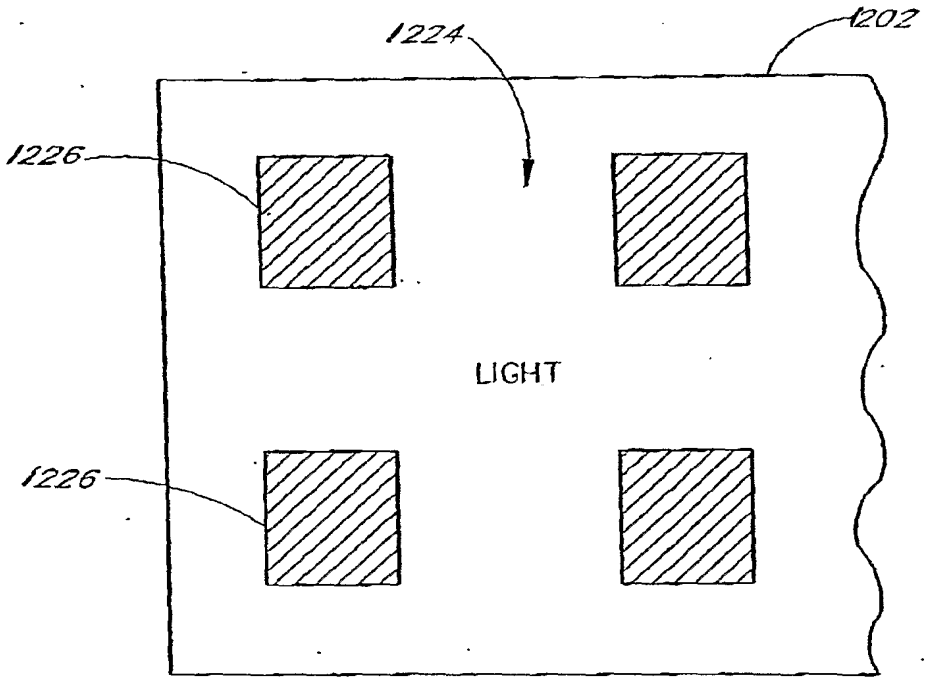

1224
1202
1226
LIGHT
1226

FIG. 18

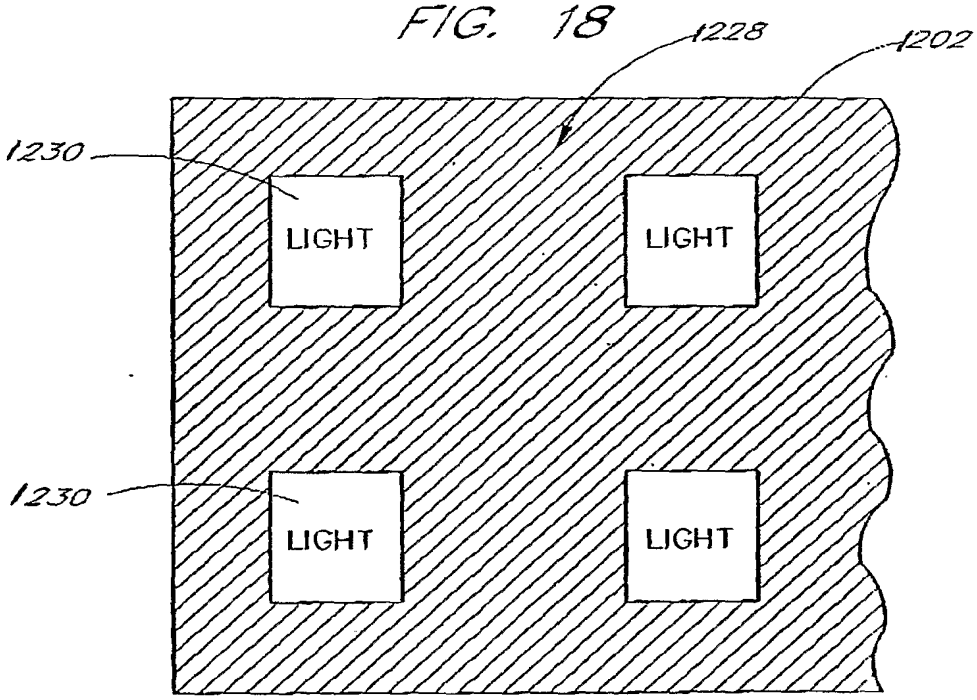

1228
1202
1230
LIGHT
LIGHT
1230
LIGHT
LIGHT

FIG. 19

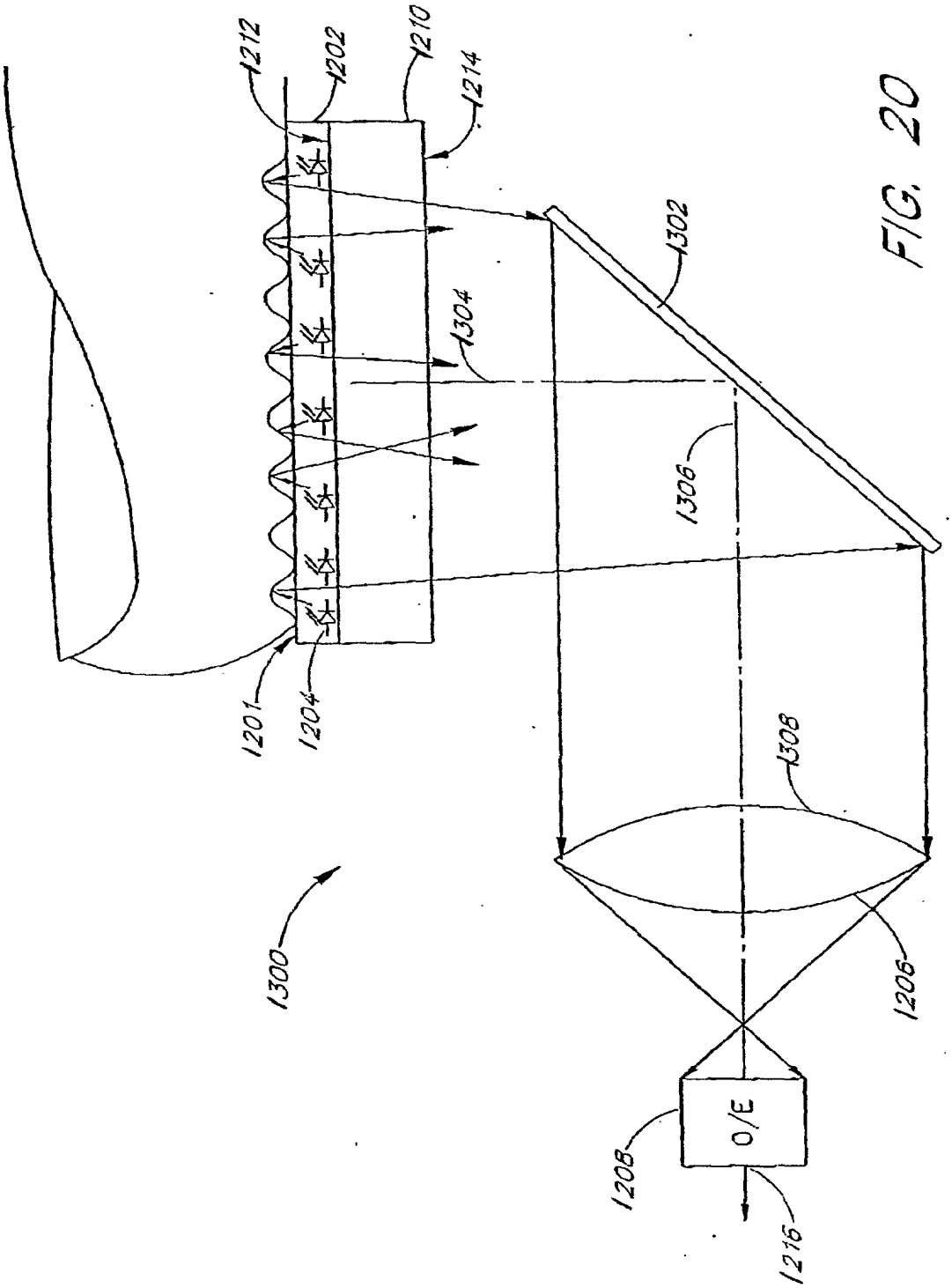

1212
1202
1210
1214
1302
1304
1306
1308
1201
1204
1300
1206
O/E
1208
1216

FIG. 20

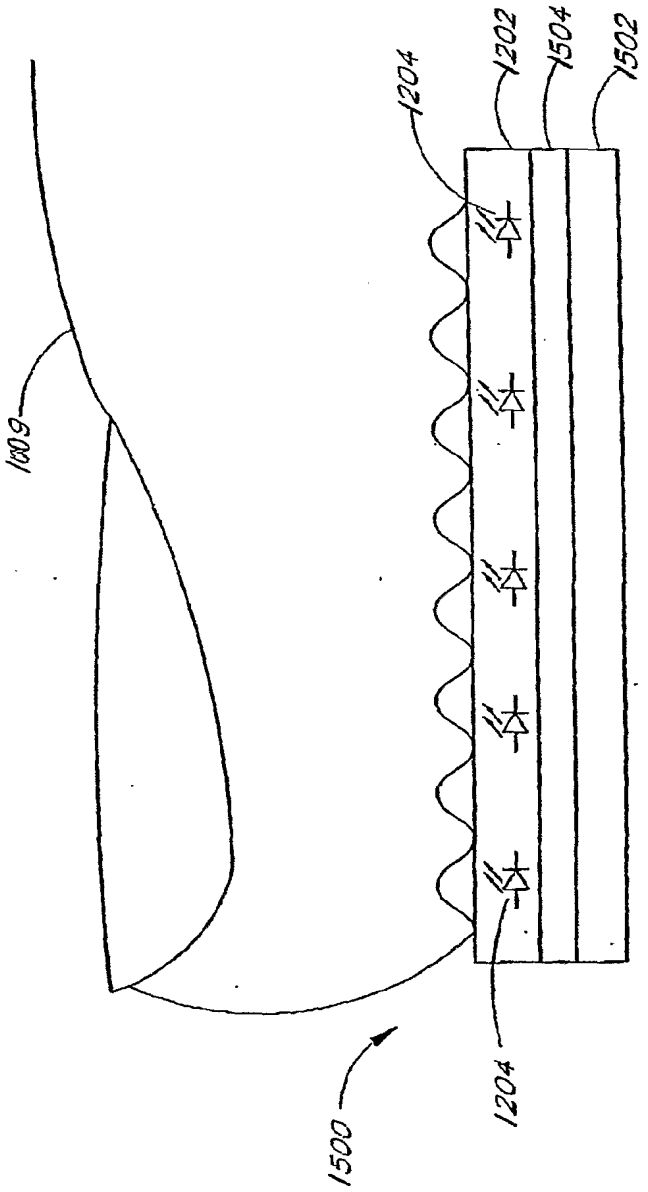


FIG. 21

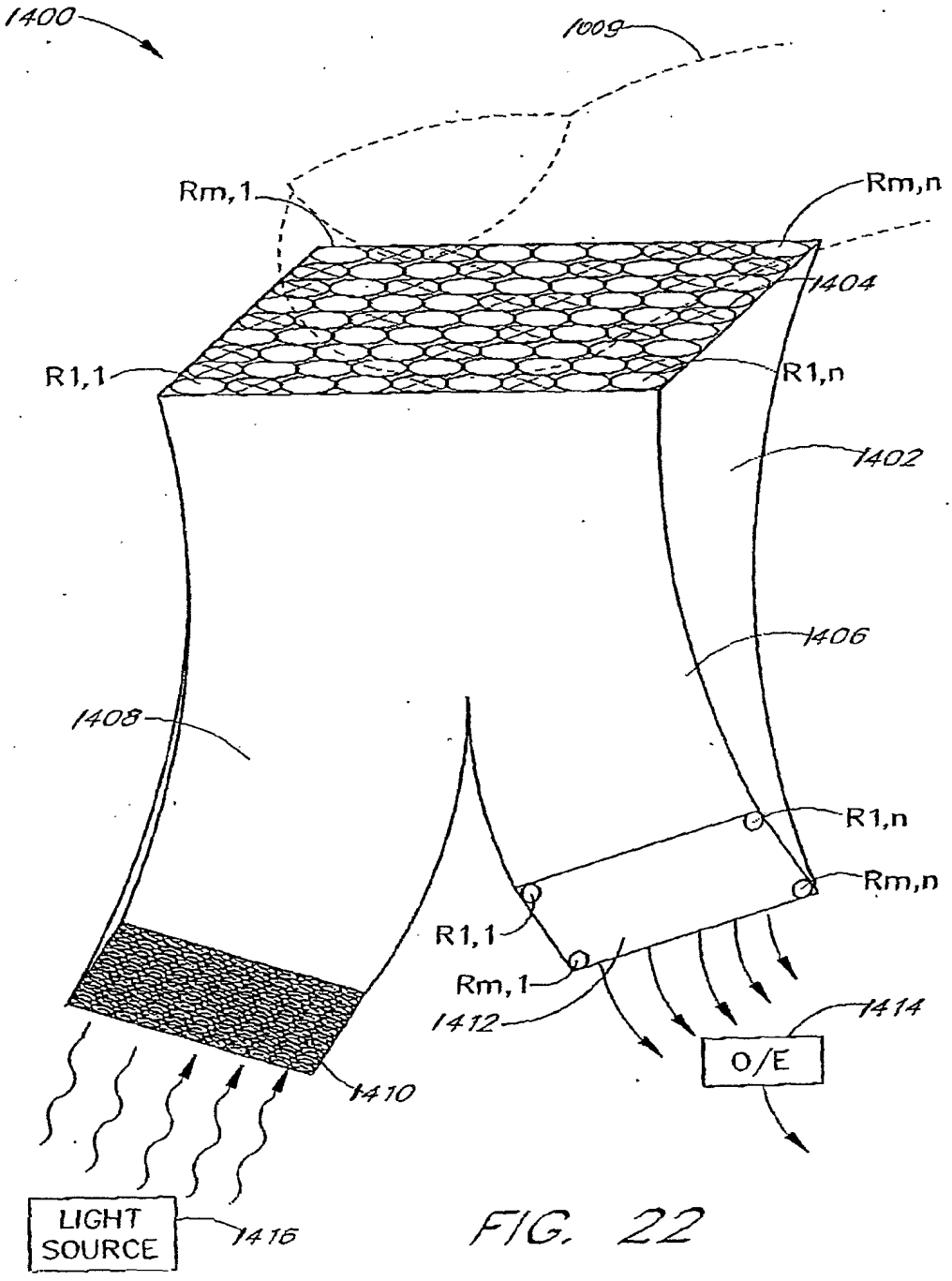

1400
1009
Rm,1
Rm,n
1404
R1,1
R1,n
1402
1406
1408
R1,n
Rm,n
R1,1
Rm,1
1412
1414
O/E
1410
LIGHT SOURCE
1416

FIG. 22

Figure 23

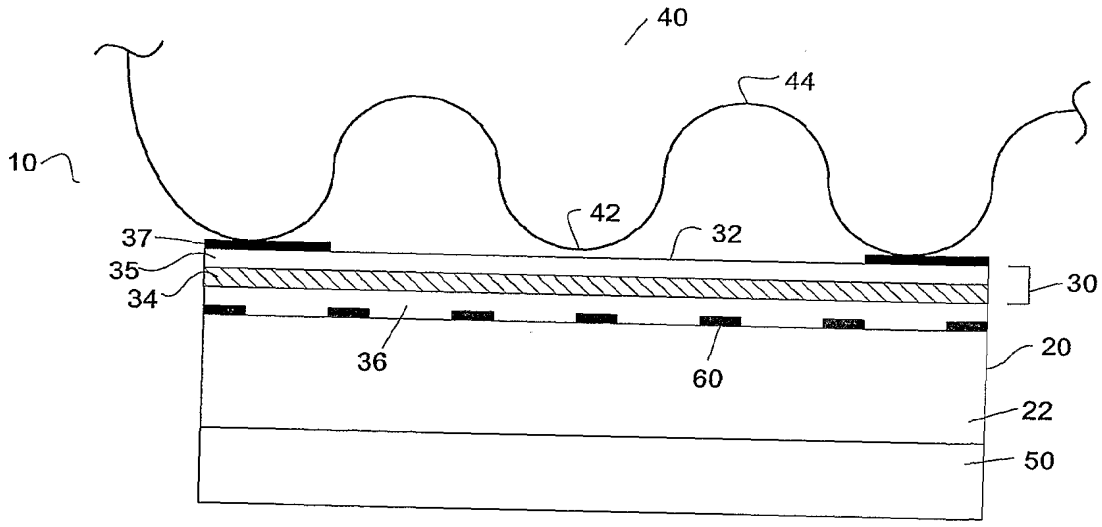


Figure 24

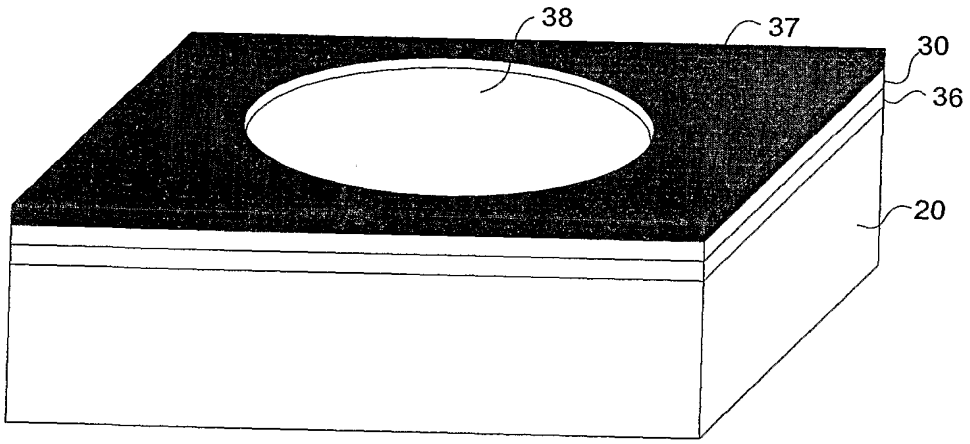


Figure 25

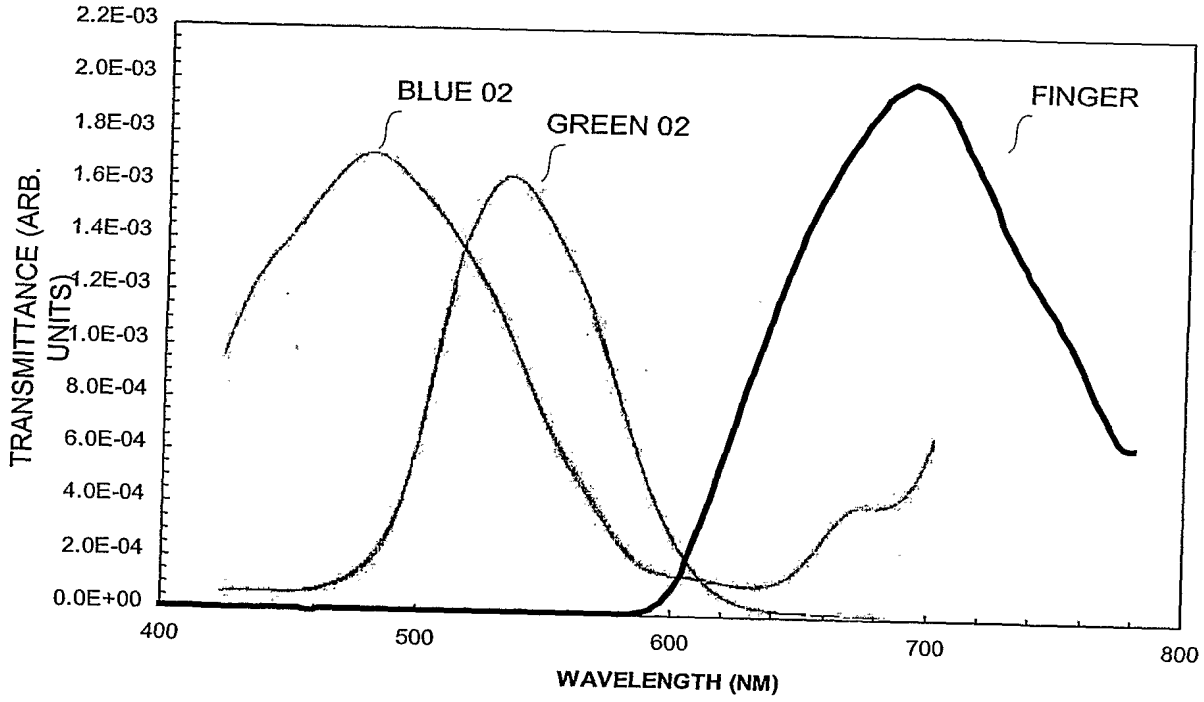

2.2E-03
2.0E-03
1.8E-03
1.6E-03
1.4E-03
1.2E-03
1.0E-03
8.0E-04
6.0E-04
4.0E-04
2.0E-04
0.0E+00
TRANSMITTANCE (ARB. UNITS)
BLUE 02
GREEN 02
FINGER
400
500
600
700
800
WAVELENGTH (NM)

Figure 26

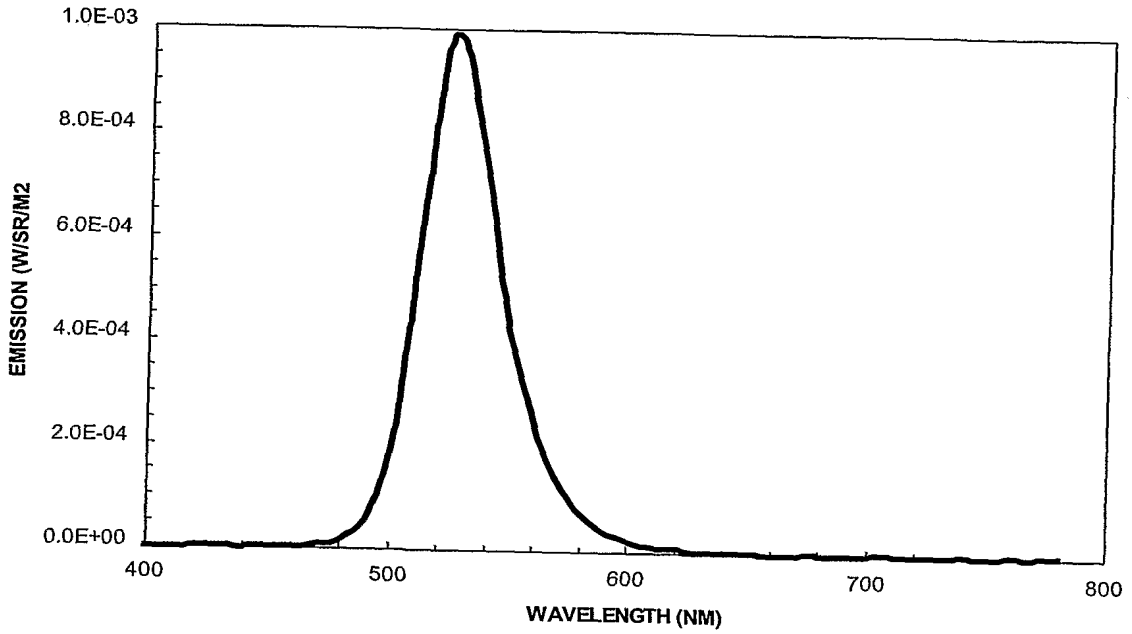

1.0E-03
8.0E-04
6.0E-04
4.0E-04
2.0E-04
0.0E+00
EMISSION (W/SR/M2
400
500
600
700
800
WAVELENGTH (NM)

Figure 27

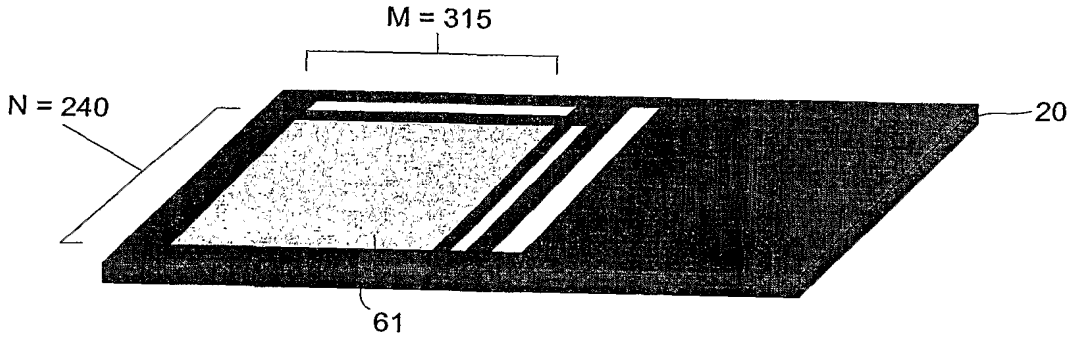


Figure 28

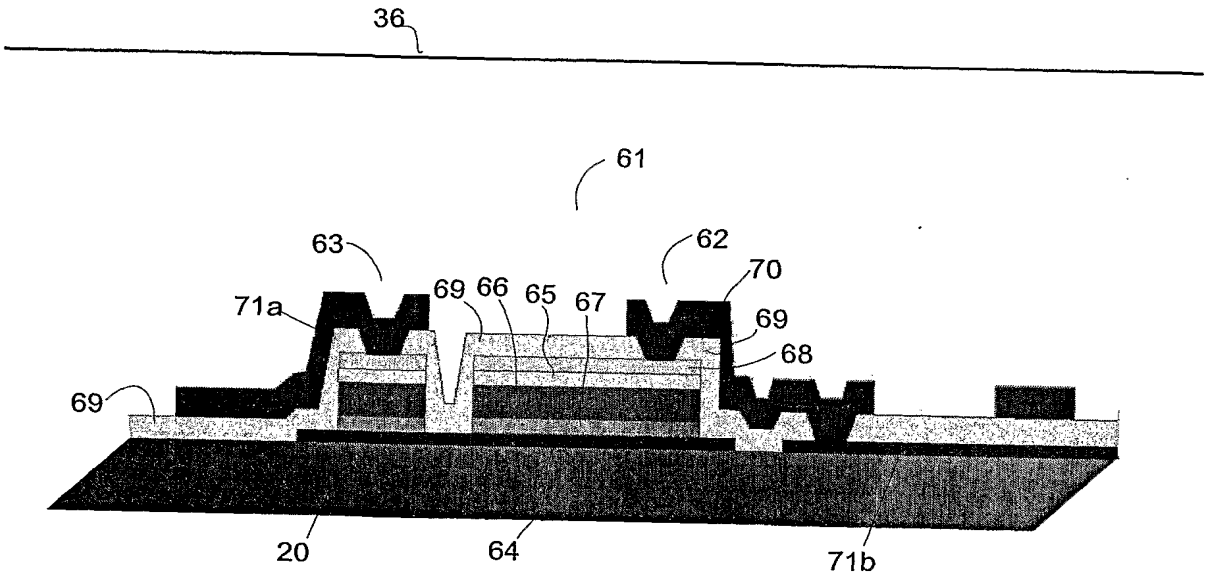


Figure 29

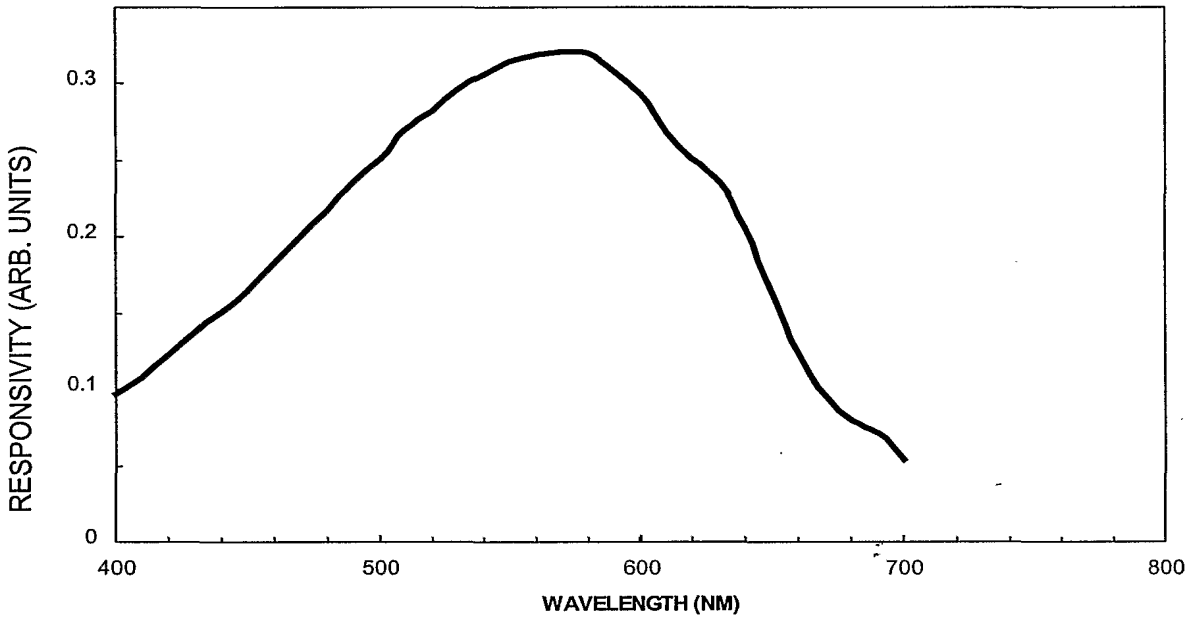

RESPONSIVITY (ARB. UNITS)
0.3
0.2
0.1
0
400
500
600
700
800
WAVELENGTH (NM)

Figure 30

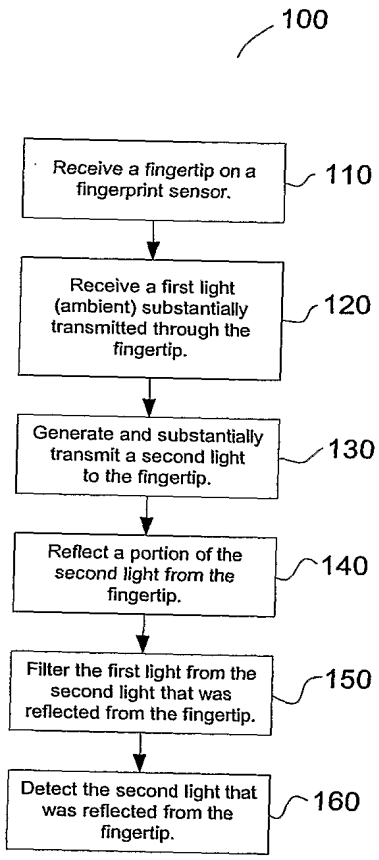

100
Receive a fingertip on a fingerprint sensor.
110
Receive a first light (ambient) substantially transmitted through the fingertip.
120
Generate and substantially transmit a second light to the fingertip.
130
Reflect a portion of the second light from the fingertip.
140
Filter the first light from the second light that was reflected from the fingertip.
150
Detect the second light that was reflected from the fingertip.
160

Figure 31a

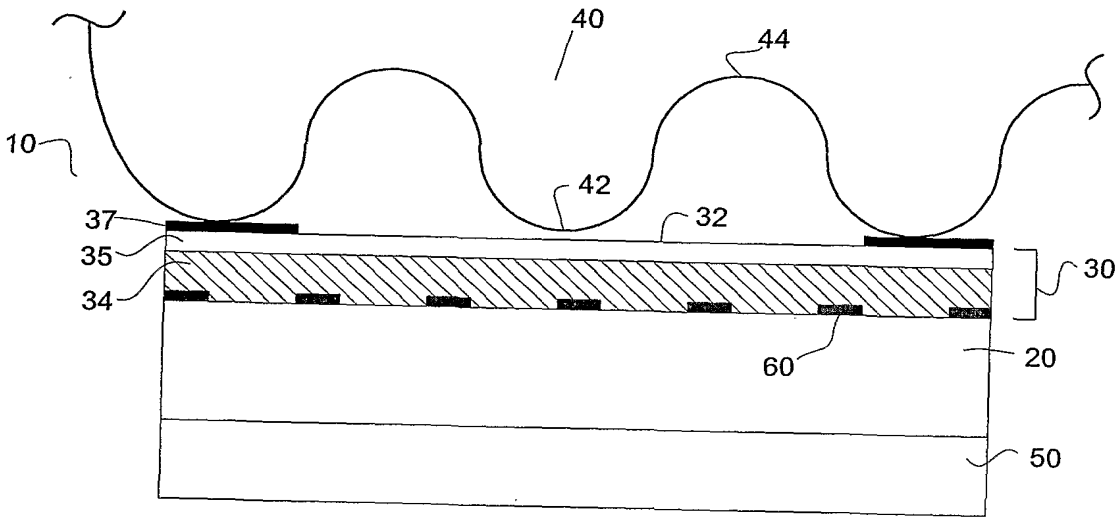


Figure 31b

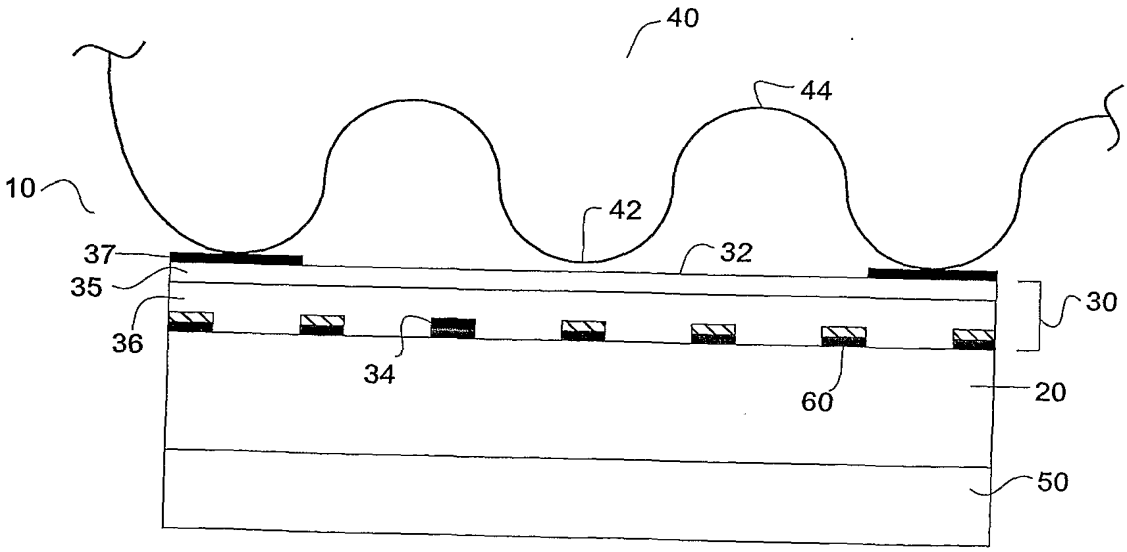


Figure 31c

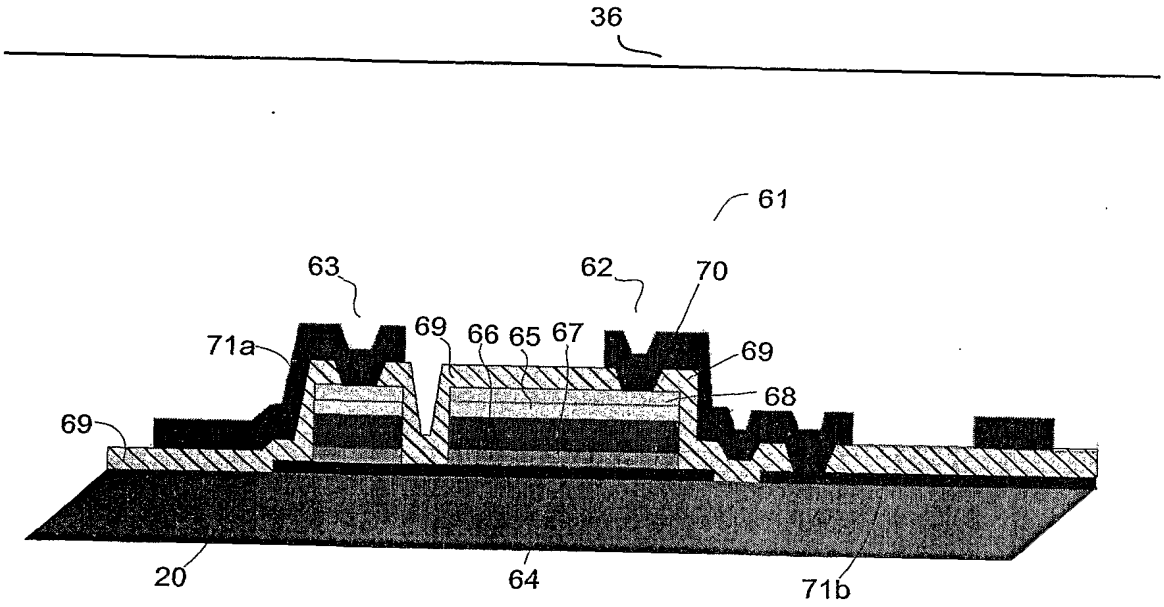


Figure 32a

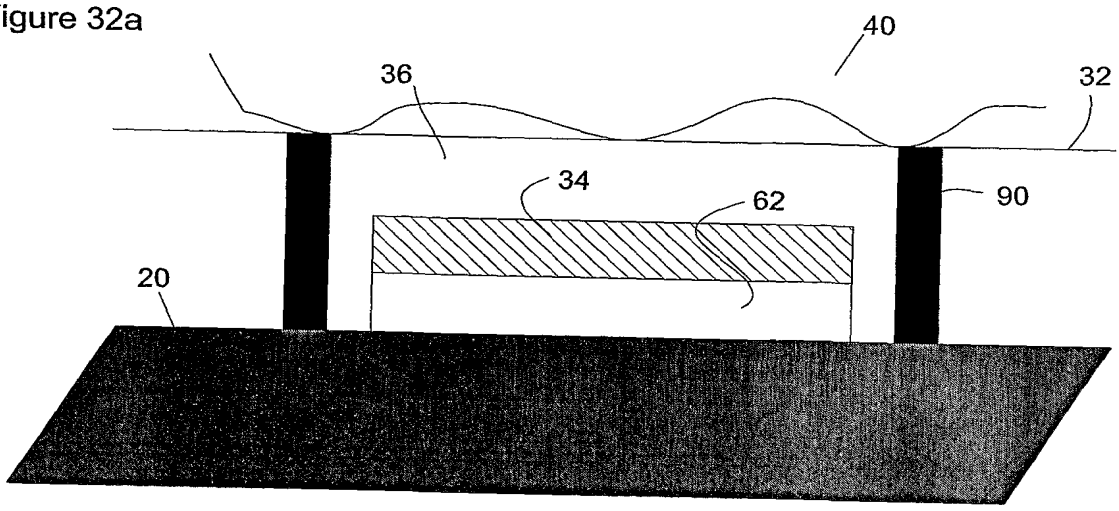


Figure 32b

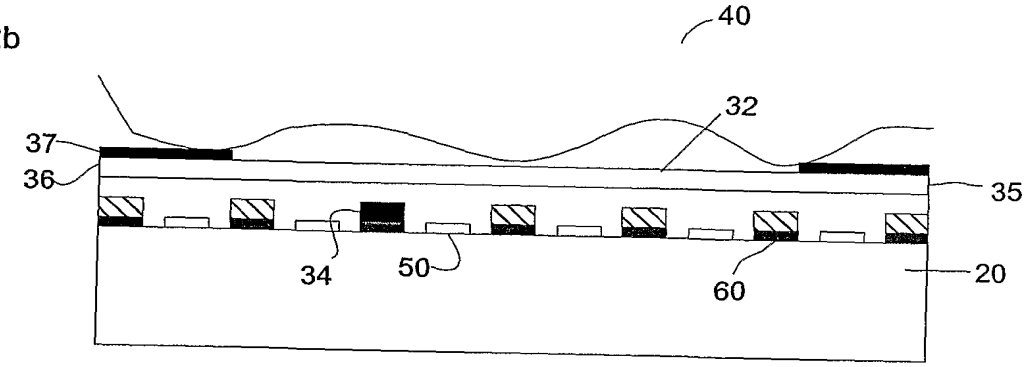


Figure 32c

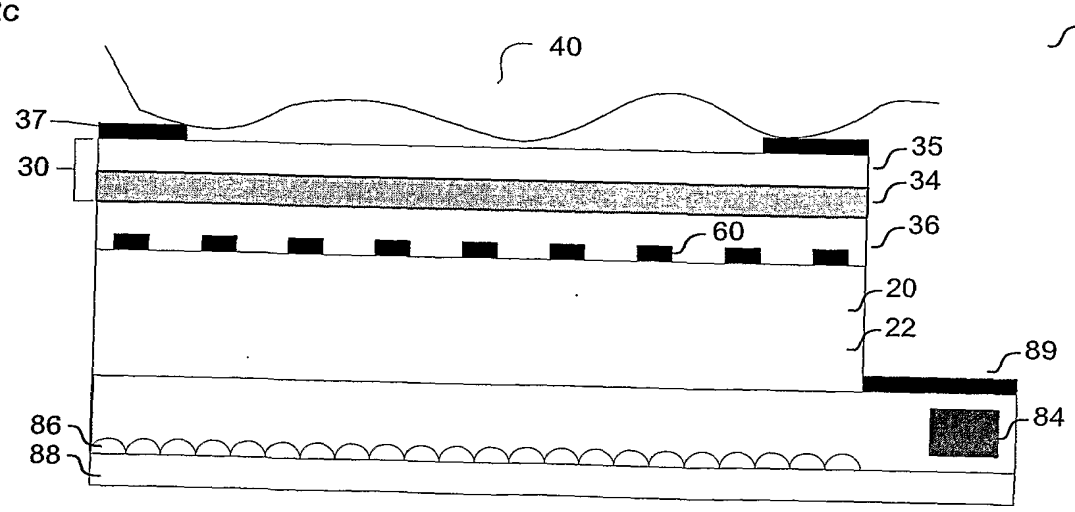


FIGURE 33A

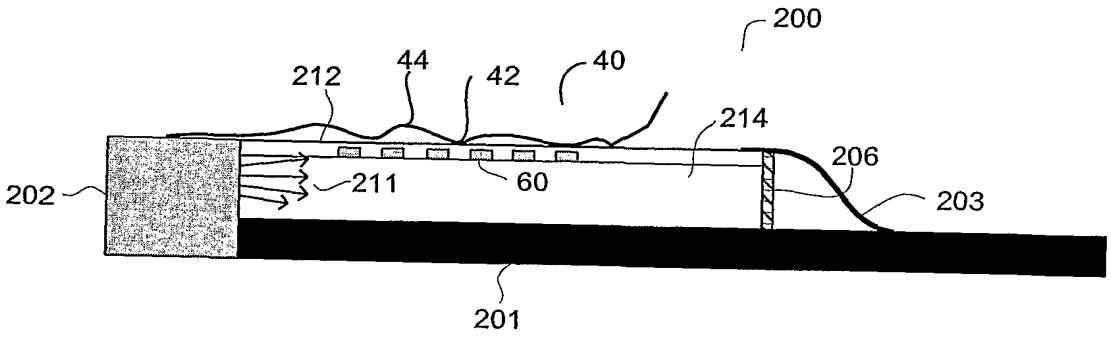


FIGURE 33B

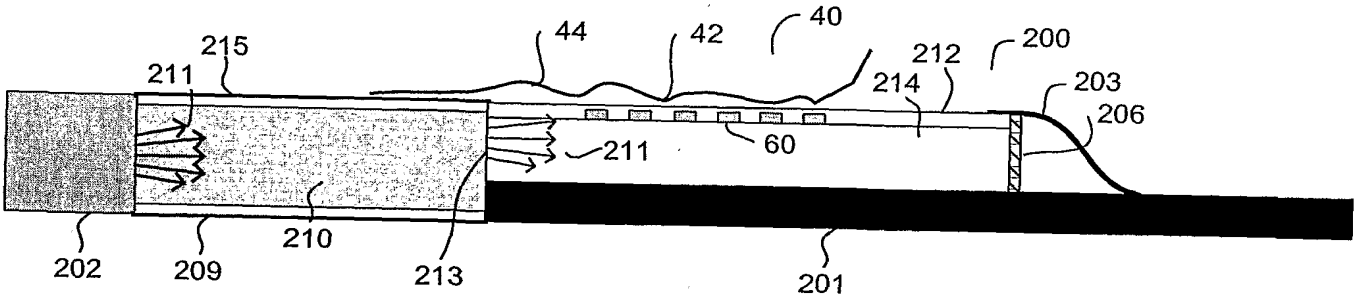


FIGURE 34A

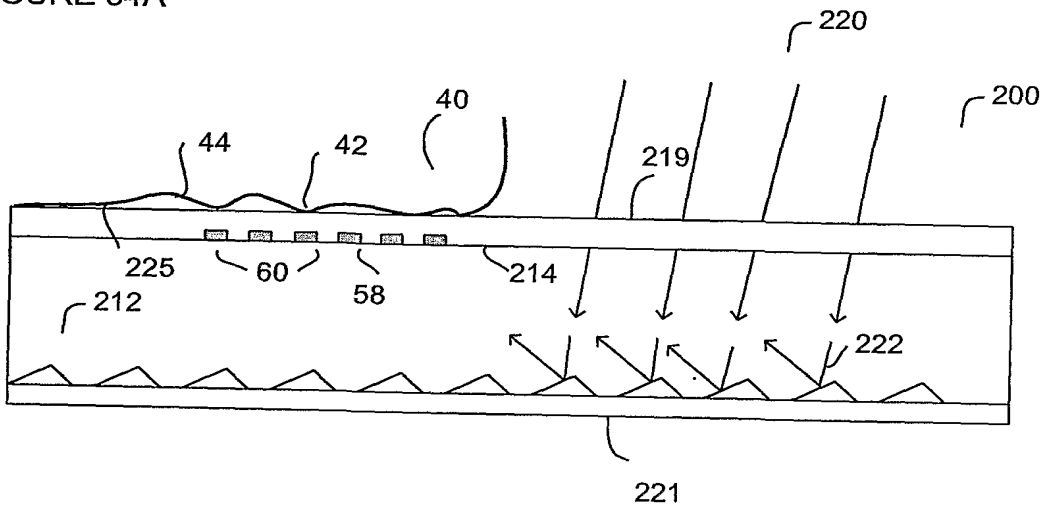


FIGURE 34B

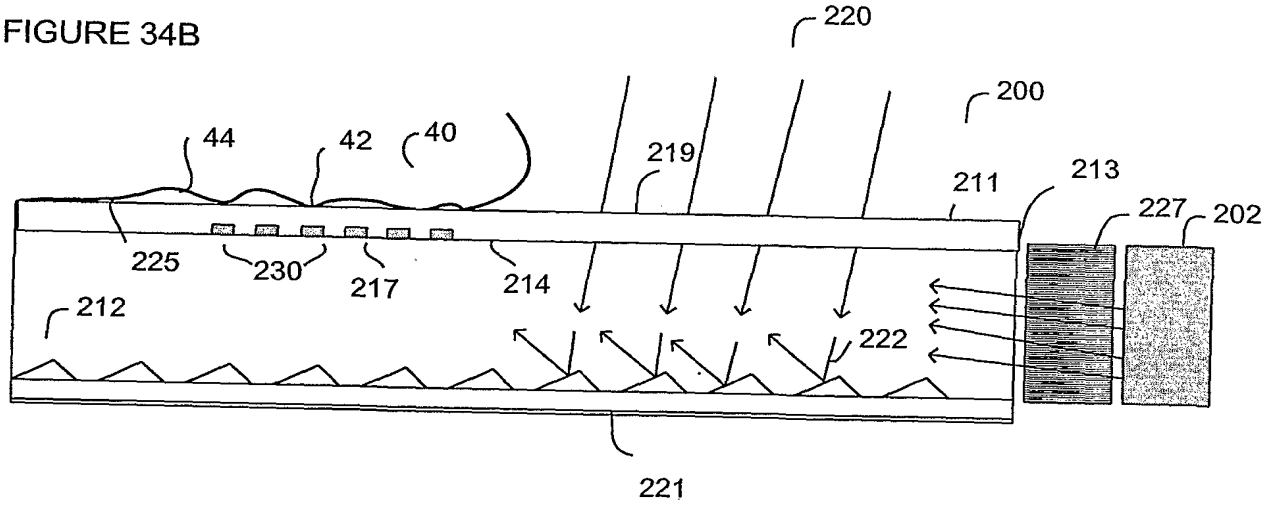


FIGURE 35

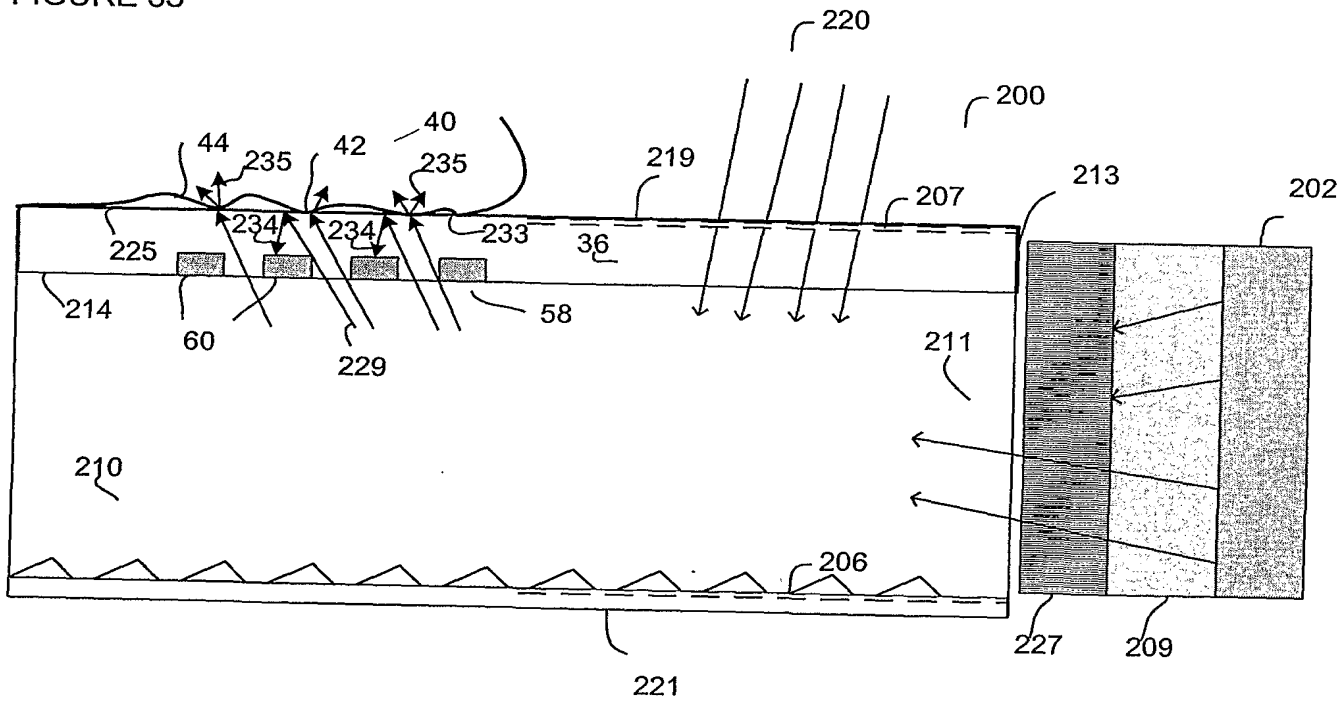

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FIGURE 36A

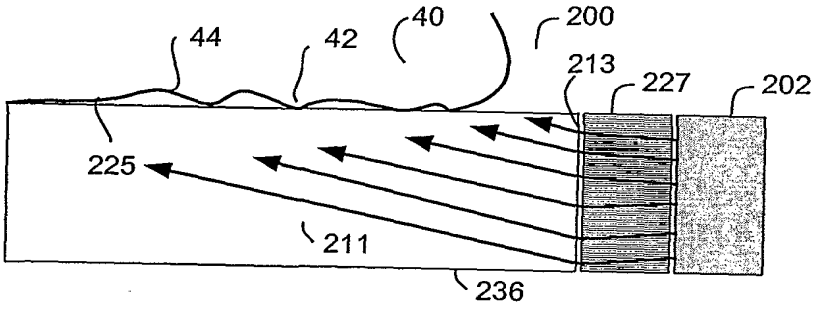


FIGURE 36B

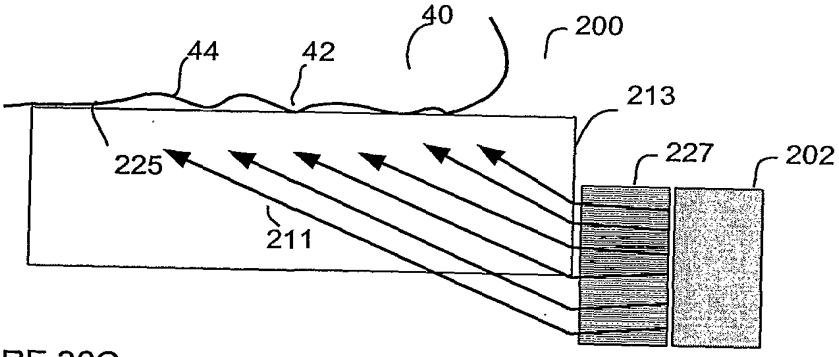


FIGURE 36C

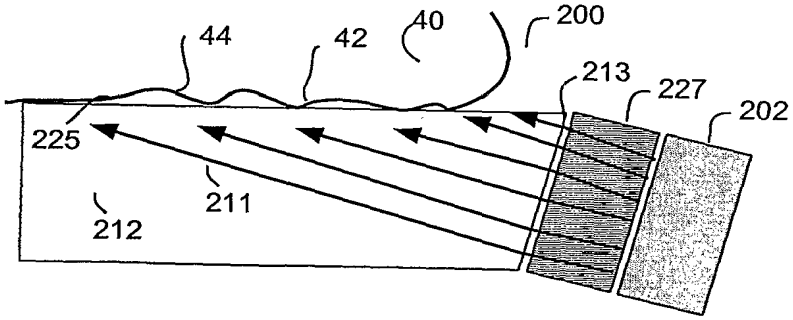


FIGURE 37A

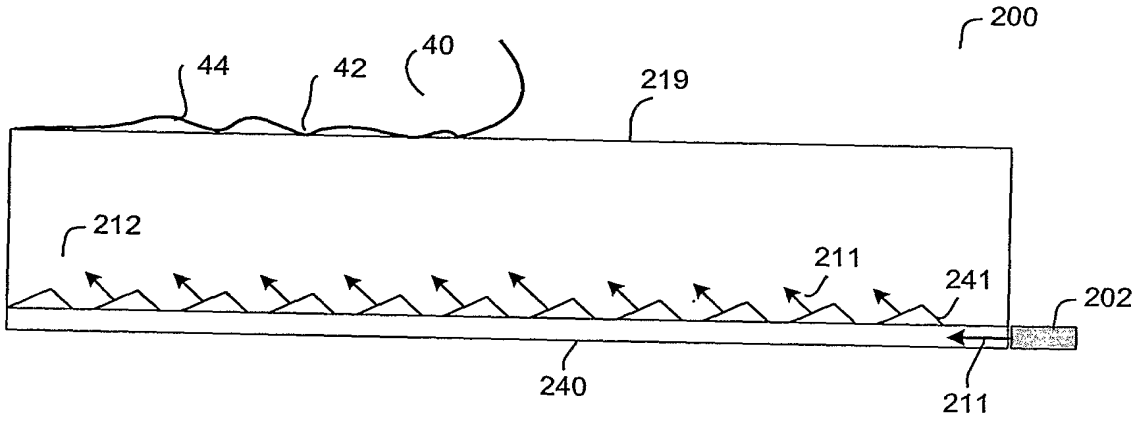


FIGURE 37B

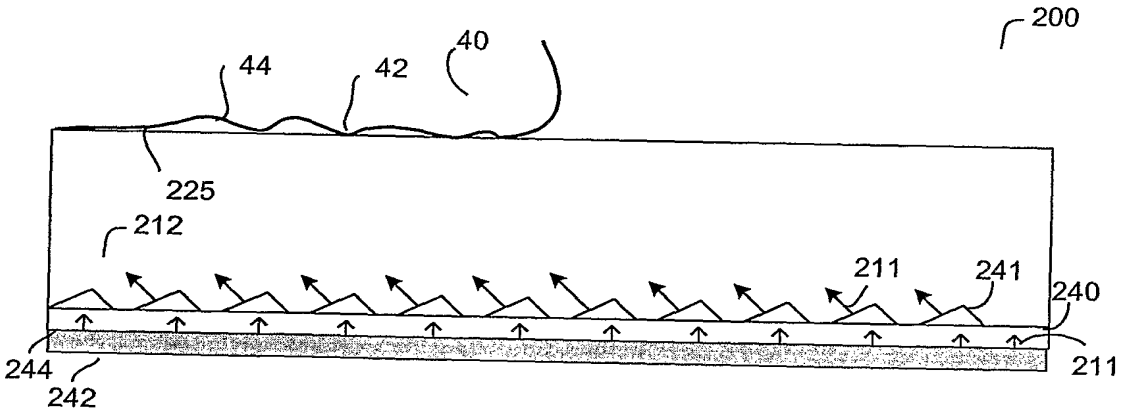


FIGURE 38A

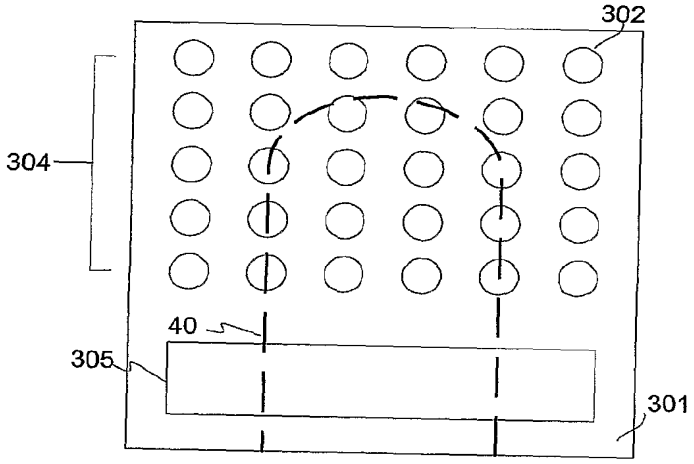


FIGURE 38B

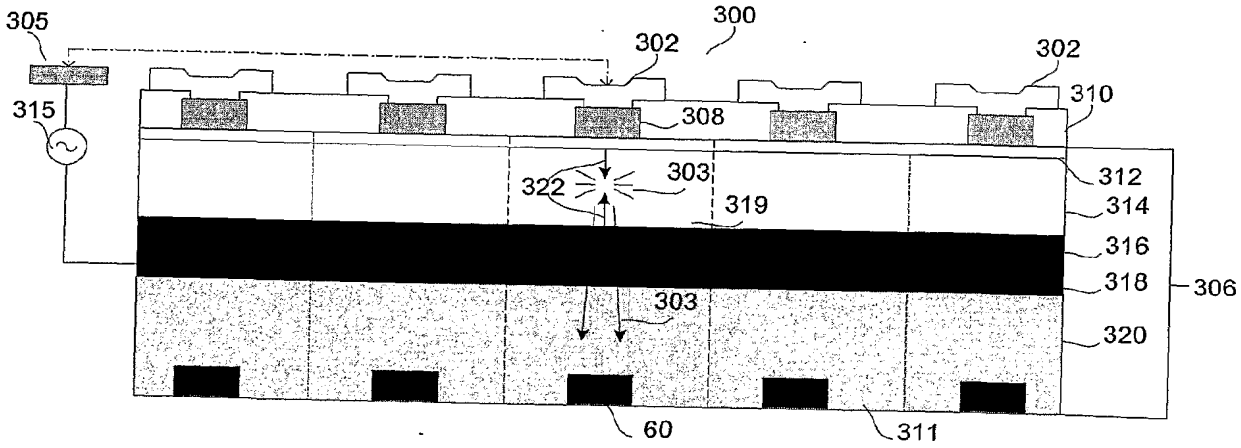


FIGURE 38C

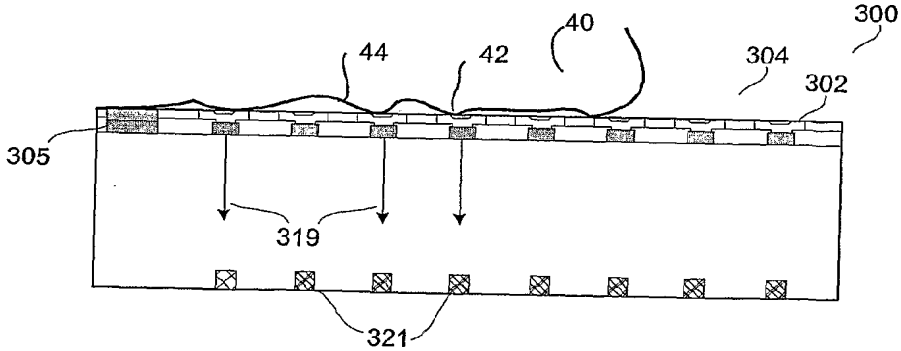


FIGURE 39

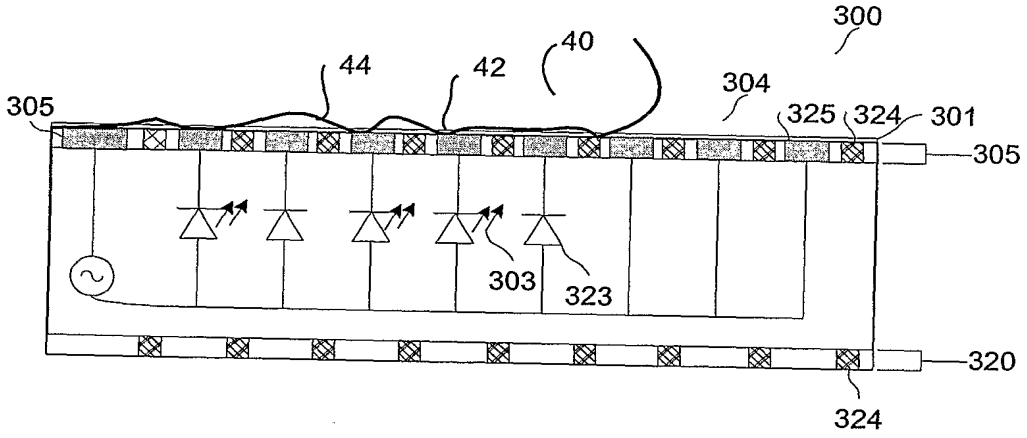


FIGURE 40A

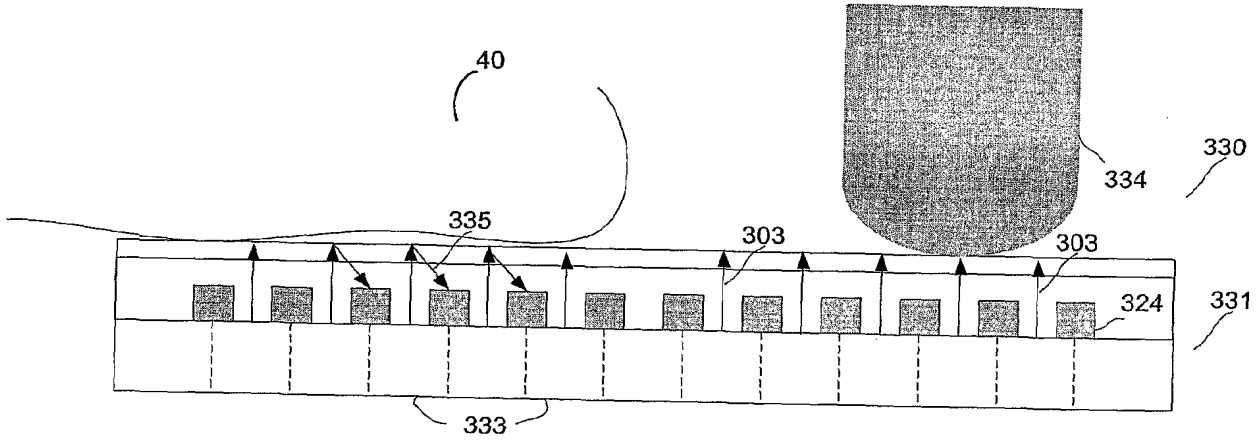


FIGURE 40B

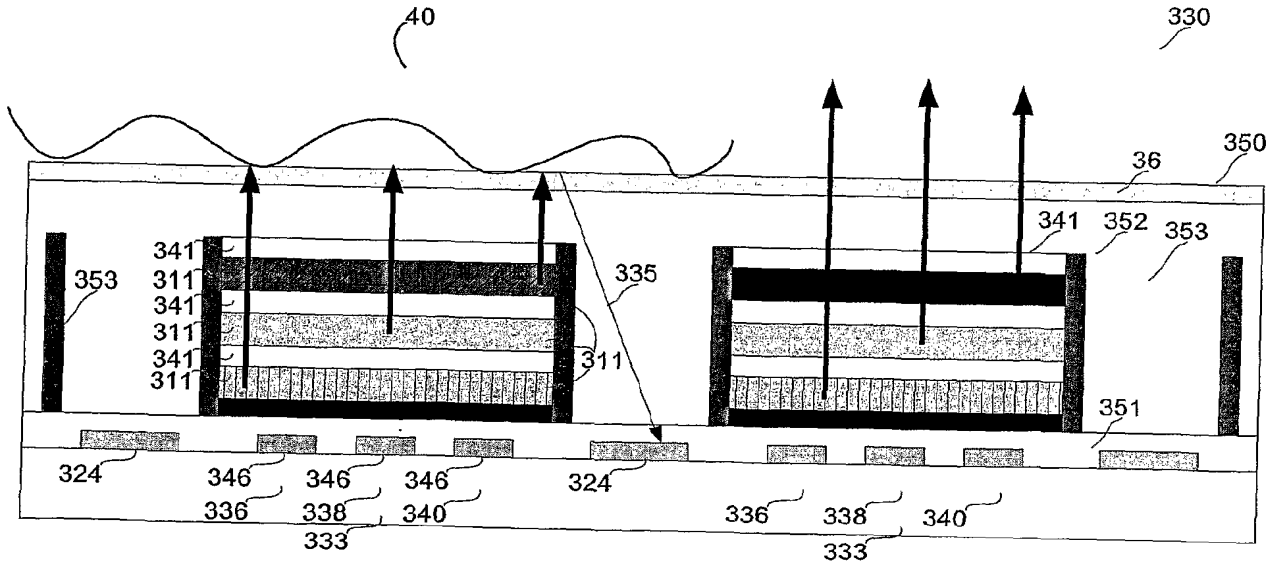


FIGURE 41

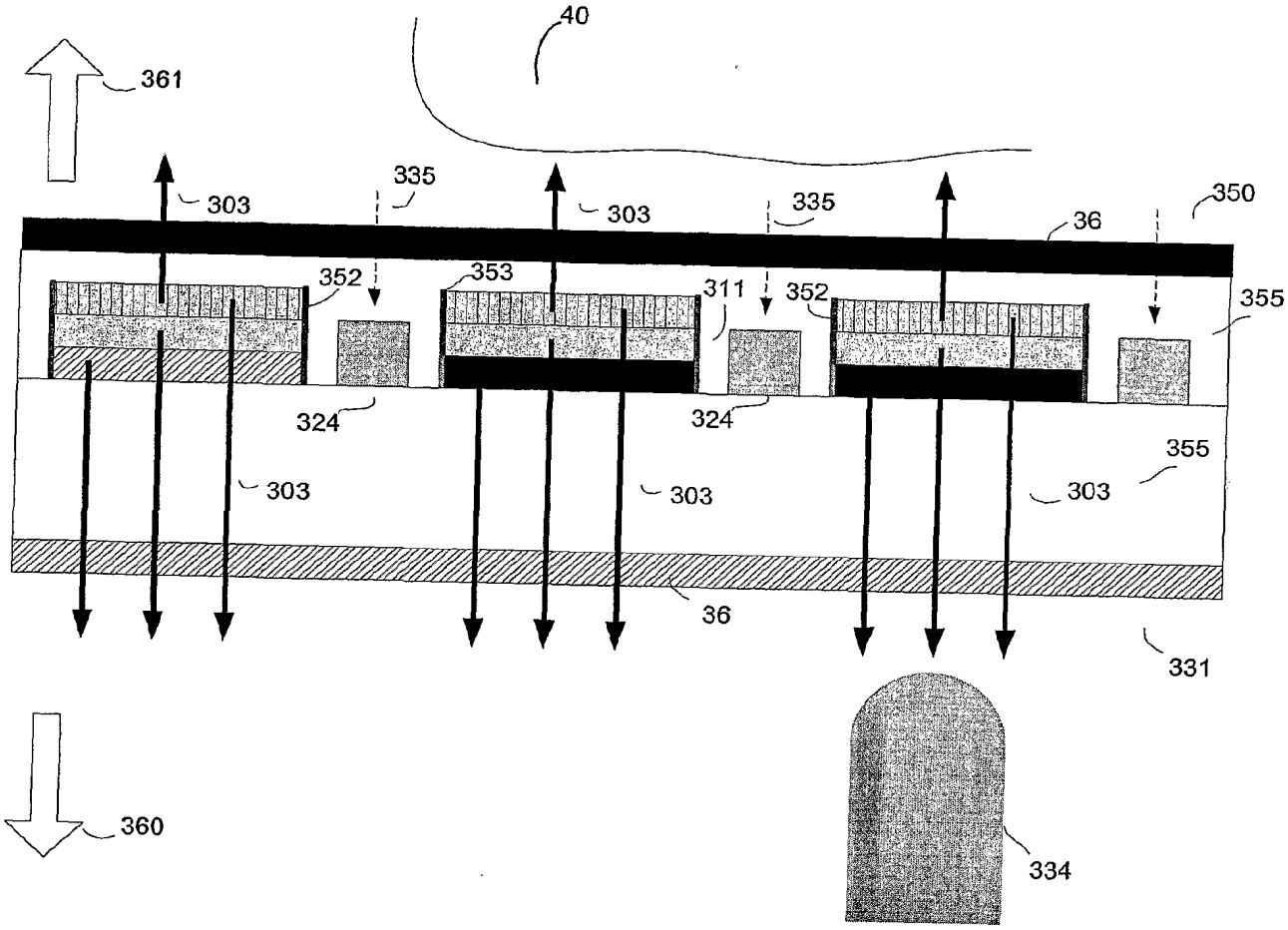

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FIGURE 42A

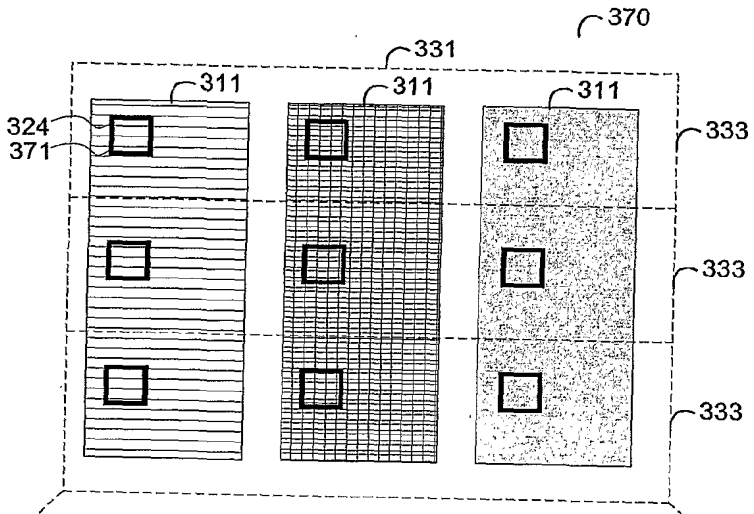


FIGURE 42B

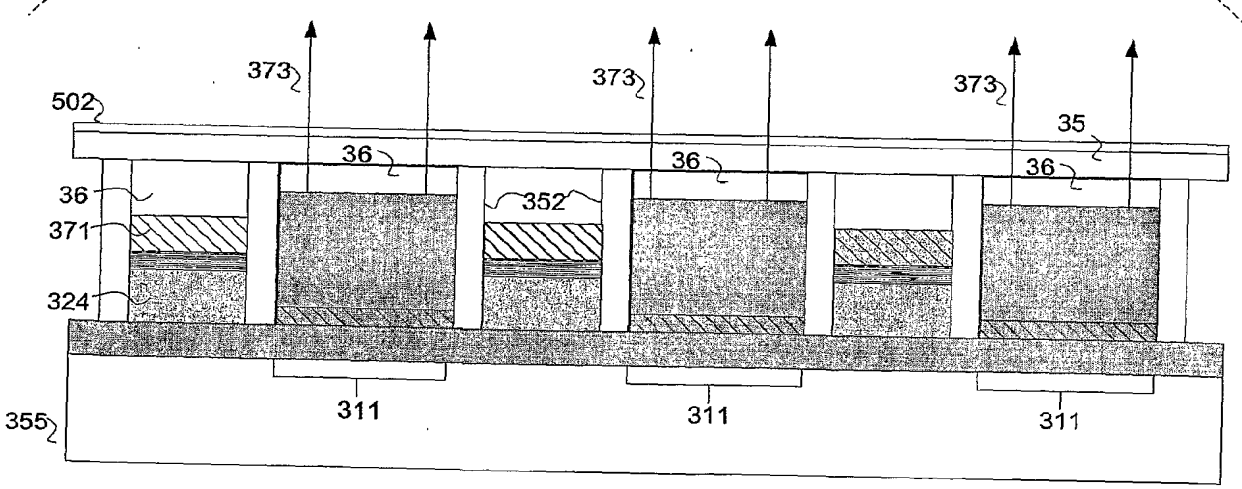


FIGURE 43A

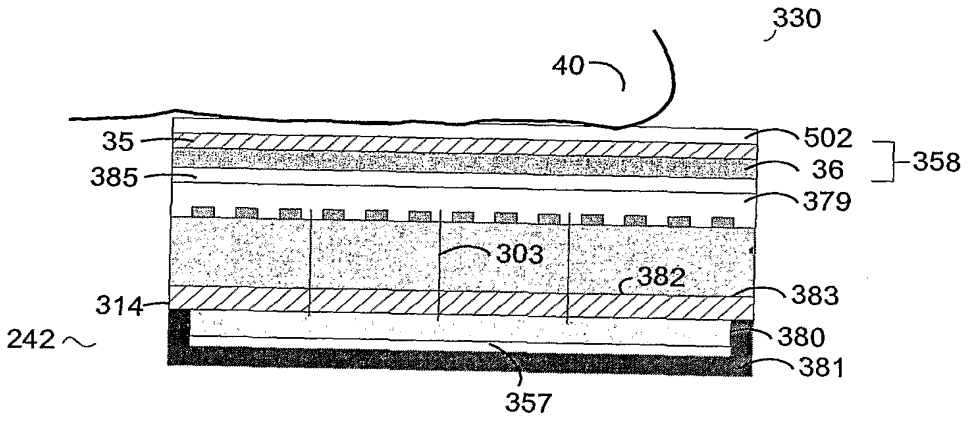


FIGURE 43B

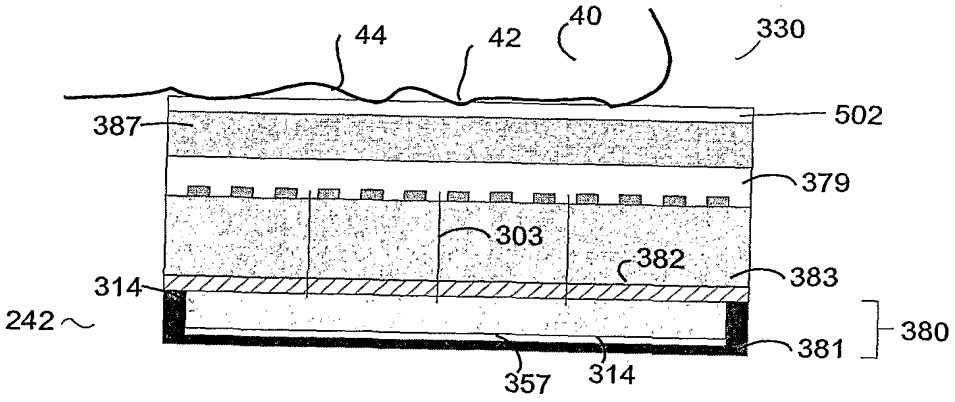


FIGURE 44A

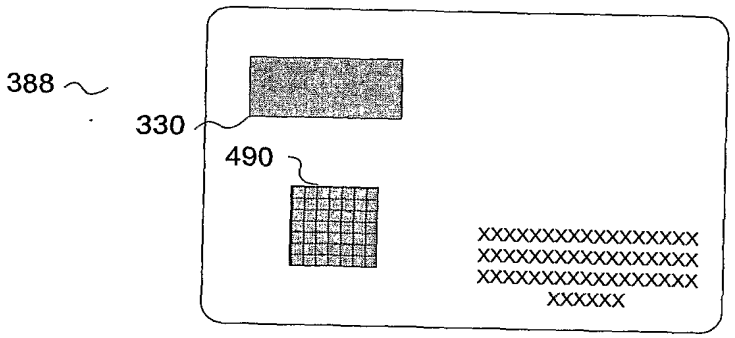


FIGURE 44B

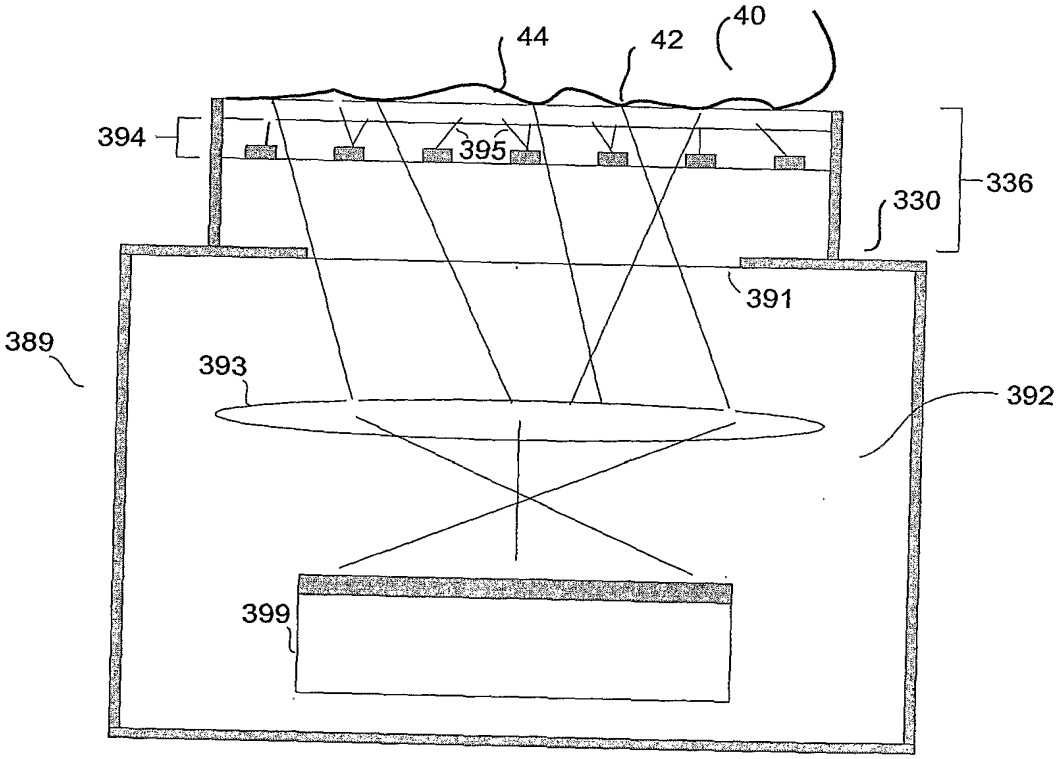


Figure 45

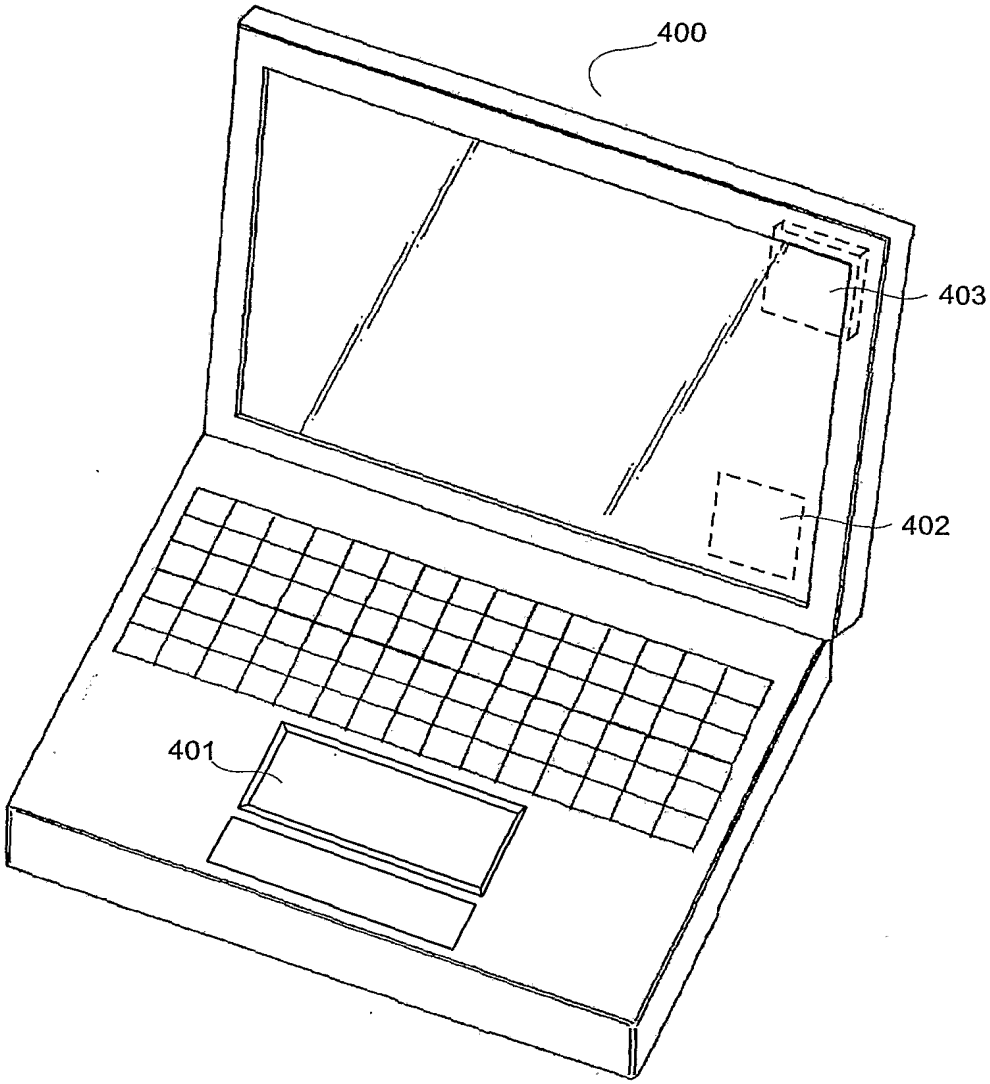


Figure 46

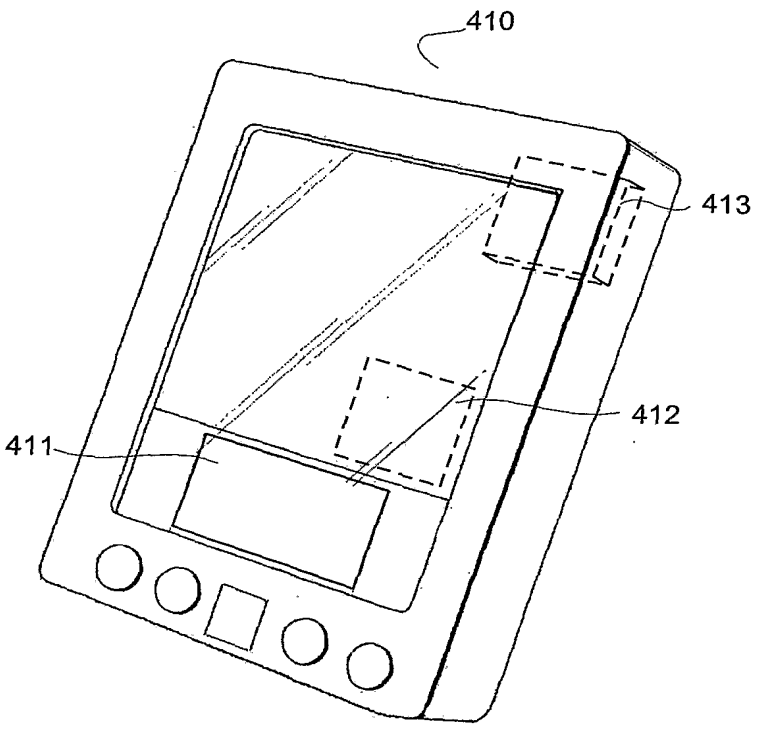


Figure 47

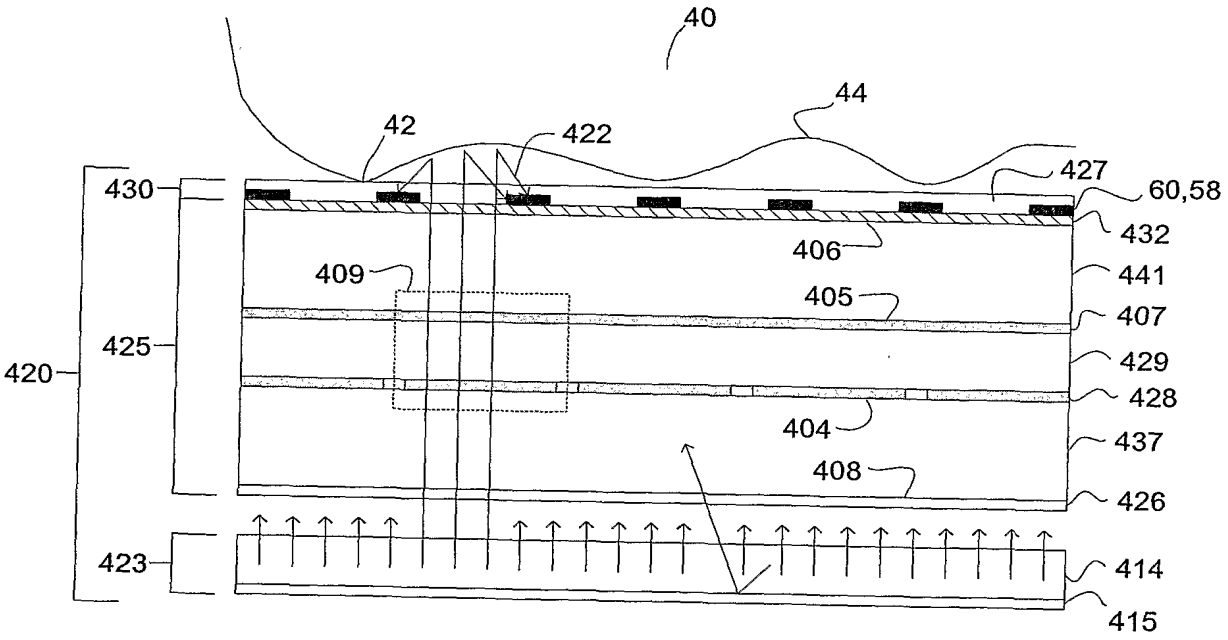

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Figure 48

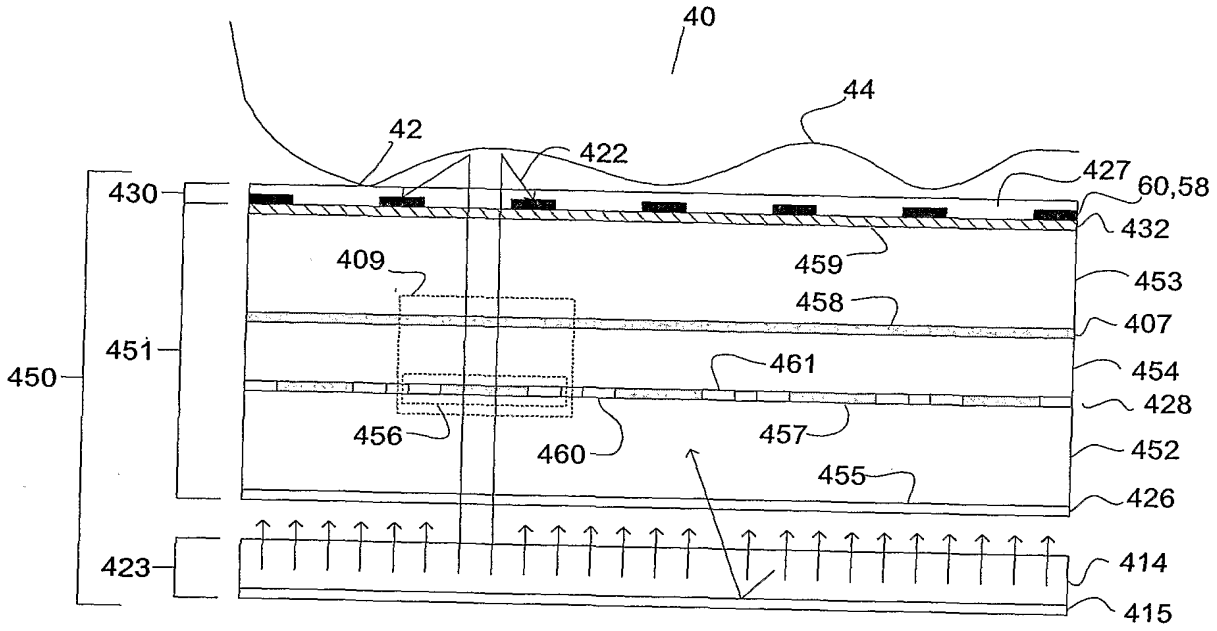

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Figure 49

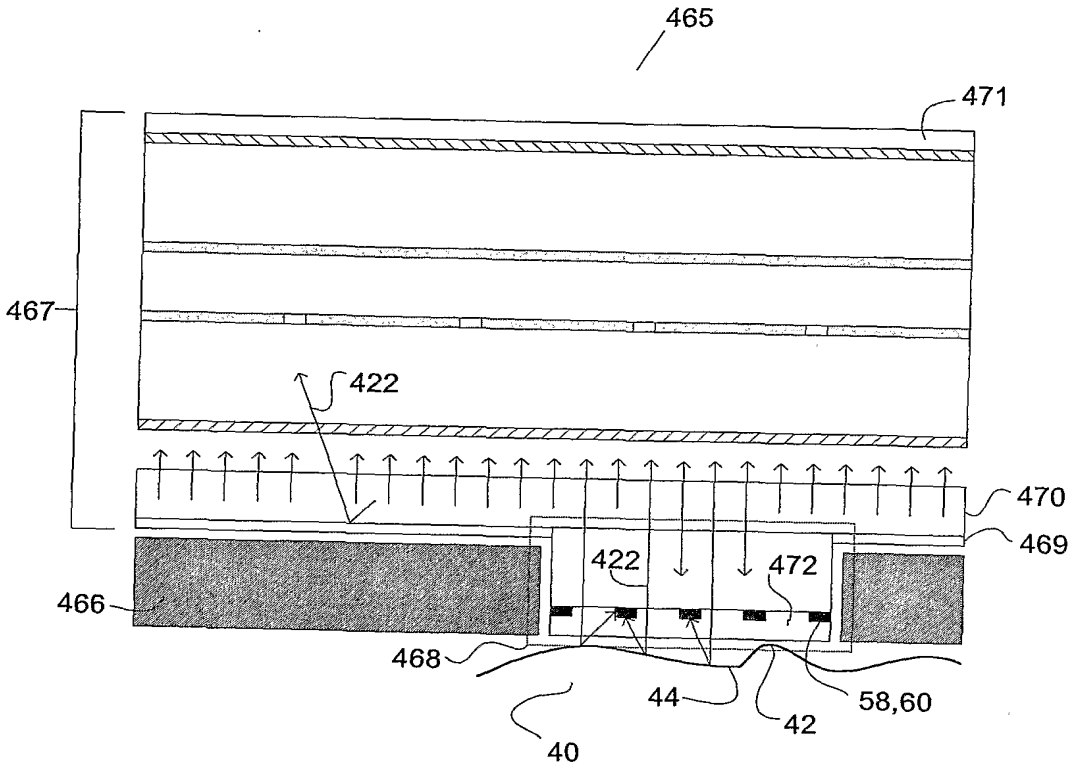


Figure 50

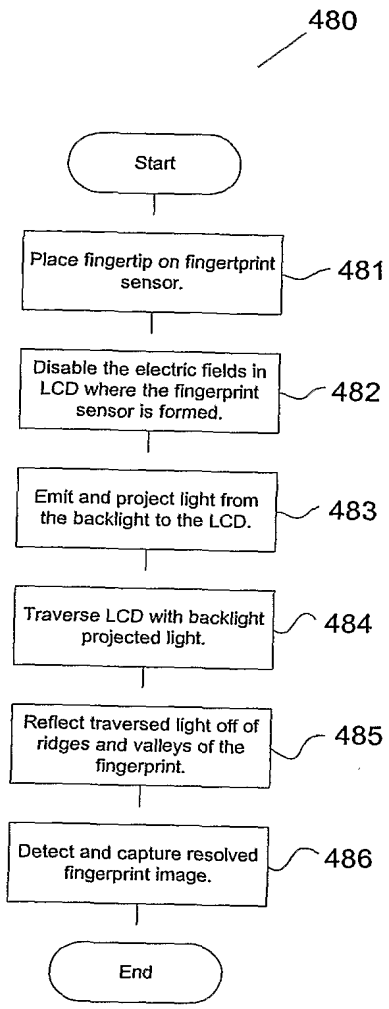

480
Start
Place fingertip on fingertprint sensor.
481
Disable the electric fields in LCD where the fingerprint sensor is formed.
482
Emit and project light from the backlight to the LCD.
483
Traverse LCD with backlight projected light.
484
Reflect traversed light off of ridges and valleys of the fingerprint.
485
Detect and capture resolved fingerprint image.
486
End

Figure 51

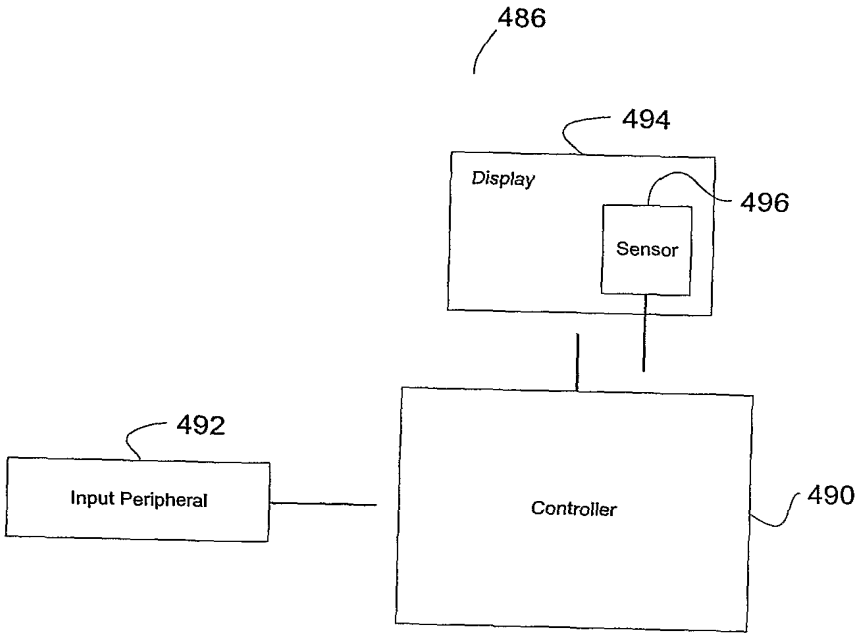

486
494
Display
496
Sensor
492
Input Peripheral
Controller
490

Figure 52

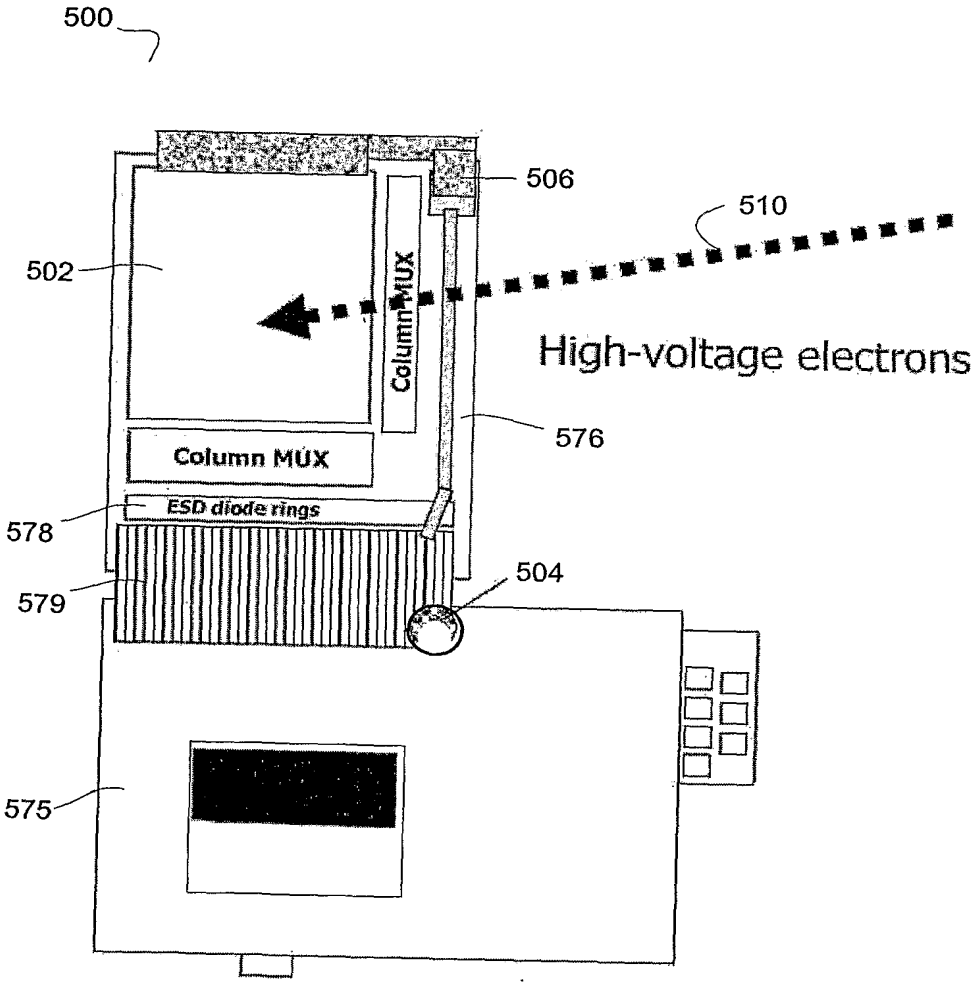

500
506
510
502
Column MUX
High-voltage electrons
576
Column MUX
ESD diode rings
578
579
504
575

Figure 53

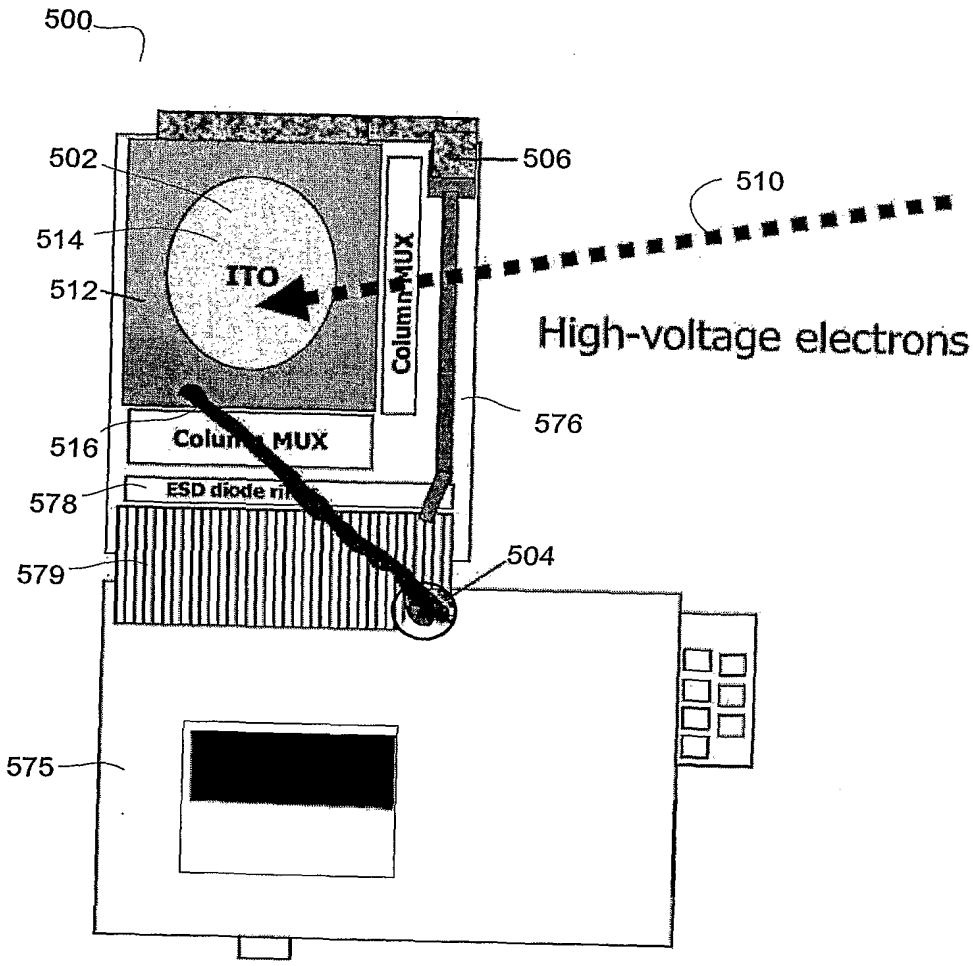

500
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ITO
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Column MUX
High-voltage electrons
576
516
Column MUX
578
ESD diode ri
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504
575

Figure 54A



Figure 54B



Figure 55

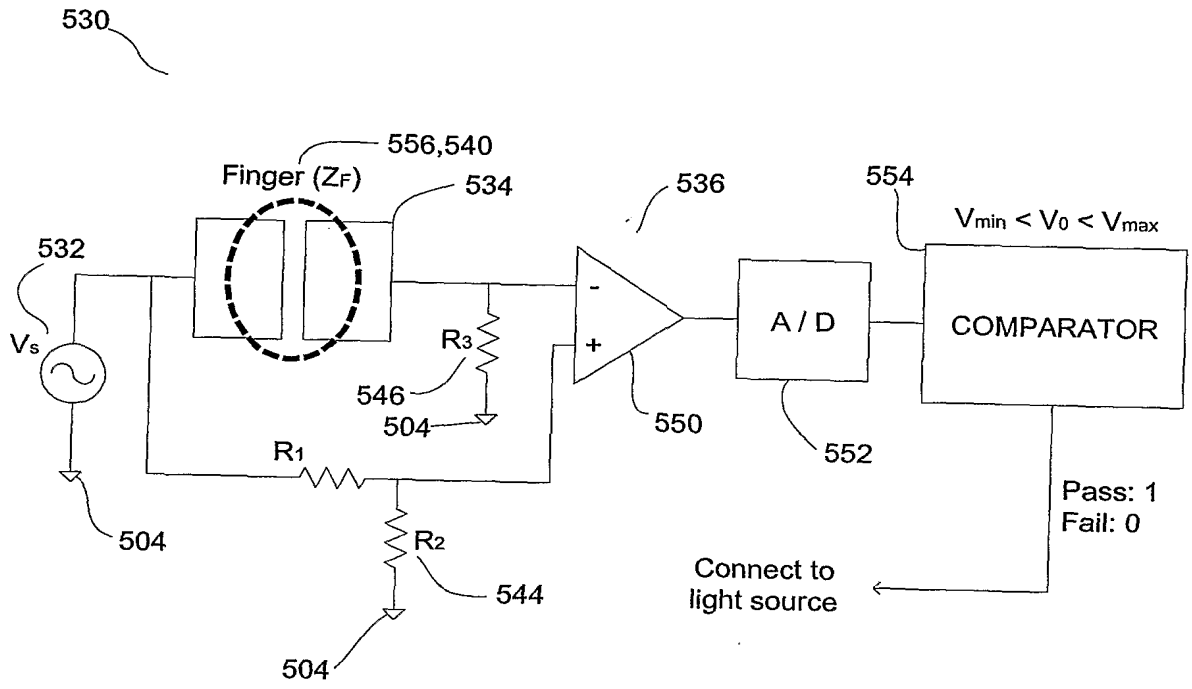

530
556,540
Finger (Z_F)
534
536
554
$V_{min} < V_0 < V_{max}$
532
V_s
R_3
546
504
504
550
A / D
COMPARATOR
552
R_1
504
R_2
544
504
Pass: 1
Fail: 0
Connect to
light source

Figure 56

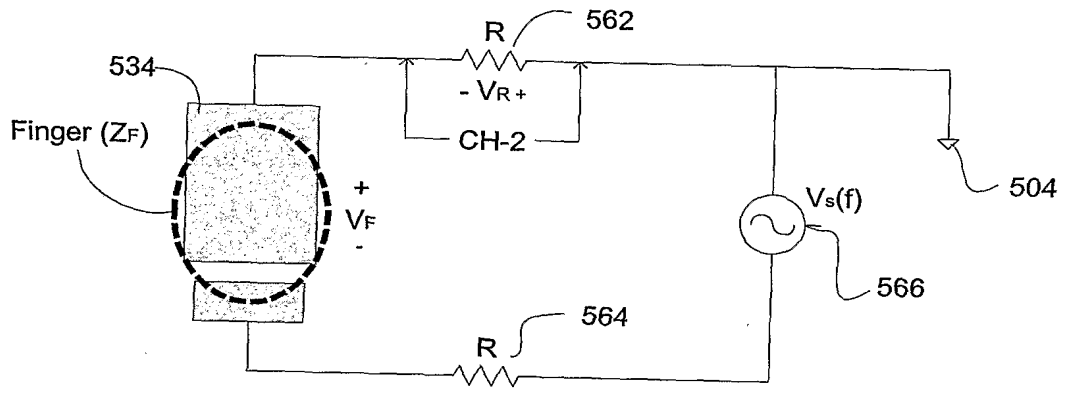


Figure 57

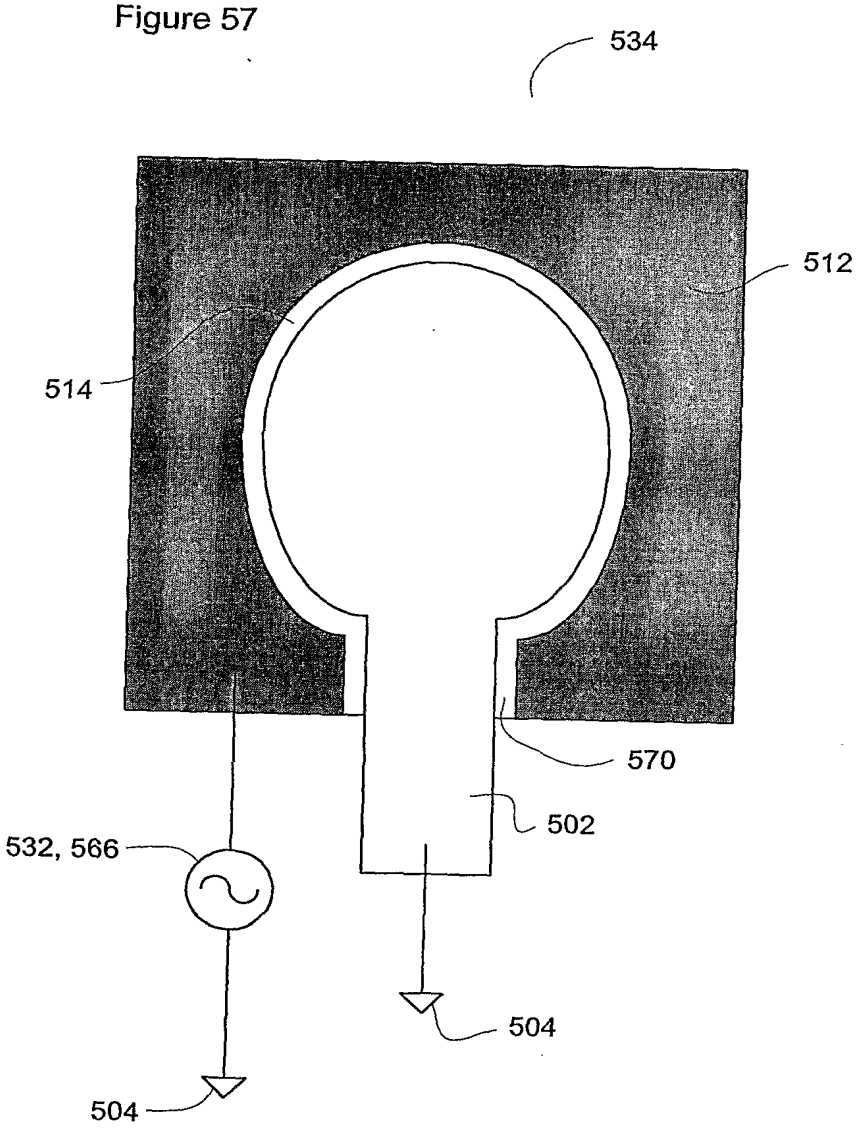


Figure 58A

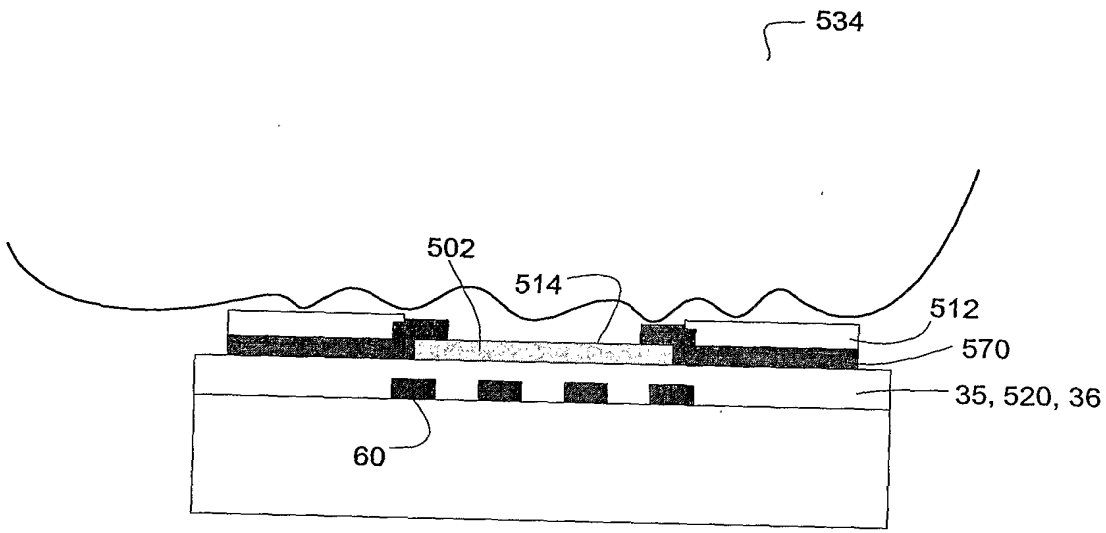


Figure 58B

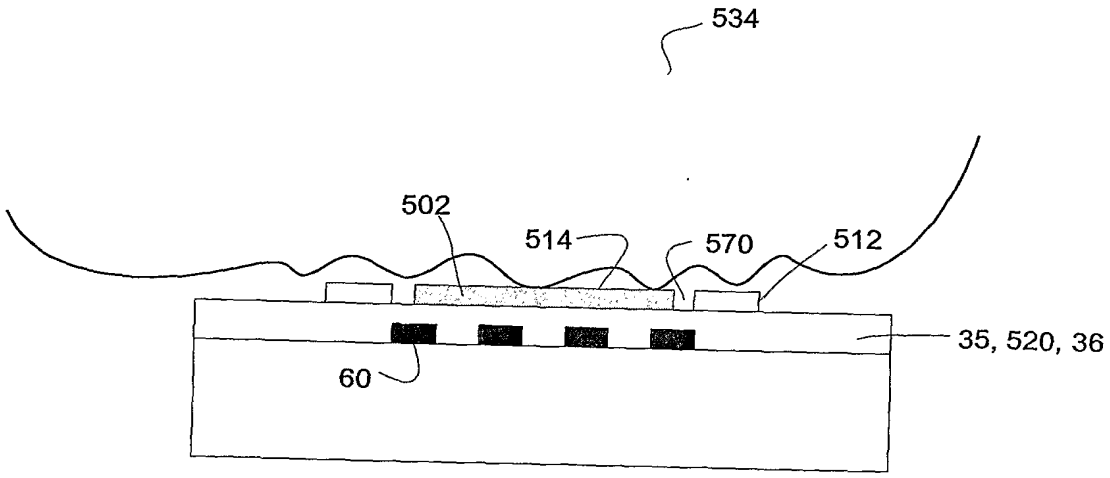
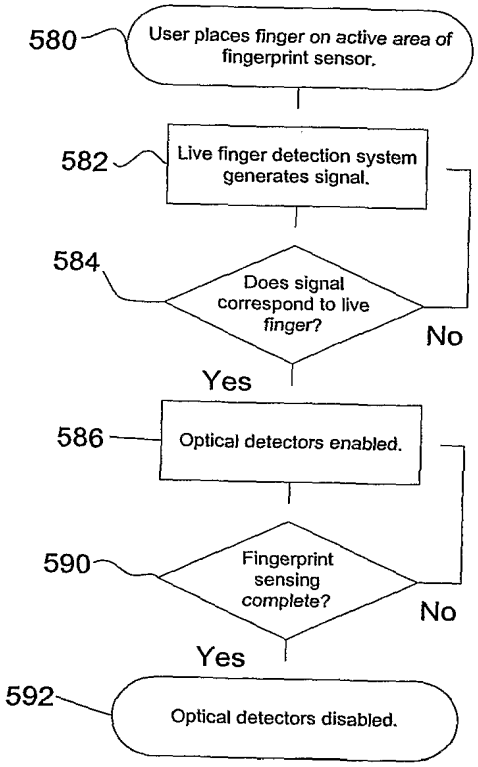


Figure 59


580
User places finger on active area of fingerprint sensor.
582
Live finger detection system generates signal.
584
Does signal correspond to live finger?
No
Yes
586
Optical detectors enabled.
590
Fingerprint sensing complete?
No
Yes
592
Optical detectors disabled.

Electronic Patent Application Fee Transmittal

Application Number:	16260879
Filing Date:	29-Jan-2019
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Filer:	Tomoki Tanida/Monique Blakey
Attorney Docket Number:	093265-0063

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

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($)
Miscellaneous:				
SUBMISSION- INFORMATION DISCLOSURE STMT	1806	1	260	260
		Total in USD ($)		**260**

Electronic Acknowledgement Receipt

EFS ID:	41438426
Application Number:	16260879
International Application Number:	
Confirmation Number:	3220
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Customer Number:	20277
Filer:	Tomoki Tanida/Monique Blakey
Filer Authorized By:	Tomoki Tanida
Attorney Docket Number:	093265-0063
Receipt Date:	18-DEC-2020
Filing Date:	29-JAN-2019
Time Stamp:	18:30:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$260
RAM confirmation Number	E2020BHI31134809
Deposit Account	
Authorized User	

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	sb08.pdf	2011725 a658885e1ad9e8387136df21a3f40b944b7ad45f	no	10
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
2	Foreign Reference	JP130.pdf	21600841 7f9301734d599183edec0eb96a4485c7e7085dcf	no	124
Warnings:					
Information:					
3	Foreign Reference	KR572.pdf	1762729 d699b6ff9fb50563cc8536ac8765f83256d7e782	no	11
Warnings:					
Information:					
4	Foreign Reference	WO243.pdf	13614989 408cf46c6c7525df7a47961bf5153261b3ec1a78	no	21
Warnings:					
Information:					
5	Non Patent Literature	NPL_Manabe.pdf	1434956 04c3c15d91f9f2eabdca464657c196c2ca2ad8e3	no	6
Warnings:					
Information:					
6	Non Patent Literature	NPL_Monrose.pdf	2388967 5420f7a15c907f306df5ce2f5b716efedc3fbf44	no	9
Warnings:					

Information:					
7	Non Patent Literature	NPL_Tan.pdf	2943882 88d919ff6c8c3b3821002de617299aa684b6d4bb	no	10
Warnings:					
Information:					
8	Non Patent Literature	NPL_APC.pdf	587793 60d10aadae0088e415fe983edabacdb3be5969c7	no	2
Warnings:					
Information:					
9	Non Patent Literature	NPL_Diefenderfer.pdf	22264746 172a10af56fc9a9a480a63da75b7d3a0e0dfc7c0	no	153
Warnings:					
Information:					
10	Non Patent Literature	NPL_Blasko.pdf	3984551 1d0e308eb7eeb967f5a80725f53fa36b954d13c1	no	19
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Information:					
11	Non Patent Literature	NPL_Chan.pdf	2307048 f9c9bda3ab61af64889f68cc470a549bb7db07d6	no	7
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Information:					
12	Non Patent Literature	NPL_Yau.pdf	2071268 71373a22ce53fa929a6b1142c6c9fd24d7dc4cfd	no	6
Warnings:					
Information:					
13	Non Patent Literature	NPL_Areekul.pdf	1302906 bc00b0bae28fa6f23b722e681c25fe13539ed29e	no	4
Warnings:					
Information:					

14	Non Patent Literature	NPL_Wang.pdf	3636784 3532ce023cd8e263f4178f989b1aaa7015c2a114	no	10
Warnings:					
Information:					
15	Foreign Reference	_GB066.pdf	16491526 2374d24f10a3172811fd46ba9b6d81fb2ad5776d	no	45
Warnings:					
Information:					
16	Foreign Reference	WO2001069520.pdf	7824837 599237349ee1c8d226d3a00209b5ee5fc6d3a1d2	no	164
Warnings:					
Information:					
17	Fee Worksheet (SB06)	fee-info.pdf	30512 d449ee2c1c3e547c757e12d254d3a058ae5a7251	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	106260060	

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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NOTICE OF ALLOWANCE AND FEE(S) DUE

20277 7590 11/23/2020

MCDERMOTT WILL & EMERY LLP
THE MCDERMOTT BUILDING
500 NORTH CAPITOL STREET, N.W.
WASHINGTON, DC 20001

EXAMINER
NASSER, ROBERT L

ART UNIT	PAPER NUMBER
3992	

DATE MAILED: 11/23/2020

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/260,879	01/29/2019	Masaaki YAMADA	093265-0063	3220

TITLE OF INVENTION: INFORMATION PROCESSING APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	02/23/2021

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

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

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

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

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

IMPORTANT REMINDER: Maintenance fees are due in utility patents issuing on applications filed on or after Dec. 12, 1980. It is patentee's responsibility to ensure timely payment of maintenance fees when due. More information is available at www.uspto.gov/PatentMaintenanceFees.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), by mail or fax, or via EFS-Web.

By mail, send to: Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

By fax, send to: (571)-273-2885

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

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

20277 7590 11/23/2020
MCDERMOTT WILL & EMERY LLP
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Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being transmitted to the USPTO via EFS-Web or by facsimile to (571) 273-2885, on the date below.

(Typed or printed name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/260,879	01/29/2019	Masaaki YAMADA	093265-0063	3220

TITLE OF INVENTION: INFORMATION PROCESSING APPARATUS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$1200	$0.00	$0.00	$1200	02/23/2021

EXAMINER	ART UNIT	CLASS-SUBCLASS
NASSER, ROBERT L	3992	345-173000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-09 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document must have been previously recorded, or filed for recordation, as set forth in 37 CFR 3.11 and 37 CFR 3.81(a). Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. Fees submitted: ❑ Issue Fee ❑ Publication Fee (if required) ❑ Advance Order - # of Copies _____

4b. Method of Payment: *(Please first reapply any previously paid fee shown above)*

❑ Electronic Payment via EFS-Web ❑ Enclosed check ❑ Non-electronic payment by credit card (Attach form PTO-2038)

❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment to Deposit Account No. _____

5. **Change in Entity Status** (from status indicated above)

❑ Applicant certifying micro entity status. See 37 CFR 1.29

❑ Applicant asserting small entity status. See 37 CFR 1.27

❑ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

Samsung - Exhibit 1005 - Page 474

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16/260,879	01/29/2019	Masaaki YAMADA	093265-0063	3220

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WASHINGTON, DC 20001

EXAMINER	
NASSER, ROBERT L	
ART UNIT	PAPER NUMBER
3992	

DATE MAILED: 11/23/2020

Determination of Patent Term Extension or Adjustment under 35 U.S.C. 154 (b)

A reissue patent is for "the unexpired part of the term of the original patent." See 35 U.S.C. 251. Accordingly, the above-identified reissue application is not eligible for Patent Term Extension or Adjustment under 35 U.S.C. 154(b).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

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

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

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

Notice of Allowability	Application No. 16/260,879	Applicant(s) YAMADA, Masaaki	
	Examiner ROBERT L NASSER	Art Unit 3992	AIA (FITF) Status No

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

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☑ This communication is responsive to papers filed 11/5/2020.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

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

3. ☑ The allowed claim(s) is/are 1-5 . As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see **http://www.uspto.gov/patents/init_events/pph/index.jsp** or send an inquiry to **PPHfeedback@uspto.gov.**

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

   Certified copies:

   a) ☑ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☑ Certified copies of the priority documents have been received in Application No. 13366983 .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____ .

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____.
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material _____.
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date. _____.
5. ☑ Examiner's Amendment/Comment
6. ☑ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/ROBERT L NASSER/
Primary Examiner, Art Unit 3992

DETAILED ACTION

I. ACKNOWLEDGEMENTS

This Office Action addresses U.S. Application No. 16/260,879 (the "879 Application" or "instant application"). Based upon a review of the instant application, the actual filing date of the instant application is December 11, 2017. Because the instant application was on or after September 16, 2012, the statutory provisions of the America Invents Act ("AIA") will govern this proceeding.

The instant application is a reissue application US Patent No. 8,654,093, ("'093 Patent"), which was filed as US Application 13/366983 ("the '983 Application"), entitled "INFORMATION PROCESSING APPARATUS."

This office action is being issued following Applicant's response of 11/5/2020, which included: 1) claim amendments and 2) arguments.

Based upon Applicant's statements as set forth in the instant application and after the Examiner's independent review of the '093 patent itself and its prosecution history, the Examiner finds that he cannot locate any ongoing proceeding before the Office or current ongoing litigation involving the '093 patent. Also based upon the Examiner's independent review of the '093 patent itself and the prosecution history, the Examiner cannot locate any previous reexaminations, supplemental examinations, or certificates of correction.

II. CLAIM STATUS

The '093 Patent issued with claims 1-7 ("Patented Claims"). The preliminary amendment filed with this reissue application adds claims 8-33. The preliminary amendment of 4/8/2019 adds claim 34. The amendment of 7/22/2020 amends claims 1 and 2 and cancels claims 6-34.

The Amendment of 11/5/2020 amends claim 1. As of the date of this Office Action, the status of the claims is:

a. Claims 1-5 ("Pending Claims").

b. Claims 1-5 are treated on the merits below ("Examined Claims")

III. AMENDMENTS OF 11/5/2020

The amendment to the filed on 11/5/20207/22/2020 have been entered and considered.

I

V. PRIORITY CLAIMS

Based upon a review of the instant application and '093 patent, the Examiner finds that the '093 patent does not claim any domestic priority.

Based upon a review of the '093 Patent itself, the Examiner finds that Applicant is claiming foreign priority under 35 USC § 119(a) to Japanese document 2011-025576, filed February 9, 2011.

Because the effective filing date of the instant application is *not* on or after March 16, 2013, the AIA First Inventor to File ("AIA-FITF") provisions do *not* apply. Instead, the earlier 'First to Invent' provisions apply.

V. REISSUE DECLARATION

The reissue declaration filed 7/22/2020 is approved.

VI. EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in an interview with Mr. Tomoki Tanida on November 16, 2020.

The application has been amended as follows:

In the claims:

Claim 1 has been rewritten as follows: --

1. (Amended) An information processing apparatus comprising: a touch panel which displays a plurality of pieces of identification information and detecting a contact of the panel with a finger of a user [an object of interest];

a storage unit which stores first information including reference identification information and a reference area range;

a detection unit[,] which detects second information necessary to identify the user when the touch panel detects a contact with the finger of the user [object], wherein detecting the second information includes detecting [which specifies] (1) identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the panel, and [which detects] (2) an area of contact [of part] where the contact occurred;

a control unit which controls the information processing apparatus to operate at least in an identification mode and a registering mode; and

[a storage unit which stores reference identification information and a reference area range;]

a determination unit which determines in the identification mode that the first information matches the second information when [whether] the identification information detected by the detection unit matches the reference identification information stored in the storage unit and when [whether] the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit, [; and]

wherein [a] the control unit [which] performs particular processing on condition the determination unit determines that the first information matches the second information in the identification mode, [the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit]

wherein the registering mode includes a first registering mode for inputting first input information corresponding to a first portion of the finger and a second registering mode for inputting second input information corresponding to a second portion of the finger,

wherein the reference identification information is generated and stored in the storage unit based on both the first input information and the second input information, the first portion corresponding to a pad of the finger,

wherein the determination unit determines in the identification mode that the first information matches the second information based on the first and second portions of the finger, and

wherein the controller is configured to associate a numeral password with the first information, and the storage unit is configured to store the association between the numeral password and the first information. --

Claim 1 was amended in line 10 to add the words “of contact” after the word area, as in claim 19, and in claims 2 and 3, the claims refer back to an area of contact.

VII. ALLOWABLE SUBJECT MATTER

Claims 1-5 are allowable.

Claims 1-5 define over the art in that none of the art associates a numeral password with the first information, where the first information comprises first input information corresponding to a pad of the finger and second input information corresponding to a second portion of a finger,

as claimed. The combination used in the last office action, Kuncl and Townsend, distinguished between the finger touch and a palm or side of hand touch, but does not have the reference identification information being based on a first portion of a finger, the pad, and a second portion of the finger. In addition, while Ghassabian does have reference information corresponding to multiple finger portions, the device does not associate a numeral password with the first information, corresponding to first and second portions of the finger

VIII. CONCLUSION

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT L NASSER whose telephone number is (571)272-4731. The examiner can normally be reached on M-F 8-6.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Kosowski can be reached on (571) 272-3744. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/ROBERT L NASSER/
Primary Examiner, Art Unit 3992

Conferees:
/JOSHUA D CAMPBELL/
Primary Examiner, Art Unit 3992

/ALEXANDER J KOSOWSKI/
Supervisory Patent Examiner, Art Unit 3992

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/260,879	YAMADA, Masaaki
	Examiner	Art Unit
	ROBERT L NASSER	3992

CPC - Searched*		
Symbol	Date	Examiner
G06F 3/041, 21/31	11/10/2020	nasser
G09G 5/10	11/10/2020	nasser

CPC Combination Sets - Searched*		
Symbol	Date	Examiner

US Classification - Searched*			
Class	Subclass	Date	Examiner

* See search history printout included with this form or the SEARCH NOTES box below to determine the scope of the search.

Search Notes		
Search Notes	Date	Examiner
east search attached	01/09/2020	nasser
east search	11/10/2020	nasser

Interference Search			
US Class/CPC Symbol	US Subclass/CPC Group	Date	Examiner
G06F	3/041, 21/31	11/10/2020	NASSER
G09G	5/10	11/10/2020	NASSER

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/260,879	YAMADA, Masaaki
	Examiner	**Art Unit**
	ROBERT L NASSER	3992

CPC								
Symbol							**Type**	**Version**
G06F	/	1	/	1626			F	2013-01-01
G06F	/	3	/	0412			I	2013-01-01
G06F	/	3	/	04842			I	2013-01-01
G06F	/	3	/	0488			I	2013-01-01
G06F	/	21	/	31			I	2013-01-01
G06F	/	2221	/	2109			A	2013-01-01
G06F	/	2221	/	2117			A	2013-01-01

CPC Combination Sets								
Symbol							**Type**	**Set**	**Ranking**	**Version**
	/		/							

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	5	
/ROBERT L NASSER/ Primary Examiner, Art Unit 3992	10 November 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

U.S. Patent and Trademark Office

Part of Paper No.: 20201110

Samsung - Exhibit 1005 - Page 485

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/260,879	YAMADA, Masaaki
	Examiner	**Art Unit**
	ROBERT L NASSER	3992

INTERNATIONAL CLASSIFICATION				
CLAIMED				
G06F	/	3	/	041
G09G	/	5	/	10

NON-CLAIMED				
	/		/	

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**

CROSS REFERENCES(S)						
CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	5	
/ROBERT L NASSER/ Primary Examiner, Art Unit 3992	10 November 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

U.S. Patent and Trademark Office — Part of Paper No.: 20201110

Samsung - Exhibit 1005 - Page 486

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/260,879	YAMADA, Masaaki
	Examiner	**Art Unit**
	ROBERT L NASSER	3992

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

CLAIMS

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1														
2	2														
3	3														
4	4														
5	5														
6	6														
7	7														

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	5	
/ROBERT L NASSER/ Primary Examiner, Art Unit 3992	10 November 2020	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

U.S. Patent and Trademark Office

Part of Paper No.: 20201110

Samsung - Exhibit 1005 - Page 487

United States Patent And Trademark Office	**Application No.**	**Art Unit**
	16/260,879	3992
Reissue Terminal Disclaimer Review Form	**Examiner**	**AIA Status**
	ROBERT L NASSER	No

Original Patent Number of Patent to be Reissued is: 8654093	**The Maintenance fee status is:** ◉ up to date ○ not up to date (Consult with SPRS)

Is there a terminal disclaimer filed and accepted during the prosecution of (i) the current reissue application, (ii) the underlying patent, and/or (iii) reexamination proceeding(s) of the underlying patent?

◉ NO
○ YES (Complete the rest of the form)

The reissue patent is subject to Terminal Disclaimer(s) that was/were:

☐ filed and accepted (DISQ or DISQ.E.FILE) during the prosecution of the current reissue application. (Enter terminal disclaimer(s) filing date(s) below).

1. _____ 2. _____ 3. _____

The underlying patent of the current reissue application is subject to Terminal DIsclaimer(s) that was/were:

☐ accepted (DISQ or DISQ.E.FILE) and of record in the prosecution of the underlying patent and/or reexamination procceeding(s) of the underlying patent. (Enter application/control no(s) and terminal disclaimer(s) filing date(s) below).

1. _____ _____ 2. _____ _____ 3. _____ _____

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	27	touch adj (screen or panel) same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2020/11/10 21:18
L3	4	(password same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2020/11/10 21:19
L4	773,379	touch adj (screen or panel)	US-PGPUB; USPAT	OR	ON	2020/11/10 21:20
L5	5	L4 and detect$3 with finger with heel with area with touch	US-PGPUB; USPAT	OR	ON	2020/11/10 21:20
L6	113,372	g06f3/041.cpc. or g09g5/10.cpc. or g06f21/31.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/11/10 21:21
L7	32,044	6 and (touch adj (screen or panel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/11/10 21:22
L8	433	7 and finger near3 pad	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/11/10 21:22
L9	32,720	6 and (touch adj (screen or panel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/11/10 21:25
L10	501	9 and finger near3 pad	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/11/10 21:25
L11	588	9 and finger adj tip	US-PGPUB; USPAT;	OR	ON	2020/11/10 21:31

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
L12	196	9 and finger near5 flat	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/11/10 21:31
L13	163	10 and 11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/11/10 21:34
L14	113,372	g06f3/041.cpc. or g09g5/10.cpc. or g06f21/31.cpc.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/11/10 21:34
L16	724,319	"15" and (touch adj (screen or panel))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/11/10 21:35
S1	1	"8654093".pn.	USPAT	OR	OFF	2019/12/09 15:52
S2	1	"8982086".pn.	USPAT	OR	OFF	2019/12/09 15:54
S3	0	"8654093".pn. and fingerprint	USPAT	OR	OFF	2019/12/10 13:16
S4	0	"8654093".pn. and finger adj print	USPAT	OR	OFF	2019/12/10 13:16
S5	0	"8654093".pn. and finger adj print	USPAT	OR	ON	2019/12/10 13:17
S6	0	"8654093".pn. and fingerprint	USPAT	OR	ON	2019/12/10 13:17
S7	1	"8654093".pn. and reference	USPAT	OR	ON	2019/12/10 13:18
S8	0	"8654093".pn. and threshhold	USPAT	OR	ON	2019/12/10 13:20
S9	1	"8654093".pn. and threshold	USPAT	OR	ON	2019/12/10 13:20

S10	0	"20050162407"	USPAT	OR	ON	2019/12/10 17:10
S11	1	"20050162407"	US-PGPUB; USPAT	OR	ON	2019/12/10 17:10
S12	25	touch adj (screen or panel) same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/10 17:12
S13	108	("2007/0097096").URPN.	USPAT	OR	OFF	2019/12/11 12:23
S14	3	S13 and ((fingertip or (finger adj tip)) and (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:29
S15	0	("8654093").URPN.	USPAT	OR	OFF	2019/12/11 12:32
S16	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:34
S17	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:35
S18	4	(password same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:35
S19	0	(pid same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:35
S20	1	(code same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:36
S21	2	("20050162407" | "5844547").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/12/11 12:36
S22	1	"8654093".pn. and range	USPAT	OR	ON	2019/12/11 13:29
S23	687,910	touch adj (screen or panel)	US-PGPUB; USPAT	OR	ON	2019/12/11 14:32
S24	12,567	S23 and (contact adj area)	US-PGPUB; USPAT	OR	ON	2019/12/11 14:32
S25	809	((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/16 18:17
S26	173	touch adj (screen or panel) and ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/16 18:18

S27	0	unlock with screen with contact adj area with threshold	US-PGPUB; USPAT	OR	ON	2020/01/06 11:34
S28	0	unlock$3 with screen with contact adj area with threshold	US-PGPUB; USPAT	OR	ON	2020/01/06 11:34
S29	29	unlock$3 with screen with area with threshold	US-PGPUB; USPAT	OR	ON	2020/01/06 11:35
S30	14,348	unlock with screen wqith id adj code	USPAT	OR	OFF	2020/01/06 12:57
S31	0	unlock with screen w\ith id adj code	USPAT	OR	OFF	2020/01/06 12:58
S32	0	unlock with screen with id adj code	USPAT	OR	OFF	2020/01/06 12:58
S34	350	unlock with screen with passcode	US-PGPUB; USPAT	OR	OFF	2020/01/06 12:58
S35	0	tocu adj (screen or panel) and ((two adj step) with authentication)	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:04
S36	261	touch adj (screen or panel) and ((two adj step) with authentication)	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:04
S37	2	"20100253471" and authentication	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:08
S38	279	unlock with screen with passcode and touch	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:11
S39	0	unlock with screen with passcode and touch	EPO	OR	OFF	2020/01/06 13:20
S40	1	unlock with touch with area	EPO	OR	OFF	2020/01/06 13:20
S41	15	unlock with area	EPO	OR	OFF	2020/01/06 13:21
S42	1	"2148497"	EPO	OR	OFF	2020/01/06 13:21
S43	0	"20100020035" and password	US-PGPUB; USPAT	OR	ON	2020/01/06 13:23
S44	2	"20100020035" and code	US-PGPUB; USPAT	OR	ON	2020/01/06 13:23
S45	2	"20100020035" and pass$4	US-PGPUB; USPAT	OR	ON	2020/01/06 13:23
S46	693,596	touch adj (screen or panel)	US-PGPUB; USPAT	OR	ON	2020/01/06 13:26
S47	3,036	S46 and accident$5 with area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:27
S48	48	S46 and detect with accident$5 with area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:27

S49	149	S46 and detect$3 with accident$5 with area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:27
S50	28	S46 and detect$3 with accident$5 with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:31
S51	7,072	S46 and detect$3 with finger with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:34
S52	53,268	S46 and detect$3 with finger or heel with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:35
S53	5	S46 and detect$3 with finger with heel with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:35
S54	7	S46 and detect$3 with glanc$3 with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:36
S55	29	S46 and detect$3 with inadvertent with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:36
S56	6	("20040046744" | "20080042994" | "20110050576" | "20110154390" | "20110221684").PN. OR ("8248385").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/06 13:38
S57	5	S56 and area	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/06 13:38
S58	4	S46 and identif$6 with (inadvertent$3 or accident$5) with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:41
S59	1	"10416876".pn. and accidental	US-PGPUB; USPAT	OR	ON	2020/01/06 13:42
S60	1	"10416876".pn. and ignor$5	US-PGPUB; USPAT	OR	ON	2020/01/06 13:43
S61	1	"10416876".pn. and area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:43
S62	463	S46 and (inadvertent$3 or accident$5) with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 14:10
S63	1,536,433	S62 nor S55	US-PGPUB; USPAT	OR	ON	2020/01/06 14:10
S64	434	S62 not S55	US-PGPUB; USPAT	OR	ON	2020/01/06 14:10
S65	350	S34 not S48	US-PGPUB; USPAT	OR	ON	2020/01/06 14:11
S66	425	S64 not S48	US-PGPUB; USPAT	OR	ON	2020/01/06 14:11
S67	2	"20070152976" and area	US-PGPUB; USPAT	OR	ON	2020/01/06 14:15
S68	171,901	touch adj (screen or panel) and mobile adj device	US-PGPUB; USPAT	OR	ON	2020/01/06 14:57

S69	1,124	S68 and (keypad with (password or passcode or (pass adj word) or (pass adj code)))	US-PGPUB; USPAT	OR	ON	2020/01/06 14:59
S70	0	"201200075098" and touch	US-PGPUB; USPAT	OR	ON	2020/01/06 15:38
S71	2	"20120075098" and touch	US-PGPUB; USPAT	OR	ON	2020/01/06 15:38
S72	1	"20050253814"	US-PGPUB; USPAT	OR	ON	2020/01/06 16:06
S73	0	tocuh adj (screen or paneL) AND (PASSCODE WITH REGOSTRATION)	US-PGPUB; USPAT	OR	ON	2020/01/06 16:12
S74	0	tocuh adj (screen or paneL) AND (PASSCODE WITH REGiSTRATION)	US-PGPUB; USPAT	OR	ON	2020/01/06 16:12
S75	136	touch adj (screen or paneL) AND (PASSCODE WITH REGiSTRATION)	US-PGPUB; USPAT	OR	ON	2020/01/06 16:13
S76	1	"8718874".pn.	US-PGPUB; USPAT	OR	ON	2020/01/07 09:29
S77	1	"4352960".pn.	US-PGPUB; USPAT	OR	ON	2020/01/07 09:52
S78	725,227	smartphone or smart adj phone	US-PGPUB; USPAT	OR	ON	2020/01/07 09:59
S79	532	S78 and ((passcode or (pass adj code)) with register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 10:00
S80	323	((cellular adj (telephone or phone)) or cellphone) and ((passcode or (pass adj code)) with register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:47
S81	7,400	((cellular adj (telephone or phone)) or cellphone) and ((password or (pass adj word)) with register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:47
S82	4,294	((cellular adj (telephone or phone)) or cellphone) and ((password or (pass adj word)) near7 register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:47
S83	725,227	smartphone or smart adj phone	US-PGPUB; USPAT	OR	ON	2020/01/07 13:48
S84	5,628	S83 and ((password or (pass adj word)) near7 register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:48
S85	3,565	S83 and ((password or (pass adj word)) near7 registration)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:52
S87	1	"20070238449" and register$4	US-PGPUB; USPAT	OR	ON	2020/01/07 13:57

S88	1	"20070238449" and register$4 same password	US-PGPUB; USPAT	OR	ON	2020/01/07 14:01
S89	369	S83 and ((password or (pass adj word)) with (initializ$ or (set adj up))) with (stor$3)	US-PGPUB; USPAT	OR	ON	2020/01/07 14:03
S90	1	"20100180336"	USPAT	OR	OFF	2020/01/07 14:28
S91	2	"20100180336"	US-PGPUB; USPAT	OR	OFF	2020/01/07 14:28
S92	1,942,720	"20050253814" and touch panel	US-PGPUB; USPAT	OR	ON	2020/01/07 16:40
S93	0	"20050253814" and touch panel	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:40
S94	1	"20050253814" and touch screen	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:40
S95	1	"20050253814" and finger	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:41
S96	0	"20050253814" and finger and password	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S97	0	"20050253814" and finger and pass word	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S98	0	"20050253814" and finger and pass code	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S99	0	"20050253814" and finger and passcode	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S100	134	unlock with screen with passcode	USPAT	OR	OFF	2020/01/07 16:52
S101	1	"8654093".pn.	USPAT	OR	OFF	2020/01/07 16:52
S102	0	S101 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:52
S103	25	touch adj (screen or panel) same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S104	0	S103 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S105	0	S104 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S106	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S107	0	S106 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53

S108	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S109	0	S108 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S110	0	S109 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S111	1	"20050253814" and (touch or contact)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:58
S112	1	"20050253814" and (processor or controller)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:00
S113	1	"20050253814" and (microprocessor or controller)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:04
S114	0	"20050253814" and (microprocessor)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:04
S115	1	"20050253814" and (computer)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:05
S116	1	"20050253814" and tip same flat	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:10
S117	0	"8654093".pn. and finger same edge	USPAT	OR	OFF	2020/01/07 17:22
S118	0	"8654093".pn. and edge	USPAT	OR	OFF	2020/01/07 17:22
S119	2	"20100180336" and security	US-PGPUB; USPAT	OR	OFF	2020/01/07 17:23
S120	2	"20100180336" and unlock	US-PGPUB; USPAT	OR	OFF	2020/01/07 17:23
S121	0	"20050253814" and unlock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:24
S122	1	"20050253814" and security	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:24
S123	1	"20050253814" and lock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:24
S124	3,503	calibrat$4 with display with instructions	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:11
S125	2,256	S124 and (touch adj (screen or panel))	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:21
S126	84	S124 and (touch adj (screen or panel)) and (calibrat$4 same finger)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:22
S127	1,321	calibrat$4 with (display near10 instructions)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:22

S128	55	S127 and (touch adj (screen or panel)) and (calibrat$4 same finger)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:23
S129	2	"20070195067" and instructions	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:25
S130	61	calibrat$4 with (display near10 instructions) and (calibrat$4 with (touch adj (screen or panel)))	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:29
S131	1	"8654093".pn. and shaded	USPAT	OR	OFF	2020/01/08 10:42
S132	1	"8654093".pn. and (tap$3 or flick$3 or drag$4 or pinch$3)	USPAT	OR	OFF	2020/01/08 10:43
S133	0	"20050253814" and pinch$3	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:46
S134	1	"20050253814" and tap$4	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:46
S135	0	"20050253814" and flick$3	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:46
S136	4,370	touch adj (screen or panel) and (tap$4 same flick$4 saem drag$4 same pinch$4) same finger	US-PGPUB; USPAT	OR	ON	2020/01/08 10:47
S137	643	touch adj (screen or panel) and (tap$4 same flick$4 same drag$4 same pinch$4) same finger	US-PGPUB; USPAT	OR	ON	2020/01/08 10:47
S138	643	touch adj (screen or panel) and (tap$4 same flick$4 same drag$4 same pinch$4) same finger	US-PGPUB; USPAT	OR	ON	2020/01/08 10:48
S139	589	S138 and (smartphone or phone of telephone or cellphone)	US-PGPUB; USPAT	OR	ON	2020/01/08 10:49
S140	643	touch adj (screen or panel) and (tap$4 same flick$4 same drag$4 same pinch$4) same finger and flick$3 and drag$4 and pinch$3 and tap$4	US-PGPUB; USPAT	OR	ON	2020/01/08 11:02
S141	589	S140 and (smartphone or phone of telephone or cellphone)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:02
S142	35	S138 and (smartphone or phone of telephone or cellphone) and (mov$3 with icon with drag$4)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:14
S143	3,804	(smartphone or phone of telephone or cellphone) and (mov$3 with icon with drag$4)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:15
S144	1,022	(smartphone) and (mov$3 with icon with drag$4)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:18

S145	0	"8654093".pn. and sufficient	USPAT	OR	ON	2020/01/08 11:27
S146	1	"8654093".pn. and contact	USPAT	OR	ON	2020/01/08 11:27
S147	1	"8654093".pn. and range with threshold	USPAT	OR	ON	2020/01/08 11:27
S148	274,105	touch adj (screen or panel)	USPAT	OR	ON	2020/01/08 13:32
S149	992,035	touch adj (screen or panel)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:33
S150	0	(touch adj (screen or panel)) same capacative adj plates	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:34
S151	56	(touch adj (screen or panel)) same capacitive adj plates	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:35
S152	27	(touch adj (screen or panel)) same capacitive adj plates same sensor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:35
S153	495	(touch adj (screen or panel)) and capacitive adj plates same sensor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:36
S154	0	"8654093".pn. and capacitive	USPAT	OR	OFF	2020/01/08 13:44
S155	1	"8654093".pn. and capac$9	USPAT	OR	OFF	2020/01/08 13:45
S156	0	"8654093".pn. and plate	USPAT	OR	ON	2020/01/08 13:46
S157	17,233	(touch adj (screen or panel)) same sensors same capacitance	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2020/01/08 13:49

			EPO; JPO; DERWENT; IBM_TDB			
S158	4,220	(touch adj (screen or panel)) same sensors same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/01/08 13:49
S159	166	(touch adj (screen or panel)) same sensors same capacitance same grid	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/01/08 13:55
S160	3,596	touch adj (screen or panel) and (sufficient near3 contact)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 15:27
S161	106	touch adj (screen or panel) and (sufficient near3 contact) with (determin$3) with whether	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 15:27
S162	5	S149 and (unlock$ same (finger with tip) same (finger with pad))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 15:34
S163	0	ryu.in. and (unlock$3 with contact with area)	EPO	OR	ON	2020/01/08 15:39
S164	0	ryu.in. and (unlock$3 with contact with area)	US-PGPUB; USPAT	OR	ON	2020/01/08 15:39
S165	998	ryu.in. and (contact with area)	US-PGPUB; USPAT	OR	ON	2020/01/08 15:39
S166	49	S148 and S165	US-PGPUB; USPAT	OR	ON	2020/01/08 15:39
S167	1	"2148497"	EPO	OR	ON	2020/01/08 15:40
S168	3	(mobile adj terminal) adj event adj control adj method	US-PGPUB; USPAT; EPO	OR	ON	2020/01/08 15:41
S169	3	(mobile adj terminal) adj2 event adj control adj method	US-PGPUB; USPAT; EPO	OR	ON	2020/01/08 15:41

S170	2	"20100020035" and area	US-PGPUB; USPAT	OR	ON	2020/01/08 15:42
S171	1	"20050253814" and (security)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 16:13
S172	1	"20050253814" and tip	US-PGPUB; USPAT	ADJ	ON	2020/01/08 16:18
S173	2	"20100020035" and area	US-PGPUB; USPAT	OR	ON	2020/01/09 10:21
S174	992,877	touch adj (screen or panel)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:24
S175	100	S174 and (unlock$ with finger with portion)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:24
S176	1	"8654085".pn. and (finger with portion)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:30
S177	2	"20100045608" and (finger with portion)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:33
S178	2	"20100045608" and unlock$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:35
S179	11	("20030076306" | "20040204129" | "20040207606" | "20040263488" | "20060044280" | "20060218325" | "20080100586" | "6340979" | "7800592").PN. OR ("8654085").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:38
S180	9	S179 and finger	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:41

S181	1	"20040204129" and (firm and light)	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:44
S182	2	S179 and unlock$3	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:46
S183	2	"20100020035" and unlock$3	US-PGPUB; USPAT	OR	ON	2020/01/09 10:51
S184	0	"20050253814" and unlock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/09 10:51
S185	1	"20050253814" and security	US-PGPUB; USPAT	ADJ	ON	2020/01/09 10:52
S186	0	"20040204129" and (firm and light) and shad$3	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 11:00
S187	0	"20100045608" and unlock$3 and shad$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:01
S188	10	S174 and display with touch with shad$ with circle$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:05
S189	188	S174 and display with shad$ with circle$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:07
S190	9	S174 and display with contact adj area with shad$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:10
S191	136	S174 and display with contact near10 shad$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:13
S192	92	S174 and display with contact near10 shadow	US-PGPUB; USPAT; USOCR; FPRS;	OR	ON	2020/01/09 11:14

			EPO; JPO; DERWENT; IBM_TDB			
S193	44	S191 not S192	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:14
S194	2	"20120284297"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:28
S195	2	"20120289201"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:30
S196	1	"20120192100"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:30
S197	1	"20120229406"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32
S198	0	"20120229406" and hsape	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32
S199	1	"20120229406" and shape	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32
S200	1	"20120229406" and shape with unlock	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32
S201	1	"20070097096"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:34
S202	0	"20070097096" and unlock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:35
S203	111	blow.in.	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:46
S204	8	blow.in. and touch	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:46
S205	2	"20120075098"	US-PGPUB; USPAT	OR	ON	2020/07/27 15:57
S206	1	"20070152976"	USPAT	OR	OFF	2020/07/27 16:38
S207	2	"20070152976"	US-PGPUB; USPAT	OR	OFF	2020/07/27 16:38
S208	2	"20070152976" and accident$3	US-PGPUB; USPAT	OR	OFF	2020/07/27 16:50
S209	2	"20070152976" and unintentional	US-PGPUB; USPAT	OR	OFF	2020/07/27 16:51
S210	2	"20060236013"	US-PGPUB; USPAT	OR	OFF	2020/07/27 17:38

S211	2	"20080201548"	US-PGPUB; USPAT	OR	OFF	2020/07/27 17:39

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L15	35,129	g06f3/041.cpc. or g09g5/10.cpc. or g06f21/31.cpc.	US-PGPUB; USPAT	OR	OFF	2020/11/10 21:35
L17	18,185	l15 and (touch adj (screen or panel))	US-PGPUB; USPAT	OR	ON	2020/11/10 21:35
L18	22	l17 and (finger near3 pad).clm.	US-PGPUB; USPAT	OR	ON	2020/11/10 21:36

11/10/2020 9:36:50 PM
C:\Users\bnasser\Documents\EAST\Workspaces\16260879.wsp

Bibliographic Data

Application No: 16/260,879

Foreign Priority claimed: (•) Yes ( ) No

35 USC 119 (a-d) conditions met: [✓] Yes [ ] No [ ] Met After Allowance

Verified and Acknowledged: /ROBERT L NASSER/ [ ]

Examiner's Signature | Initials

Title: INFORMATION PROCESSING APPARATUS

FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
01/29/2019	345	3992	093265-0063
RULE			

APPLICANTS

MAXELL, LTD., Kyoto, JAPAN

INVENTORS

Masaaki YAMADA, Yokohama, JAPAN

CONTINUING DATA

This application is a REI of 13366983 02/06/2012 PAT 8654093

FOREIGN APPLICATIONS

JAPAN JP2011-025576 02/09/2011

IF REQUIRED, FOREIGN LICENSE GRANTED**

02/06/2019

STATE OR COUNTRY

JAPAN

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UNITED STATES

FILING FEE RECEIVED

$5,120

OK TO ENTER: /R.L.N/

Docket No.: 093265-0063 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Masaaki YAMADA	:	Customer Number: 20277
Application No.: 16/260,879	:	Confirmation No.: 3220
Filed: January 29, 2019	:	Art Unit: 3992
For: INFORMATION PROCESSING APPARATUS	:	Examiner: Nasser, Robert L

OK TO ENTER: /R.L.N/

AMENDMENT IN RESPONSE TO FINAL OFFICE ACTION UNDER 37 C.F.R. § 1.116

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

Sir:

In response to the Office Action dated August 5, 2020, wherein a three-month shortened statutory period for response is set to expire on November 5, 2020, Applicant respectfully requests reconsideration of the above-identified application in view of the following amendments and remarks.

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

Remarks begin on page 5 of this paper.

OK TO ENTER: /R.L.N/

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/260,879	Filing Date 01/29/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 7	Minus	** 7	= 0		x $0 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 1	= 0		x $0 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☑ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							0
							TOTAL ADD'L FEE	0

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/RHONDA BELL/
*** 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.	

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.

Docket No.: 093265-0063 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Masaaki YAMADA	:	Customer Number: 20277
Application No.: 16/260,879	:	Confirmation No.: 3220
Filed: January 29, 2019	:	Art Unit: 3992
For: INFORMATION PROCESSING APPARATUS	:	Examiner: Nasser, Robert L

AMENDMENT IN RESPONSE TO FINAL OFFICE ACTION UNDER 37 C.F.R. § 1.116

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

Sir:

In response to the Office Action dated August 5, 2020, wherein a three-month shortened statutory period for response is set to expire on November 5, 2020, Applicant respectfully requests reconsideration of the above-identified application in view of the following amendments and remarks.

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

Remarks begin on page 5 of this paper.

Electronic Acknowledgement Receipt

EFS ID:	41043949
Application Number:	16260879
International Application Number:	
Confirmation Number:	3220
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Customer Number:	20277
Filer:	Tomoki Tanida/Taylor Livingston
Filer Authorized By:	Tomoki Tanida
Attorney Docket Number:	093265-0063
Receipt Date:	05-NOV-2020
Filing Date:	29-JAN-2019
Time Stamp:	12:44:18
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		093265-0063_Amendment.pdf	50973 394e14db64b95a62765e088bef8a1fb183a33e47	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Applicant Arguments/Remarks Made in an Amendment	5	7
	Claims	2	4
	Response After Final Action	1	1
Warnings:			
Information:			
	Total Files Size (in bytes):	50973	

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.

REMARKS

Status of Claims

In accordance with 37 CFR 1.173(c), the state of the claims is as follows:

Claims 1–5 are pending in this reissue application, of which claim 1 is independent.

Claims 6–34 were canceled by the Amendment of July 22, 2020.

Claims 1–5 stands rejected under 35 U.S.C. § 251 as being broadened in a reissue application filed outside the two year statutory period.

Claim 1 is amended by the present Amendment.

Claim 2 was amended by the Amendment of July 22, 2020.

Claims 1–5 would be allowable if the broadening issue above is corrected.

Support for Claim Changes

The following is the explanation of exemplary support in the disclosure for the amendments in accordance with 37 CFR 1.173(c).

Claim 1 has been amended to improve the claimed wording. For example, claim 1 has been amended not to use the phrase "are coincident with," but use the word "matches," as set forth in claim 1.

Substance of Interview

Applicant thank Examiner Nasser, Supervisory Patent Examiner Kosowski, and Examiner Basehoar for their time and courtesy during an interview conducted with the Applicant's representative, Tomoki Tanida (Reg. #60,453) on October 7, 2020. During the interview, the rejection of the broadening reissue and the issue of the defective reissue declaration were discussed.

As mentioned in the Interview Summary of October 14, 2020, Applicant understands that (1) the amendments to claim 1 can overcome the rejection under 35 U.S.C. § 251 as being broadened in a reissue application filed outside the two year statutory period; and (2) because the rejection of the broadening reissue can be overcome, the declaration filed on July 22, 2020 are acceptable.

This response reflects the substance of the interview.

Reissue Declaration

Claims 1–5 were rejected as being based upon a defective reissue declaration under 35 U.S.C. 251.

The Office Action stated, "[w]hen a claim is both broadened and narrowed, the error statement must identify an error that is broadening," but "since Applicant did not show an intent to broaden prior to 2 years from the issue date of the '093 patent, Applicant cannot broaden in this case."

As discussed below, the amendments to claim 1 can overcome the rejection of the broadening reissue. Therefore, as discussed in the interview, the issue of the defective reissue declaration has been rendered moot. Favorable consideration of the reissue declaration is respectfully solicited.

Broadening

Claims 1–5 were rejected under 35 U.S.C. § 251 as being broadened in a reissue application filed outside the two year statutory period.

As discussed in the interview, Applicant has studied the Examiner's comments on page 4 under the header "V. REISSUE DECLARATION," and amended claim 1 as set forth above. For example, claim 1 has been amended not to use the phrase "are coincident with," but use the word "matches." As agreed by the Examiner during the interview, the amendments to claim 1 can overcome the rejection under 35 U.S.C. § 251 as being broadened in a reissue application filed outside the two year statutory period.

Withdrawal of the rejection of claims 1–5 is respectfully solicited.

Claim Objections

1. Claims 1–5 were objected to as being included in an amendment that does not conform to 37 CFR 1.173.

The Office Action pointed out, "the amendment to the claims is not in conformance with 37 CFR 1.173." The Office Action at page 3. In response, Applicant has revised the amendments to claim 1 by the July 22, 2020 to be in proper format under 37 CFR 1.173.

2. Claim 1 was objected to because the phrase "area of part" in line 10 appears to be idiomatically incorrect.

Claim 1 has been amended to recite "an area [of part] where the contact occurred."

Applicant believes that these amendments are fully responsive to the Examiner's concerns. Withdrawal of the objections to the claims is respectfully solicited.

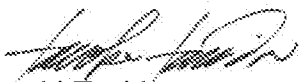
Conclusion

In view of the above amendments and remarks, Applicant submits that this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP



Tomoki Tanida
Registration No. 60453

500 North Capitol Street, N.W.
Washington, DC 20001
Phone: (202) 756-8196
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Date: November 5, 2020

Please recognize our Customer No. 20277 as our correspondence address.

AMENDMENT TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Amended) An information processing apparatus comprising:

a touch panel which displays a plurality of pieces of identification information and detecting a contact of the panel with a finger of a user [an object of interest];

a storage unit which stores first information including reference identification information and a reference area range;

a detection unit[,] which detects second information necessary to identify the user when the touch panel detects a contact with the finger of the user [object], wherein detecting the second information includes detecting [which specifies] (1) identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the panel, and [which detects] (2) an area [of part] where the contact occurred;

a control unit which controls the information processing apparatus to operate at least in an identification mode and a registering mode; and

[a storage unit which stores reference identification information and a reference area range;]

a determination unit which determines in the identification mode that the first information matches the second information when [whether] the identification information detected by the detection unit matches the reference identification information stored in the storage unit and when [whether] the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit, [; and]

wherein [a] the control unit [which] performs particular processing on condition the determination unit determines that the first information matches the second information in the identification mode, [the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit]

wherein the registering mode includes a first registering mode for inputting first input information corresponding to a first portion of the finger and a second registering mode for inputting second input information corresponding to a second portion of the finger,

wherein the reference identification information is generated and stored in the storage unit based on both the first input information and the second input information, the first portion corresponding to a pad of the finger,

wherein the determination unit determines in the identification mode that the first information matches the second information based on the first and second portions of the finger, and

wherein the controller is configured to associate a numeral password with the first information, and the storage unit is configured to store the association between the numeral password and the first information.

2. (Amended) The information processing apparatus according to claim 1, wherein:

[the storage unit stores] the reference identification information and the reference area range stored in the storage unit are based on [, when a predetermined condition is satisfied,] the identification information and the area of the contact detected by the detection unit [as the reference identification information and the reference area range, respectively].

3. (Original) The information processing apparatus according to claim 1 or 2, wherein:

the storage unit stores first identification information and a first area range and second identification information and a second area range as the reference identification information and the reference area ranges; and

the determination unit determines, on condition the identification information detected by the detection unit matches the first identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the first area range stored in the storage unit, whether the identification information detected by the detection unit matches the second identification information stored in the storage unit and the area of the contact detected by the detecting unit falls within the second area range stored in the storing unit.

4. (Original) The information processing apparatus according to claim 1 or 2, wherein:

the storage unit stores a threshold value; and

the reference area range stored in the storage unit is defined based on the threshold value.

5. (Original) The information processing apparatus according to claim 4, wherein:

the area of the contact detected by the detection unit is registered as the threshold value when a predetermined condition is satisfied.

6–34. (Cancelled)

Samsung - Exhibit 1005 - Page 515

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/260,879	01/29/2019	Masaaki YAMADA	093265-0063	3220

20277 7590 10/14/2020

MCDERMOTT WILL & EMERY LLP
THE MCDERMOTT BUILDING
500 NORTH CAPITAL STREET, N.W.
WASHINGTON, DC 20001

EXAMINER	
NASSER, ROBERT L	

ART UNIT	PAPER NUMBER
3992	

NOTIFICATION DATE	DELIVERY MODE
10/14/2020	ELECTRONIC

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

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

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

ipdocketmwe@mwe.com

Applicant-Initiated Interview Summary	**Application No.** 16/260,879	**Applicant(s)** YAMADA, Masaaki	
	Examiner ROBERT L NASSER	**Art Unit** 3992	**AIA (FITF) Status** No

All participants (applicant, applicants representative, PTO personnel):

(1) ROBERT L. NASSER.

(2) Adam Basehoar, USPTO.

(3) Alexander Kosowski, SPE USPTO.

(4) Tom Tanida, for Applicant.

Date of Interview: 07 October 2020.

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

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

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

Claim(s) discussed: all.

Identification of prior art discussed: none.

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

The Examiner agreed that the proposed amendment overcome the rejection for broadening outside of two years. In addition, because the claims were no longer being broadened, the declaration filed 7/22/2020 was acceptable. The Examiner also confirmed that the form used for the declaration was the correct form, and that no RCE would be necessary at this time..

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

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

☑ Attachment

/ROBERT L NASSER/ Primary Examiner, Art Unit 3992	/A.J.K/ Supervisory Patent Examiner, Art Unit 3992

Summary of Record of Interview Requirements

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

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

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

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

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

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

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

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

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

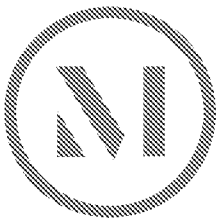
It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes,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

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

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

Examiner to Check for Accuracy

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



McDermott Will & Emery

EMAIL

Date: October 5, 2020 **Time Sent:**

To:	**Company:**	**Facsimile No:**	**Telephone No:**
Examiner Nasser (Art Unit 3992)	United States Patent and Trademark Office		571-272-4731

From:	Tomoki Tanida	*Direct Phone:*	+1 202 756 8196
E-Mail:	ttanida@mwe.com	*Direct Fax:*	+1 202 756 8087
Sent By:		*Direct Phone:*	
Client/Matter/Tkpr:	093265-0063/05265	*Original to Follow by Mail:*	No
		Number of Pages, Including Cover:	4

Re: Interview Agenda for Telephone Interview on October 7, 2020 at 2:00pm EDT
U.S. Patent Application No. 16/260,879

Message:

Dear Examiner Nasser,

Attached please find an interview agenda for an interview. Thank you for giving us an opportunity to discuss with you.

Very truly yours,

Tomoki Tanida (Reg. # 60,453)

This agenda is NOT intended to place in the PTO file, but only for your information, i.e. this does not provide any guidance of constructing the claims.

The information contained in this facsimile message is legally privileged and confidential information intended only for the use of the individual or entity named above. If the reader of this message is not the intended recipient, you are hereby notified that any dissemination, distribution, or copy of this facsimile is strictly prohibited. If you have received this facsimile in error, please notify us immediately by telephone and return the original message to us at the below address by mail. Thank you.

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We would like to discuss with you (1) amendments to claim 1, and (2) reissue declaration.

(1) Amendments to Claim 1

Please see our proposed amendments to claim 1 below (emphasis show changes).

Regarding the broadening amendment to claim 1, the Office Action on page 4 stated as follows:

> The amended claim 1 now recites that the control unit performs particular processing on condition that the first information and second information are coincident with each other. This is broader for two reasons. First, the word coincident means "of a similar nature. " As such, coincident is broader than matching. Second, the claim omits the limitation as to the area of contact falling within the reference range.

We propose not using "are coincident with," but using the word "matches," as set forth in claim 1 below.

Regarding the limitation as to the area of contact falling within the reference range, we propose amending the limitations regarding the determination unit and the control unit, as follows:

> a determination unit which determines in the identification mode that the first information **matches** the second information **when [whether]** the identification information detected by the detection unit matches the reference identification information stored in the storage unit and whether the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit, [; and]
>
> wherein [a] the control unit [which] performs particular processing on condition the determination unit determines that the first information **matches** the second information in the identification mode,

We believe that the limitation as to the area of contact falling within the reference range is included in the above limitations.

We also propose amending the phrase "area of part," as attached.

(2) Reissue Declaration

We would like to discuss the language of the declaration.

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Proposed Amendments to Claim 1

1. (Amended) An information processing apparatus comprising:

a touch panel which displays a plurality of pieces of identification information and detecting a contact of the panel with a finger of a user [an object of interest];

a storage unit which stores first information including reference identification information and a reference area range;

a detection unit[,] which detects second information necessary to identify the user when the touch panel detects a contact with the **finger of the user** [object], wherein detecting the second information includes detecting ~~which specifies~~ (1) identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the panel, and ~~which detects~~ (2) an area **[of part]** where the contact occurred;

a control unit which controls the information processing apparatus to operate at least in an identification mode and a registering mode; and

~~a storage unit which stores reference identification information and a reference area range;~~

a determination unit which determines in the identification mode that the first information **matches** the second information **when [whether]** the identification information detected by the detection unit matches the reference identification information stored in the storage unit and **when [whether]** the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit, [; and]

wherein [a] the control unit [which] performs particular processing on condition the determination unit determines that the first information **matches** the second information in the identification mode, ~~the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit~~

wherein the registering mode includes a first registering mode for inputting first input information corresponding to a first portion of the finger and a second registering mode for inputting second input information corresponding to a second portion of the finger,

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wherein the reference identification information is generated and stored in the storage unit based on both the first input information and the second input information, the first portion corresponding to a pad of the finger,

wherein the determination unit determines in the identification mode that the first information **matches** the second information based on the first and second portions of the finger, and

wherein the controller is configured to associate a numeral password with the first information, and the storage unit is configured to store the association between the numeral password and the first information.

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Doc Code: ECOMM.AUTH/ECOMM.WTDW
Doc Description: Internet Communications Authorized/Internet Communications Authorization Withdrawn

PTO/SB/439 (11-15)

AUTHORIZATION FOR INTERNET COMMUNICATIONS IN A PATENT APPLICATION OR REQUEST TO WITHDRAW AUTHORIZATION FOR INTERNET COMMUNICATIONS		
	Application No.	16/260,879
	Filing Date	January 29, 2019
	First Named Inventor	Masaaki YAMADA
	Art Unit	3992
	Examiner Name	NASSER, ROBERT L
	Practitioner Docket No.	093265-0063

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

I. To authorize permission for Internet Communications.

☑ Recognizing that Internet communications are not secure, I hereby authorize the USPTO to communicate with the undersigned and practitioners in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via video conferencing, instant messaging, or electronic mail. I understand that a copy of these communications will be made of record in the application file. (MPEP 502.03)

II. To withdraw authorization for Internet Communications.

☐ The authorization given on _____, to the USPTO to communicate with the undersigned and any practitioner in accordance with 37 CFR 1.33 and 37 CFR 1.34 concerning any subject matter of this application via Internet communications such as video conferencing, instant messaging, or electronic mail is hereby withdrawn. I understand that the withdrawal is effective when approved rather than when received.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 60,453.

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

/Tomoki Tanida/ — Signature

October 5, 2020 — Date

Tomoki Tanida — Typed or printed name

202-756-8196 — 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. Juristic entities must be represented by a patent practitioner (see 37 CFR 1.31, which is applicable to any paper filed on or after September 16, 2012, that is presented on behalf of a juristic entity, regardless of application filing date). Submit multiple forms if more than one signature is required, see below*.

☑ * Total of 1 forms are submitted.

Privacy Act Statement

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

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

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

Electronic Acknowledgement Receipt

EFS ID:	40757062
Application Number:	16260879
International Application Number:	
Confirmation Number:	3220
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Customer Number:	20277
Filer:	Tomoki Tanida/Taylor Livingston
Filer Authorized By:	Tomoki Tanida
Attorney Docket Number:	093265-0063
Receipt Date:	05-OCT-2020
Filing Date:	29-JAN-2019
Time Stamp:	12:40:44
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	Internet Communications Authorized	sb0439.pdf	110844 67b77cd186ba7050ca2df1f48c5775b5955e0622	no	2

Warnings:

Information:	
Total Files Size (in bytes):	110844

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/260,879	01/29/2019	Masaaki YAMADA	093265-0063	3220

20277 7590 08/05/2020

MCDERMOTT WILL & EMERY LLP
THE MCDERMOTT BUILDING
500 NORTH CAPITAL STREET, N.W.
WASHINGTON, DC 20001

EXAMINER
NASSER, ROBERT L

ART UNIT	PAPER NUMBER
3992	

NOTIFICATION DATE	DELIVERY MODE
08/05/2020	ELECTRONIC

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

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

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

ipdocketmwe@mwe.com

Office Action Summary	Application No. 16/260,879	Applicant(s) YAMADA, Masaaki	
	Examiner ROBERT L NASSER	Art Unit 3992	AIA (FITF) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

1)☑ Responsive to communication(s) filed on 7/22/2020.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

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

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

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

Disposition of Claims*

5) ☑ Claim(s) 1-5 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) 1-5 is/are rejected.

8) ☑ Claim(s) 1-5 is/are objected to.

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

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

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

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☑ All b)☐ Some** c)☐ None of the:

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

2.☑ Certified copies of the priority documents have been received in Application No. 13/366983.

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

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

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

I. ACKNOWLEDGEMENTS

This Office Action addresses U.S. Application No. 16/260,879 (the "879 Application" or "instant application"). Based upon a review of the instant application, the actual filing date of the instant application is December 11, 2017. Because the instant application was on or after September 16, 2012, the statutory provisions of the America Invents Act ("AIA") will govern this proceeding.

The instant application is a reissue application US Patent No. 8,654,093, ("'093 Patent"), which was filed as US Application 13/366983 ("the '983 Application"), entitled "INFORMATION PROCESSING APPARATUS."

This office action is being issued following Applicant's response of 7/22/2020, which included: 1) claim amendments 2) specification amendments 3) a new reissue declaration and 4) arguments.

Based upon Applicant's statements as set forth in the instant application and after the Examiner's independent review of the '093 patent itself and its prosecution history, the Examiner finds that he cannot locate any ongoing proceeding before the Office or current ongoing litigation involving the '093 patent. Also based upon the Examiner's independent review of the '093 patent itself and the prosecution history, the Examiner cannot locate any previous reexaminations, supplemental examinations, or certificates of correction.

II. CLAIM STATUS

The '093 Patent issued with claims 1-7 ("Patented Claims"). The preliminary amendment filed with this reissue application adds claims 8-33. The preliminary amendment of 4/8/2019

adds claim 34. The amendment of 7/22/2020 amends claims 1 and 2 and cancels claims 6-34. As of the date of this Office Action, the status of the claims is:

a. Claims 1-5 ("Pending Claims").

b. Claims 1-5 are treated on the merits below ("Examined Claims")

III. AMENDMENTS OF 7/22/2020

The amendment to the specification and claims filed on 7/22/2020 have been entered and considered. The Examiner notes that the amendment to the claims is not in conformance with 37 CFR 1.173. Specifically, all subject matter to be deleted from a claim must be enclosed in brackets, not lined through. In addition, any new material added to the claim must be underlined. At present, the words "finger of the user" were added in line 7 of claim 1, and are not underlined. In response to this Office Action, Applicant should submit a proper claim listing.

IV. PRIORITY CLAIMS

Based upon a review of the instant application and '093 patent, the Examiner finds that the '093 patent does not claim any domestic priority.

Based upon a review of the '093 Patent itself, the Examiner finds that Applicant is claiming foreign priority under 35 USC § 119(a) to Japanese document 2011-025576, filed February 9, 2011.

Because the effective filing date of the instant application is *not* on or after March 16, 2013, the AIA First Inventor to File ("AIA-FITF") provisions do *not* apply. Instead, the earlier 'First to Invent' provisions apply.

V. REISSUE DECLARATION

The reissue declaration is defective because it is a broadening reissue, but does not identify a claim being broadened and specific language being removed via reissue. The declaration states that this is a narrowing reissue. However, the claims are broadened in some respects. While the new claims are narrowed in some regards, a claim is considered to be broadened if it is broader in any one respect even though it may be narrower in other respects. For example, original claim 1 recited that the control unit performs particular processing on condition that the determination unit determines that the identification information … matches the reference identification information and the area of contact … falls within the reference range. The amended claim 1 now recites that the control unit performs particular processing on condition that the first information and second information are coincident with each other. This is broader for two reasons. First, the word coincident means "of a similar nature.[1]" As such, coincident is broader than matching. Second, the claim omits the limitation as to the area of contact falling within the reference range. As such, this is a broadening reissue.

When a claim is both broadened and narrowed, the error statement must identify an error that is broadening. However, since Applicant did not show an intent to broaden prior to 2 years from the issue date of the '093 patent, Applicant cannot broaden in this case.

Claims 1-5 are rejected as being based upon a defective reissue declaration under 35 U.S.C. 251 as set forth above. See 37 CFR 1.175.

The nature of the defect(s) in the declaration is set forth in the discussion above in this Office action.

[1] See Merriam-Webster online dictionary from 2/20/2010.

VI. BROADENING

Claims 1-5 are rejected under 35 U.S.C. 251 as being broadened in a reissue application filed outside the two year statutory period. A claim is broader in scope than the original claims if it contains within its scope any conceivable product or process which would not have infringed the original patent. A claim is broadened if it is broader in any one respect even though it may be narrower in other respects.

The Examiner notes that since Applicant is outside of the 2 year window, no broadening is permitted.

VII. CLAIM OBJECTIONS

Claims 1-5 are objected to as being included in an amendment that does not conform to 37 CFR 1.173.

Claim 1 is further objected to because the phrase "area of part" in line 10 appears to be idiomatically incorrect. It appears that is should read area of contact.

VIII. ALLOWABLE SUBJECT MATTER

Claims 1-5 would be allowable if the broadening issue above is corrected.

Claims 1-5 define over the art in that none of the art associates a numeral password with the first information, where the first information comprises first input information corresponding to a pad of the finger and second input information corresponding to a second portion of a finger, as claimed. The combination used in the last office action, Kuncl and Townsend, distinguished between the finger touch and a palm or side of hand touch, but does not have the reference

identification information being based on a first portion of a finger, the pad, and a second portion of the finger. In addition, while Ghassabian does have reference information corresponding to multiple finger portions, the device does not associate a numeral password with the first information, corresponding to first and second portions of the finger

IX. CONCLUSION

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 ROBERT L NASSER whose telephone number is (571)272-4731. The examiner can normally be reached on M-F 8-6.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is

encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Kosowski can be reached on (571) 272-3744. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/ROBERT L NASSER/
Primary Examiner, Art Unit 3992

Conferees:

/ADAM L BASEHOAR/
Primary Examiner, Art Unit 3992

/ALEXANDER J KOSOWSKI/
Supervisory Patent Examiner, Art Unit 3992

Notice of References Cited	Application/Control No. 16/260,879	Applicant(s)/Patent Under Reexamination YAMADA, Masaaki	
	Examiner ROBERT L NASSER	Art Unit 3992	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	CPC Classification	US Classification
	A					
	B					
	C					
	D					
	E					
	F					
	G					
	H					
	I					
	J					
	K					
	L					
	M					

FOREIGN PATENT DOCUMENTS

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

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	merriam-webster dictionary definition of coincident from February 20, 2010.
	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.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/260,879	Filing Date 01/29/2019	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	07/22/2020	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 6	Minus	** 37	= 0		x $100 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	*** 4	= 0		x $460 =	0
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
	☐ Application Size Fee (37 CFR 1.16(s))							
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LIE
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/RHONDA BELL/
*** 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.	

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.

Docket No.: 093265-0063 **PATENT**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Masaaki YAMADA	:	Customer Number: 20277
Application No.: 16/260,879	:	Confirmation No.: 3220
Filed: January 29, 2019	:	Art Unit: 3992
For: INFORMATION PROCESSING APPARATUS	:	Examiner: Nasser, Robert L

AMENDMENT IN RESPONSE TO NON-FINAL OFFICE ACTION UNDER 37 C.F.R. § 1.111

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

Sir:

In response to the Office Action dated January 22, 2020 having a three-month shortened statutory period for response set to expire April 22, 2020, and three-month extension of time up to and including July 22, 2020 being filed concurrently herewith, Applicants respectfully request reconsideration of the above-identified application in view of the following amendments and remarks.

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

Amendments to the Claims begin on page 3 of this paper.

Remarks begin on page 6 of this paper.

AMENDMENT TO THE SPECIFICATION

Please replace the paragraph at column 1, lines 36–59 with the following amended paragraph:

To solve the foregoing problem, an aspect of the present invention provides an information processing apparatus comprising: a touch panel which [displaies] displays a plurality of pieces of identification information including letters, figures, and symbols, and for detecting a contact of the panel with a finger of a user or other objects; a detection unit, when the touch panel detects a contact of the panel with the object, which species identification information indicated by a position of the contact at which the contact in question occurred, of the multiple pieces of identification information displayed on the touch panel, and which detects an area of part where the contact occurred; a storage unit which stores reference identification information and a reference area range; a determination unit which determines whether the identification information detected by the detection unit matches the reference identification information stored in the storage unit and whether the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit; and a control unit which performs particular processing when the determination unit determines that the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detecting unit falls within the reference area range stored in the storing unit.

AMENDMENT TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (Amended) An information processing apparatus comprising:

a touch panel which displays a plurality of pieces of identification information and detecting a contact of the panel with a finger of a user [an object of interest];

a storage unit which stores first information including reference identification information and a reference area range;

a detection unit[,] which detects second information necessary to identify the user when the touch panel detects a contact with the finger of the user [object], wherein detecting the second information includes detecting ~~which specifies~~ (1) identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the panel, and ~~which detects~~ (2) an area of part where the contact occurred;

a control unit which controls the information processing apparatus to operate at least in an identification mode and a registering mode; and

~~a storage unit which stores reference identification information and a reference area range;~~

a determination unit which determines in the identification mode that the first information and the second information are coincident with each other, the determination unit determining whether the identification information detected by the detection unit matches the reference identification information stored in the storage unit and whether the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit, [; and]

wherein [a] the control unit [which] performs particular processing on condition the determination unit determines that the first information and the second information are coincident with each other in the identification mode, ~~the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit~~

wherein the registering mode includes a first registering mode for inputting first input information corresponding to a first portion of the finger and a second registering mode for inputting second input information corresponding to a second portion of the finger,

wherein the reference identification information is generated and stored in the storage unit based on both the first input information and the second input information, the first portion corresponding to a pad of the finger,

wherein the determination unit determines in the identification mode that the first information and the second information are coincident with each other based on the first and second portions of the finger, and

wherein the controller is configured to associate a numeral password with the first information, and the storage unit is configured to store the association between the numeral password and the first information.

2. (Amended) The information processing apparatus according to claim 1, wherein:

[the storage unit stores] the reference identification information and the reference area range stored in the storage unit are based on [, when a predetermined condition is satisfied,] the identification information and the area of the contact detected by the detection unit [as the reference identification information and the reference area range, respectively].

3. (Original) The information processing apparatus according to claim 1 or 2, wherein:

the storage unit stores first identification information and a first area range and second identification information and a second area range as the reference identification information and the reference area ranges; and

the determination unit determines, on condition the identification information detected by the detection unit matches the first identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the first area range stored in the storage unit, whether the identification information detected by the detection unit matches the second identification information stored in the storage unit and the area of the contact detected by the detecting unit falls within the second area range stored in the storing unit.

4. (Original) The information processing apparatus according to claim 1 or 2, wherein:

the storage unit stores a threshold value; and

the reference area range stored in the storage unit is defined based on the threshold value.

5. (Original) The information processing apparatus according to claim 4, wherein:

the area of the contact detected by the detection unit is registered as the threshold value when a predetermined condition is satisfied.

6–34. (Cancelled)

REMARKS

Introduction

Applicant respectfully disagrees with all rejections in the present Office Action. However, in an effort for compact prosecution and to reach compromise with the Office, Applicant has amended the claims in the present Amendment in an effort to obtain reissue in an efficient and expedited manner.

Entry of various comments regarding the claims and/or the art, in the Office Action, should not be construed as any acquiescence or agreement by Applicant with the stated reasoning, regardless of whether or not these remarks specifically address any particular comment from the Office Action.

Status of Claims

Claims 1–34 were pending at the time of the Office Action dated January 22, 2020. By this response, claims 1 and 2 have been amended, and claims 6 and 7 have been canceled, without prejudice, reserving right to prosecution in a reissue continuation/divisional application. Previously added claims 8–34 have also been canceled, without prejudice, reserving right to prosecution in a reissue continuation/divisional application.

Applicant acknowledges, with appreciation, the Examiner's comments on claims 20 and 33 as follows:

> Claims 20 and 33 define over the art in that none of the art associates a numeral password with the first information, where the first information comprises first input information corresponding to a first portion of the finger and second input information corresponding to a second portion of a finger, as claimed. However, before patentability can be pronounced, the rejections above, including the rejection for broadening outside of two years, must be overcome.

The Office Action at page 16.

Support for Claim Changes

Claim 1 has been amended to include claim 20. Support for amendments to claim 1 can be found in, for example, Figs. 1A, 1B, 4A, 4B, 5A, 5B, 7A–7C, 9, 10A, 10B, 12A, 12B, 13, and 14, and relevant description thereof in the specification. Claim 2 has been amended only to rephrase the claimed wording. Care has been exercised to avoid the introduction of new matter.

Reissue Declaration

The Office Action stated that claims 1–34 were rejected as being based upon a defective reissue declaration under 35 U.S.C. § 251. Specifically, the Office Action stated, "[t]he reissue declaration is defective because it is a broadening reissue." The Office Action at page 3.

As discussed below, only to expedite prosecution of the present application, Applicant has amended claim 1 to include claim 20. As indicated in the Reissue Declaration submitted with this Amendment, claim 1 has been amended to become narrower than original claim 1. Claims 2–5 depend on claim 1. Claims 6–34 have been canceled. Applicant, therefore, respectfully solicits withdrawal of the rejection of the claims under 35 U.S.C. § 251.

Broadening

Claims 8–34 were rejected under 35 U.S.C. § 251 as being broadened in a reissue application filed outside the two year statutory period.

Only to expedite prosecution of the present application, Applicant has canceled claims 8–34, rendering this rejection moot.

Objection to the Specification

The specification was objected to in that the change at column 1, line 38, which was made in the certificate of correction, has not been added in the reissue application.

In response, Applicant has amended to include the change made in the certificate of correction in the specification, as set forth above. Withdrawal of the objection to the specification is respectfully solicited.

Claim Rejections under 35 U.S.C. § 112, First Paragraph

Claims 8, 9, 14, 21, 22, and 27 were rejected under 35 U.S.C. § 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement.

Only to expedite prosecution of the present application, Applicant has canceled claims 8, 9, 14, 21, 22, and 27, obviating the basis for this rejection. Withdrawal of the rejection of the claims under35 U.S.C. § 112 is respectfully solicited.

New Matter

The Office Action stated that claims 8–34 were rejected under 35 U.S.C. § 251 as being based upon new matter added to the patent for which reissue is sought.

Only to expedite prosecution of the present application, Applicant has canceled claims 8–34, obviating the basis for this rejection. Withdrawal of the rejection of the claims is respectfully solicited.

Claim Rejection under 35 U.S.C. § 112, Second Paragraph

Claims 2, 3/2–5/2, and 8–34 were rejected under 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the applicant regards as the invention.

Applicant has amended claim 2 only to rephrase the claimed wording, and has canceled claims 8–34 only to expedite prosecution of the present application.

Withdrawal of the rejection of the claims under 35 U.S.C. § 112, second paragraph is respectfully solicited.

Claim Rejection under 35 U.S.C. §§ 102 and 103

1. Claims 1 and 3/1, 6, and 7 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Kuncl (U.S. Patent Application Publication No. 2012/0075098) in view of Townsend et al. (U.S. Patent Application Publication No. 2007/0152976).

2. Claims 2, 3/2, 4, and 5 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Kuncl in vie w of Townsend et al., and further in view of Jones et al. (U.S. Patent Application Publication No. 2010/0180336) and Ghassabian (U.S. Patent Application Publication No. 2005/0253814).

3. Claims 8, 10, 21, and 23 were rejected under pre-AIA 35 U.S.C. § 102(b) as being anticipated by Ghassabian.

4. Claims 9, 22, and 34 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Ghassabian in view of Ningrat (U.S. Patent Application Publication No. 2010/0066701).

5. Claims 11 and 24 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Ghassabian in view of Chen et al. (U.S. Patent Application Publication No. 2010/0060571).

6. Claims 12, 13, 25, and 26 are rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Ghassabian in view of Ryu (U.S. Patent Application Publication No. 2010/0020035).

7. Claims 14 and 27 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Ghassabian in view of Lessing (U.S. Patent Application Publication No. 2010/0045608 and Blow et al. (U.S. Patent Application Publication No. 2012/0032979).

8. Claims 15, 16, 28 and 29 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Ghassabian in view of Ozawa et al. (U.S. Patent Application Publication No. 2010/0110228).

9. Claims 17 and 30 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Ghassabian in view of Nichols (U.S. Patent Application Publication No. 2010/0070931) in view of Ozawa et al.

10. Claims 18, 19, 31, and 32 were rejected under pre-AIA 35 U.S.C. § 103(a) as being unpatentable over Ghassabian in view of Liu et al. (U.S. Patent Application Publication No. 2009/0046065).

Only to expedite prosecution of the present application, Applicant has amended claim 1 to include claim 20.

Applicant, therefore, respectfully solicits withdrawal of the rejection of the claims under 35 U.S.C. §§ 102 and 103.

Claim Construction

The Office Action stated the limitations "controller" and "detector" in claim 8 invoke 35 U.S.C. § 112, sixth paragraph.

Since claim 8 has been canceled in this Amendment, there is no basis in the present application for invoking 35 U.S.C. § 112, sixth paragraph.

Conclusion

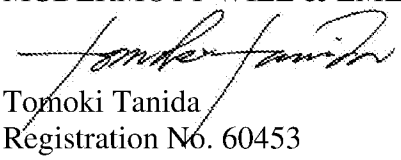
In view of the above amendments and remarks, Applicant submits that this application should be allowed and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper,

including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

MCDERMOTT WILL & EMERY LLP



Tomoki Tanida
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Date: July 22, 2020

Please recognize our Customer No. 20277 as our correspondence address.

PTO/AIA/22 (03-13)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)	Docket Number (Optional) 093265-0063
Application Number 16/260,879-Conf. #3220	Filed January 29, 2019
For INFORMATION PROCESSING APPARATUS	
Art Unit 3992	Examiner R. L. Nasser

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	Micro Entity Fee	
☐ One month (37 CFR 1.17(a)(1))	$200	$100	$50	$
☐ Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☒ Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$ 1,400.00
☐ Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐ Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☒ The Director has already been authorized to charge fees in this application to a Deposit Account.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-0417 .

☒ 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.

☒ attorney or agent of record. Registration number 60,453 .

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

/Tomoki Tanida/ — Signature
July 22, 2020 — Date

Tomoki Tanida — Typed or printed name
(202) 756-8196 — 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 1 forms are submitted.

Doc code: REIS.DECL
Document Description: Reissue Declaration Filed In Accordance With MPEP 1414

PTO/AIA/07 (09-13)
Approved for use through 01/31/2020. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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SUBSTITUTE STATEMENT IN LIEU OF AN OATH OR DECLARATION FOR REISSUE PATENT APPLICATION (35 U.S.C. 115(d) AND 37 CFR 1.64)

Title of Invention	INFORMATION PROCESSING APPARATUS

This statement is directed to:

[ ] The attached application,

OR

[x] was filed on 01/29/2019 as reissue application number 16/260,879.

LEGAL NAME of inventor to whom this substitute statement applies:

(*E.g.*, Given Name (first and middle (if any)) and Family Name or Surname)

Masaaki YAMADA

Residence (except for a deceased or legally incapacitated inventor):

Yokohama		Japan
City	State	Country

Mailing Address (except for a deceased or legally incapacitated inventor):

c/o Hitachi, Ltd., Intellectual Property Group, 6-1, Marunouchi 1-chome, Chiyoda-ku

Tokyo		100-8220	Japan
City	State	Zip	Country

I believe the above-named inventor or joint inventor to be the original inventor or an original joint inventor of a claimed invention in the application.

The above-identified application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this statement is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Relationship to the inventor to whom this substitute statement applies:

[ ] Legal Representative (for deceased or legally incapacitated inventor only),

[x] Assignee, or

[ ] Joint Inventor.

Circumstances permitting execution of this substitute statement:

[ ] Inventor is deceased,

[ ] Inventor is under legal incapacity,

[x] Inventor cannot be found or reached after diligent effort, or

[ ] Inventor has refused to execute the oath or declaration under 37 CFR 1.175.

Samsung - Exhibit 1005 - Page 548

PTO/AIA/07 (09-13)
Approved for use through 01/31/2020. OMB 0651-0033
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.

SUBSTITUTE STATEMENT IN LIEU OF AN OATH OR DECLARATION FOR REISSUE PATENT APPLICATION (35 U.S.C. 115(d) AND 37 CFR 1.64)

If there are joint inventors, please check the appropriate box below:

[x] An application data sheet under 37 CFR 1.76 (PTO/AIA/14 or equivalent) naming the entire inventive entity has been or is currently submitted.

OR

[ ] An application data sheet under 37 CFR 1.76 (PTO/AIA/14 or equivalent) has not been submitted. Thus, a Substitute Statement Supplemental Sheet (PTO/AIA/11 or equivalent) naming the entire inventive entity and providing inventor information is attached. See 37 CFR 1.64(b).

I believe the original patent to be wholly or partly inoperative or invalid, for the reasons described below.
(Check all boxes that apply.)

[ ] by reason of a defective specification or drawing.

[x] by reason of the patentee claiming more or less than he had the right to claim in the patent.

[ ] by reason of other errors.

At least one error upon which reissue is based is described below. If the reissue is a broadening reissue, a claim that the application seeks to broaden must be identified:

At least the scope of amended claim 1 is narrower than the scope of original claim 1. For example, amended claim 1 further recites, "the controller is configured to associate a numeral password with the first information, and the storage unit is configured to store the association between the numeral password and the first information."

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

PERSON EXECUTING THIS SUBSTITUTE STATEMENT:

Name: Tatsuya Yamamoto	Date (Optional): July 22, 2020

Signature: /Tatsuya Yamamoto/

APPLICANT NAME AND TITLE OF PERSON EXECUTING THIS SUBSTITUTE STATEMENT:

If the applicant is a juristic entity, list the applicant name and the title of the signer.

Applicant Name: MAXELL, LTD.

Title of Person Executing This Substitute Statement: General Manager, IP Innovation Business Unit, Maxell, Ltd.

The signer, whose title is supplied above, is authorized to act on behalf of the applicant.

SUBSTITUTE STATEMENT IN LIEU OF AN OATH OR DECLARATION FOR REISSUE PATENT APPLICATION (35 U.S.C. 115(d) AND 37 CFR 1.64)

Residence of the signer (unless provided in an application data sheet, PTO/SB/14 or equivalent):

CityKyoto	State	Japan Country

Mailing Address of the signer (unless provided in an application data sheet, PTO/SB/14 or equivalent):

c/o MAXELL, LTD., 1 Koizumi, Oyamazaki, Oyamazaki-cho, Otokuni-gun

Kyoto City	State	Zip	Japan Country

Note: Use an additional PTO/AIA/07 form for each inventor who is deceased, legally incapacitated, cannot be found or reached after diligent effort, or has refused to execute the oath or declaration under 37 CFR 1.63.

Electronic Patent Application Fee Transmittal

Application Number:	16260879
Filing Date:	29-Jan-2019
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Filer:	Tomoki Tanida/Lisa Grant
Attorney Docket Number:	093265-0063

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

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($)
Extension - 3 months with $0 paid	1253	1	1400	1400
Miscellaneous:				
			Total in USD ($)	**1400**

Electronic Acknowledgement Receipt

EFS ID:	40069859
Application Number:	16260879
International Application Number:	
Confirmation Number:	3220
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Customer Number:	20277
Filer:	Tomoki Tanida/Lisa Grant
Filer Authorized By:	Tomoki Tanida
Attorney Docket Number:	093265-0063
Receipt Date:	22-JUL-2020
Filing Date:	29-JAN-2019
Time Stamp:	10:18:19
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1400
RAM confirmation Number	E20207LA18495636
Deposit Account	500417
Authorized User	Lisa Grant

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		879Amend.pdf	61201 a3f66884e27f9bb6715bf8d980d3b7ff0eaeb405	yes	10
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Specification		2	2	
	Claims		3	5	
	Applicant Arguments/Remarks Made in an Amendment		6	10	
Warnings:					
Information:					
2	Extension of Time	879Ext.pdf	21314 3a5ba577dafe6785537126f5ceab10c22148f0a7	no	1
Warnings:					
Information:					
3	Reissue dec filed in accordance with MPEP 1414	879SubStatement.pdf	128223 d3f317305f57545bc08a33c675840f574aa29cc8	no	3
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30685 4881b790a099be60c30f72c7c61a53191186d8a9	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	241423		

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
16/260,879	01/29/2019	Masaaki YAMADA	093265-0063	3220

20277 7590 01/22/2020

MCDERMOTT WILL & EMERY LLP
THE MCDERMOTT BUILDING
500 NORTH CAPITAL STREET, N.W.
WASHINGTON, DC 20001

EXAMINER	
NASSER, ROBERT L	

ART UNIT	PAPER NUMBER
3992	

NOTIFICATION DATE	DELIVERY MODE
01/22/2020	ELECTRONIC

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

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

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

ipdocketmwe@mwe.com

Office Action Summary	Application No. 16/260,879	Applicant(s) YAMADA, Masaaki	
	Examiner ROBERT L NASSER	Art Unit 3992	AIA (FITF) Status No

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

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

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

Status

1)☑ Responsive to communication(s) filed on 1/29/2019.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

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

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

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

Disposition of Claims*

5) ☑ Claim(s) 1-34 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) 1-34 is/are rejected.

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

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

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to **PPHfeedback@uspto.gov.**

Application Papers

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

11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

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

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

Priority under 35 U.S.C. § 119

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

Certified copies:

a)☐ All b)☐ Some** c)☐ None of the:

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

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

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

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

Attachment(s)

1) ☑ Notice of References Cited (PTO-892)

2) ☑ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date 1/29/2019 and 2/15/2019.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date _____.

4) ☐ Other: _____.

DETAILED ACTION

I. ACKNOWLEDGEMENTS

This non-final Office Action addresses U.S. Application No. 16/260,879 (the "879 Application" or "instant application"). Based upon a review of the instant application, the actual filing date of the instant application is December 11, 2017. Because the instant application was on or after September 16, 2012, the statutory provisions of the America Invents Act ("AIA") will govern this proceeding.

The instant application is a reissue application US Patent No. 8,654,093, ("'093 Patent"), which was filed as US Application 13/366983 ("the '983 Application"), entitled "INFORMATION PROCESSING APPARATUS."

Based upon Applicant's statements as set forth in the instant application and after the Examiner's independent review of the '093 patent itself and its prosecution history, the Examiner finds that he cannot locate any ongoing proceeding before the Office or current ongoing litigation involving the '093 patent. Also based upon the Examiner's independent review of the '093 patent itself and the prosecution history, the Examiner cannot locate any previous reexaminations, supplemental examinations, or certificates of correction.

II. CLAIM STATUS

The '093 Patent issued with claims 1-7 ("Patented Claims"). The preliminary amendment filed with this reissue application adds claims 8-33. The preliminary amendment of 4/8/2019 adds claim 34. As of the date of this Office Action, the status of the claims is:

a. Claims 1-34 ("Pending Claims").

b. Claims 1-34 are treated on the merits below ("Examined Claims")

III. PRELIMINARY AMENDMENTS OF 1/29/2019 AND 4/8/2019

The amendment to the specification and claims filed on 1/29/2019 and 4/8/2019 have been entered and considered.

IV. PRIORITY CLAIMS

Based upon a review of the instant application and '093 patent, the Examiner finds that the '093 patent does not claim any domestic priority.

Based upon a review of the '093 Patent itself, the Examiner finds that Applicant is claiming foreign priority under 35 USC § 119(a) to Japanese document 2011-025576, filed February 9, 2011.

Because the effective filing date of the instant application is *not* on or after March 16, 2013, the AIA First Inventor to File ("AIA-FITF") provisions do *not* apply. Instead, the earlier 'First to Invent' provisions apply.

V. REISSUE DECLARATION

The reissue declaration is defective because it is a broadening reissue, but does not identify a claim being broadened and specific language being removed via reissue. The declaration states that this is a narrowing reissue. However, the claims are broadened in some respects. While the new claims are narrowed in some regards, a claim is considered to be broadened if it is broader in any one respect even though it may be narrower in other respects. As to claim 8, while it is narrower in some respects, the claim broadens other aspects of the claims. For instance, claim 8 omits the limitation from claims 1 and 6 of "a touch panel which

displays a plurality of pieces of information and detecting a contact of the panel with an object of interest." Instead, claim 8 merely states "a touch panel configured to detect a contact of a finger of a user." Further, claim 8 omits the detection unit, storage unit, and control unit of claims 1 and 6, and the determination unit of claim 1. As such, claims 8-20 are broadened.

As to claim 21, the new claim is a method claim. Changing claimed inventions is broadening in and of itself, as it allows the patent owner to sue parties for infringement which could not previously been sued. See MPEP 1412.03. Further, claim 21 lacks the limitation that the touch panel displays a plurality of pieces of information and detecting contact with an object of interest, and further omits limitations equivalent to the detection unit, storage unit, determination unit, and control unit of claims 1 and/or 6. As such, claims 21-34 are broadened.

When a claim is both broadened and narrowed, the error statement must identify an error that is broadening.

Claims 1-34 are rejected as being based upon a defective reissue declaration under 35 U.S.C. 251 as set forth above. See 37 CFR 1.175.

The nature of the defect(s) in the declaration is set forth in the discussion above in this Office action.

VI. BROADENING

Claims 8-34 are rejected under 35 U.S.C. 251 as being broadened in a reissue application filed outside the two year statutory period. A claim is broader in scope than the original claims if it contains within its scope any conceivable product or process which would not have infringed the original patent. A claim is broadened if it is broader in any one respect even though it may be narrower in other respects.

The Examiner notes that since Applicant is outside of the 2 year window, no broadening is permitted.

VII. OBJECTIONS TO THE SPECIFICATION

The specification is objected to in that the change at column 1, line 38, which was made in the certificate of correction, has not been added in the reissue application. Applicant should present an amended paragraph that conforms to 37 CFR 1.173. See MPEP 1411.01, 1453(IV) and 1453(VI)c.

VIII. WRITTEN DESCRIPTION

The following is a quotation of the first paragraph of pre-AIA 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 8, 9, 14, 21, 22, and 27 are rejected under 35 U.S.C. 112(a) or 35 U.S.C. 112 (pre-AIA), first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor or a joint inventor, or for pre-AIA the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claims 8 and 21 both recite storing first information corresponding to a fingerprint of the user. There is no support for storing information related to a fingerprint, as the specification discloses storing information as to the fingertip or finger pad.

Claims 9 and 22 are rejected in that there is no support for the screen being made up of capacitive plates. Rather, the disclosure is for sensors that vary in capacitance, but the sensors do not appear to be plates.

Claims 14 and 27 are rejected in that there is no support for displaying images of the portion of the fingerprint detected, as there is no support for using a fingerprint.

Claims 18, 19, 31, and 32 are rejected in that there is no algorithm or steps for performing the method disclosed. Specifically, there is no mention of determining whether there is sufficient contact.

IX. NEW MATTER

Claims 8-34 are rejected under 35 U.S.C. 251 as being based upon new matter added to the patent for which reissue is sought.

The added material which is not supported by the prior patent is discussed immediately above in the written description rejection.

X. REJECTIONS UNDER 35 USC 112, SECOND PARAGRAPH

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 2, 3/2-5/2, and 8-34 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 2 is rejected as being indefinite in that it is unclear how the contact area is stored as a range. In other words, a contact area is a single point, but a range, by definition, is at least two points.

Claims 8 and 21 are rejected in that there is no antecedent basis for the generation of the second information in the third to last line, as the previous recitation was a detector that detects the second information.

Claim 13 is rejected in that there is no antecedent basis for the identification mode, as claim 13 depends on claim 1, but the identification mode is only recited in claim 8. For the purposes of art, the claim will be treated as if it depends on claim 8.

XI. ART REJECTIONS

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

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of pre-AIA 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, 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.

Claims 1, 3/1, 6, and 7 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Kuncl US PG PUB 2012/0075098 in view of Townsend et al US PG PUB 2007/0152976.

Kuncl shows a typical touch screen device, in figure 4a, where the user touches the number corresponding to the desired input value and the password is compared to a known password to authenticate the device (see paragraph [0047]. As such, Kuncl has a touch panel which displays pieces of information, i.e. the numbers on the keypad, and detects contact with the numbers, a storage unit of some kind which stores a reference id code (the device must inherently have a storage medium storing a reference code for the code be known to it, as described in paragraph [0047]). Kuncl further must have a determination unit that determines whether the inputted code matches the code known to the device, and a control unit, i.e. processors 210, which perform a first processing when the pass codes match, i.e. unlocks the device. It does not compare a range of contact to a reference range, as claimed. However, Townsend teaches device for eliminating unintentional touches based on the area of contact, as shown in figures 6 and 7. When the area of contact is above a threshold, i.e. outside of a reference range, the touch is rejected (see paragraph [0036]). As such, it would have been obvious to modify Kuncl to use scheme like that of Townsend to reject unwanted touches, to ensure the accuracy of the device. Therefore, the combination would have to store a range of acceptable contact area and well as the id code, and detect when the touch is in the range as well as when the codes match. As such, the combination meets claim 1.

As to claim 3/1, there are 4 digits in the passcode, so there is first and second identification information and touch area values stored and compared.

Claim 6 is rejected for the reasons given above.

Claim 7 is rejected in that the system of the combination performs first processing, unlocking the system, when the password and contact area match the stored password and first set of ranges (all corresponding to finger touches) and a second set of processing when the

password matches, but the contact area is in a second range, i.e. corresponding to a hand or palm or side of hand.

Claims 2, 3/2, and 4-5 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Kuncl in view of Townsend et al, as applied to claims 1, 3/1, 6, and 7 above, further in view of Jones et al US PG PUB 2010/0180336 and Ghassabian US PG PUB 2005/0253814.

The Examiner notes that the Kuncl teaches comparing the input password to a known password, but does not teach how the known value is stored. Jones teaches in paragraphs [0022] and [0023], a method for entering a password and storing the password as a known value for later comparison. As such, it would have been obvious to modify Kuncl to use the password generating method of Jones, as it is merely the use of a known method to generate a known value for a password. The combination does not save the input touch area as a reference. However, in paragraph [0146], Ghassabian teaches calibrating a touch screen for an individual user for finger size. As such, it would have been obvious to modify the combination to use such a calibration mode, to tune the specific device to the specific user, to further prevent false inputs. As such, in the combination, when a condition is satisfied, i.e. in calibration or set up mode, the system would store the identification information and contact area as reference values.

As to claim 3/2, there are 4 digits in the passcode, so there is first and second identification information and touch area values stored and compared.

As to claims 4 and 5, in Townsend, there is a reference value stored, i.e. the area of contact corresponding to a threshold differentiating finger from side of hand, for example, and used to generate the reference range.

Claims 8, 10, 21, and 23 are is/are rejected under pre-AIA 35 U.S.C. 102b as being anticipated by Ghassabian.

As to claim 8, Ghassabian shows a system that executes different functions based on the portion of the finger contacting the screen. Specifically, Ghassabian has a touch panel 1408 (see paragraphs [0032], [0144], and [0176]). In addition, the system of Ghassabian operates in two modes, an identification mode, i.e. a mode that identifies the portion of the finger touching the screen (see paragraph [0143] and a registration mode, i.e. a mode that calibrates the system (see paragraph [0146]). The system stores first information regarding the portion of the user's finger that touches the finger pad during an identification mode (the information as to the fingertip or flat portion of the finger, discussed in paragraphs [0143] and [0180] must be stored in a memory in order to be able to match the information detected to the information from calibration). The Examiner further notes that the claim requires that the first information is related to identification of a user. However, the Examiner notes that the claim does not require using the first information to identify the user. The information stored in Ghassabian, i.e. finger pad or fingertip, is the same information stored by Applicant's invention. As such, it is information relating to identification of a user. Ghassabian then has a detector, 1408, that detects second information needed to identify the user when the user contacts the pad 1408 with a finger (see paragraph [0143]. In other words, the memory stores the information gathered during calibration and the detector detects the information during contact with the pad. When the first information and second information match, a specific process is executed, for example inputting a specific letter or function (see paragraphs [0143] and [0180]). The Examiner further notes that the registration mode, i.e. calibration mode, has a mode to store information regarding the tip of the finger, and a different portion, for example the flat portion, of a finger (see paragraph [0146]). The second information is based on whether the fingertip or pad contacts the pad 1408. The Examiner notes that Ghassabian does not specifically state that there is a controller. However, in

paragraph [0143], Ghassabian states that the method is used in a computer (see also paragraphs [0025], [0087], and [0130]). A computer necessarily has a controller. Hence, Ghassabian anticipates the claim.

As to claim 10, the second portion of the finger is the edge of the finger, i.e. the nail or tip.

Claims 21 and 23 are rejected for the reasons given above.

Claims 9, 22, and 34 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ghassabian in view of Ningrat US PG PUB 2010/0066701.

Ghassabian does not teach the structure of the touch screen. However, in figures 1 and 2 and paragraphs [0007] and [0008], Ningrat teaches a typical touch screen structure where grid of capacitive plate sensors change their capacitance when the screen is touched. As such, it would have been obvious to modify Ghassabian to use such a screen structure, as it is merely the use of a well-known touch screen in the art.

Claims 11 and 24 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ghassabian in view of Chen et al US PG PUB 2010/0060571.

Ghassabian does not teach displaying images and descriptive text during the registration of calibration mode, discussed in paragraph [0146]. However, Chen teaches what is well known, that when calibrating a device, the computer can display an image and instructions for performing the calibration. As such, it would have been obvious to modify Ghassabian to use such a display or instructions, as it is merely the use of a known calibration technique.

Claims 12, 13, 25, and 26 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ghassabian in view of Ryu US PG PUB 2010/0020035.

Ghassabian does not teach unlocking the device based on the first information about the finger portions, but it does reference using the portions of the finger for security (see paragraph [0103]. Ryu teaches that is it well known to use contact attributes of the contact with a touch screen and finger to unlock a device. As such, it would have been obvious to modify Ghassabian to use contact area, i.e. finger portions, to unlock the device, to further enhance security of the device.

Claims 14 and 27 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ghassabian in view of Lessing US PG PUB 2010/0045608 and Blow et al US PG PUB 2012/0032979

Ghassabian does not teach displaying a shaded region corresponding to the contact area during calibration. In figures 5A and 5B, Lessing illustrates the contact area of a fingertip or finger pad touch on a grid. While it is not explicitly displayed, it would have been obvious to one skilled in the art to display such information, to allow the user to understand the difference between the different kinds of touches. The area is not shaded. Blow is selected from a myriad of references that teach indicating a contact area with shading. As such, it would have been obvious to modify the combination to shade the contact area, as it is merely the substitution of one known contact area depiction method for another.

Claims 15, 16, 28 and 29 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ghassabian in view of Ozawa et al US PG PUB 2010/0110228.

Ghassabian does not discuss all 4 of the functions listed in claims 15 and 28. However, Ozawa teaches that it is well known to detect a pinch, flick, drag and tap in a touch screen

(paragraph [0068]). As such, it would have been obvious to modify Ghassabian to recognize the different types of finger inputs, as it is simply the use of a known input technique in touch screens.

As to claims 16 and 29, Ozawa teaches the specific methods of detecting each of the operations in paragraphs [0069] - [0072].

Claims 17 and 30 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ghassabian in view of Nichols US PG PUB 2010/0070931 in view of Ozawa et al.

Ghassabian does not teach dragging an icon to move the icon. Nichols teaches this feature in figures 7A and 7B and the associated discussion. Hence, it would have been obvious to modify Ghassabian to move the icons by dragging the icons, as it is merely the use of a known method of organizing icons in a smartphone, like that in Ghassabian. Further, Ozawa teaches detecting a drag by contact for a period of time in paragraphs [0069] - [0072]. Hence, it would have been obvious to modify the combination to use the method for drag detection of Ozawa, as it is merely the use of a well-known method for detecting a drag operation.

Claims 18, 19, 31, and 32 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Ghassabian in view of Liu et al 2009/0046065.

Ghassabian does not determine whether there is sufficient contact. However, Liu teaches that it is known to determine whether a key press was considered sufficient by measuring the force applied. It would have been obvious to modify Ghassabian to use such a force detecting step to identify sufficient contact, to prevent inadvertent touches from registering.

XII. CLAIM CONSTRUCTION

The claims in this application are given their broadest reasonable interpretation using the plain meaning of the claim language in light of the specification as it would be understood by one of ordinary skill in the art. The broadest reasonable interpretation of a claim element (also commonly referred to as a claim limitation) is limited by the description in the specification when 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is invoked.

As explained in MPEP § 2181, subsection I, claim limitations that meet the following three-prong test will be interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph:

(A) the claim limitation uses the term "means" or "step" or a term used as a substitute for "means" that is a generic placeholder (also called a nonce term or a non-structural term having no specific structural meaning) for performing the claimed function;

(B) the term "means" or "step" or the generic placeholder is modified by functional language, typically, but not always linked by the transition word "for" (e.g., "means for") or another linking word or phrase, such as "configured to" or "so that"; and

(C) the term "means" or "step" or the generic placeholder is not modified by sufficient structure, material, or acts for performing the claimed function.

Use of the word "means" (or "step") in a claim with functional language creates a rebuttable presumption that the claim limitation is to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites sufficient structure, material, or acts to entirely perform the recited function.

Absence of the word "means" (or "step") in a claim creates a rebuttable presumption that the claim limitation is not to be treated in accordance with 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph. The presumption that the claim limitation is not interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, is rebutted when the claim limitation recites function without reciting sufficient structure, material or acts to entirely perform the recited function.

Claim limitations in this application that use the word "means" (or "step") are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action. Conversely, claim limitations in this application that do not use the word "means" (or "step") are not being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, except as otherwise indicated in an Office action.

This application includes one or more claim limitations that do not use the word "means," but are nonetheless being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, because the claim limitation(s) uses a generic placeholder that is coupled with functional language without reciting sufficient structure to perform the recited function and the generic placeholder is not preceded by a structural modifier. Such claim limitation(s) is/are:

1) controller in claim 8.

2. detector in claim 8.

Because this/these claim limitation(s) is/are being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, it/they is/are being interpreted to cover the corresponding structure described in the specification as performing the claimed function, and equivalents thereof.

If applicant does not intend to have this/these limitation(s) interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph, applicant may: (1) amend the claim limitation(s) to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph (e.g., by reciting sufficient structure to perform the claimed function); or (2) present a sufficient showing that the claim limitation(s) recite(s) sufficient structure to perform the claimed function so as to avoid it/them being interpreted under 35 U.S.C. 112(f) or pre-AIA 35 U.S.C. 112, sixth paragraph.

XIII. ALLOWABLE SUBJECT MATTER

Claims 20 and 33 define over the art in that none of the art associates a numeral password with the first information, where the first information comprises first input information corresponding to a first portion of the finger and second input information corresponding to a second portion of a finger, as claimed. However, before patentability can be pronounced, the rejections above, including the rejection for broadening outside of two years, must be overcome.

XIV. PRIOR ART

Aguera-Arcas et al US PG PUB 2012/0284297 teaches unlocking a touch screen with a gesture and password in paragraph [0003].

Wang et al US PG PUB 2012/0192100 teaches unlocking a touch screen with a gesture and password in paragraph [0058].

Wu et al US PG PUB 2012/0229406 teaches unlocking a touch screen based on contact area shape.

Rosenberg US PG PUB 2007/0097096 performs different functions based on fingertip versus finger pad contact to a touch screen.

XIII. CONCLUSION

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT L NASSER whose telephone number is (571)272-4731. The examiner can normally be reached on M-F 8-6.

Examiner interviews are available via telephone, in-person, and video conferencing using a USPTO supplied web-based collaboration tool. To schedule an interview, applicant is encouraged to use the USPTO Automated Interview Request (AIR) at http://www.uspto.gov/interviewpractice.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexander Kosowski can be reached on (571) 272-3744. 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 https://ppair-my.uspto.gov/pair/PrivatePair. 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.

/ROBERT L NASSER/
Primary Examiner, Art Unit 3992

Conferee:

/ADAM L BASEHOAR/
Primary Examiner, Art Unit 3992
/M.F/
Supervisory Patent Examiner, Art Unit 3992

Notice of References Cited	Application/Control No. 16/260,879	Applicant(s)/Patent Under Reexamination YAMADA, Masaaki	
	Examiner ROBERT L NASSER	Art Unit 3992	Page 1 of 2

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*	D	US-20050253814-A1	11-2005	Ghassabian, Firooz	G06F1/1616	345/168
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	Examiner ROBERT L NASSER	Art Unit 3992	Page 2 of 2

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Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	16/260,879	YAMADA, Masaaki
	Examiner	Art Unit
	ROBERT L NASSER	3992

CPC - Searched*		
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CPC Combination Sets - Searched*		
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	
Filing Date	2019-01-29
First Named Inventor	Masaaki YAMADA
Art Unit	N/A
Examiner Name	Not Yet Assigned
Attorney Docket Number	093265-0063

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5844547	A	1998-12-01	Minakuchi et al.	Corresponds to JP 5-100809A

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	1	20050162407	A1	2005-07-28	Sakurai et al.	Corresponds to JP 2005-202527A
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	1	2005-202527	JP	A	2005-07-28	Fujitsu Component Ltd.	Corresponds to U.S. 2005/0162407A1	
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	
	Filing Date	2019-01-29
	First Named Inventor	Masaaki YAMADA
	Art Unit	N/A
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	093265-0063

	3	201101130	TW	A1	2011-01-01	AU OPTRONICS CORP	w/English Language Abstract	

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	1	Entire Prosecution of U.S. Patent Application No. 13/366,983, filed February 6, 2012, now U.S. Patent No. 8,654,093, issued February 18, 2014 to YAMADA entitled "INFORMATION PROCESSING APPARATUS".	
	2	Entire Prosecution of U.S. Patent Application No. 14/154,993, filed January 14, 2014, now U.S. Patent No. 8,982,086, issued March 17, 2015 to YAMADA entitled "INFORMATION PROCESSING APPARATUS".	
	3	Chinese Office Action issued in corresponding Chinese Patent Application No. 2014062700460410, dated July 2, 2014.	

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Examiner Signature	/ROBERT L NASSER/	Date Considered	12/18/2019

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	Application Number	
	Filing Date	2019-01-29
	First Named Inventor	Masaaki YAMADA
	Art Unit	N/A
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	093265-0063

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Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement 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 the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Tomoki Tanida/	Date (YYYY-MM-DD)	2019-01-29
Name/Print	Tomoki Tanida	Registration Number	60453

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

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

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16260879
Filing Date	2019-01-29
First Named Inventor	Masaaki YAMADA
Art Unit	2624
Examiner Name	Not Yet Assigned
Attorney Docket Number	093265-0063

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	5	9304602	B2	2016-04-05	Ghassabian	
	6	7982721	B2	2011-07-19	Hio	
	7	8528073	B2	2013-09-03	Tawara	
	8	6360004	B1	2002-03-19	Akizuki	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.L.N/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16260879
	Filing Date	2019-01-29
	First Named Inventor	Masaaki YAMADA
	Art Unit	2624
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	093265-0063

	9	7345675	B1	2008-03-18	Minakuchi et al.	Corresponds to JP H05100809

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20090313693	A1	2009-12-17	ROGERS	
	2	20090169070	A1	2009-07-02	Fadell	
	3	20100225443	A1	2010-09-09	Bayram et al.	
	4	20100279738	A1	2010-11-04	KIM et al.	
	5	20050253814	A1	2005-11-17	Ghassabian	
	6	20070152976	A1	2007-07-05	Townsend et al.	
	7	20100303311	A1	2010-12-02	SHIN et al.	
	8	20100325721	A1	2010-12-23	Bandyopadhyay et al.	

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.L.N/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	16260879
	Filing Date	2019-01-29
	First Named Inventor	Masaaki YAMADA
	Art Unit	2624
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	093265-0063

	9	20120056846	A1	2012-03-08	Zaliva	
	10	20060066589	A1	2006-03-30	Ozawa et al.	Corresponds to CN 1755604
	11	20100097176	A1	2010-04-22	SAKURAI et al.	
	12	20110310049	A1	2011-12-22	Homma et al.	Corresponds to WO 2010/104015
	13	20070097096	A1	2007-05-03	Rosenberg	

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FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	1755604	CN	A	2006-04-05	Tokyo Shibaura Electric Co.	English abstract, corresponds to U.S. 2006/0066589	
	2	2010/104015	WO	A1	2010-09-16	Sony Corporation	English abstract, corresponds to U.S. 2011/0310049	
	3	1226691	CN	A	2005-11-09		English abstract of CN 1567288	
	4	H05100809	JP	A	1993-04-23	Fujitsu Ltd.	English abstract, corresponds to U.S. 7,345,675	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

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Application Number	16260879
Filing Date	2019-01-29
First Named Inventor	Masaaki YAMADA
Art Unit	2624
Examiner Name	Not Yet Assigned
Attorney Docket Number	093265-0063

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	NUMABE et al., "Finger Identification for Touch Panel Operation Using Tapping Fluctuation," The 13th IEEE International Symposium on Consumer Electronics, pgs. 899-902 (2009)	
	2	ELECCION, "Automatic Fingerprint Identification," IEEE Spectrum (1973)	
	3	HOLZ et al., "The Generalized Perceived Input Point Model and How to Double Touch Accuracy By Extracting Fingerprints," Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (2010)	
	4	WANG et al., "Detecting and Leveraging Finger Orientation for Interaction With Direct-Touch Surfaces," Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology (2009)	
	5	SAEVANEE et al., "User Authentication Using Combination of Behavioral Biometrics Over the Touchpad Acting Like Touch Screen of Mobile Device," International Conference on Computer and Electrical Engineering (2008)	
	6	HARRISON et al., "TapSense: Enhancing Finger Interaction on Touch Surfaces," Proceedings of the 24th Annual ACM Symposium on User Interface Software and Technology (2011)	

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature	/ROBERT L NASSER/	Date Considered	12/18/2019

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

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /R.L.N/

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	16260879
Filing Date	2019-01-29
First Named Inventor	Masaaki YAMADA
Art Unit	2624
Examiner Name	Not Yet Assigned
Attorney Docket Number	093265-0063

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

That each item of information contained in the information disclosure statement 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 the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement 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 information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Bernard P. Codd/	Date (YYYY-MM-DD)	2019-02-15
Name/Print	Bernard P. Codd	Registration Number	46,429

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

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

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

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	2	"20100020035" and area	US-PGPUB; USPAT	OR	ON	2020/01/09 10:21
L2	992877	touch adj (screen or panel)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:24
L3	100	L2 and (unlock$ with finger with portion)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:24
L4	1	"8654085".pn. and (finger with portion)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:30
L5	2	"20100045608" and (finger with portion)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:33
L6	2	"20100045608" and unlock$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 10:35
L7	11	("20030076306" | "20040204129" | "20040207606" | "20040263488" | "20060044280" | "20060218325" | "20080100586" | "6340979" | "7800592").PN. OR ("8654085").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:38
L8	9	7 and finger	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:41
L9	1	"20040204129" and (firm and light)	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:44
L10	2	7 and unlock$3	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 10:46
L11	2	"20100020035" and unlock$3	US-PGPUB; USPAT	OR	ON	2020/01/09 10:51

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L12	0	"20050253814" and unlock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/09 10:51
L13	1	"20050253814" and security	US-PGPUB; USPAT	ADJ	ON	2020/01/09 10:52
L14	0	"20040204129" and (firm and light) and shad$3	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/09 11:00
L15	0	"20100045608" and unlock$3 and shad$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:01
L16	10	L2 and display with touch with shad$ with circle$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:05
L17	188	L2 and display with shad$ with circle$4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:07
L18	9	L2 and display with contact adj area with shad$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:10
L19	136	L2 and display with contact near10 shad$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:13
L20	92	L2 and display with contact near10 shadow	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:14
L21	44	19 not 20	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/09 11:14
L22	2	"20120284297"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:28
L23	2	"20120289201"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:30
L24	1	"20120192100"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:30
L25	1	"20120229406"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32
L26	0	"20120229406" and hsape	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32

L27	1	"20120229406" and shape	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32
L28	1	"20120229406" and shape with unlock	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:32
L29	1	"20070097096"	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:34
L30	0	"20070097096" and unlock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:35
L31	111	blow.in.	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:46
L32	8	blow.in. and touch	US-PGPUB; USPAT	ADJ	ON	2020/01/09 11:46
S1	1	"8654093".pn.	USPAT	OR	OFF	2019/12/09 15:52
S2	1	"8982086".pn.	USPAT	OR	OFF	2019/12/09 15:54
S3	0	"8654093".pn. and fingerprint	USPAT	OR	OFF	2019/12/10 13:16
S4	0	"8654093".pn. and finger adj print	USPAT	OR	OFF	2019/12/10 13:16
S5	0	"8654093".pn. and finger adj print	USPAT	OR	ON	2019/12/10 13:17
S6	0	"8654093".pn. and fingerprint	USPAT	OR	ON	2019/12/10 13:17
S7	1	"8654093".pn. and reference	USPAT	OR	ON	2019/12/10 13:18
S8	0	"8654093".pn. and threshhold	USPAT	OR	ON	2019/12/10 13:20
S9	1	"8654093".pn. and threshold	USPAT	OR	ON	2019/12/10 13:20
S10	0	"20050162407"	USPAT	OR	ON	2019/12/10 17:10
S11	1	"20050162407"	US-PGPUB; USPAT	OR	ON	2019/12/10 17:10
S12	25	touch adj (screen or panel) same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/10 17:12
S13	108	("2007/0097096").URPN.	USPAT	OR	OFF	2019/12/11 12:23
S14	3	S13 and ((fingertip or (finger adj tip)) and (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:29
S15	0	("8654093").URPN.	USPAT	OR	OFF	2019/12/11 12:32
S16	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:34
S17	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:35
S18	4	(password same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:35

S19	0	(pid same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:35
S20	1	(code same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2019/12/11 12:36
S21	2	("20050162407" | "5844547").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2019/12/11 12:36
S22	1	"8654093".pn. and range	USPAT	OR	ON	2019/12/11 13:29
S23	687910	touch adj (screen or panel)	US-PGPUB; USPAT	OR	ON	2019/12/11 14:32
S24	12567	S23 and (contact adj area)	US-PGPUB; USPAT	OR	ON	2019/12/11 14:32
S25	809	((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/16 18:17
S26	173	touch adj (screen or panel) and ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2019/12/16 18:18
S27	0	unlock with screen with contact adj area with threshold	US-PGPUB; USPAT	OR	ON	2020/01/06 11:34
S28	0	unlock$3 with screen with contact adj area with threshold	US-PGPUB; USPAT	OR	ON	2020/01/06 11:34
S29	29	unlock$3 with screen with area with threshold	US-PGPUB; USPAT	OR	ON	2020/01/06 11:35
S30	14348	unlock with screen wqith id adj code	USPAT	OR	OFF	2020/01/06 12:57
S31	0	unlock with screen w\ith id adj code	USPAT	OR	OFF	2020/01/06 12:58
S32	0	unlock with screen with id adj code	USPAT	OR	OFF	2020/01/06 12:58
S34	350	unlock with screen with passcode	US-PGPUB; USPAT	OR	OFF	2020/01/06 12:58
S35	0	tocu adj (screen or panel) and ((two adj step) with authentication)	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:04
S36	261	touch adj (screen or panel) and ((two adj step) with authentication)	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:04
S37	2	"20100253471" and authentication	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:08
S38	279	unlock with screen with passcode and touch	US-PGPUB; USPAT	OR	OFF	2020/01/06 13:11
S39	0	unlock with screen with passcode and touch	EPO	OR	OFF	2020/01/06 13:20
S40	1	unlock with touch with area	EPO	OR	OFF	2020/01/06 13:20
S41	15	unlock with area	EPO	OR	OFF	2020/01/06 13:21
S42	1	"2148497"	EPO	OR	OFF	2020/01/06 13:21
S43	0	"20100020035" and password	US-PGPUB; USPAT	OR	ON	2020/01/06 13:23
S44	2	"20100020035" and code	US-PGPUB;	OR	ON	2020/01/06

			USPAT			13:23
S45	2	"20100020035" and pass$4	US-PGPUB; USPAT	OR	ON	2020/01/06 13:23
S46	693596	touch adj (screen or panel)	US-PGPUB; USPAT	OR	ON	2020/01/06 13:26
S47	3036	S46 and accident$5 with area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:27
S48	48	S46 and detect with accident$5 with area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:27
S49	149	S46 and detect$3 with accident$5 with area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:27
S50	28	S46 and detect$3 with accident$5 with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:31
S51	7072	S46 and detect$3 with finger with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:34
S52	53268	S46 and detect$3 with finger or heel with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:35
S53	5	S46 and detect$3 with finger with heel with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:35
S54	7	S46 and detect$3 with glanc$3 with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:36
S55	29	S46 and detect$3 with inadvertent with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:36
S56	6	("20040046744" | "20080042994" | "20110050576" | "20110154390" | "20110221684").PN. OR ("8248385").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/06 13:38
S57	5	S56 and area	US-PGPUB; USPAT; USOCR	OR	OFF	2020/01/06 13:38
S58	4	S46 and identif$6 with (inadvertent$3 or accident$5) with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 13:41
S59	1	"10416876".pn. and accidental	US-PGPUB; USPAT	OR	ON	2020/01/06 13:42
S60	1	"10416876".pn. and ignor$5	US-PGPUB; USPAT	OR	ON	2020/01/06 13:43
S61	1	"10416876".pn. and area	US-PGPUB; USPAT	OR	ON	2020/01/06 13:43
S62	463	S46 and (inadvertent$3 or accident$5) with area with touch	US-PGPUB; USPAT	OR	ON	2020/01/06 14:10
S63	1536433	S62 nor S55	US-PGPUB; USPAT	OR	ON	2020/01/06 14:10
S64	434	S62 not S55	US-PGPUB; USPAT	OR	ON	2020/01/06 14:10
S65	350	S34 not S48	US-PGPUB; USPAT	OR	ON	2020/01/06 14:11
S66	425	S64 not S48	US-PGPUB; USPAT	OR	ON	2020/01/06 14:11
S67	2	"20070152976" and area	US-PGPUB; USPAT	OR	ON	2020/01/06 14:15
S68	171901	touch adj (screen or panel) and mobile adj device	US-PGPUB; USPAT	OR	ON	2020/01/06 14:57
S69	1124	S68 and (keypad with (password or	US-PGPUB;	OR	ON	2020/01/06

		passcode or (pass adj word) or (pass adj code)))	USPAT			14:59
S70	0	"201200075098" and touch	US-PGPUB; USPAT	OR	ON	2020/01/06 15:38
S71	2	"20120075098" and touch	US-PGPUB; USPAT	OR	ON	2020/01/06 15:38
S72	1	"20050253814"	US-PGPUB; USPAT	OR	ON	2020/01/06 16:06
S73	0	tocuh adj (screen or paneL) AND (PASSCODE WITH REGOSTRATION)	US-PGPUB; USPAT	OR	ON	2020/01/06 16:12
S74	0	tocuh adj (screen or paneL) AND (PASSCODE WITH REGiSTRATION)	US-PGPUB; USPAT	OR	ON	2020/01/06 16:12
S75	136	touch adj (screen or paneL) AND (PASSCODE WITH REGiSTRATION)	US-PGPUB; USPAT	OR	ON	2020/01/06 16:13
S76	1	"8718874".pn.	US-PGPUB; USPAT	OR	ON	2020/01/07 09:29
S77	1	"4352960".pn.	US-PGPUB; USPAT	OR	ON	2020/01/07 09:52
S78	725227	smartphone or smart adj phone	US-PGPUB; USPAT	OR	ON	2020/01/07 09:59
S79	532	S78 and ((passcode or (pass adj code)) with register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 10:00
S80	323	((cellular adj (telephone or phone)) or cellphone) and ((passcode or (pass adj code)) with register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:47
S81	7400	((cellular adj (telephone or phone)) or cellphone) and ((password or (pass adj word)) with register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:47
S82	4294	((cellular adj (telephone or phone)) or cellphone) and ((password or (pass adj word)) near7 register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:47
S83	725227	smartphone or smart adj phone	US-PGPUB; USPAT	OR	ON	2020/01/07 13:48
S84	5628	S83 and ((password or (pass adj word)) near7 register$5)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:48
S85	3565	S83 and ((password or (pass adj word)) near7 registration)	US-PGPUB; USPAT	OR	ON	2020/01/07 13:52
S87	1	"20070238449" and register$4	US-PGPUB; USPAT	OR	ON	2020/01/07 13:57
S88	1	"20070238449" and register$4 same password	US-PGPUB; USPAT	OR	ON	2020/01/07 14:01
S89	369	S83 and ((password or (pass adj word)) with (initializ$ or (set adj up))) with (stor$3)	US-PGPUB; USPAT	OR	ON	2020/01/07 14:03
S90	1	"20100180336"	USPAT	OR	OFF	2020/01/07 14:28
S91	2	"20100180336"	US-PGPUB; USPAT	OR	OFF	2020/01/07 14:28
S92	1942720	"20050253814" and touch panel	US-PGPUB; USPAT	OR	ON	2020/01/07 16:40
S93	0	"20050253814" and touch panel	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:40

S94	1	"20050253814" and touch screen	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:40
S95	1	"20050253814" and finger	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:41
S96	0	"20050253814" and finger and password	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S97	0	"20050253814" and finger and pass word	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S98	0	"20050253814" and finger and pass code	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S99	0	"20050253814" and finger and passcode	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:42
S100	134	unlock with screen with passcode	USPAT	OR	OFF	2020/01/07 16:52
S101	1	"8654093".pn.	USPAT	OR	OFF	2020/01/07 16:52
S102	0	S101 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:52
S103	25	touch adj (screen or panel) same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad)))	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S104	0	S103 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S105	0	S104 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S106	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) with (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S107	0	S106 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S108	4	touch adj (screen or panel) and (password same ((fingertip or (finger adj tip)) same (fingerpad or (finger adj pad))))	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S109	0	S108 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S110	0	S109 and ghassabian.in.	US-PGPUB; USPAT	OR	ON	2020/01/07 16:53
S111	1	"20050253814" and (touch or contact)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 16:58
S112	1	"20050253814" and (processor or controller)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:00
S113	1	"20050253814" and (microprocessor or controller)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:04
S114	0	"20050253814" and (microprocessor)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:04
S115	1	"20050253814" and (computer)	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:05
S116	1	"20050253814" and tip same flat	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:10
S117	0	"8654093".pn. and finger same edge	USPAT	OR	OFF	2020/01/07 17:22
S118	0	"8654093".pn. and edge	USPAT	OR	OFF	2020/01/07 17:22

S119	2	"20100180336" and security	US-PGPUB; USPAT	OR	OFF	2020/01/07 17:23
S120	2	"20100180336" and unlock	US-PGPUB; USPAT	OR	OFF	2020/01/07 17:23
S121	0	"20050253814" and unlock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:24
S122	1	"20050253814" and security	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:24
S123	1	"20050253814" and lock$3	US-PGPUB; USPAT	ADJ	ON	2020/01/07 17:24
S124	3503	calibrat$4 with display with instructions	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:11
S125	2256	S124 and (touch adj (screen or panel))	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:21
S126	84	S124 and (touch adj (screen or panel)) and (calibrat$4 same finger)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:22
S127	1321	calibrat$4 with (display near10 instructions)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:22
S128	55	S127 and (touch adj (screen or panel)) and (calibrat$4 same finger)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:23
S129	2	"20070195067" and instructions	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:25
S130	61	calibrat$4 with (display near10 instructions) and (calibrat$4 with (touch adj (screen or panel)))	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:29
S131	1	"8654093".pn. and shaded	USPAT	OR	OFF	2020/01/08 10:42
S132	1	"8654093".pn. and (tap$3 or flick$3 or drag$4 or pinch$3)	USPAT	OR	OFF	2020/01/08 10:43
S133	0	"20050253814" and pinch$3	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:46
S134	1	"20050253814" and tap$4	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:46
S135	0	"20050253814" and flick$3	US-PGPUB; USPAT	ADJ	ON	2020/01/08 10:46
S136	4370	touch adj (screen or panel) and (tap$4 same flick$4 saem drag$4 same pinch$4) same finger	US-PGPUB; USPAT	OR	ON	2020/01/08 10:47
S137	643	touch adj (screen or panel) and (tap$4 same flick$4 same drag$4 same pinch$4) same finger	US-PGPUB; USPAT	OR	ON	2020/01/08 10:47
S138	643	touch adj (screen or panel) and (tap$4 same flick$4 same drag$4 same pinch$4) same finger	US-PGPUB; USPAT	OR	ON	2020/01/08 10:48
S139	589	S138 and (smartphone or phone of telephone or cellphone)	US-PGPUB; USPAT	OR	ON	2020/01/08 10:49
S140	643	touch adj (screen or panel) and (tap$4 same flick$4 same drag$4 same pinch$4) same finger and flick$3 and drag$4 and pinch$3 and tap$4	US-PGPUB; USPAT	OR	ON	2020/01/08 11:02
S141	589	S140 and (smartphone or phone of telephone or cellphone)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:02

S142	35	S138 and (smartphone or phone of telephone or cellphone) and (mov$3 with icon with drag$4)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:14
S143	3804	(smartphone or phone of telephone or cellphone) and (mov$3 with icon with drag$4)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:15
S144	1022	(smartphone) and (mov$3 with icon with drag$4)	US-PGPUB; USPAT	OR	ON	2020/01/08 11:18
S145	0	"8654093".pn. and sufficient	USPAT	OR	ON	2020/01/08 11:27
S146	1	"8654093".pn. and contact	USPAT	OR	ON	2020/01/08 11:27
S147	1	"8654093".pn. and range with threshold	USPAT	OR	ON	2020/01/08 11:27
S148	274105	touch adj (screen or panel)	USPAT	OR	ON	2020/01/08 13:32
S149	992035	touch adj (screen or panel)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:33
S150	0	(touch adj (screen or panel)) same capacative adj plates	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:34
S151	56	(touch adj (screen or panel)) same capacitive adj plates	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:35
S152	27	(touch adj (screen or panel)) same capacitive adj plates same sensor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:35
S153	495	(touch adj (screen or panel)) and capacitive adj plates same sensor	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:36
S154	0	"8654093".pn. and capacitive	USPAT	OR	OFF	2020/01/08 13:44
S155	1	"8654093".pn. and capac$9	USPAT	OR	OFF	2020/01/08 13:45
S156	0	"8654093".pn. and plate	USPAT	OR	ON	2020/01/08 13:46
S157	17233	(touch adj (screen or panel)) same sensors same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 13:49

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S158	4220	(touch adj (screen or panel)) same sensors same capacitance	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/01/08 13:49
S159	166	(touch adj (screen or panel)) same sensors same capacitance same grid	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2020/01/08 13:55
S160	3596	touch adj (screen or panel) and (sufficient near3 contact)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 15:27
S161	106	touch adj (screen or panel) and (sufficient near3 contact) with (determin$3) with whether	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 15:27
S162	5	S149 and (unlock$ same (finger with tip) same (finger with pad))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2020/01/08 15:34
S163	0	ryu.in. and (unlock$3 with contact with area)	EPO	OR	ON	2020/01/08 15:39
S164	0	ryu.in. and (unlock$3 with contact with area)	US-PGPUB; USPAT	OR	ON	2020/01/08 15:39
S165	998	ryu.in. and (contact with area)	US-PGPUB; USPAT	OR	ON	2020/01/08 15:39
S166	49	S148 and S165	US-PGPUB; USPAT	OR	ON	2020/01/08 15:39
S167	1	"2148497"	EPO	OR	ON	2020/01/08 15:40
S168	3	(mobile adj terminal) adj event adj control adj method	US-PGPUB; USPAT; EPO	OR	ON	2020/01/08 15:41
S169	3	(mobile adj terminal) adj2 event adj control adj method	US-PGPUB; USPAT; EPO	OR	ON	2020/01/08 15:41
S170	2	"20100020035" and area	US-PGPUB; USPAT	OR	ON	2020/01/08 15:42
S171	1	"20050253814" and (security)	US-PGPUB; USPAT	ADJ	ON	2020/01/08 16:13
S172	1	"20050253814" and tip	US-PGPUB; USPAT	ADJ	ON	2020/01/08 16:18

EAST Search History (Interference)

< This search history is empty>

1/9/2020 11:48:24 AM
C:\Users\bnasser\Documents\EAST\Workspaces\16260879.wsp

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/260,879	01/29/2019	2621	6300	093265-0063	34	4

CONFIRMATION NO. 3220

UPDATED FILING RECEIPT

20277
MCDERMOTT WILL & EMERY LLP
THE MCDERMOTT BUILDING
500 NORTH CAPITAL STREET, N.W.
WASHINGTON, DC 20001

OC000000109974591

Date Mailed: 07/29/2019

Receipt is acknowledged of this reissue 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 FIRST INVENTOR, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection.

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Inventor(s)

Masaaki YAMADA, Yokohama, JAPAN;

Applicant(s)

MAXELL, LTD., Kyoto, JAPAN, Assignee (with 37 CFR 1.172 Interest);

Power of Attorney: The patent practitioners associated with Customer Number 20277

Domestic Priority data as claimed by applicant

This application is a REI of 13/366,983 02/06/2012 PAT 8654093

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
JAPAN 2011-025576 02/09/2011 No Access Code Provided

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If Required, Foreign Filing License Granted: 02/06/2019

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/260,879**

Projected Publication Date: None, application is not eligible for pre-grant publication

Non-Publication Request: No

Early Publication Request: No

Title

INFORMATION PROCESSING APPARATUS

Preliminary Class

345

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: Yes

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PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 16/260,879

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	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	2200
TOTAL CLAIMS (37 CFR 1.16(i))	37 minus 20 =	* 17			OR	x 100 =	1700
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 460 =	460
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							820
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	6140

APPLICATION AS AMENDED - PART II

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

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

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
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01 FC:1205 100.00 DA

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01 FC:1253 1400.00 DA

02 FC:1205 100.00 DA

03 FC:1203 820.00 DA

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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: MAXELL, LTD.

Application No./Patent No.: 16/260,879 Filed/Issue Date: January 29, 2019

Titled: INFORMATION PROCESSING APPARATUS

MAXELL, LTD. , a corporation
(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. [x] The assignee of the entire right, title, and interest.

2. [ ] An assignee of less than the entire right, title, and interest (check applicable box):

   [ ] The extent (by percentage) of its ownership interest is _____ %). Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   [ ] There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. [ ] The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. [ ] The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. [ ] An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____ , Frame _____ , or for which a copy thereof is attached.

B. [x] A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: Masaaki YAMADA To: Hitachi Consumer Electronics Co., Ltd.
   The document was recorded in the United States Patent and Trademark Office at
   Reel 027659 , Frame 0095 , or for which a copy thereof is attached.

2. From: Hitachi Consumer Electronics Co., Ltd. To: Hitachi Maxell, Ltd.
   The document was recorded in the United States Patent and Trademark Office at
   Reel 033694 , Frame 0745 , or for which a copy thereof is attached.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. 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.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Hitachi Maxell, Ltd. To: Maxell, Ltd.
   The document was recorded in the United States Patent and Trademark Office at
   Reel 045142 , Frame 0208 , or for which a copy thereof is attached.

4. From: _____ To: _____
   The document was recorded in the United States Patent and Trademark Office at
   Reel _____ , Frame _____ , or for which a copy thereof is attached.

5. From: _____ To: _____
   The document was recorded in the United States Patent and Trademark Office at
   Reel _____ , Frame _____ , or for which a copy thereof is attached.

6. From: _____ To: _____
   The document was recorded in the United States Patent and Trademark Office at
   Reel _____ , Frame _____ , or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Tomoki Tanida/	June 12, 2019
Signature	Date
Tomoki Tanida	60,453
Printed or Typed Name	Title or Registration Number

Electronic Acknowledgement Receipt

EFS ID:	36286742
Application Number:	16260879
International Application Number:	
Confirmation Number:	3220
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Customer Number:	20277
Filer:	Tomoki Tanida/Pamela Morris
Filer Authorized By:	Tomoki Tanida
Attorney Docket Number:	093265-0063
Receipt Date:	13-JUN-2019
Filing Date:	29-JAN-2019
Time Stamp:	10:32:27
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	Assignee showing of ownership per 37 CFR 3.73	093265_0063_POA_Statement.pdf	23814 dc1acfd9edc2f720ea69c4bc41990f3d2f45a0de	no	2

Warnings:

Information:	
Total Files Size (in bytes):	23814

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

New Applications Under 35 U.S.C. 111

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

National Stage of an International Application under 35 U.S.C. 371

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

New International Application Filed with the USPTO as a Receiving Office

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

PTO/AIA/50 (10-17)
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REISSUE PATENT APPLICATION TRANSMITTAL

Address to:

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

Attorney Docket No.	093265-0063
First Named Inventor	Masaaki YAMADA
Original Patent Number	8,654,093
Original Patent Issue Date (Month/Day/Year)	02/18/2014
Priority Mail Express® Label No.	

APPLICATION FOR REISSUE OF: *(Check applicable box)* [X] Utility Patent [ ] Design Patent [ ] Plant Patent

APPLICATION ELEMENTS (37 CFR 1.173)

1. [ ] **Fee Transmittal Form** (PTO/SB/56)
2. [ ] **Applicant asserts small entity status.** See 37 CFR 1.27
3. [ ] **Applicant certifies micro entity status.** See 37 CFR 1.29. Applicant must attach form PTO/SB/15A or B or equivalent.
4. [ ] **Specification and Claims** in double column copy of patent format (*amended, if appropriate*)
5. [ ] **Drawing(s)** (*proposed amendments, if appropriate*)
6. [X] **Reissue Oath/Declaration or Substitute Statement** (37 CFR 1.175) (PTO/AIA/05, 06, or 07)
7. [ ] **Application Data Sheet** **NOTE:** Benefit claims under 37 CFR 1.78 and foreign priority claims under 37 CFR 1.55 MUST be set forth in an Application Data Sheet (ADS).
8. [X] **Original U.S. Patent currently assigned?** [X] Yes [ ] No (*If Yes, check applicable box(es)*)
   - [X] Written Consent of all Assignees (PTO/AIA/53)
   - [ ] 37 CFR 3.73(c) Statement (PTO/AIA/96)
9. [ ] **CD-ROM or CD-R** in duplicate, Computer Program (*Appendix*) or large table
   - [ ] Landscape Table on CD
10. **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 (2 copies) or CD-R (2 copies); **or**
      - ii. [ ] Paper
    - c. [ ] Statements verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

11. [ ] **Statement of status and support for all changes to the claims.** See 37 CFR 1.173(c).
12. [ ] **Power of Attorney**
13. [ ] **Information Disclosure Statement (IDS)** PTOSB/08 or PTO-1449
    - [ ] Copies of citations attached
14. [ ] **English translation of Reissue Oath/Declaration** (*if applicable*)
15. [ ] **Return Receipt Postcard** (MPEP § 503) (Should be specifically itemized)
16. [ ] **Preliminary Amendment** (37 CFR 1.173; MPEP § 1453)
17. [ ] **Other:**

[ ] This is a continuation reissue or divisional reissue application (*i.e.*, a second or subsequent reissue application for the same issued patent). (*Check box if applicable.*)

18. CORRESPONDENCE ADDRESS

[X] The address associated with Customer Number: 20277 **OR** [ ] Correspondence address below

Name					
Address					
City		State		Zip Code	
Country		Telephone			
Email					

Signature	/Tomoki Tanida/	Date	June 12, 2019
Name (Print/Type)	Tomoki Tanida	Registration No.	60,453

Doc code: REIS.DECL
Document Description: Reissue Declaration Filed In Accordance With MPEP 1414

PTO/AIA/07 (09-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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SUBSTITUTE STATEMENT IN LIEU OF AN OATH OR DECLARATION FOR REISSUE PATENT APPLICATION (35 U.S.C. 115(d) AND 37 CFR 1.64)

Title of Invention	INFORMATION PROCESSING APPARATUS

This statement is directed to:

☐ The attached application,

OR

☒ was filed on 01/29/2019 as reissue application number 16/260,879.

LEGAL NAME of inventor to whom this substitute statement applies:

(*E.g.*, Given Name (first and middle (if any)) and Family Name or Surname)

Masaaki YAMADA

Residence (except for a deceased or legally incapacitated inventor):

Yokohama		Japan
City	State	Country

Mailing Address (except for a deceased or legally incapacitated inventor):

c/o Hitachi, Ltd., Intellectual Property Group, 6-1, Marunouchi 1-chome, Chiyoda-ku

Tokyo		100-8220	Japan
City	State	Zip	Country

I believe the above-named inventor or joint inventor to be the original inventor or an original joint inventor of a claimed invention in the application.

The above-identified application was made or authorized to be made by me.

I hereby acknowledge that any willful false statement made in this statement is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Relationship to the inventor to whom this substitute statement applies:

☐ Legal Representative (for deceased or legally incapacitated inventor only),

☒ Assignee, or

☐ Joint Inventor.

Circumstances permitting execution of this substitute statement:

☐ Inventor is deceased,

☐ Inventor is under legal incapacity,

☒ Inventor cannot be found or reached after diligent effort, or

☐ Inventor has refused to execute the oath or declaration under 37 CFR 1.175.

PTO/AIA/07 (09-13)
Approved for use through 01/31/2020. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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SUBSTITUTE STATEMENT IN LIEU OF AN OATH OR DECLARATION FOR REISSUE PATENT APPLICATION (35 U.S.C. 115(d) AND 37 CFR 1.64)

If there are joint inventors, please check the appropriate box below:

[x] An application data sheet under 37 CFR 1.76 (PTO/AIA/14 or equivalent) naming the entire inventive entity has been or is currently submitted.

OR

[ ] An application data sheet under 37 CFR 1.76 (PTO/AIA/14 or equivalent) has not been submitted. Thus, a Substitute Statement Supplemental Sheet (PTO/AIA/11 or equivalent) naming the entire inventive entity and providing inventor information is attached. See 37 CFR 1.64(b).

I believe the original patent to be wholly or partly inoperative or invalid, for the reasons described below. (Check all boxes that apply.)

[ ] by reason of a defective specification or drawing.

[x] by reason of the patentee claiming more or less than he had the right to claim in the patent.

[ ] by reason of other errors.

At least one error upon which reissue is based is described below. If the reissue is a broadening reissue, a claim that the application seeks to broaden must be identified:

At least the scope of new claim 8 is narrower than the scope of original claim 1. For example, new claim 8 further recites, "a controller configured to control the information processing apparatus to operate in two operating modes: at least an identification mode and a registering mode" and "to execute a specified process when the first information and the second information are coincident within the identification mode."

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available.

PERSON EXECUTING THIS SUBSTITUTE STATEMENT:

Name: Keiji NAKAMURA	Date (Optional):

Signature: Keiji Nakamura

APPLICANT NAME AND TITLE OF PERSON EXECUTING THIS SUBSTITUTE STATEMENT:

If the applicant is a juristic entity, list the applicant name and the title of the signer.

Applicant Name: MAXELL, LTD.

Title of Person Executing This Substitute Statement: President and Representative Director

The signer, whose title is supplied above, is authorized to act on behalf of the applicant.

PTO/AIA/07 (09-13)
Approved for use through 01/31/2020. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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SUBSTITUTE STATEMENT IN LIEU OF AN OATH OR DECLARATION FOR REISSUE PATENT APPLICATION (35 U.S.C. 115(d) AND 37 CFR 1.64)

Residence of the signer (unless provided in an application data sheet, PTO/SB/14 or equivalent):

CityKyoto	State	Japan Country

Mailing Address of the signer (unless provided in an application data sheet, PTO/SB/14 or equivalent):

c/o MAXELL, LTD., 1 Koizumi, Oyamazaki, Oyamazaki-cho, Otokuni-gun

Kyoto City	State	618-8525 Zip	Japan Country

Note: Use an additional PTO/AIA/07 form for each inventor who is deceased, legally incapacitated, cannot be found or reached after diligent effort, or has refused to execute the oath or declaration under 37 CFR 1.63.

PTO/AIA/53 (09-12)
Approved for use through 01/31/2020. OMB 0651-0033
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.

REISSUE APPLICATION: CONSENT OF ASSIGNEE; STATEMENT OF NON-ASSIGNMENT	Docket Number (Optional) 093265-0063

This is part of the application for a reissue patent based on the original patent identified below.

Name of Patentee(s)
MAXELL, LTD.

Patent Number	Date Patent Issued
8,654,093	February 18, 2014

Title of Invention
INFORMATION PROCESSING APPARATUS

1. [X] Filed herein is a statement under 37 CFR 3.73(c). (Form PTO/AIA/96)

2. [ ] Ownership of the patent is in the inventor(s), and no assignment of the patent is in effect.

One of boxes 1 or 2 above must be checked. If multiple assignees, complete this form for each assignee. If box 2 is checked, skip the next entry and go directly to "Name of Assignee."

The written consent of all assignees and inventors owning an undivided interest in the original patent is included in this application for reissue.

The assignee(s) owning an undivided interest in said original patent is/are MAXELL, LTD., and the assignee(s) consents to the accompanying application for reissue.

Name of assignee/inventor (if not assigned)
MAXELL, LTD.

Signature	Date
Keiji Nakamura	2019.05.13

Typed or printed name and title of person signing for assignee (if assigned)

Keiji NAKAMURA, President and Representative Director

This collection of information is required by 37 CFR 1.172. 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 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.

Privacy Act Statement

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

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

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

Electronic Patent Application Fee Transmittal

Application Number:	16260879
Filing Date:	29-Jan-2019
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Filer:	Tomoki Tanida/Pamela Morris
Attorney Docket Number:	093265-0063

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	1051	1	160	160
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**160**

Electronic Acknowledgement Receipt

EFS ID:	36283352
Application Number:	16260879
International Application Number:	
Confirmation Number:	3220
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Customer Number:	20277
Filer:	Tomoki Tanida/Doris Barnes
Filer Authorized By:	Tomoki Tanida
Attorney Docket Number:	093265-0063
Receipt Date:	12-JUN-2019
Filing Date:	29-JAN-2019
Time Stamp:	19:07:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$160
RAM confirmation Number	061319INTEFSW00005751500417
Deposit Account	500417
Authorized User	Doris Barnes

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Reissue Application	REISSUE_TRANSMITTAL.pdf	61487 a43fd85cbe93234db5dc8c04ad77a8d8bca7b87c	no	1
Warnings:					
Information:					
2	Reissue dec filed in accordance with MPEP 1414	SUBSTITUTE_STATEMENT.pdf	140475 e1b738f1758d2da7e9755ecdad7c66f6bc7a8c9c	no	3
Warnings:					
Information:					
3	Consent of Assignee accompanying the declaration	CONSENT.pdf	117652 461362b310fa716703bfea941679ad76b9694c7d	no	2
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30180 c5be768b0f8feeab430cab0e9b5d62ecbccb5fa0	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	349794		

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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.

Docket No.: 093265-0063
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Reissue Application of: U.S. Patent No. 8,654,093	:	Customer Number: 20277
Application No.: 16/260,879	:	Confirmation No.: 3220
Filed: January 29, 2019	:	Art Unit: 2624
For: INFORMATION PROCESSING APPARATUS	:	Examiner: Not Yet Assigned

SECOND PRELIMINARY AMENDMENT UNDER 37 C.F.R. § 1.115

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

INTRODUCTORY COMMENTS

Prior to examination on the merits, please amend the above-identified U.S. patent application as follows:

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

Remarks/Arguments begin on page 10 of this paper.

AMENDMENTS TO THE CLAIMS

1. (Original) An information processing apparatus comprising:

a touch panel which displays a plurality of pieces of identification information and detecting a contact of the panel with an object of interest;

a detection unit, when the touch panel detects a contact with the object, which specifies identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the panel, and which detects an area of part where the contact occurred;

a storage unit which stores reference identification information and a reference area range;

a determination unit which determines whether the identification information detected by the detection unit matches the reference identification information stored in the storage unit and whether the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit; and

a control unit which performs particular processing on condition the determination unit determines that the identification information detected by the detection unit matches the reference identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the reference area range stored in the storage unit.

2. (Original) The information processing apparatus according to claim 1, wherein:

the storage unit stores, when a predetermined condition is satisfied, the identification information and the area of the contact detected by the detection unit as the reference identification information and the reference area range, respectively.

3. (Original) The information processing apparatus according to claim 1 or 2, wherein:

the storage unit stores first identification information and a first area range and second identification information and a second area range as the reference identification information and the reference area ranges; and

the determination unit determines, on condition the identification information detected by the detection unit matches the first identification information stored in the storage unit and the area of the contact detected by the detection unit falls within the first area range stored in the storage

unit, whether the identification information detected by the detection unit matches the second identification information stored in the storage unit and the area of the contact detected by the detecting unit falls within the second area range stored in the storing unit.

4. (Original) The information processing apparatus according to claim 1 or 2, wherein: the storage unit stores a threshold value; and

the reference area range stored in the storage unit is defined based on the threshold value.

5. (Original) The information processing apparatus according to claim 4, wherein:

the area of the contact detected by the detection unit is registered as the threshold value when a predetermined condition is satisfied.

6. (Original) An information processing apparatus comprising:

a touch panel which displays a plurality of pieces of identification information and detecting a contact of the panel with an object of interest;

a detection unit for, when the touch panel detects a contact of the panel with the object, which specifies identification information indicated by a position at which the contact in question occurred, of the multiple pieces of identification information displayed on the touch panel, and which detects an area of part where the contact occurred;

a storage unit which stores a series of identification information and a series of area ranges, the series of area ranges each corresponding to the respective identification information; and

a control unit which performs particular processing on condition that a set of identification information detected by the detection unit matches the series of identification information stored in the storage unit and a series of contact areas detected by the detection unit each falls within the corresponding one of the series of area ranges stored in the storage unit.

7. (Original) The information processing apparatus according to claim 6, wherein:

the storage unit stores a first set of area ranges and a second set of area ranges as corresponding area ranges of the stored series of identification information; and

first processing is performed on condition that a set of identification information detected by the detecting unit matches the series of identification information stored in the storage unit and the

areas of the contact detected by the detecting unit each falls within a corresponding one of the first set of area ranges stored in the storage unit, and second processing is performed on condition that a set of identification information detected by the detecting unit matches the series of identification information stored in the storing unit and the areas of the contact detected by the detecting unit each falls within a corresponding one of the second set of area ranges stored in the storage unit.

8. (New) An information processing apparatus comprising:

a touch panel configured to detect a contact of a finger of a user;

a controller configured to control the information processing apparatus to operate in two operating modes: at least an identification mode and a registering mode;

a memory configured to store first information relating to identification of the user during operation of the registering mode, the first information corresponding to a fingerprint of the user;

a detector configured to detect second information necessary for an identification of the user when contact is detected between the touch panel and the finger of the user;

wherein the controller is configured to execute a specified process when the first information and the second information are coincident within the identification mode,

wherein the registering mode includes a first registering mode for inputting first input information corresponding to a first portion of the finger and a second registering mode for inputting second input information corresponding to a second portion of the finger and said first information is generated and stored in memory based on both the first input information and the second input information, the first portion corresponding to a pad of the finger; and

wherein generation of the second information in the identification mode is based on the first and second portions of the finger to determine whether the second information is coincident with the stored first information.

9. (New) The information processing apparatus according to claim 8, wherein the touch panel includes a group of capacitive plates that generate changes in capacitance based on contact of the finger.

10. (New) The information processing apparatus according to claim 8, wherein the second portion of the finger corresponds to an edge of the finger.

11. (New) The information processing apparatus according to claim 8, further comprising a display screen for displaying a first image with first descriptive text and a second image with a second descriptive text during the registration mode,

wherein the first image and the first descriptive text inform the user to use the first portion of the finger, and the second image and second descriptive text inform the user to use the second portion of the finger.

12. (New) The information processing apparatus according to claim 8, wherein the specified process corresponds to an unlocking operation of the information processing apparatus.

13. (New) The information processing apparatus according to claim 1, further comprising a display screen for displaying information during the identification mode informing the user to use the finger to execute the specified operation,

wherein the specified operation corresponds to an unlocking operation of the information processing apparatus.

14. (New) The information processing apparatus according to claim 8, further comprising a display screen for displaying one or more images during registration mode,

wherein one or more images includes a shaded portion indicating portions of the fingerprint detected by the touch panel and a non-shaded portion indicating portions of the fingerprint not detected by the touch panel.

15. (New) The information processing apparatus according to claim 8, wherein the controller is configured to execute tapping, dragging, flicking, and pinching operations based on detection of contact of the finger.

16. (New) The information processing apparatus according to claim 15, wherein the tapping operation includes detection of contact of the finger for a first time period, the dragging operation includes the user moving the finger while maintaining the contact for a second time

period, the flicking operation includes the user sliding the finger for a third period of time that is shorter than the second time period, and the pinching operation includes the user establishing two contacts changing the distance between the established two contacts.

17. (New) The information processing apparatus according to claim 8, further comprising a display screen for displaying a plurality of icons corresponding to applications being executed an operation for moving one of the plurality of icons based on a drag operation using the finger, the drag operation requiring the detection of contact of the finger with the touch panel for a predetermined period of time.

18. (New) The information processing apparatus according to claim 8, wherein generation of the first information during operation of the registration mode includes determining whether there is sufficient contact between the finger and the touch panel based on a threshold value related to a contact range.

19. (New) The information processing apparatus according to claim 8, wherein generation of the second information during operation of the identification mode includes determining whether there is sufficient contact between the finger and the touch panel based on a threshold value related to a contact range.

20. (New) The information processing apparatus according to claim 8, wherein the controller is configured to associate a numeral password with the first information, and the memory is configured to store the association between the numeral password and the first information.

21. (New) A method for controlling an information processing apparatus comprising the steps of:

detecting a contact of a finger of a user by a touch panel;

operating the information processing apparatus in two operating modes: at least an identification mode and a registering mode by a controller;

storing a first information relating to identification of the user during operation of the registering mode, the first information corresponding to a fingerprint of the user in a memory;

detecting a second information necessary for an identification of the user when contact is detected between the touch panel and the finger of the user by a detector; and

executing a specified process when the first information and the second information are coincident within the identification mode by the controller;

wherein the registering mode includes a first registering mode for inputting first input information corresponding to a first portion of the finger and a second registering mode for inputting second input information corresponding to a second portion of the finger, and the first information is generated and stored in the memory based on both the first input information and the second input information, the first portion corresponding to a pad of the finger; and

wherein generation of the second information in the identification mode is based on the first and second portions of the finger to determine whether the second information is coincident with the stored first information.

22. (New) The method for controlling the information processing apparatus according to claim 21, wherein the touch panel includes a group of capacitive plates that generate changes in capacitance based on contact of the finger.

23. (New) The method for controlling the information processing apparatus according to claim 21, wherein the second portion of the finger corresponds to an edge of the finger.

24. (New) The method for controlling the information processing apparatus according to claim 21, further comprising the step of displaying a first image with first descriptive text and a second image with a second descriptive text during the registration mode by a display screen,

wherein the first image and the first descriptive text inform the user to use the first portion of the finger, and the second image and second descriptive text inform the user to use the second portion of the finger.

25. (New) The method for controlling the information processing apparatus according to claim 21, wherein the specified process corresponds to an unlocking operation of the information processing apparatus.

26. (New) The method for controlling the information processing apparatus according to claim 21, further comprising the step of displaying information during the identification mode informing the user to use the finger to execute the specified operation by a display screen,

wherein the specified operation corresponds to an unlocking operation of the information processing apparatus.

27. (New) The method for controlling the information processing apparatus according to claim 21, further comprising the step of displaying one or more images during registration mode by a display screen,

wherein one or more images includes a shaded portion indicating portions of the fingerprint detected by the touch panel and a non-shaded portion indicating portions of the fingerprint not detected by the touch panel.

28. (New) The method for controlling the information processing apparatus according to claim 21, further comprising the step of executing tapping, dragging, flicking and pinching operations based on detection of contact of the finger.

29. (New) The method for controlling the information processing apparatus according to claim 21, wherein the tapping operation includes detection of a contact of the finger for a first time period, the dragging operation includes the user moving the finger while maintaining the contact for a second time period, the flicking operation includes the user sliding the finger for a third period of time that is shorter than the second time period, and the pinching operation includes the user establishing two contacts changing the distance between the established two contacts.

30. (New) The method for controlling the information processing apparatus according to claim 21, further comprising the step of displaying a plurality of icons corresponding to applications being executed an operation for moving one of the plurality of icons based on a drag operation using the finger by a display, the drag operation requiring the detection of contact of the finger with the touch panel for a predetermined period of time.

31. (New) The method for controlling the information processing apparatus according to claim 21, wherein generation of the first information during operation of the registration mode includes determining whether there is sufficient contact between the finger and the touch panel based on a threshold value related to a contact range.

32. (New) The method for controlling the information processing apparatus according to claim 21, wherein generation of the second information during operation of the identification mode includes determining whether there is sufficient contact between the finger and the touch panel based on a threshold value related to a contact range.

33. (New) The method for controlling the information processing apparatus according to claim 21, further comprising the steps of:

associating a numeral password with the first information; and

storing the association between the numeral password and the first information in the memory.

34. (New) The information processing apparatus of claim 8, further comprising a display screen, wherein the touch panel includes one or more sensors that are placed under the display screen such that the one or more sensors detect the contact of the finger when the user touches the display screen.

REMARKS

I. Status of Claims

The state of the claims is as follows: claims 1–34 are pending in the reissue application. New claim 34 is added in the present Amendment.

II. Support for Claim Changes

The explanation of exemplary support in the disclosure for the amendment is as follows:

Support for new claims 8–34 can be found in, for example, Figs. 1A, 2, 4A, 4B, 5A, 5B, 7A–7C, 9, 10A, 10B, 13, and 14, and column 3, lines 9–40; and column 3,lines 41–56, of the '093 patent. Care has been exercised to avoid the new matter.

III. Conclusion

Applicant submits that all of the claims are in condition for allowance, an indication of which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicant's attorney at the telephone number shown below.

Authorization is hereby given to charge the fee of $100.00 for one additional dependent claim to our Deposit Account No. 50-0417, under Order No. 093265-0063 from which the undersigned is authorized to draw. Further, please charge any shortage in fees due in connection with the filing of this paper to Deposit Account 50-0417, and please credit any excess fees to such deposit account.

Respectfully submitted,

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Date: April 8, 2019

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Electronic Patent Application Fee Transmittal

Application Number:	16260879
Filing Date:	29-Jan-2019
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Filer:	Tomoki Tanida/Lynn Cruz
Attorney Docket Number:	093265-0063

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
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Pages:				
Claims:				
CLAIMS IN EXCESS OF 20	1202	1	100	100
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**100**

Electronic Acknowledgement Receipt

EFS ID:	35658907
Application Number:	16260879
International Application Number:	
Confirmation Number:	3220
Title of Invention:	INFORMATION PROCESSING APPARATUS
First Named Inventor/Applicant Name:	Masaaki YAMADA
Customer Number:	20277
Filer:	Tomoki Tanida/Pamela Morris
Filer Authorized By:	Tomoki Tanida
Attorney Docket Number:	093265-0063
Receipt Date:	08-APR-2019
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Application Type:	Utility under 35 USC 111(a)

Payment information:

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Payment Type	DA
Payment was successfully received in RAM	$100
RAM confirmation Number	040919INTEFSW00004866500417
Deposit Account	500417
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37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

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	Document Description		**Start**	**End**	
	Preliminary Amendment		1	1	
	Claims		2	9	
	Applicant Arguments/Remarks Made in an Amendment		10	10	
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PTO/SB/08a (02-18)
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(Not for submission under 37 CFR 1.99)

Application Number	16260879
Filing Date	2019-01-29
First Named Inventor	Masaaki YAMADA
Art Unit	2624
Examiner Name	Not Yet Assigned
Attorney Docket Number	093265-0063

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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	2	9626099	B2	2017-04-18	Michaelis et al.	
	3	6950539	B2	2005-09-27	Bjorn et al.	
	4	6546122	B1	2003-04-08	Russo	
	5	9304602	B2	2016-04-05	Ghassabian	
	6	7982721	B2	2011-07-19	Hio	
	7	8528073	B2	2013-09-03	Tawara	
	8	6360004	B1	2002-03-19	Akizuki	

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	Art Unit	2624
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	093265-0063

	9	7345675	B1	2008-03-18	Minakuchi et al.	Corresponds to JP H05100809

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	1	20090313693	A1	2009-12-17	ROGERS	
	2	20090169070	A1	2009-07-02	Fadell	
	3	20100225443	A1	2010-09-09	Bayram et al.	
	4	20100279738	A1	2010-11-04	KIM et al.	
	5	20050253814	A1	2005-11-17	Ghassabian	
	6	20070152976	A1	2007-07-05	Townsend et al.	
	7	20100303311	A1	2010-12-02	SHIN et al.	
	8	20100325721	A1	2010-12-23	Bandyopadhyay et al.	

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	Filing Date	2019-01-29
	First Named Inventor	Masaaki YAMADA
	Art Unit	2624
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	093265-0063

	9	20120056846	A1	2012-03-08	Zaliva	
	10	20060066589	A1	2006-03-30	Ozawa et al.	Corresponds to CN 1755604
	11	20100097176	A1	2010-04-22	SAKURAI et al.	
	12	20110310049	A1	2011-12-22	Homma et al.	Corresponds to WO 2010/104015
	13	20070097096	A1	2007-05-03	Rosenberg	

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	1	1755604	CN	A	2006-04-05	Tokyo Shibaura Electric Co.	English abstract, corresponds to U.S. 2006/0066589	
	2	2010/104015	WO	A1	2010-09-16	Sony Corporation	English abstract, corresponds to U.S. 2011/0310049	
	3	1226691	CN	A	2005-11-09		English abstract of CN 1567288	
	4	H05100809	JP	A	1993-04-23	Fujitsu Ltd.	English abstract, corresponds to U.S. 7,345,675	

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(Not for submission under 37 CFR 1.99)

Application Number	16260879
Filing Date	2019-01-29
First Named Inventor	Masaaki YAMADA
Art Unit	2624
Examiner Name	Not Yet Assigned
Attorney Docket Number	093265-0063

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	1	NUMABE et al., "Finger Identification for Touch Panel Operation Using Tapping Fluctuation," The 13th IEEE International Symposium on Consumer Electronics, pgs. 899-902 (2009)	
	2	ELECCION, "Automatic Fingerprint Identification," IEEE Spectrum (1973)	
	3	HOLZ et al., "The Generalized Perceived Input Point Model and How to Double Touch Accuracy By Extracting Fingerprints," Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (2010)	
	4	WANG et al., "Detecting and Leveraging Finger Orientation for Interaction With Direct-Touch Surfaces," Proceedings of the 22nd Annual ACM Symposium on User Interface Software and Technology (2009)	
	5	SAEVANEE et al., "User Authentication Using Combination of Behavioral Biometrics Over the Touchpad Acting Like Touch Screen of Mobile Device," International Conference on Computer and Electrical Engineering (2008)	
	6	HARRISON et al., "TapSense: Enhancing Finger Interaction on Touch Surfaces," Proceedings of the 24th Annual ACM Symposium on User Interface Software and Technology (2011)	

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	Application Number	16260879
	Filing Date	2019-01-29
	First Named Inventor	Masaaki YAMADA
	Art Unit	2624
	Examiner Name	Not Yet Assigned
	Attorney Docket Number	093265-0063

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That each item of information contained in the information disclosure statement 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 the information disclosure statement. See 37 CFR 1.97(e)(1).

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See attached certification statement.

The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

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

Signature	/Bernard P. Codd/	Date (YYYY-MM-DD)	2019-02-15
Name/Print	Bernard P. Codd	Registration Number	46,429

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Espacenet

Bibliographic data: JPH05100809 (A) — 1993-04-23

DISPLAY METHOD FOR OBJECT BY TOUCH PANEL

Inventor(s): MIZUGUCHI TAMOTSU; OKUYAMA SATOSHI; KAWAMURA AKIKO; KAMATA HAJIME ± (MIZUGUCHI TAMOTSU, ; OKUYAMA SATOSHI, ; KAWAMURA AKIKO, ; KAMATA HAJIME)

Applicant(s): FUJITSU LTD ± (FUJITSU LTD, ; FUJITSU KK)

Classification: - international: ***G06F3/033; G06F3/041; G06F3/048; G06F3/14;*** (IPC1-7): G06F3/03; G06F3/14
- cooperative: **G06F3/0481; G06F3/04842; G06F3/04845; G06F3/0485; G06F3/0488; G06F3/04883**

Application number: JP19910258232 19911007

Priority number(s): JP19910258232 19911007

Also published as: DE69231270 (T2) DE69233133 (T2) DE69233211 (T2) DE69233284 (T2) DE69233600 (T2) more

Abstract of JPH05100809 (A)

PURPOSE:To provide environment where a user who does not have special knowledge on a computer can naturally display an object without using a keyboard and an icon. CONSTITUTION:An information processor provided with a touch panel device 1 is provided with a display information table (1) consisting of the physical type of the object, display position information on a display 3, file information where the state of the object is set, the name of a regular display file storing display data of the object, the name of a file in a special state (inverted display), and with touch panel information (2) consisting of a touch position coordinate and touch pressure information.; A physical operation decided by a corresponding relation between physical information which the display information table (1) shows and physical information which touch panel information (2) shows is given to the object so as to display it.

(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

特開平5－100809

(43)公開日　平成５年(1993)４月23日

(51)Int.Cl.[5]		識別記号	庁内整理番号	ＦＩ	技術表示箇所
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(54)【発明の名称】　タッチパネルによるオブジェクトの表示方法

(57)【要約】

【目的】　タッチパネルによるオブジェクトの表示方法に関し、キーボード，アイコンを使用することなく、コンピュータに対する特別な知識を持っていないユーザにも自然にオブジェクトの表示を行うことができる環境を提供する。

【構成】　タッチパネル装置を備えた情報処理装置において、少なくとも、オブジェクトの物理的種別と，ディスプレイ上の表示位置情報と，該オブジェクトの状態が設定されているファイル情報と，該オブジェクトの表示データが格納されている通常表示ファイルの名称と，特殊状態（反転表示）にあるファイルの名称とからなる表示情報テーブルと、タッチ位置座標と、タッチ圧力情報とからなるタッチパネル情報とを設け、上記表示情報テーブルが示す物理的情報と、上記タッチパネル情報が示す物理的情報との対応関係で決まる物理操作を、該オブジェクトに与えて表示するように構成する。

【特許請求の範囲】

【請求項１】タッチパネル装置(1) を備えた情報処理装置において、

少なくとも、オブジェクトの物理的種別と，ディスプレイ上の表示位置情報と，該オブジェクトの状態が設定されているファイル情報と，該オブジェクトの通常表示データが格納されている通常表示ファイルの名称と，該オブジェクトの特殊状態（反転表示）の表示データが格納されている特殊状態ファイルの名称とからなる表示情報テーブル（）と、タッチ位置座標と、タッチ圧力情報とからなるタッチパネル情報（）とを設け、

上記表示情報テーブル（）が示す物理的情報（重心位置，重力方向，摩擦力，回転体，可塑性等）と、上記タッチパネル情報が示す物理的情報（タッチ位置，タッチ方向，タッチ圧力等）との対応関係で決まる物理操作（瞬時移動，平行移動，回転，慣性移動，重力移動等）を、該オブジェクトに与えて表示することを特徴とするタッチパネルによるオブジェクトの表示方法。

【請求項２】請求項１に記載のオブジェクト表示方法で、横方向にディスプレイ画面外まで仮想的に続いているオブジェクトに対して、指をタッチパネル(1a)に触れたまま右，又は、左から左方向，又は、右方向へ移動させ、その移動速度，あるいは、移動量が、予め定めた一定値を越えたとき，該オブジェクトを右，又は、左から左，又は、右へ指の移動速度を初速としてスクロール表示させ、その後スクロール表示速度を次第に緩めて行き、初速に応じた時間を経過すると、該オブジェクトのスクロール表示速度が“０”となり停止するが、該停止する以前に再び指でタッチパネル(1a)を右，又は、左から左，又は右へ擦ると，指の移動速度に応じたスクロール表示を再び行うことを特徴する請求項１に記載のタッチパネルによるオブジェクトの表示方法。

【請求項３】上記請求項２に記載のオブジェクトのスクロール表示中において、該オブジェクトが停止する以前にオブジェクト表示上の一箇所で指を移動させずに触り続けることによって、スクロール速度を急激に緩め、停止に到らせる表示を行うことを特徴とする請求項２に記載のタッチパネルによるオブジェクトの表示方法。

【請求項４】上記請求項１に記載のオブジェクト表示方法で、画面に表示されているオブジェクトを、２本指による挟み込み動作を使ったタッチパネル操作を認識すると、該オブジェクト表示を掴めたことをユーザに示す表示（特殊状態ファイル名による表示）に変更し、その後、ユーザの２本指がタッチパネル(1a)上を移動するに従って、該オブジェクト表示を２本指指示のほぼ中央に位置するよう表示位置を変更し、該２本指の間隔がある一定値以上広がる操作（該オブジェクトを放す動作）を認識すると、表示位置変更処理は行わず、該オブジェクト表示を元の掴めていないことをユーザに示す表示（通る請求項１に記載のタッチパネルによるオブジェクトの表示方法。

【請求項５】上記請求項１に記載のオブジェクト表示方法で、画面に表示されているオブジェクトの周辺を指などで触り，指をタッチパネル(1a)に触れたまま該オブジェクトの上を移動するとき、該オブジェクトをあたかも指で押して移動させているように、該指の移動に伴い、該指の移動方向で指に隣接する位置へオブジェクト表示の移動を行い、指がタッチパネルより離れるまで続けることを特徴とする請求項１に記載のタッチパネルによるオブジェクトの表示方法。

【請求項６】上記請求項５に記載のオブジェクト表示方法で、上記指の移動に伴うオブジェクトの表示移動中において、該オブジェクトの中心あるいは重心位置を大きく外れた位置を押した場合には、上記オブジェクトの移動表示に加え、該重心位置を中心とした回転表示を行い、指がタッチパネル(1a)より離れるまで続けることを特徴とする請求項５に記載のタッチパネルによるオブジェクトの表示方法。

【請求項７】上記請求項１に記載のオブジェクト表示方法で、画面に表示されているオブジェクトから少し離れた位置を指などで触り、指をタッチパネル(1a)に触れたまま該オブジェクト上まで移動するとき、該オブジェクトをあたかも指で弾いたように、初めにタッチパネルに触れた位置からオブジェクト上までの指の移動方向に，指の移動速度に比例した距離だけ、該オブジェクトの移動表示を行うことを特徴とする請求項１に記載のタッチパネルによるオブジェクトの表示方法。

【請求項８】上記請求項７に記載のオブジェクト表示方法で、該オブジェクトに対して、特定の重力がかかっている場合、該指による弾き動作に伴うオブジェクトの表示移動中において、初めにタッチパネル(1a)に触れた位置からオブジェクト上までの指の移動方向を初期移動方向として、あたかも画面の下方向に重力がかかっているかのような放物線を描きながら、指の移動速度に比例した距離だけ、該オブジェクトの移動表示を行うことを特徴とする請求項７に記載のタッチパネルによるオブジェクトの表示方法。

【請求項９】上記請求項１に記載のオブジェクト表示方法で、画面に球形や円筒形を倒した、あたかも指で転がせるような形状をしたオブジェクトが表示され、該オブジェクト上の一点を指などで触れ、指をタッチパネル(1a)に触れたまま、該オブジェクト上で移動するとき、あたかも、該オブジェクトが画面上で転がったかのように、初めに触れたオブジェクトと指との位置関係が指の移動に伴って変化するように，該指の移動方向に該オブジェクトの回転・移動表示を行い，指がタッチパネル(1a)より離れるまで続けることを特徴とする請求項１に記載のタッチパネルによるオブジェクトの表示方法。

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方法で、画面に表示されているオブジェクト上を指などで触れると、あたかもオブジェクトが柔らかくて潰れてしまったような、該オブジェクトが歪んだ表示（特殊状態ファイル名による表示）に変更し、指がタッチパネル(1a)から離れると元の歪みのないオブジェクト表示（通常状態ファイル名による表示）に変更することを特徴とする請求項１に記載のタッチパネルによるオブジェクトの表示方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、タッチパネルによるオブジェクトの表示方法に関する。最近のコンピュータによるデータ処理の普及に伴って、コンピュータに対する専門的な知識のないユーザによる操作が多くなる動向にあり、かかるコンピュータに対する専門的な知識のないユーザでも、使用し易いユーザインタフェースが要求される。

【０００２】

【従来の技術】図１０は、従来のコンピュータのユーザインタフェースを説明する図である。最近のワークステーションなどの情報処理装置においては、非常に多くのアプリケーションソフトウェアが整備され、複雑な処理も、幾つかのアプリケーションを組み合わせることによって実現される。

【０００３】然し、その反面、コンピュータの専門知識を持たないユーザにとって、これらの情報処理装置は扱い難いものとなっている。例えば、コンピュータの専門知識を持たないユーザは、図示されているキーボードやマウス 2といった装置すら敬遠する傾向にある。具体的には、ディスプレイ 3に表示されているオブジェクトを操作する場合、ユーザは、該キーボードやマウス 2を使用して、該ディスプレイ 3に表示されているオブジェクトを操作する為のコマンドを入力する。

【０００４】又、ディスプレイ 3上に表示されている、上記キーボード 2からの入力に対応する機能を抽象化した絵記号であるアイコンを、例えば、マウス 2等を使用して選択し、該アイコンが指示する操作を行っていた。

【０００５】

【発明が解決しようとする課題】このような、従来のコンピュータインタフェースにおいては、キーボード，マウス，アイコン等を使用して、ディスプレイ上に表示されているオブジェクトに対する表示操作を行う必要があり、コンピュータの専門知識のないユーザにとっては、該コンピュータは、極めて扱い難いものとなっていた。

【０００６】本発明は上記従来の欠点に鑑み、コンピュータインタフェースにおいて、キーボードや，単にある機能を抽象化したアイコンを使うのではなく，ディスプレイを現実の空間に見立て、すなわち、表示するオブジェクトの重量や硬軟，摩擦抵抗，引力などを表現する表パネルによる操作方法を用いることにより，コンピュータの特別な知識を持っていないユーザが自然に使える環境を提供することを目的とするものである。

【０００７】

【課題を解決するための手段】図１，図２は本発明の原理説明図であり、図１(a) は原理構成図を示し、図２(b1)は表示情報テーブルの構成例を示し、図２(b2)はタッチパネル装置からのタッチパネル情報の構成例を示している。上記の問題点は、下記のように構成したタッチパネルによるオブジェクト表示方法によって解決される。

【０００８】(1) タッチパネル装置 1を備えた情報処理装置において、少なくとも、オブジェクトの物理的種別と，ディスプレイ上の表示位置情報と，該オブジェクトの状態が設定されているファイル情報と，該オブジェクトの通常の表示データが格納されている通常表示ファイルの名称と，該オブジェクトの特殊状態（反転表示）の表示データが格納されている特殊状態ファイルの名称とからなる表示情報テーブルと、タッチ位置座標と、タッチ圧力情報とからなるタッチパネル情報とを設け、

上記表示情報テーブルが示す物理的情報（重心位置，重力方向，摩擦力，回転体，可塑性等）と、上記タッチパネル情報が示す物理的情報（タッチ位置，タッチ方向，タッチ圧力等）との対応関係で決まる物理操作(瞬時移動，平行移動，回転，慣性移動，重力移動等)を、該オブジェクトに与えて表示するように構成する。

【０００９】(2) 上記(1) 項　に記載のオブジェクト表示方法で、横方向にディスプレイ画面外まで仮想的に続いているオブジェクトに対して、指をタッチパネル 1aに触れたまま右，又は、左から左方向，又は、右方向へ移動させ、その移動速度，あるいは、移動量が、予め定めた一定値を越えたとき，該オブジェクトを右，又は、左から左，又は、右へ指の移動速度を初速としてスクロール表示させ、その後スクロール表示速度を次第に緩めて行き、初速に応じた時間を経過すると、該オブジェクトのスクロール表示速度が“０”となり停止するが、該停止する以前に再び指でタッチパネル 1a を右，又は、左から左，又は右へ擦ると，指の移動速度に応じたスクロール表示を再び行うように構成する。

【００１０】(3) 上記(2) に記載のオブジェクトのスクロール表示中において、該オブジェクトが停止する以前にオブジェクト表示上の一箇所で指を移動させずに触り続けることによって、スクロール速度を急激に緩め、停止に到らせる表示を行うように構成する。

【００１１】(4) 上記(1) 項に記載のオブジェクト表示方法で、画面に表示されているオブジェクトを、２本指による挟み込み動作を使ったタッチパネル操作を認識すると、該オブジェクト表示を掴めたことをユーザに示す表示（特殊状態ファイル名による表示）に変更し、その

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従って、該オブジェクト表示を２本指指示のほぼ中央に位置するよう表示位置を変更し、該２本指の間隔がある一定値以上広がる操作（該オブジェクトを放す動作）を認識すると、表示位置変更処理は行わず、該オブジェクト表示を元の掴めていないことをユーザに示す表示（通常状態ファイルによる表示）に変更するように構成する。

【００１２】(5) 上記(1) 項に記載のオブジェクト表示方法で、画面に表示されているオブジェクトの周辺を指などで触り，指をタッチパネル 1a に触れたまま該オブジェクトの上を移動するとき、該オブジェクトをあたかも指で押して移動させているように、該指の移動に伴い、該指の移動方向で指に隣接する位置へオブジェクト表示の移動を行い、指がタッチパネル 1a より離れるまで続けるように構成する。

【００１３】(6) 上記(5) 項に記載のオブジェクト表示方法で、上記指の移動に伴うオブジェクトの表示移動中において、該オブジェクトの中心あるいは重心位置を大きく外れた位置を押した場合には、上記オブジェクトの移動表示に加え、該重心位置を中心とした回転表示を行い、指がタッチパネル1a より離れるまで続けるように構成する。

【００１４】(7) 上記(1) 項に記載のオブジェクト表示方法で、画面に表示されているオブジェクトから少し離れた位置を指などで触り、指をタッチパネル 1a に触れたまま該オブジェクト上まで移動するとき、該オブジェクトをあたかも指で弾いたように、初めにタッチパネル 1a に触れた位置からオブジェクト上までの指の移動方向に、指の移動速度に比例した距離だけ、該オブジェクトの移動表示を行うように構成する。

【００１５】(8) 上記(7) 項に記載のオブジェクト表示方法で、該オブジェクトに対して、特定の重力がかかっている場合、該指による弾き動作に伴うオブジェクトの表示移動中において、初めにタッチパネル 1a に触れた位置からオブジェクト上までの指の移動方向を初期移動方向として、あたかも画面の下方向に重力がかかっているかのような放物線を描きながら、指の移動速度に比例した距離だけ、該オブジェクトの移動表示を行うように構成する。

【００１６】(9) 上記(1) 項に記載のオブジェクト表示方法で、画面に球形や円筒形を倒した、あたかも指で転がせるような形状をしたオブジェクトが表示され、該オブジェクト上の一点を指などで触れ、指をタッチパネル 1a に触れたまま、該オブジェクト上で移動するとき、あたかも、該オブジェクトが画面上で転がったかのように、初めに触れたオブジェクトと指との位置関係が指の移動に伴って変化するように、該指の移動方向に該オブジェクトの回転・移動表示を行い、指がタッチパネル 1a より離れるまで続けるように構成する。

【００１７】(10) 上記(1) 項に記載のオブジェクト表示方法で、画面に表示されているオブジェクト上を指などで触れると、あたかもオブジェクトが柔らかくて潰れてしまったような、該オブジェクトが歪んだ表示（特殊状態ファイル名による表示）に変更し、指がタッチパネル 1a から離れると元の歪みのないオブジェクト表示（通常状態ファイル名による表示）に変更するように構成する。

【００１８】

【作用】即ち、本発明においては、タッチパネル装置 1 を備えた情報処理装置において、少なくとも、オブジェクトの物理的種別と，ディスプレイ上の表示位置情報と，該オブジェクトの状態が設定されているファイル情報と，該オブジェクトの通常の表示データが格納されている通常表示ファイルの名称と，該オブジェクトの特殊状態（反転表示）の表示データが格納されている特殊状態ファイルの名称とからなる表示情報テーブルと、タッチ位置座標と、タッチ圧力情報とからなるタッチパネル情報とを設け、上記表示情報テーブルが示す物理的情報（例えば、重心位置，重力方向，摩擦力，回転体，可塑性等）と、上記タッチパネル情報が示す物理的情報（例えば、タッチ位置，タッチ方向，タッチ圧力等）との対応関係で決まる物理操作（例えば、瞬時移動，平行移動，回転，慣性移動，重力移動等）を、該オブジェクトに与えて表示する。

【００１９】具体的には、タッチパネルを操作することで、該タッチパネルが指示する物理操作に対応した表示操作（座標変更）を、上記表示情報テーブル上で行い、この表示情報テーブルの表示情報と、該当のオブジェクトが格納されているファイル名を表示管理部に渡すことにより、該表示管理部は、ハードディスクから該当する表示データファイルを読み出し、表示フレームメモリの、該当の表示位置にロードして表示するようにしたものである。

【００２０】つまり、ディスプレイを現実の空間に見立て、表示するオブジェクトの重量,硬軟，摩擦抵抗，引力（重力）等を、該オブジェクトの表示情報テーブル上で設定しておき、該オブジェクトに対して、タッチパネルからの、指のタッチ位置の座標，タッチ圧力等を示すタッチパネル情報が入力されてると、上記表示情報テーブル上の上記物理的な情報と比較して、どのような物理操作を行うことができるかを認識して、例えば、該オブジェクトをスクロールしたり，挟み込み移動を行ったり、転がし移動，慣性移動，重力（下向き）移動を行うようにしたものである。

【００２１】従って、上記のような、現実の空間をまねたインタフェースを採用することにより、ワークステーションといったコンピュータの専門知識を持たないユーザでも、ディスプレイ上のオブジェクトを操作し易い使用環境を提供することができる効果が得られる。

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【実施例】以下本発明の実施例を図面によって詳述する。前述の図１，図２は、本発明の原理説明図であり、図３は、タッチパネル付きワークステーションの構成例を示し、図４～図９は、本発明の一実施例を示した図であり、図４は、画面外まで仮想的に続いているオブジェクトに対するスクロール表示の例を示し、図５は２本指によるオブジェクト操作の例を示し、図６は指による平行移動，回転移動の例を示し、図７は指でオブジェクトを弾いた場合の慣性移動，慣性＋重力（下向き）移動の例を示し、図８は指によるオブジェクトの転がり移動の例を示し、図９は指によるオブジェクトの歪み／復元の表示例を示し、それぞれにおいて、(a)は表示画面の例を示し、(b) は表示情報テーブルの例を示している。

【００２３】本発明においては、タッチパネル装置 1を備えた情報処理装置において、少なくとも、オブジェクトの物理的種別と，ディスプレイ上の表示位置情報と，該オブジェクトの状態が設定されているファイル情報と，該オブジェクトの通常の表示データが格納されている通常表示ファイルの名称と，該オブジェクトの特殊状態（反転表示）の表示データが格納されている特殊状態ファイルの名称とからなる表示情報テーブルと、タッチ位置座標と、タッチ圧力情報とからなるタッチパネル情報とを設け、上記表示情報テーブルが示す物理的情報と、上記タッチパネル情報が示す物理的情報との対応関係で決まる物理操作を、該オブジェクトに与えて表示する手段が、本発明を実施するのに必要な手段である。尚、全図を通して同じ符号は同じ対象物を示している。

【００２４】以下、図１，図２を参照しながら、図３，及び、図４～図９によって、本発明によるタッチパネルによるオブジェクト表示の方法を説明する。先ず、図３は、タッチパネル装置 1を装備したワークステーションのハードウェア構成を示している。本図において、中央処理装置(CPU) 4 は、メインメモリ5上の表示制御プログラムを実行することにより、図１(a) に示した表示動作を行う。

【００２５】図１(a) 中の全体管理部 50,タッチ判定部 51,表示管理部 52 が、図２のメインメモリ 5中の、上記表示制御プログラムの構成内容であり、該全体管理部 50の管理する表示情報テーブルの構成例を図２(b1) に、さらに、タッチパネル装置 1からのタッチパネル情報の構成例を該図２(b2)に示す。

【００２６】図１(a) 中のタッチ判定部 51 は、タッチパネル装置 1から送られてくるタッチ座標と，そのタッチ座標の送信されて来る時間間隔を計測して、タッチ種別を判定する。

【００２７】該判定結果のタッチ種別は、タッチ座標と共に全体管理部 50 に送信される。全体管理部 50 は、ユーザのタッチ座標や，タッチ圧力等を示す上記タッチから、ユーザの意図する表示操作を理解し、表示切換え要求を表示管理部 52 に出す。

【００２８】該表示切換え要求では、上記表示情報テーブルにより、当該オブジェクトの表示位置情報（ディスプレイ上の表示領域の左上座標，サイズ，オブジェクトのサイズ，現在の表示位置座標など）と、該オブジェクトの表示データが格納されているハードディスク 7内のファイル名を渡す。

【００２９】表示管理部 52 が全体管理部 50 から表示切換え要求を受信すると、ハードディスク 7から該当するファイル名の表示データファイルを読出して、図示されていない表示用フレームメモリの表示位置へロードする。

【００３０】このようにして、ユーザの操作したタッチ操作に従って、該タッチ操作が指示する物理的な操作情報、即ち、タッチパネル情報と、該オブジェクトの表示情報テーブルが持っている、当該オブジェクトの物理情報に対応した物理操作が、該オブジェクトに与えられ、該物理操作に対応して、予め、定められている表示が行われる。（請求項１の実施例)尚、上記オブジェクトに対応した表示情報テーブルの内、表示位置情報は、ディスプレイ上のオブジェクトの表示位置を示し、ファイル情報は、当該オブジェクトの情報（サイズ，表示位置）を示し、通常表示ファイル名は、該オブジェクトの通常表示データが格納されているファイル名を示し、特殊状態ファイル名は、該オブジェクトの特殊状態、例えば、表示色を反転したオブジェクトの表示データが格納されているファイル名を示している。

【００３１】《請求項２の実施例》：図４参照
タッチパネル装置 1からの情報がタッチ判定部 51 へ送信され，指がタッチパネル 1a に触れたまま移動し始めた（以下、連続タッチ開始と呼ぶ）ことを判定したとき、タッチ判定部 51 はタッチ通知（内容：連続タッチ開始，座標(800,800))を全体管理部 50 へ送信する。

【００３２】その後のタッチパネル装置 1からのタッチパネル情報は、タッチ通知（内容：連続タッチ中，座標(780,800))というように、次々に、全体管理部 50 へ送信し、タッチパネル装置 1からのタッチパネル情報が、例えば、100m秒以上途絶えたとき、タッチ通知（内容：連続タッチ終了，座標(700,800))を全体管理部 50 へ送信する。

【００３３】該全体管理部 50 は、タッチ通知の連続タッチ開始を受信した時点で、図４(a) に示したように、この領域が画面外までおよぶ大きなオブジェクトの表示領域であることを、図４(b) に示した、当該オブジェクトの表示情報テーブルの、「オブジェクト種別」の「画面外」情報から認識｛若し、この領域が画面外までおよぶ大きなオブジェクトの表示領域であることを認識できなかったときに、該タッチパネル操作を無視する。

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れて来るタッチ通知の連続タッチ中の座標を見て、例えば、右から左方向に、どれ程の速度で指が動いたかを認識する。

【００３４】ここでは、その速度について、１回のタッチ通知で、例えば、20ドット以上動いている場合を、高速として、最初は100m秒間隔でスクロール表示をして、それ以下を、通常速度として、最初500m秒間隔でスクロールをさせ、その後、スクロール表示間隔（表示管理部へ表示切換え要求を送信する時間間隔）を1.5 倍に落としてゆき、２秒以上になった時点でスクロールを終了するものとする。

【００３５】さらに、上記スクロールの開始は、例えば、上記の速度で、40ドット以上の距離を指が動いたことを確認してからとし、確認後、全体管理部 50 は、図４(b)に示した当該オブジェクトの表示情報テーブルの、ファイル情報の内、ファイルの全体情報の表示位置（網掛けで示す）を、例えば、10ドット分左方向へ表示がずれるように書換え、表示管理部 52 に、表示切換え要求（内容：表示位置情報＋ファイルの全体情報＋通常表示ファイル名）を送信する。

【００３６】表示管理部 52 は、上記全体管理部 50 からの表示切換え要求の表示ファイルを一度、メインメモリ 5にロードし、ファイルの全体情報の、上記網掛けで示した表示位置(X) の部分だけを、表示位置情報で示される表示用フレームメモリ 6上へコピーする。（図３参照)その後も、全体管理部 50 は前述の時間間隔で表示切換え要求を表示管理部 52 へ送信する。

【００３７】該スクロールが停止する以前に、さらに、連続タッチ開始が通知された時には、スクロールが必要であるかどうか判定し、スクロール表示を行うものであれば、後から来た要求を優先してスクロール表示をその場所から，前述の初速で再び始める。

【００３８】《請求項３の実施例》：図４参照
上記のスクロール中に、全体管理部 50 に送信されて来るタッチ通知が、同じ場所の，あるいは、５ドット程度の近傍であれば、表示管理部 52 へ送る表示切換え要求の送信時間間隔を２倍（即ち、遅くして）として、スクロールが早く終了するようにする。

【００３９】《請求項４の実施例》：図５参照
タッチ判定部 51 から全体管理部 50 に送信されてくるタッチ通知が、図５(a) に示されるようなオブジェクトとの位置関係、即ち、該オブジェクトを挟み込む位置関係になっているかを、図５(b) に示した、当該オブジェクトの表示情報テーブルの内容と比べ、該オブジェクトを挟み込んだ位置関係になっているとき、全体管理部 50 は、該オブジェクトの特殊状態ファイル（掴んだときの表示ファイルで、例えば、色反転ファイル）を現在の表示位置に表示するよう、表示切り変え要求を表示管理部 52 へ送信する。上記の位置関係になっていないと

【００４０】その後、タッチ通知を受信して、表示位置を２本指のほぼ中央に変更するように、図５(b) に示した表示情報テーブルの表示位置情報の表示座標(X,Y)（網掛けで示す）を更新し、該更新した表示情報テーブルに基づいた表示切り変え要求を表示管理部 52 へ送信する。

【００４１】タッチ通知で連続タッチ終了が来ると、全体管理部 50 は、該掴み表示されているオブジェクトの通常表示ファイルを、その時点での表示位置に表示するよう、表示切り変え要求を表示管理部 52 へ送信する。

【００４２】《請求項５の実施例》：図６(a1)参照
タッチ判定部 51 から全体管理部 50 に送信されてくるタッチ通知が、図６(a1)に示されるようなオブジェクトとの位置関係、即ち、該オブジェクトを指で移動させる位置関係｛具体的には、オブジェクトの端を指で触り、指をタッチパネル 1a に触れたまま、該オブジェクト上を移動する関係｝になっているかを、図６(b) の表示情報テーブルの内容と比べ，該位置関係になっているとき、全体管理部 50 はタッチ通知の示すユーザの指の位置にオブジェクトの表示が隣接するよう、表示切り変え要求｛表示情報テーブルの表示位置情報の左上座標(X,Y) ＋通常表示ファイル名｝を表示管理部 52 へ送信する。該タッチ通知で連続タッチ終了が来るまで、該表示を続ける。

【００４３】《請求項６の実施例》：図６(a2)参照
上記請求項５の実施例で、全体管理部 50 がオブジェクトの中心を指が押しているかどうかを判定し、図６(a2)に示したように、中心からはずれていたら、図６(b) の表示情報テーブルの回転角（表示角度）を２度ずつ増加させて、その旨の表示切り変え要求を表示管理部 52 へ送信する。

【００４４】表示管理部 52 は、該当の表示ファイルをハードディスク 7からメインメモリ5へロードし（図３参照）、オブジェクトの左上座標(X,Y) を表示切り変え要求で指示された場所で、そこを中心に回転角分回転させ、表示用フレームメモリ 6上へコピーする。

【００４５】《請求項７の実施例》：図７(a1)参照
タッチ判定部 51 から全体管理部 50 に送信されてくるタッチ通知が、図７(a1)に示されるようなオブジェクトとの位置関係、即ち、オブジェクトを指ではじくような位置関係になっているかを、図７(b)に示した表示情報テーブルの内容と比べ、該位置関係になっているとき、全体管理部 50 はタッチ通知から指の速度を決定すると共に、上記請求項２の実施例と同様にして、オブジェクトの移動速度（表示管理部へ表示切換え要求を送信する時間間隔）を決定し、指の移動した方向に表示を移動するため、図７(b) の表示情報テーブルの表示位置情報の左上座標(X,Y) を変更しながら、表示切換え要求を表示管理部 52 へ送信する。該表示時間間隔が、例え

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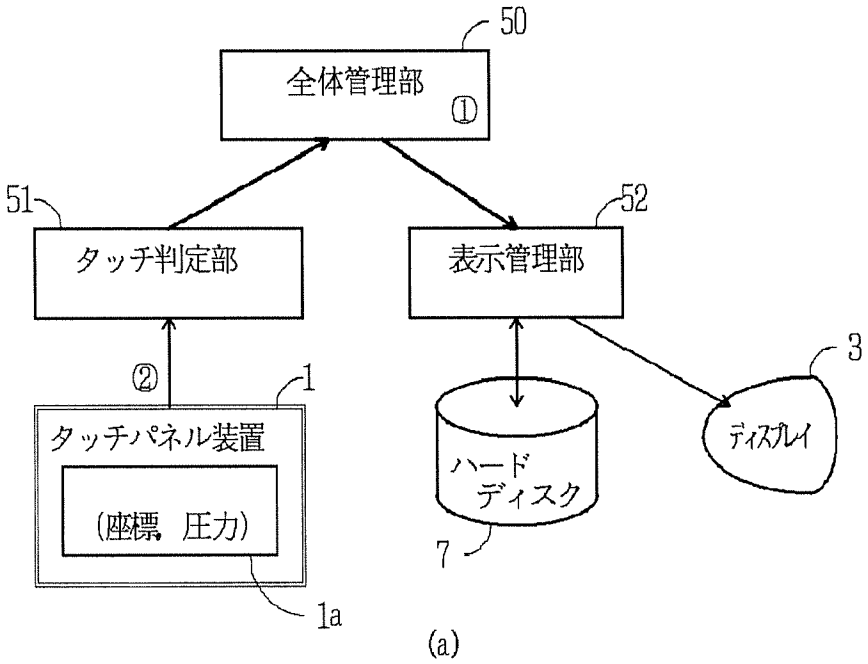
【００４６】この場合のオブジェクトの移動は、指の速度を初速度とする、所謂、慣性移動となる。
《請求項８の実施例》：図７(a2)参照
上記請求項７の実施例で、オブジェクトを移動表示するとき、該オブジェクトの表示情報テーブルのオブジェクト種別が、例えば、該オブジェクトに重力がかかっていることを指示しているとき、該オブジェクトの移動は、図７(a2)に示したように、上記慣性移動＋重力移動となるので、例えば、２の表示切換え回数乗した数（指数関数）をＹ座標に加えて、図７(b) に示した表示情報テーブルの表示位置情報の左上座標(X,Y) を変更しながら、表示切換え要求を表示管理部52 へ送信する。
【００４７】この場合も、上記請求項７の実施例と同じく、表示時間間隔が２秒以上になったら、該オブジェクト移動を終了する。
《請求項９の実施例》：図８参照
タッチ判定部 51 から全体管理部 50 に送信されてくるタッチ通知が、図８(b) に示した表示情報テーブルのオブジェクト種別から、例えば、図８(a) に示したように、転がるオブジェクトに対するものだと確認できたとき、全体管理部50 はタッチ通知での指の移動方向の、例えば、10%遅らせた位置にオブジェクトの表示を行うように、図８(b) の表示情報テーブルの表示位置情報の左上座標(X,Y) を変更しながら、表示切換え要求を表示管理部 52 へ送信する。そして、該表示切換え要求を表示管理部 52 へ送信は、タッチ通知で連続タッチ終了が来るまで続ける。
【００４８】若し、上記において、転がるオブジェクトに対するものでなかったとき、該タッチ操作は無視される。
《請求項１０の実施例》：図９参照
タッチ判定部 51 から全体管理部 50 に送信されてくるタッチ通知が、図９(b) に示した表示情報テーブルのオブジェクト種別から、例えば、図９(a) に示したように、歪みオブジェクト、即ち、指による圧力で変形するオブジェクトに対するものだと確認できたとき、全体管理部は図９(b) の表示情報テーブルが指示する、当該オブジェクトの特殊状態ファイル（歪んだときの表示ファイル）を現在の表示位置に表示するよう、表示切り変え要求を表示管理部 52 へ送信する。
【００４９】その後のタッチ通知で連続タッチ終了が来ると、全体管理部50 は、該オブジェクトの通常表示ファイルを現在の表示位置に表示するよう、表示切り変え要求を表示管理部 52 へ送信する。
【００５０】上記の実施例においては、オブジェクトの歪みが１つの例で説明したが、タッチパネル 1a からのタッチパネル情報が指示する、例えば、指の圧力が、種々あり、それぞれに対して、オブジェクトの歪み量が変わるような場合には、上記特殊状態ファイル（歪んだとがある。
【００５１】勿論、上記において、指による圧力で変形するオブジェクトに対するものだと確認できなかったときには、該タッチパネル操作を無視する。このように、本発明は、タッチパネル装置 1を備えた情報処理装置において、少なくとも、オブジェクトの物理的種別と，ディスプレイ上の表示位置情報と，該オブジェクトの状態が設定されているファイル情報と，該オブジェクトの通常表示データが格納されている通常表示ファイルの名称と，該オブジェクトの特殊状態（反転表示）にある表示データが格納されている特殊状態ファイルの名称とからなる表示情報テーブルと、タッチ位置座標と、タッチ圧力情報とからなるタッチパネル情報とを設け、上記表示情報テーブルが示す物理的情報と、上記タッチパネル情報が示す物理的情報との対応関係で決まる物理操作を、該オブジェクトに与えて表示するようにしたところに特徴がある。
【００５２】
【発明の効果】以上、詳細に説明したように、本発明のタッチパネルによるオブジェクト表示方法は、タッチパネル装置を備えた情報処理装置において、少なくとも、オブジェクトの物理的種別と，ディスプレイ上の表示位置情報と，該オブジェクトの状態が設定されているファイル情報と，該オブジェクトの通常の表示データが格納されている通常表示ファイルの名称と，該オブジェクトの特殊状態（反転表示）にある表示データが格納されている特殊状態ファイルの名称とからなる表示情報テーブルと、タッチ位置座標と、タッチ圧力情報とからなるタッチパネル情報とを設け、上記表示情報テーブルが示す物理的情報と、上記タッチパネル情報が示す物理的情報との対応関係で決まる物理操作を、該オブジェクトに与えて表示するようにしたものであるので、ワークステーションなどの専門的な知識を持たないユーザにも、現実の空間をまねたインタフェースを採用することによって、馴染みやすい使用環境を提供できる効果が得られる。
【図面の簡単な説明】
【図１】本発明の原理説明図（その１）
【図２】本発明の原理説明図（その２）
【図３】タッチパネル付きワークステーションの構成例を示した図
【図４】本発明の一実施例を示した図（その１）
【図５】本発明の一実施例を示した図（その２）
【図６】本発明の一実施例を示した図（その３）
【図７】本発明の一実施例を示した図（その４）
【図８】本発明の一実施例を示した図（その５）
【図９】本発明の一実施例を示した図（その６）
【図１０】従来のコンピュータのユーザインタフェースを説明する図

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1	タッチパネル装置	1a	タッチパネル	定部			
				52	表示管理部		
2	キーボード／マウス	3	ディスプレイ	6	表示用フレームメモリ	7	２次記憶装置，ハードディスク
4	中央処理装置(CPU)	5	メインメモリ		表示情報テーブル		タッチパネル情報
50	全体管理部	51	タッチ判				

【図１】

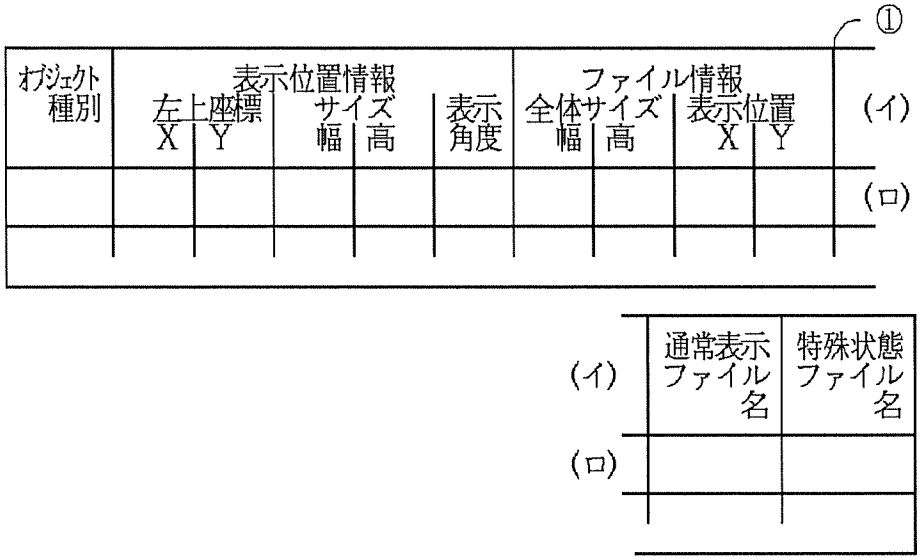
本発明の原理説明図（その１）



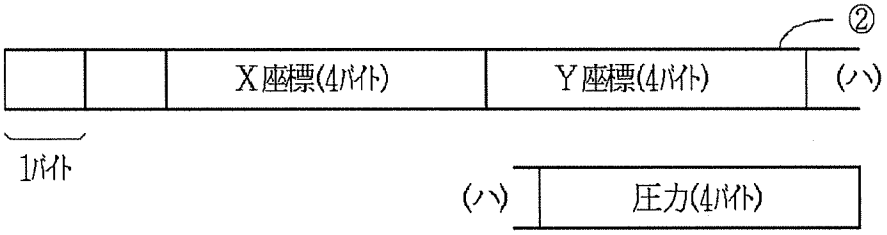
(a)

【図２】

本発明の原理説明図（その２）



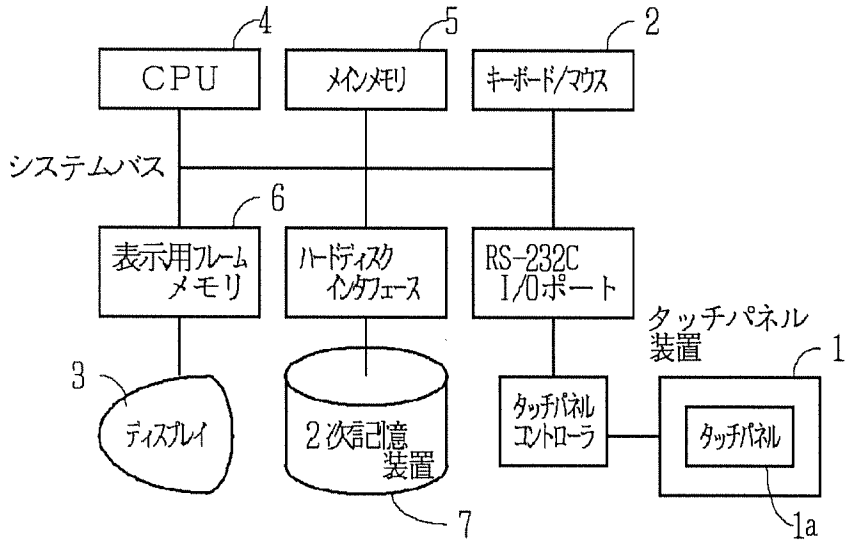
(b1)



(b2)

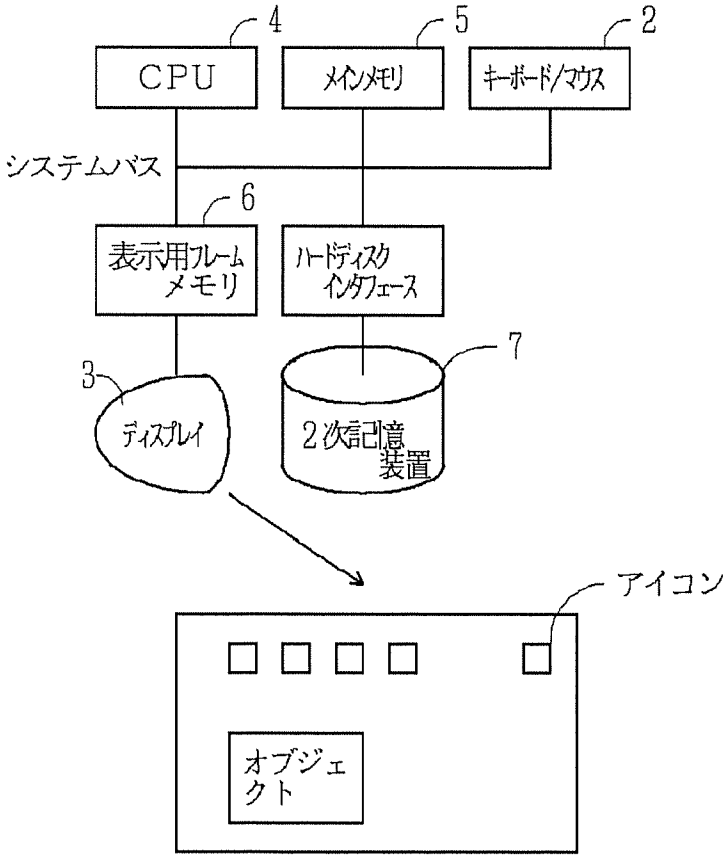
【図3】

タッチパネル付きワークステーションの構成例を示した図



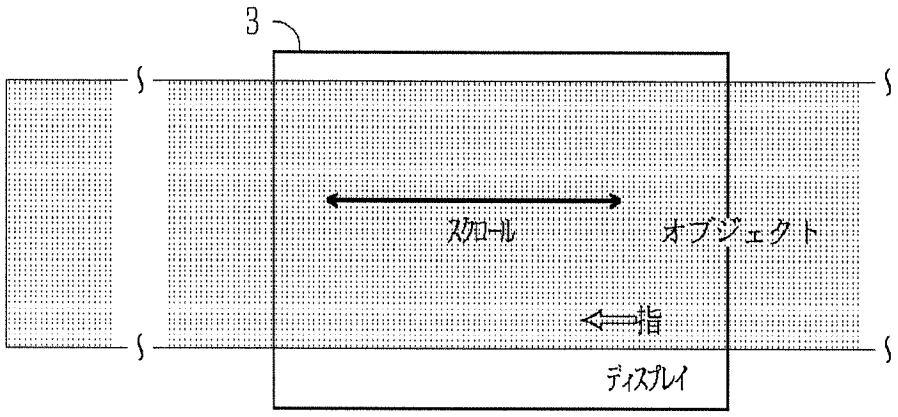
【図10】

従来のコンピュータのユーザインタフェースを説明する図



【図４】

本発明の一実施例を示した図（その１）



(a)

①

オブジェクト種別	表示位置情報 左上座標 X	左上座標 Y	サイズ 幅	サイズ 高	表示角度	ファイル情報 全体サイズ 幅	全体サイズ 高	表示位置 X	表示位置 Y	
画面外	0	100	1152	700	0	3000	700	1000	0	(ロ)

(イ)

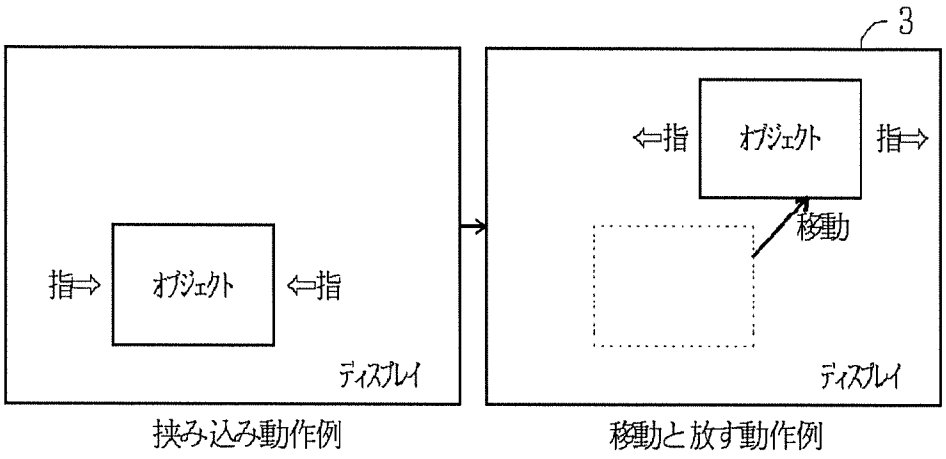
★網掛け部分を10ドットずつ増やして行く

	通常表示ファイル名	特殊状態ファイル名
(ロ)	BIG	——

(b)

【図５】

本発明の一実施例を示した図（その２）



(a)

①

ｵﾌﾞｼﾞｪｸﾄ種別	表示位置情報 左上座標 X	左上座標 Y	サイズ 幅	サイズ 高	表示角度	ファイル情報 全体サイズ 幅	全体サイズ 高	表示位置 X	表示位置 Y	(イ)
通常	200	500	400	300	0	—	—	—	—	(ロ)

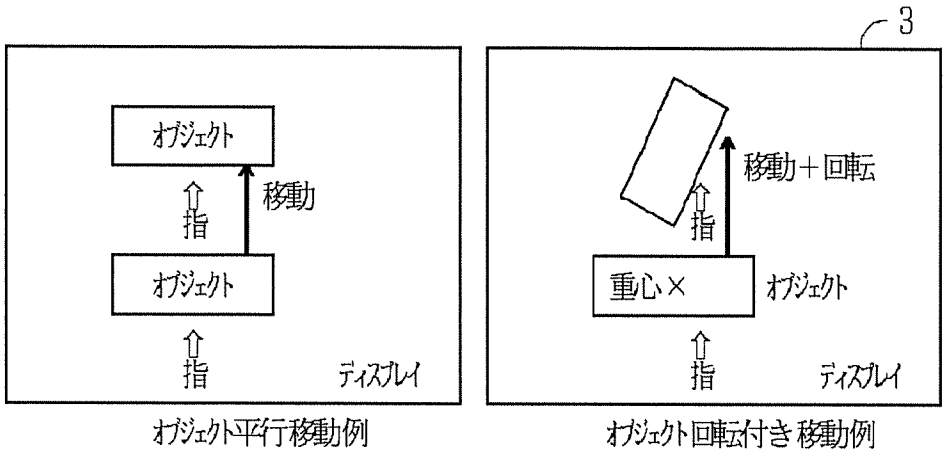
★網掛け部分を指の動きに合わせて変更して行く

(イ)	通常表示ファイル名	特殊状態ファイル名
(ロ)	OBJ1	OBJ10

(b)

【図6】

本発明の一実施例を示した図（その3）



オブジェクト平行移動例　　オブジェクト回転付き移動例

(a1)　　(a2)

①

オブジェクト種別	表示位置情報 左上座標 X	左上座標 Y	サイズ 幅	サイズ 高	表示角度	ファイル情報 全体サイズ 幅	全体サイズ 高	表示位置 X	表示位置 Y	(イ)
通常	200	500	400	100	0	—	—	—	—	(ロ)

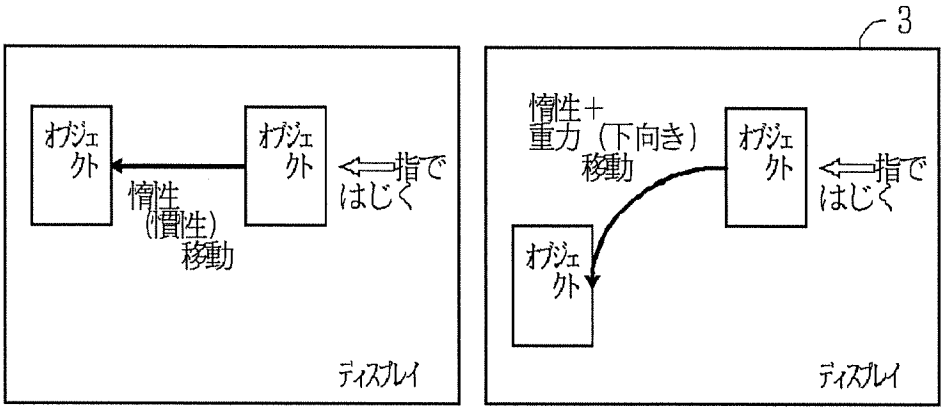
★請求項5では表示位置情報の左上座標のみを、変更し請求項6では表示角度も変更して行く。

(イ)	通常表示ファイル名	特殊状態ファイル名
(ロ)	OBJ2	——

(b)

【図７】

本発明の一実施例を示した図（その４）



指弾き移動例　　重力を考慮した指弾き移動例

(a1)　　(a2)

①

オブジェクト種別	表示位置情報 左上座標 X	左上座標 Y	サイズ 幅	サイズ 高	表示角度	ファイル情報 全体サイズ 幅	全体サイズ 高	表示位置 X	表示位置 Y	(イ)
通常	500	100	200	400	0	—	—	—	—	(ロ)

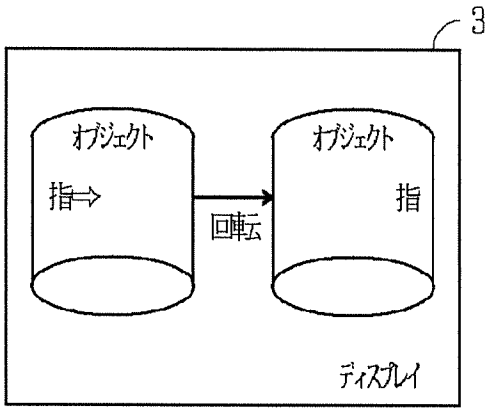
★網掛け部分を指の動きに合わせて変更して行く

(イ)	通常表示ファイル名	特殊状態ファイル名
(ロ)	OBJ3	——

(b)

【図８】

本発明の一実施例を示した図（その５）



(a)

①

オブジェクト種別	表示位置情報 左上座標 X	左上座標 Y	サイズ 幅	サイズ 高	表示角度	ファイル情報 全体サイズ 幅	全体サイズ 高	表示位置 X	表示位置 Y	(イ)
転がり	50	100	400	500	0	—	—	—	—	(ロ)

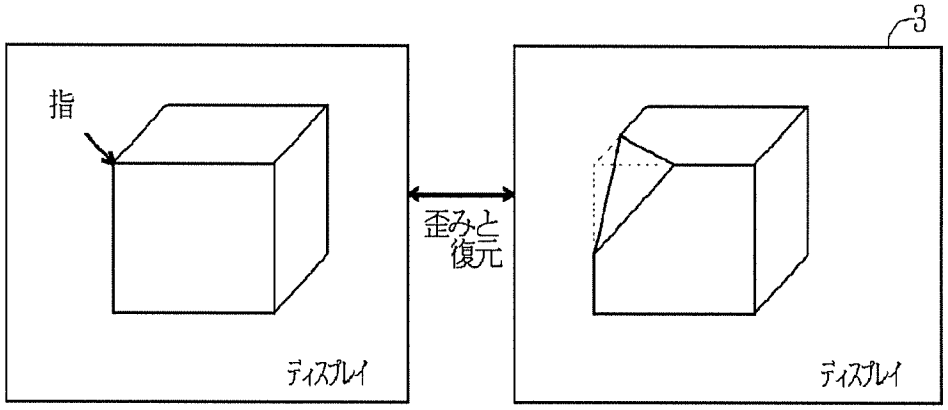
★網掛け部分を指の動きに合わせて変更して行く

(イ)	通常表示ファイル名	特殊状態ファイル名
(ロ)	OBJ4	——

(b)

【図9】

本発明の一実施例を示した図（その6）



(a)

①

オブジェクト種別	表示位置情報 左上座標 X	Y	サイズ 幅	高	表示角度	ファイル情報 体サイズ 幅	高	表示位置 X	Y	(イ)
歪み	200	200	400	400	0	—	—	—	—	(ロ)

★変更箇所は無し

(イ)	通常表示ファイル名	特殊状態ファイル名
(ロ)	OBJ5	OBJ50

(b)

フロントページの続き

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[続葉有]

(54) **Title**: INFORMATION PROCESSING DEVICE, INFORMATION PROCESSING METHOD, AND INFORMATION PROCESSION PROGRAM

(54) 発明の名称 : 情報処理装置、情報処理方法及び情報処理プログラム

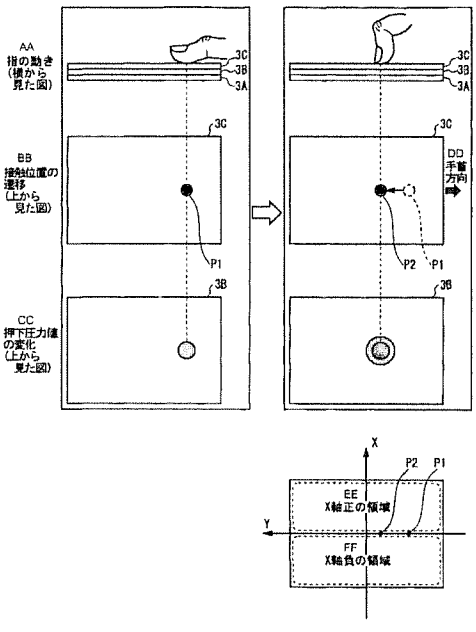


図 4

AA... FINGER MOTION (SIDE VIEW FIGURE)
BB... TRANSIT OF TOUCH LOCATION (TOP VIEW FIGURE)
CC... CHANGE IN PUSHING PRESSURE (TOP VIEW FIGURE)
DD... DIRECTION OF WRIST
EE... POSITIVE REGION OF X AXIS
FF... NEGATIVE REGION OF X AXIS

(57) **Abstract**: It is possible for a user to easily input operations without viewing an operating surface. With respect to the operating surface of a touchscreen (3C) of a music playback device (1), when an operation is detected where, while maintaining finger contact, the contact point of a finger is changed from the pad of the finger to the tip, it is presumed that the direction going from the finger tip contact location to the finger pad contact location is the direction of the wrist of a hand that is operating the touchscreen (3C), and coordinate axes are set where said direction is the down direction with respect to the operating surface. Then, the contact location of the finger with respect to the operating surface is converted to coordinates based on said coordinate axes, and commands are input with respect to said coordinates. As a result, it is possible to recognize the operations of the user in accordance with the direction of the user's hand with respect to the operating surface, and so the user may perform operations with the direction of the user's hand with respect to the operating surface as a baseline, and the user may easily perform operations even without viewing the operating surface.

(57) 要約:

[続葉有]

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CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

添付公開書類:

— 国際調査報告（条約第 21 条(3)）

ユーザに操作面を視認させなくても容易に操作入力を行わせることができる。音楽再生装置（１）は、タッチパネル（３Ｃ）の操作面に対して、指を接触させたまま、接触部分を指の腹から先へ変える操作が行われたことを認識すると、指の先が接触した位置から指の腹が接触した位置へ向かう方向をタッチパネル（３Ｃ）を操作する手の手首方向と推定し、操作面に対して当該方向を下方向とする座標軸を設定する。そして、操作面に対して指が接触した接触位置を当該座標軸に基づいて座標に変換し、当該座標に基づいて命令を入力する。このように、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができるので、操作面に対するユーザの手の向きを基準とした操作をユーザに行わせる

明　細　書

発明の名称　情報処理装置、情報処理方法及び情報処理プログラム

技術分野

本発明は、情報処理装置、情報処理方法及び情報処理プログラムに関し、例えばタッチパネルを有する情報処理装置に適用して好適なものである。

背景技術

近年、表示部の表示面上に透明なタッチパネルを有し、ユーザがタッチパネルの操作面を触ることで操作入力が可能な情報処理装置が広く普及している。

このような情報処理装置としては、例えばユーザが表示面に表示されたボタンやアイコンなどの表示子を、操作面を介して指で押下するように選択し、選択された表示子に応じた処理を実行するものが提案されている。

またこのような情報処理装置として、例えばユーザが表示面に表示された画面に対して操作面を介して所定の軌跡を描くような操作を行い、この軌跡に応じた処理を実行するものも提案されている（例えば、特許文献１参照）。

先行技術文献

特許文献１　特開２００５－３３９４２０号公報

発明の概要

ところで、上述した情報処理装置は、表示面に操作対象となる表示子や画面を表示し、これらに対して操作面を介して操作されることで、命令を入力するようになされている。

従って、上述した情報処理装置において、ユーザが所望の操作を行うためには、表示面に表示されている表示子や画面などを、操作面を介して視認して操作入

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力を行わなければならなかった。

ゆえに、ユーザが、上述した情報処理装置を鞄の中や衣服のポケットの中などに入れている場合、操作面を視認するために情報処理装置を取り出さなければならず、不便であった。

本発明は以上の点を考慮してなされたもので、ユーザに操作面を視認させなくても容易に操作を行わせ得る情報処理装置、情報処理方法及び情報処理プログラムを提案しようとするものである。

かかる課題を解決するため本発明の情報処理装置においては、操作部の操作面に対して指が接触した位置を検出する接触検出部と、操作面に設定された座標軸に基づいて、接触検出部が検出した当該位置を座標に変換する座標変換部と、座標変換部から得られる座標に基づいて命令を入力する命令入力部と、操作面に対して、指を接触させたまま、接触部分を指の腹から先へ、もしくはその逆に変える操作が行われたことを認識する操作認識部と、操作認識部により当該操作が認識されると、指の腹が接触した位置から指の先が接触した位置へ向かう方向を操作部を操作する手の手首方向と推定し、操作面に対して、当該方向に応じて座標軸を設定する座標軸設定部とを設けるようにした。

このように操作面に対するユーザの手の向きに応じて操作面の座標軸を設定することで、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。これにより、操作面に対するユーザの手の向きがどのような向きであろうと、常に操作面に対するユーザの手の向きを基準とした操作をユーザに行わせることができる。

また、かかる課題を解決するため本発明の情報処理装置においては、操作部の操作面に対して指が接触した位置及び指が接触した範囲を検出する接触検出部と、操作面に設定された座標軸に基づいて、接触検出部が検出した当該位置を座標に変換する座標変換部と、座標変換部から得られる座標に基づいて命令を入力する命令入力部と、操作面に対して、指を接触させたまま回転させる操作が行われたことを認識する操作認識部と、操作認識部により当該操作が認識されると、指

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が接触した範囲の中から指の根元が接触した位置と指の先が接触した位置とを検出し、当該指の根元が接触した位置から当該指の先が接触した位置へ向かう方向を操作部を操作する手の手首方向と推定し、操作面に対して、当該方向に応じて座標軸を設定する座標軸設定部とを設けるようにした。

このように操作面に対するユーザの手の向きに応じて操作面の座標軸を設定することで、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。これにより、操作面に対するユーザの手の向きがどのような向きであろうと、常に操作面に対するユーザの手の向きを基準とした操作をユーザに行わせることができる。

本発明によれば、操作面に対するユーザの手の向きに応じて操作面の座標軸を設定することで、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。これにより、操作面に対するユーザの手の向きがどのような向きであろうと、常に操作面に対するユーザの手の向きを基準とした操作をユーザに行わせることができる。かくして、ユーザに操作面を視認させなくても容易に操作を行わせ得る情報処理装置、情報処理方法及び情報処理プログラムを実現することができる。

図面の簡単な説明

図１は、本発明における音楽再生装置の構成を示す略線図である。

図２は、本発明における音楽再生装置の構成を示すブロック図である。

図３は、本発明における楽曲切替え操作の説明に供する略線図である。

図４は、本発明の第１の実施の形態におけるブラインドモード切替え操作の説明に供する略線図である。

図５は、本発明における楽曲切替え操作の説明に供する略線図である。

図６は、本発明の第１の実施の形態におけるブラインド操作処理手順を示すフローチャートである。

図７は、本発明の第１の実施の形態における音楽再生装置の機能構成を示すブ

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ロック図である。

図８は、本発明の第２の実施の形態におけるブラインドモード切替え操作の説明に供する略線図である。

図９は、本発明の第２の実施の形態におけるブラインド操作処理手順を示すフローチャートである。

図１０は、本発明の第２の実施の形態における音楽再生装置の機能構成を示すブロック図である。

図１１は、本発明の他の実施の形態におけるブラインドモード切替え操作の説明の供する略線図である。

発明を実施するための形態

以下、発明を実施するための最良の形態（以下実施の形態とする）について説明する。なお、説明は以下の順序で行う。

１．第１の実施の形態（指を立てる操作をブラインドモード切替え操作とする例）

２．第２の実施の形態（指を回転させる操作をブラインドモード切替え操作とする例）

３．他の実施の形態

＜１．第１の実施の形態＞

［１－１．音楽再生装置の全体構成］

図１において、１は全体として音楽再生装置を示す。この音楽再生装置１は携帯型であり、片手で把持し得る程度の大きさ（いわゆる手の平サイズ）でなる扁平矩形状の筐体２を有する。この筐体２の表面には、長方形板状の表示部３が設けられている。図１（Ｂ）に示すように表示部３は、ＬＣＤ(Liquid Crystal Display)３Ａの表示面上に、透明な感圧センサ３Ｂ及び透明なタッチパネル３Ｃを順に張り付けるようにして形成されている。

音楽再生装置１は、このタッチパネル３Ｃの操作面に対する操作を認識すると

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、当該操作に応じて、楽曲の再生、停止、音量の増減などの各種命令を入力するようになされている。因みにここでは、静電容量方式のタッチパネル３Ｃを用いている。

また、この表示部３の裏面には各電子回路が実装された基板４が張り付けられ、当該基板４と表示部３とが電気的に接続されるようになされている。

ちなみに、以下の説明では、筐体２が一方向へは比較的短く形成されているため当該一方向を筐体短手方向とも呼ぶ。また以下の説明では、筐体が他方向へは比較的長く形成されているため当該他方向を筐体長手方向とも呼ぶ。またここでは、筐体短手方向を筐体２の左右方向とし、筐体長手方向を筐体２の上下方向とする。そして以下の説明では、筐体２の四方の側面において右方の側面を右面、左方の側面を左面、上方の側面を上面、下方の側面を下面とも呼ぶ。

筐体２の下面には、ヘッドホン端子（図示せず）が設けられ、このヘッドホン端子を介して、ヘッドホン５が接続されるようになされている。音楽再生装置１は、このヘッドホン５を介してユーザに再生した楽曲の音声を聴取させるようになされている。

［１－２．音楽再生装置の回路構成］

つづいて、音楽再生装置１の各回路部を、図２を用いて説明する。音楽再生装置１では、各回路部がバス１０を介して接続されている。ＣＰＵ１１は、不揮発性メモリ１２に記憶されているプログラムをＲＡＭ（Random Access Memory）１３に読み出す。そしてＣＰＵ１１は、読み出したプログラムをＲＡＭ１３上で展開し、この展開したプログラムに従って各回路部を制御すると共に、各種処理を実行するようになされている。

ＣＰＵ１１は、接続部（図示せず）を介して外部機器と接続されると、外部機器から楽曲データを取得し、この楽曲データを不揮発性メモリ１２に記憶するようになされている。因みに、楽曲データには楽曲の音声データだけでなく、その楽曲に関連する情報（タイトル名、アーティスト名、アルバム名、ジャケット写真画像など）のデータが含まれる。

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また、ＣＰＵ１１は、タッチパネル３Ｃを介して楽曲を再生する操作が行われたことを認識すると、これに応じて不揮発性メモリ１２からこの楽曲の音声データを読み出して、これを再生部１４に送出する。

再生部１４は、この楽曲の音声データに対して復号処理及び増幅処理などの所定の再生処理を施すことにより音声信号を得て、この音声信号を音声出力部１５に送出する。この結果、音声出力部１５からヘッドホン５を介してこの音声信号に基づく楽曲の音声が出力されるようになされている。

また、ＣＰＵ１１は、不揮発性メモリ１２に記憶されている楽曲データから楽曲に関連する情報（タイトル名、アーティスト名、アルバム名、ジャケット写真画像など）を取得し、ＬＣＤ３Ａに表示するようになされている。

タッチパネル３Ｃは、格子状に配置された複数の静電センサを有している。これらの静電センサは、ユーザの指が接触すると静電容量を増加させるようになされている。

タッチパネル３Ｃは、静電センサの静電容量が変化すると、当該静電センサの静電容量の値と当該静電センサのタッチパネル３Ｃの操作面における位置とを示す静電センサ情報をＣＰＵ１１に送出する。

ＣＰＵ１１は、この静電センサ情報に基づいて、タッチパネル３Ｃに対してユーザの指が接触した範囲（これを接触範囲とも呼ぶ）を検出し、タッチパネル３Ｃの操作面に設定された座標軸に基づいて、この接触範囲を座標に変換する。

そしてＣＰＵ１１は、この座標に基づいて接触範囲の形状を算出し、その形状における重心の座標を算出する。そしてＣＰＵ１１は、この重心の座標をユーザの指が接触した位置（これを接触位置とも呼ぶ）の座標として算出する。そしてＣＰＵ１１は、この接触位置の座標に基づいてタッチパネル３Ｃの操作面に対するユーザの操作を認識し、この操作に応じて各種命令を入力する。

感圧センサ３Ｂは、ユーザの指がタッチパネル３Ｃの操作面を押下した圧力（これを押下圧力とも呼ぶ）を検出し、この押下圧力を示す押下圧力値をＣＰＵ１１に送出する。尚、ここで、押下圧力値は、０～２５５の値をとるとする。

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［１－３．楽曲切替え操作］

次に、この音楽再生装置１での楽曲切替え操作について、詳しく説明する。まず、ＣＰＵ１１は、不揮発性メモリ１２に記録されている楽曲データから複数枚の楽曲のジャケット写真画像を読み出す。そして、ＣＰＵ１１は、図３（Ａ）に示すように、これらのジャケット写真画像Ｊ（Ｊ０、Ｊ１、Ｊ２、…、Ｊｎ）を奥行き方向に連続して重ねるように配置した楽曲切替え画面２０をＬＣＤ３Ａに表示する。

具体的に、ＣＰＵ１１は、楽曲切替え画面２０において、一番手前のジャケット写真画像Ｊ０が手前に倒れたように表示し、このジャケット写真画像Ｊ０の奥にジャケット写真画像Ｊ１を他のジャケット写真画像と重ならないように表示する。このような楽曲切替え画面２０において、ＣＰＵ１１はジャケット写真画像Ｊ１に対応する楽曲を選択している状態である。

このときＣＰＵ１１は、ユーザが表示部３を視認して操作を行う通常モードであるとする。通常モードのとき、ＣＰＵ１１は、タッチパネル３Ｃの操作面の中心を原点とし、筐体短手方向をＸ軸、筐体長手方向をＹ軸とする座標軸を当該操作面に設定する。ＣＰＵ１１は、この座標軸を、Ｙ軸正の方向が上面方向、Ｙ軸負の方向が下面方向、Ｘ軸正の方向が右面方向、Ｘ軸負の方向が左面方向となるように設定する。ＣＰＵ１１は、通常モードのとき、この座標軸に従って、ＬＣＤ３Ａに各種表示画面（例えば楽曲切替え画面２０）を表示し、ユーザに各種操作を行わせる。

この通常モードのとき、例えばユーザが指によりタッチパネル３Ｃの操作面内における右側の領域、つまりＸ軸正の領域を押下したとする。

このときＣＰＵ１１は、タッチパネル３Ｃを介して接触位置の座標を取得し、感圧センサ３Ｂを介して押下圧力値を取得する。そしてＣＰＵ１１は、接触位置がＸ軸正の領域であり、図３（Ｂ）に示すように、押下圧力値が所定の閾値Ａ１（例えば５０）以上閾値Ａ２（例えば７０）未満であると判別すると、選択する楽曲を次の楽曲に切替える。

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またＣＰＵ１１は、接触位置がＸ軸正の領域であり、押下圧力値が閾値Ａ２以上閾値Ａ３（例えば９０）未満であると判別すると、選択する楽曲を次のアルバムの楽曲に切替える。

またＣＰＵ１１は、接触位置がＸ軸正の領域であり、押下圧力値が閾値Ａ３以上であると判別すると、選択する楽曲を次の頭文字のアルバム名を持つアルバムの楽曲に切替える。次の頭文字のアルバム名を持つアルバムとは、例えば、現在選択されている楽曲のアルバム名の頭文字が「Ａ」の場合、アルバム名の頭文字が「Ｂ」のアルバムである。

このようにＣＰＵ１１は、押下圧力に応じて楽曲を切替える単位を変化させるようになされており、ユーザが指でタッチパネル３Ｃを強く押し込むほど楽曲を切替える単位を大きくするようになされている。

そしてＣＰＵ１１は、本のページをめくるように、今まで選択されていた楽曲に対応するジャケット写真画像Ｊ１を手前側に倒すようなアニメーションを表示し、切替えた楽曲に対応するジャケット写真画像Ｊ２を新たに表示する。これによりＣＰＵ１１は、選択する楽曲を次の楽曲に切り替えたことをユーザに認識させることができる。

また、ユーザがタッチパネル３Ｃから指を離したとする。このときＣＰＵ１１は、タッチパネル３Ｃを介して、当該タッチパネル３Ｃからユーザの指が離れたことを認識し、選択された楽曲（ジャケット写真画像Ｊ２に対応する楽曲）の音声データを再生部１４に再生させる。この結果、音声出力部１５からこの楽曲の音声が出力される。

また通常モードのとき、例えばユーザが指でタッチパネル３Ｃの操作面内における左側の領域、つまりＸ軸負の領域を押下したとする。

このときＣＰＵ１１は、タッチパネル３Ｃを介して接触位置の座標を取得し、感圧センサ３Ｂを介して押下圧力値を取得する。そして、ＣＰＵ１１は、これらの情報から接触位置がＸ軸負の領域であり、押下圧力値が閾値Ａ１以上閾値Ａ２未満であると判別すると、選択する楽曲を前の楽曲に切替える。

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またＣＰＵ１１は、接触位置がＸ軸負の領域であり、押下圧力値が閾値Ａ２以上閾値Ａ３未満であると判別すると、選択する楽曲を前のアルバムの楽曲に切替える。

またＣＰＵ１１は、接触位置がＸ軸負の領域であり、押下圧力値が閾値Ａ３以上であると判別すると、選択する楽曲を前の頭文字のアルバム名を持つアルバムの楽曲に切替える。

そしてＣＰＵ１１は、本のページをめくるように、手前側に倒れていたジャケット写真画像Ｊ０を起こすようなアニメーションを表示し、選択された楽曲に対応するジャケット写真画像Ｊ０をよく見える状態で表示する。これによりＣＰＵ１１は、選択する楽曲を前の楽曲に切り替えたことをユーザに認識させることができる。

また、ユーザがタッチパネル３Ｃの操作面から指を離したとする。このときＣＰＵ1.1は、タッチパネル３Ｃを介して操作面からユーザの指が離れたことを認識し、選択された楽曲（ジャケット写真画像Ｊ０に対応する楽曲）の音声データを再生部１４に再生させる。この結果、音声出力部１５からこの楽曲の音声が出力される。

またユーザが、例えば楽曲の再生中、タッチパネル３Ｃの操作面に指を接触させ、下から上へ指をすべらせる操作を行ったとする。このときＣＰＵ１１は、タッチパネル３Ｃを介して、下から上へ指をすべらせる操作が行われたことを認識し、音声出力部１５を制御して出力する音声の音量を上げるようになされている。

一方ユーザが、楽曲の再生中、タッチパネル３Ｃの操作面に指を接触させ、上から下へ指をすべらせる操作を行ったとする。このときＣＰＵ１１は、タッチパネル３Ｃを介して上から下へ指をすべらせる操作が行われたことを認識し、音声出力部１５を制御して出力する音声の音量を下げるようになされている。

このように音楽再生装置１は、ユーザがタッチパネル３Ｃの操作面内の右側の領域を押下したことを認識すると選択する楽曲を次の楽曲に切り替え、当該操作

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面内の左側の領域を押下したことを認識すると選択する楽曲を前の楽曲に切替えるようになされている。

また音楽再生装置１は、ユーザがタッチパネル３Ｃの操作面から指を離したことを認識すると、そのとき選択している楽曲を再生するようになされている。

また音楽再生装置１は、ユーザがタッチパネル３Ｃの操作面上で、上から下、又は下から上へ指をすべらせる操作が行われたことを認識すると、音声出力部１５から出力される音量の増減を行うようになされている。

以上のように音楽再生装置１は、通常モードのとき、予めタッチパネル３Ｃの操作面に設定された座標軸に従って、ユーザの操作を認識するようになされている。従って音楽再生装置１は、この座標軸に応じた所定の向きでユーザに操作されるようになされている。

［１－４．ブラインド操作］

さらに、この音楽再生装置１では、ユーザが表示部３を視認せず操作を行うブラインドモードが設けられている。尚、ユーザが表示部３を視認せず行う操作をブラインド操作とも呼ぶ。この音楽再生装置１でのブラインド操作について、詳しく説明する。

音楽再生装置１では、通常モードからブラインドモードに切替えるための操作（これをブラインドモード切替え操作とも呼ぶ）が設定されている。具体的に、ブラインドモード切替え操作とは、図４に示すように、ユーザが、タッチパネル３Ｃの操作面に対して指を接触させたまま、指の接触している部分を指の腹から指の先へ変える操作である。つまり、ユーザがタッチパネル３Ｃの操作面を指の腹で押下し、さらにその指を操作面から離さずに、指の関節を曲げて指を立てることで操作面を指の先で押下する操作である。尚、このブラインドモード切替え操作は指１本で行うことが可能な操作である。

ここでユーザが、このようなブラインドモード切替え操作を行ったとする。このときＣＰＵ１１は、タッチパネル３Ｃを介して接触位置の座標を取得し、感圧センサ３Ｂを介して押下圧力値を取得する。そして、ＣＰＵ１１は、操作始めか

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ら操作終わりまでの接触位置の遷移と押下圧力値の変化とを検出する。

ここで、人間の指において、指の腹の重心と指の先の重心の位置が異なることより、ブラインドモード切替え操作は、タッチパネル３Ｃの操作面に対する接触位置が移動する操作となることが考えられる。

また、指の腹で押下するよりも指の関節を曲げて指の先で押下する方がユーザの指に力が入ることより、ブラインドモード切替え操作が行われたとき、操作始めから操作終わりに向かって感圧センサ３Ｂで検出される押下圧力値が増加すると考えられる。

従ってＣＰＵ１１は、タッチパネル３Ｃを介して取得した接触位置の座標に基づいて、接触位置が所定距離以上移動したか否かを判別する。またＣＰＵ１１は、操作始めの押下圧力値と比較して操作終わりの押下圧力値が所定値以上増加したか否かを判別する。

そしてＣＰＵ１１は、接触位置が所定距離以上移動し、操作始めの押下圧力値と比較して操作終わりの押下圧力値が所定値以上増加したことを検出すると、ユーザがブラインドモード切替え操作を行ったと認識する。このときＣＰＵ１１は、図４に示すように、操作始めの接触位置Ｐ１が指の腹が接触した位置であり、操作終わりの接触位置Ｐ２が指の先が接触した位置であることを認識する。そしてＣＰＵ１１は、ブラインドモードに切り替わる。

また、人間の指の特徴として、指の腹の重心が指の先の重心よりも手首側にあることより、指の腹が接触した位置よりも指の先が接触した位置はユーザの手首側にあると考えられる。

従って、ＣＰＵ１１は、ブラインドモードに切り替わると、操作終わりの接触位置Ｐ２から操作始めの接触位置Ｐ１へ向かう方向を、タッチパネル３Ｃを操作する手の手首方向であると推定する。そして、ＣＰＵ１１は、この手首方向をタッチパネル３Ｃの操作面における下方向と定義する。

そしてＣＰＵ１１は、定義したタッチパネル３Ｃの下方向をＹ軸負の方向とし、接触位置Ｐ１と接触位置Ｐ２とが通る直線がＹ軸となるように、タッチパネル

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３Ｃの操作面に設定された座標を変換する。すなわち、接触位置Ｐ１と接触位置Ｐ２とが通る直線によって、タッチパネル３Ｃの操作面がＸ軸正の領域（Ｙ軸に対して右側の領域）とＸ軸負の領域（Ｙ軸に対して左側の領域）とに分けられる。

このようにＣＰＵ１１は、ブラインドモード切替え操作が行われたことを認識するとブラインドモードに切り替わり、ブラインドモード切替え操作に基づいて、ユーザの手首方向を下方向とする座標軸をタッチパネル３Ｃの操作面に設定するようになされている。

そしてこのブラインドモードのとき、例えば図５に示すように、ユーザが、表示部３を視認せず、ブラインドモード切替え操作を行った位置からユーザにとっての右側に指をずらしてタッチパネル３Ｃを押下したとする。すなわちユーザは、タッチパネル３Ｃ上で、ブラインドモード切替え操作により変換された座標におけるＸ軸正の領域を押下する。

このときＣＰＵ１１は、タッチパネル３Ｃを介して接触位置の座標を取得し、感圧センサ３Ｂを介して押下圧力値を取得する。そしてＣＰＵ１１は、通常モードのときと同様に、接触位置の座標がＸ軸正の領域にあると判別すると、押下圧力値に応じて、選択する楽曲を次の楽曲又は次のアルバムの楽曲又は次の頭文字のアルバム名を持つアルバムの楽曲に切替える。

このようにＣＰＵ１１は、タッチパネル３Ｃの操作面に対するユーザの手の向きに応じた座標軸を当該操作面に設定することで、当該操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。これによりＣＰＵ１１は、ユーザに対して、操作面に対するユーザの手の向きを基準とした操作を行わせることができるので、ブラインド操作を行わせることができる。

そしてＣＰＵ１１は、選択する楽曲を切替えたことをユーザに通知する音声（これを通知音声とも呼ぶ）の音声データを不揮発性メモリ１２から読み出し、これを再生部１４に送出して再生部１４に再生させる。この結果、音声出力部１５からこの通知音声が出力される。通知音声とは、例えば「ネクストチューン」な

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ど次の楽曲であることを示す音声や、その楽曲のタイトル名を示す音声などである。

これにより音楽再生装置１は、ブラインドモードのとき、ユーザに表示部３を視認させなくても、選択されている楽曲が切替わったことをユーザに対して認識させることができる。

そして、ＣＰＵ１１は、通常モードのときと同様に、タッチパネル３Ｃの操作面からユーザの指が離れたことを検出すると、選択された楽曲の音声データを再生部１４に再生させる。この結果、音声出力部１５からこの楽曲の音声が出力される。

またブラインドモードのとき、例えば図５に示すように、ユーザが、表示部３を視認せず、ブラインドモード切替え操作を行った位置からユーザにとっての左側に指をずらしてタッチパネル３Ｃを押下したとする。すなわちユーザは、ブラインドモード切替え操作により変換された座標においてＸ軸負の領域を押下する。

このときＣＰＵ１１は、タッチパネル３Ｃを介して接触位置の座標を取得し、感圧センサ３Ｂを介して押下圧力値を取得する。そしてＣＰＵ１１は、通常モードのときと同様に、接触位置がＸ軸負の領域であると判別すると、押下圧力値に応じて、選択する楽曲を前の楽曲又は前のアルバムの楽曲又は前の頭文字のアルバム名を持つアルバムの楽曲に切替える。そしてＣＰＵ１１は、上述したと同様に通知音声を再生部１４に再生させ、音声出力部１５からこの通知音声を出力させる。

そして、ＣＰＵ１１は、通常モードのときと同様に、タッチパネル３Ｃの操作面からユーザの指が離れたことを認識すると、選択された楽曲の音声データを再生部１４に再生させる。この結果、音声出力部１５からこの楽曲の音声が出力される。

またユーザが、表示部３を視認せず、例えば、楽曲の再生中、タッチパネル３Ｃの操作面に指を接触させ、ユーザの手首方向から指の先方向へ指をすべらせる

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操作を行ったとする。すなわちユーザは、ブラインドモード切替え操作により変換された操作面の座標軸における下から上（Ｙ軸正の方向）へ指をすべらせる操作を行う。

このときＣＰＵ１１は、通常モードのときと同様に、タッチパネル３Ｃを介して、下から上へ指をすべらせる操作が行われたと認識し、音声出力部１５を制御して出力する音声の音量を上げるようになされている。

一方ユーザが、表示部３を視認せず、例えば、楽曲の再生中、タッチパネル３Ｃの操作面に指を接触させ、ユーザの指の先方向から手首方向へ指をすべらせる操作を行ったとする。すなわちユーザは、ブラインドモード切替え操作により変換された操作面の座標軸における上から下（Ｙ軸負の方向）へ指をすべらせる操作を行う。

このときＣＰＵ１１は、通常モードのときと同様に、タッチパネル３Ｃを介して上から下へ指をすべらせる操作が行われたと認識し、音声出力部１５を制御して出力する音声の音量を下げるようになされている。

このように音楽再生装置１は、ブラインドモードのときも、通常モードのときと同様に、タッチパネル３Ｃの操作面に設定された座標軸における右側の領域をユーザが押下したと認識すると選択する楽曲を次の楽曲に切り替えるようになされている。また音楽再生装置１は、当該座標軸における左側の領域をユーザが押下したと認識すると選択する楽曲を前の楽曲に切替えるようになされている。

そして音楽再生装置１は、ブラインドモードのときも、通常モードのときと同様に、ユーザがタッチパネル３Ｃから指を離したことを認識すると、そのとき選択されている楽曲を再生するようになされている。また、音楽再生装置１は、ブラインドモードのときも、通常モードのときと同様に、タッチパネル３Ｃの操作面に設定された座標軸に従って、当該操作面上で上から下、又は下から上へ指をすべらせる操作を認識し、音量の増減を行うようになされている。因みに、このような楽曲の切替え、再生、音量の増減などの操作は、全て指１本で行うことが可能な操作である。

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以上のように音楽再生装置１は、ブラインドモードのとき、タッチパネル３Ｃの操作面に対するユーザの手の向きに応じた座標軸を当該操作面に設定することで、当該操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。

これにより音楽再生装置１は、ユーザに、当該操作面に対する手の向きがどのような向きであろうと、当該操作面に対するユーザの手の向きを基準とした操作を行わせることができるので、ブラインド操作を行わせることができる。

またこれにより音楽再生装置１は、ブラインドモードのときも通常モードのときと同様の操作感覚で、楽曲の切替え、楽曲の再生、音量の増減などのブラインド操作をユーザに行わせることができる。

［１－５．ブラインド操作処理手順］

次に上述した音楽再生装置１によるブラインド操作の動作処理手順（これをブラインド操作処理手順とも呼ぶ）ＲＴ１を、図６に示すフローチャートを用いて詳しく説明する。ちなみに、このブラインド操作処理手順ＲＴ１は、音楽再生装置１のＣＰＵ１１が、不揮発性メモリ１２にインストールされたプログラムに従って実行するものである。

図６に示すように、音楽再生装置１のＣＰＵ１１は、タッチパネル３Ｃを介して操作面に対してユーザの指が押下されたことを認識すると、ブラインド操作処理手順ＲＴ１をステップＳＰ０から開始して、次のステップＳＰ１に移る。

ステップＳＰ１においてＣＰＵ１１は、タッチパネル３Ｃを介して取得した接触位置の座標に基づいて、接触位置が所定距離以上移動したか否かを判定する。このステップＳＰ１において肯定結果が得られると、このときＣＰＵ１１は、ステップＳＰ２に移る。

ステップＳＰ２においてＣＰＵ１１は、感圧センサ３Ｂを介して取得した押下圧力値に基づいて、操作始めの押下圧力値と比較して操作終わりの押下圧力値が所定値以上増加しているか否かを判定する。このステップＳＰ２において肯定結果が得られると、このときＣＰＵ１１は、ステップＳＰ３に移る。

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ステップＳＰ３においてＣＰＵ１１は、ユーザによりブラインドモード切替え操作が行われたことを認識し、ブラインドモードに切り替わる。またこのときＣＰＵ１１は、操作始めの接触位置Ｐ１が指の腹が接触した位置であり、操作終わりの接触位置Ｐ２が指の先が接触した位置であることを認識する。

そして、ＣＰＵ１１は、操作終わりの接触位置Ｐ２（図４）から操作始めの接触位置Ｐ１（図４）に向かう方向をユーザの手首方向と推定し、この方向をタッチパネル３Ｃの操作面における下方向と定義して、ステップＳＰ４に移る。

ステップＳＰ４においてＣＰＵ１１は、ステップＳＰ３において定義された下方向をＹ軸負の方向とし、接触位置Ｐ１と接触位置Ｐ２とが通る直線がＹ軸となるように、タッチパネル３Ｃの操作面に設定された座標を変換して、ステップＳＰ５に移る。

一方、ステップＳＰ１において否定結果が得られると、このことは、ユーザによりブラインドモード切替え操作が行われていないことを意味し、このときＣＰＵ１１は、タッチパネル３Ｃの操作面に設定された座標の変換を行わず、ステップＳＰ５に移る。

また、ステップＳＰ２において否定結果が得られると、このことは、ユーザによりブラインドモード切替え操作が行われていないことを意味し、このときＣＰＵ１１は、タッチパネル３Ｃの操作面に設定された座標の変換を行わず、ステップＳＰ５に移る。

ステップＳＰ５においてＣＰＵ１１は、タッチパネル３Ｃを介して取得した接触位置の座標に基づいて、タッチパネル３Ｃの操作面に設定された座標におけるＸ軸負の領域、つまりＹ軸に対して左側の領域がユーザの指により押下されたか否かを判定する。このステップＳＰ５において肯定結果が得られると、このことは、ユーザが前の楽曲を選択しようとして楽曲切替え操作を行ったことを意味し、このときＣＰＵ１１は、ステップＳＰ６に移る。

ステップＳＰ６においてＣＰＵ１１は、このとき感圧センサ３Ｂを介して取得した押下圧力値に応じて、選択する楽曲を前の楽曲又は前のアルバムの楽曲又は

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前の頭文字のアルバム名を持つアルバムの楽曲に切替えて、ステップＳＰ７に移る。

一方、ステップＳＰ５において否定結果が得られると、このことは、ユーザが前の楽曲を選択するための楽曲切替え操作を行ってはいないことを意味し、このときＣＰＵ１１は、ステップＳＰ７に移る。

ステップＳＰ７においてＣＰＵ１１は、タッチパネル３Ｃを介して取得した接触位置の座標に基づいて、タッチパネル３Ｃの操作面に設定されている座標におけるＸ軸正の領域、つまりＹ軸に対して右側の領域が押下されたか否かを判定する。このステップＳＰ７において肯定結果が得られると、このことは、ユーザが次の楽曲を選択しようとして楽曲切替え操作を行ったことを意味し、このときＣＰＵ１１は、ステップＳＰ８に移る。

ステップＳＰ８においてＣＰＵ１１は、このとき感圧センサ３Ｂを介して取得した押下圧力値に応じて、選択する楽曲を次の楽曲又は次のアルバムの楽曲又は次の頭文字のアルバム名を持つアルバムの楽曲に切替えて、ステップＳＰ１に戻る。

一方、ステップＳＰ７において否定結果が得られると、このことは、ユーザが次の楽曲を選択するための楽曲切替え操作を行ってはいないことを意味し、このときＣＰＵ１１は、ステップＳＰ１に戻る。このようにＣＰＵ１１は、ブラインド操作処理手順ＲＴ１を繰り返す。

このようなブラインド操作処理手順ＲＴ１より、ＣＰＵ１１は、ユーザにブラインド操作を行わせることができるようになされている。

［１－６．動作及び効果］

以上の構成において、音楽再生装置１は、ユーザの指によりタッチパネル３Ｃの操作面が押下されると、タッチパネル３Ｃを介して、当該操作面に対する指の接触位置を検出する。また、音楽再生装置１は、感圧センサ３Ｂを介して、このときユーザの指により当該操作面が押下された圧力を示す押下圧力値を検出する。

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そして音楽再生装置１は、タッチパネル３Ｃの操作面に対してユーザの指が接触しているときに、接触位置が移動し、操作始めと比較して操作終わりの押下圧力値が増加したことを検出すると、ユーザによりブラインドモード切替え操作が行われたと認識する。このとき音楽再生装置１は、操作始めの接触位置Ｐ１が指の腹が接触した位置であり且つ操作終わりの接触位置Ｐ２が指の先が接触した位置であると認識する。

そして音楽再生装置１は、指の先が接触した位置である操作終わりの接触位置Ｐ２から指の腹が接触した位置である操作始めの接触位置Ｐ１へ向かう方向を、タッチパネル３Ｃを操作する手の手首方向と推定する。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に対して、この方向を下方向とする座標軸を設定し、指の腹が接触した位置と指の先が接触した位置とを通る直線を当該座標軸のＹ軸として設定する。

そして音楽再生装置１は、ユーザの指によりタッチパネル３Ｃの操作面が押下されると、当該タッチパネル３Ｃの操作面に対する指の接触位置を検出する。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に設定された座標軸に基づいて、この接触位置を座標に変換する。そして音楽再生装置１は、この座標に応じて各種操作を認識し、当該操作に応じて各種命令を入力する。

このように音楽再生装置１は、タッチパネル３Ｃの操作面に対するユーザの手の向きに応じて操作面の座標軸を設定することで、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。

これにより音楽再生装置１は、操作面に対するユーザの手の向きがどのような向きであろうと、常に操作面に対するユーザの手の向きを基準とした操作をユーザに行わせることができる。かくして音楽再生装置１は、ユーザに操作面を視認させなくても容易に操作を行わることができる。

また音楽再生装置１は、接触位置の座標がＹ軸に対して右側の領域にあると判別すると、選択する楽曲を次の楽曲に切替え、接触位置の座標がＹ軸に対して左側にあると判別すると、選択する楽曲を前の楽曲に切替えるようにした。

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これにより音楽再生装置１は、ユーザの手首方向を下方向として、右側又は左側を指で押下するという操作をユーザに行わせるだけでよく、ユーザに複雑な操作を覚えさせることなく簡単に操作を行わせることができる。

また音楽再生装置１は、ブラインドモード切替え操作及びブラインド操作を指１本による操作でユーザに行わせるようにした。

これにより音楽再生装置１は、ポケットの中や鞄の中のような狭いスペースにおいてもブラインドモード切替え操作及びブラインド操作を容易に行わせることができる。

またこれにより音楽再生装置１は、ユーザに、親指でブラインドモード切替え操作及びブラインド操作を行わせる場合、当該操作を行わない４本の指で音楽再生装置１の筐体２を把持させることができるので、筐体２を安定して把持させることができる。

また音楽再生装置１は、ブラインドモード切替え操作として、タッチパネル３Ｃの操作面に対して指を接触させたまま、指の接触している部分を指の腹から指の先へ変える操作を行わせるようにした。

これにより音楽再生装置１は、タッチ操作やドラッグ操作、スクロール操作など通常タッチパネルにおいてよく用いられる操作とブラインドモード切替え操作を混同することなく認識でき、誤認識を防ぐことができる。

以上の構成によれば、音楽再生装置１は、タッチパネル３Ｃの操作面に対して指が接触した接触位置を検出するようにした。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に対して、指を接触させたまま、接触部分を指の腹から先へ変えるブラインドモード切替え操作が行われたことを認識するようにした。そして、音楽再生装置１は、当該操作が認識されると、指の先が接触した位置から指の腹が接触した位置へ向かう方向を、タッチパネル３Ｃを操作する手の手首方向と推定し、タッチパネル３Ｃの操作面に対して、当該方向に応じた座標軸を設定するようにした。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に対して指が接触した接触位置をタッチパネル３Ｃに設定された座標軸に基づいて座

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標に変換し、この座標に基づいて命令を入力するようにした。

このように音楽再生装置１は、タッチパネル３Ｃの操作面に対するユーザの手の向きに応じて操作面の座標軸を設定することで、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。

これにより音楽再生装置１は、操作面に対するユーザの手の向きがどのような向きであろうと、常に操作面に対するユーザの手の向きを基準とした操作をユーザに行わせることができる。かくして音楽再生装置１は、ユーザに操作面を視認させなくても容易に操作を行わせることができる。

［１－７．音楽再生装置の機能構成］

ここで、上述したブラインド操作に主眼を置いた音楽再生装置１の機能構成について説明する。図７に示すように、音楽再生装置１は、操作部１０１、接触検出部１０２、圧力検出部１０３、操作認識部１０４、座標軸設定部１０５、座標変換部１０６及び命令入力部１０７で構成されている。

接触検出部１０２は、操作部１０１の操作面に対して指が接触した位置を検出する。圧力検出部１０３は、操作部１０１の操作面に対する指の押下圧力を検出する。

操作認識部１０４は、操作部１０１の操作面に対して指が接触しているときに、指が接触している位置が移動し且つ当該操作面に対する指の押下圧力が変化したことを検出すると、指を接触させたまま、接触部分を指の腹から先へ変える操作（この実施例におけるブラインドモード切替え操作）が行われたと認識する。

座標軸設定部１０５は、操作認識部１０４により当該操作が認識されると、指の腹が接触した位置から指の先が接触した位置へ向かう方向を操作部１０１を操作する手の手首方向と推定し、操作部１０１の操作面に対して、当該方向に応じて座標軸を設定する。

座標変換部１０６は、操作部１０１の操作面に設定された座標軸に基づいて、接触検出部１０２が検出した当該位置を座標に変換する。命令入力部１０７は、座標変換部１０６から得られる座標に基づいて、命令を入力する。

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このような機能構成により、音楽再生装置１は、上述したブラインド操作を機能的に実現し得るようになされている。ここで、操作部１０１は、タッチパネル３Ｃに相当する機能部である。また、接触検出部１０２は、タッチパネル３Ｃ及びＣＰＵ１１に相当する機能部である。また、圧力検出部１０３は、感圧センサ３Ｂに相当する機能部である。また、操作認識部１０４、座標軸設定部１０５、座標変換部１０６及び命令入力部１０７は、ＣＰＵ１１に相当する機能部である。

＜２．第２の実施の形態＞

次に本発明の第２の実施の形態を詳述する。この第２の実施の形態においては、音楽再生装置１のブラインドモード切替え操作が異なる点以外、上述した第１の実施の形態と同様であり、同様部分である音楽再生装置１の構成、楽曲切替え操作などの説明は省略する。

［２－１．ブラインド操作］

ＣＰＵ１１は楽曲切替え画面２０をタッチパネル３Ｃに表示する。ここでユーザが、図８（Ａ）に示すように、ブラインドモード切替え操作として、タッチパネル３Ｃに対して、指を寝かせて接触させたまま、指を回転させる操作を行ったとする。尚、このブラインドモード切替え操作は指１本で行うことができる操作である。

このときＣＰＵ１１は、タッチパネル３Ｃを介して接触位置の座標及び接触範囲の座標を取得し、操作始めから操作終わりまでの接触位置の遷移と接触範囲の変化とを検出する。

ここで、ブラインドモード切替え操作は、指を回転させることにより指の接触している部分を指の腹から指の側面へ、もしくはその逆へ変える操作であるため、タッチパネル３Ｃの操作面に対する接触位置が移動する操作となることが考えられる。

従ってＣＰＵ１１は、タッチパネル３Ｃを介して取得した接触位置の座標に基づいて、接触位置が所定距離以上移動したか否かを判別する。

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また、人間の指において指の腹より指の側面の方が細いことより、指の腹が接触した範囲の形状よりも指の側面が接触した範囲の形状の方が細長いことが考えられる。

従ってＣＰＵ１１は、図８（Ｂ）に示すように、操作始めの接触範囲Ｒ１及び操作終わりの接触範囲Ｒ２の座標に基づいて、操作始めの接触範囲Ｒ１を囲む最も面積の小さい矩形ＲＳ１と操作終わりの接触範囲Ｒ２を囲む最も面積の小さい矩形ＲＳ２とを算出する。そしてＣＰＵ１１は、矩形ＲＳ１及び矩形ＲＳ２の短辺の長さをそれぞれ算出する。

そしてＣＰＵ１１は、矩形ＲＳ１及び矩形ＲＳ２の短辺の長さを比較し、矩形ＲＳ１の短辺の長さと矩形ＲＳ２の短辺の長さとの差分が所定値以上か否かを判別する。

そしてＣＰＵ１１は、接触位置が所定距離以上移動し、矩形ＲＳ１の短辺の長さと矩形ＲＳ２の短辺の長さとの差分が所定値以上であることを判別すると、ユーザによりブラインドモード切替え操作が行われたと認識し、ブラインドモードに切り替わる。

また、図８（Ｃ）に示すように、指を寝かせて接触させたまま、指を回転させる操作が行われたとき、ユーザの指の根元がタッチパネル３Ｃの操作面からはみ出すように接触されていることが考えられる。従ってこのような場合、指の腹又は指の側面が接触した範囲の一部がタッチパネル３Ｃの縁ＢＡに接しており、この箇所が指の根元に近い部分が接触した箇所であると考えられる。

従ってＣＰＵ１１は、ブラインドモードに切り替わると、操作始めの接触範囲Ｒ１がタッチパネル３Ｃの縁ＢＡに接している箇所を検出し、その箇所の中点ＰＢを検出する。そしてＣＰＵ１１は、操作始めの接触範囲Ｒ１の中で中点ＰＢから最も遠い点ＰＦを検出する。そしてＣＰＵ１１は、中点ＰＢが指の根元が接触した位置であると認識し、中点ＰＢから最も遠い点ＰＦが指の先が接触した位置であると認識する。

そしてＣＰＵ１１は、点ＰＦから中点ＰＢへ向かう方向をタッチパネル３Ｃを

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操作するユーザの手の手首方向であると推定する。そして、ＣＰＵ１１は、このユーザの手首がある方向をタッチパネル３Ｃの操作面における下方向と定義し、これに従って上述した第１の実施の形態と同様にタッチパネル３Ｃの操作面に設定された座標を変換する。

このようにＣＰＵ１１は、第１の実施の形態と同様に、ブラインドモード切替え操作が行われたことを認識するとブラインドモードに切り替わる。

そしてＣＰＵ１１は、タッチパネル３Ｃの操作面に対して、この方向を下方向とする座標軸を設定し、点ＰＦと中点ＰＢとを通る直線を当該座標軸のＹ軸として設定する。

そしてＣＰＵ１１は、上述した第１の実施の形態と同様に、タッチパネル３Ｃの操作面に設定された座標軸に従って、楽曲の切替え、再生、音量の増減などのユーザの操作を認識する。

これにより音楽再生装置１は、当該操作面に対するユーザの手の向きに従ってユーザの操作を認識することができ、ユーザに、当該操作面に対するユーザの手の向きを基準とした操作を行わせることができるので、ブラインド操作を行わせることができる。

［２－２．ブラインド操作処理手順］

次に上述した音楽再生装置１によるブラインド操作の動作処理手順（これをブラインド操作処理手順とも呼ぶ）ＲＴ２を、図９に示すフローチャートを用いて詳しく説明する。ちなみに、このブラインド操作処理手順ＲＴ２は、音楽再生装置１のＣＰＵ１１が、不揮発性メモリ１２にインストールされたプログラムに従って実行するものである。

尚、図９に示すブラインド操作処理手順ＲＴ２は、上述した第１の実施の形態のブラインド操作処理手順ＲＴ１の同一ステップに同一符号を付して示すものである。

音楽再生装置１のＣＰＵ１１は、タッチパネル３Ｃを介して操作面に対してユーザの指が押下されたことを認識すると、ブラインド操作処理手順ＲＴ２をステ

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ップＳＰ１００から開始して、次のステップＳＰ１０１に移る。

ステップＳＰ１０１においてＣＰＵ１１は、タッチパネル３Ｃを介して取得した接触位置の座標に基づいて、接触位置が所定距離以上移動したか否かを判定する。このステップＳＰ１０１において肯定結果が得られると、このときＣＰＵ１１は、ステップＳＰ１０２に移る。

ステップＳＰ１０２においてＣＰＵ１１は、操作始めの接触範囲Ｒ１を囲む矩形ＲＳ１（図８）の短辺の長さと操作終わりの接触範囲Ｒ２を囲む矩形ＲＳ２（図８）の短辺の長さとの差分が所定値以上であるか否かを判定する。このステップＳＰ１０２において肯定結果が得られると、このときＣＰＵ１１は、ステップＳＰ１０３に移る。

ステップＳＰ１０３においてＣＰＵ１１は、ユーザによりブラインドモード切替え操作が行われたと認識し、ブラインドモードに切り替わる。そして、ＣＰＵ１１は、操作始めの接触範囲Ｒ１がタッチパネル３Ｃの縁ＢＡに接している箇所の中点ＰＢと、操作始めの接触範囲Ｒ１の中で中点ＰＢから最も遠い点ＰＦとを検出し、ステップＳＰ１０４に移る。

ステップＳＰ１０４においてＣＰＵ１１は、中点ＰＢが指の根元が接触した位置であると認識し、中点ＰＢから最も遠い点ＰＦが指の先が接触した位置であると認識する。そして、ＣＰＵ１１は、点ＰＦから中点ＰＢへ向かう方向をユーザの手首がある方向と推定し、この方向をタッチパネル３Ｃの操作面における下方向と定義して、ステップＳＰ１０５に移る。

ステップＳＰ１０５においてＣＰＵ１１は、ステップＳＰ１０３において定義された下方向がＹ軸負の方向となるように、タッチパネル３Ｃの操作面に設定された座標を変換して、ステップＳＰ５に移る。

一方、ステップＳＰ１０１において否定結果が得られると、このことは、ユーザによりブラインドモード切替え操作が行われていないことを意味し、このときＣＰＵ１１は、タッチパネル３Ｃの操作面に設定されている座標の変換を行わず、ステップＳＰ５に移る。

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また、ステップＳＰ１０２において否定結果が得られると、このことは、ユーザによりブラインドモード切替え操作が行われていないことを意味し、このときＣＰＵ１１は、タッチパネル３Ｃの操作面に設定されている座標の変換を行わず、ステップＳＰ５に移る。

ＣＰＵ１１は、上述した第１の実施の形態と同様にしてステップＳＰ５～ステップＳＰ８の処理を行う。すなわちＣＰＵ１１は、第１の実施の形態と同様に、タッチパネル３Ｃの操作面に設定された座標に従って、Ｙ軸に対して右側の領域を押下されたと認識すると選択する楽曲を次の楽曲に切り替え、Ｙ軸に対して左側の領域を押下されたと認識すると選択する楽曲を前の楽曲に切替える。

このようなブラインド操作処理手順ＲＴ２より、ＣＰＵ１１は、ユーザにブラインド操作を行わせることができるようになされている。

［２－３．動作及び効果］

以上の構成において、音楽再生装置１は、ユーザの指によりタッチパネル３Ｃの操作面が押下されると、当該タッチパネル３Ｃの操作面に対する指の接触位置及び接触範囲を検出する。

そして音楽再生装置１は、タッチパネル３Ｃの操作面に対してユーザの指が接触しているときに、接触位置が移動し、接触範囲を囲む矩形の短辺の長さが操作始めと操作終わりとで変化したことを検出すると、ブラインドモード切替え操作が行われたと認識する。

そして音楽再生装置１は、操作始めの接触範囲Ｒ１がタッチパネル３Ｃの縁ＢＡに接触している箇所の中点ＰＢを指の根元が接触した位置として検出する。そして音楽再生装置１は、操作始めの接触範囲Ｒ１の中で中点ＰＢから最も遠い点ＰＦを指の先が接触した位置として検出する。

そして音楽再生装置１は、指の先が接触した位置から指の根元が接触した位置へ向かう方向をタッチパネル３Ｃを操作する手の手首方向と推定する。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に対して、この方向を下方向とする座標軸を設定する。

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そして音楽再生装置１は、ユーザの指によりタッチパネル３Ｃの操作面が押下されると、当該タッチパネル３Ｃの操作面に対する指の接触位置を検出する。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に設定された座標軸、すなわちユーザの手の向きに合った座標軸に基づいて、この接触位置を座標に変換する。そして音楽再生装置１は、この座標に応じて各種操作を認識し、当該操作に応じて各種命令を入力する。

このように音楽再生装置１は、タッチパネル３Ｃの操作面に対するユーザの手の向きに応じて操作面の座標軸を設定することで、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。

これにより音楽再生装置１は、操作面に対するユーザの手の向きがどのような向きであろうと、常に操作面に対するユーザの手の向きを基準とした操作をユーザに行わせることができる。かくして音楽再生装置１は、ユーザに操作面を視認させなくても容易に操作を行わることができる。

また音楽再生装置１は、ブラインドモード切替え操作として、タッチパネル３Ｃの操作面に対して指を寝かせて接触させたまま、指を回転させる操作を行わせるようにした。

これにより音楽再生装置１は、指が１本入る程度の狭いスペースにおいてもブラインドモードに切替えることができるので、第１の実施の形態と比べて、狭いスペースにおけるブラインド操作を一段と容易に行わせることができる。

この他第２の実施の形態における音楽再生装置１は、第１の実施の形態における音楽再生装置１とほぼ同様の作用効果を奏しうる。

以上の構成によれば、音楽再生装置１は、タッチパネル３Ｃの操作面に対して指が接触した接触位置及び接触範囲を検出するようにした。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に対して指を接触させたまま指を回転させるブラインドモード切替え操作が行われたことを認識するようにした。そして、音楽再生装置１は、当該操作が認識されると、接触範囲から指の先が接触した位置と指の根元が接触した位置とを検出するようにした。そして、音楽再生装置１は

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、指の先が接触した位置から指の根元が接触した位置へ向かう方向を手首の方向と推定し、タッチパネル３Ｃの操作面に対して、当該方向に応じた座標軸を設定するようにした。そして、音楽再生装置１は、タッチパネル３Ｃの操作面に対して指が接触した接触位置をタッチパネル３Ｃに設定された座標軸に基づいて座標に変換し、この座標に基づいて命令を入力するようにした。

このように音楽再生装置１は、タッチパネル３Ｃの操作面に対するユーザの手の向きに応じて操作面の座標軸を設定することで、操作面に対するユーザの手の向きに従って、ユーザの操作を認識することができる。

これにより音楽再生装置１は、操作面に対するユーザの手の向きがどのような向きであろうと、常に操作面に対するユーザの手の向きを基準とした操作をユーザに行わせることができる。かくして音楽再生装置１は、ユーザに操作面を視認させなくても容易に操作を行わせることができる。

［２－４．音楽再生装置の機能構成］

ここで、上述したブラインド操作に主眼を置いた音楽再生装置１の機能構成について説明する。図１０に示すように、音楽再生装置１は、操作部２０１、接触検出部２０２、操作認識部２０３、座標軸設定部２０４、座標変換部２０５及び命令入力部２０６で構成されている。

接触検出部２０２は、操作部２０１の操作面に対して指が接触した位置及び指が接触した範囲を検出する。操作認識部２０３は、操作部２０１の操作面に対して指が接触しているときに、指が接触している位置が移動し且つ指が接触している範囲の形状が変化したことを検出すると、指を接触させたまま回転させる操作が行われたと認識する。

座標軸設定部２０４は、操作認識部２０３により当該操作が認識されると、指が接触した範囲の中から指の根元が接触した位置と指の先が接触した位置とを検出する。そして座標軸設定部２０４は、当該指の根元が接触した位置から当該指の先が接触した位置へ向かう方向を操作部２０１を操作する手の手首方向と推定し、操作部２０１の操作面に対して、当該方向に応じて座標軸を設定する。

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座標変換部２０５は、操作部２０１の操作面に設定された座標軸に基づいて、接触検出部２０２が検出した当該位置を座標に変換する。命令入力部２０６は、座標変換部２０５から得られる座標に基づいて、命令を入力する。

このような機能構成により、音楽再生装置１は、上述したブラインド操作を機能的に実現し得るようになされている。ここで、操作部２０１は、タッチパネル３Ｃに相当する機能部である。また、接触検出部２０２は、タッチパネル３Ｃ及びＣＰＵ１１に相当する機能部である。また、座標変換部２０５、命令入力部２０６、操作認識部２０３及び座標軸設定部２０４は、ＣＰＵ１１に相当する機能部である。

＜３．他の実施の形態＞

［３－１．他の実施の形態１］

なお上述した第１の実施の形態では、ＣＰＵ１１は、操作始めと操作終わりの押下圧力値の変化に基づいて、ユーザがブラインドモード切替え操作を行ったと認識するようにした。

これに限らずＣＰＵ１１は、例えば操作始めと操作終わりの接触範囲の形状の変化に基づいて、ブラインドモード切替え操作が行われたかを認識するようにしてもよい。

具体的に、ユーザは、第１の実施の形態と同様に、ブラインドモード切替え操作として、タッチパネル３Ｃの操作面に対して指を接触させたまま、指の接触している部分を指の腹から指の先へ変える操作を行ったとする。

このときＣＰＵ１１は、タッチパネル３Ｃを介して接触位置の座標及び接触範囲の座標を取得し、操作始めから操作終わりまでの接触位置の遷移と接触範囲の変化とを検出する。

ここで、第１の実施の形態と同様に、ブラインドモード切替え操作は、タッチパネル３Ｃに対する接触位置が移動する操作となることが考えられる。従ってＣＰＵ１１は、タッチパネル３Ｃを介して取得した接触位置の座標に基づいて、接触位置が所定距離以上移動したか否かを判別する。

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また、図１１に示すように、指の腹が接触した範囲の面積は広く、その範囲の形状は指の太さ方向が短軸となるような略楕円形であり、指の先が接触した範囲の面積は狭く、その範囲の形状は指の太さ方向が長軸となるような略楕円形であることが考えられる。従って、指の接触している部分が指の腹から指の先へ変えられると、指の接触している範囲の長軸及び短軸が９０度入れ替わることが考えられる。

従ってＣＰＵ１１は、操作始めの接触範囲Ｒ３の座標と操作終わりの接触範囲Ｒ４の座標とに基づいて、操作始めの接触範囲Ｒ３を囲む最も面積の小さい矩形ＲＳ３及び操作終わりの接触範囲Ｒ４を囲む最も面積の小さい矩形ＲＳ４を検出する。そしてＣＰＵ１１は、矩形ＲＳ３及び矩形ＲＳ４の長辺軸及び短辺軸をそれぞれ検出する。

そしてＣＰＵ１１は、操作始めの接触範囲Ｒ３を囲む矩形ＲＳ３と操作終わりの接触範囲Ｒ４を囲む矩形ＲＳ４とを比較し、長辺軸及び短辺軸が略９０度異なるか否かを判別する。

そしてＣＰＵ１１は、接触位置が所定距離以上移動し、矩形ＲＳ３及び矩形ＲＳ４の長辺軸及び短辺軸が略９０度異なることを判別すると、ユーザがブラインドモード切替え操作を行ったと認識する。

そして、ＣＰＵ１１は、ユーザがブラインドモード切替え操作を行ったことを認識すると、ブラインドモードに切り替わる。またこのときＣＰＵ１１は、操作始めの接触位置Ｐ３が指の腹が接触した位置であり、操作終わりの接触位置Ｐ４が指の先が接触した位置であることを認識する。

そしてＣＰＵ１１は、ブラインドモードに切り替わると、操作終わりの接触位置Ｐ４から操作始めの接触位置Ｐ３へ向かう方向を、タッチパネル３Ｃを操作する手の手首方向であると推定する。そしてＣＰＵ１１は、この手首方向をタッチパネル３Ｃの操作面における下方向と定義し、これに従ってタッチパネル３Ｃの操作面に設定された座標を変換する。

このようにＣＰＵ１１は、上述した第１の実施の形態と同様に、ブラインドモ

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ード切替え操作が行われたことを認識すると、タッチパネル３Ｃの操作面に対するユーザの手の向きに応じた座標軸を当該操作面に設定する。

またこれに限らず、ＣＰＵ１１は、操作始めと操作終わりの接触範囲の面積の変化に基づいて、ブラインドモード切替え操作が行われたかを認識するようにしてもよい。

図１１に示すように、指の腹が接触した範囲の面積の方が指の先が接触した範囲の面積よりも大きいと考えられる。このことより、ＣＰＵ１１は、接触位置が所定距離以上移動し、操作始めの接触範囲Ｒ３の面積が操作終わりの接触範囲Ｒ４の面積より所定値以上大きいことを判別すると、ユーザがブラインドモード切替え操作を行ったと認識してもよい。

またこれに限らずＣＰＵ１１は、この他種々の方法で、指を接触させたまま、指の接触している部分を指の腹から指の先へ変えるブラインドモード切替え操作を認識するようにしてもよい。

また上述した第２の実施の形態では、ＣＰＵ１１は、接触範囲の形状の変化に基づいて指を回転させるブラインドモード切替え操作を認識するようにしたが、この他種々の方法で当該操作を認識するようにしてもよい。

［３－２．他の実施の形態２］

また上述した第１の実施の形態では、ブラインドモード切替え操作として、タッチパネル３Ｃの操作面に対して指を接触させたまま、指の接触している部分を指の腹から指の先へ変える操作を行わせるようにした。

これに限らず、ブラインドモード切替え操作として、タッチパネル３Ｃの操作面に対して指を接触させたまま、指の接触している部分を指の先から指の腹へ変える操作を行わせるようにしてもよい。また、指の接触している部分を指の腹から指の先へ変える操作、もしくはその逆に変える操作のどちらをユーザが行っても、ブラインドモード切替え操作として認識するようにしてもよい。

この場合ＣＰＵ１１は、ユーザによりブラインドモード切替え操作が行われると、操作始めと操作終わりの押下圧力値を比較し、どちらの押下圧力値が高いか

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を判別する。そしてＣＰＵ１１は、操作始めの押下圧力値が高かった場合、操作始めの接触位置を指の先が接触した位置であると認識し、操作終わりの接触位置を指の腹が接触した位置であると認識する。一方ＣＰＵ１１は、操作終わりの押下圧力値が高かった場合、操作終わりの接触位置を指の先が接触した位置であると認識し、操作始めの接触位置を指の腹が接触した位置であると認識する。

［３－３．他の実施の形態３］

さらに上述した第１の実施の形態では、ＣＰＵ１１は、ブラインドモード切替え操作において、指の先が接触した位置と指の腹が接触した位置とを通る直線がＹ軸となるように、タッチパネル３Ｃの操作面に設定された座標を変換するようにした。

これに限らず、ＣＰＵ１１は、ブラインドモード切替え操作において、当該Ｙ軸と直交し、例えば指の先が接触した位置を通る直線がＸ軸となるように、タッチパネル３Ｃの操作面に設定された座標を変換するようにしてもよい。

これによりＣＰＵ１１は、例えばユーザの指による押下操作などユーザ操作に対して、割り当てる命令入力を増やすことができる。例えば、ＣＰＵ１１は、ユーザがＸ軸に対して上側を押下すると楽曲を再生し、Ｘ軸に対して下側を押下すると楽曲を停止するようにしてもよい。

［３－４．他の実施の形態４］

さらに上述した第１及び第２の実施の形態では、ＣＰＵ１１は、ユーザによりＹ軸に対して右側が押下されると選択する楽曲を次の楽曲に切替え、Ｙ軸に対して左側が押下されると選択する楽曲を前の楽曲に切替えるようにした。

これに限らず、ＣＰＵ１１は、この他種々のユーザ操作をタッチパネル３Ｃに設定された座標軸に基づいて認識し、この他種々の命令入力を割り当てるようにしてもよい。

［３－５．他の実施の形態５］

さらに上述した第２の実施の形態では、ＣＰＵ１１は、操作始めの接触範囲Ｒ１がタッチパネル３Ｃの縁ＢＡに接する箇所の中点ＰＢを指の根元が接触した位

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置として検出するようにした。そしてＣＰＵ１１は、接触範囲Ｒ１の中で中点ＰＢから最も遠い点ＰＦを指の先が接触した位置として検出するようにした。

これに限らず、ＣＰＵ１１は、例えば操作始めの接触範囲Ｒ１の形状を検出し、その形状が細くなっている方を指の先が接触した位置として検出し、そこから接触範囲Ｒ１の中で最も遠い位置を指の根元が接触した位置として検出するようにしてもよい。またこれに限らずＣＰＵ１１は、この他種々の方法で、接触範囲の中から指の根元が接触した位置と指の先が接触した位置とを検出するようにしてもよい。

［３－６．他の実施の形態６］

さらに上述した第１の実施の形態では、ＣＰＵ１１は、ブラインドモード切替え操作において、指の先が接触した位置から指の腹が接触した位置へ向かう方向をユーザの手首方向と推定した。そしてＣＰＵ１１は、この方向を下方向とするような座標軸をタッチパネル３Ｃの操作面に設定するようにした。

これに限らずＣＰＵ１１は、ユーザの手首方向と推定した方向に応じた座標軸であれば、この他種々の座標軸をタッチパネル３Ｃの操作面に設定するようにしてもよい。

例えばＣＰＵ１１は、ブラインドモード切替え操作においてユーザの手首方向と推定した方向から、所定の角度（例えば１０～３０［°］）ずらした方向を下方向とするような座標軸を設定するようにしてもよい。ユーザは、通常モードのとき、操作面の下方向から多少ずれた方向に手首をおくような形で操作面を操作することも想定される。このような場合、ＣＰＵ１１は、ユーザの手首方向と推定した方向から所定の角度ずらした方向を下方向とする座標軸を設定することで、ブラインドモードのときも、ユーザに通常モードのときと同様の操作感覚で操作させることができる。ゆえに、ＣＰＵ１１は、ブラインドモードのときの操作性を一段と向上させることができる。

［３－７．他の実施の形態７］

さらに上述した第１及び第２の実施の形態では、音楽再生装置１の動作処理を

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実行するためのプログラムを不揮発性メモリ１２に記憶しておくようにした。

これに限らず、このプログラムをＣＤ（Compact Disc）などの所定の記録媒体に記録しておき、ＣＰＵ１１がこのプログラムを記録媒体から読み出して実行するようにしてもよい。また、ＣＰＵ１１がこのプログラムをインターネット上の所定のサーバからダウンロードして不揮発性メモリ１２にインストールするようにしてもよい。

［３－８．他の実施の形態８］

さらに上述した実施の形態では、情報処理装置としての音楽再生装置１に、接触検出部としてのタッチパネル３Ｃと、圧力検出部としての感圧センサ３Ｂと、接触検出部、座標変換部、命令入力部、操作認識部、座標軸設定部としてのＣＰＵ１１とを設けるようにした。

これに限らず、同様の機能を有するのであれば、上述した音楽再生装置１の各機能部を、他の種々のハードウェア又はソフトウェアにより構成するようにしてもよい。例えば、接触検出部をタッチパネルのみで実現するようにしてもよいし、座標変換部、命令入力部、操作認識部、座標軸設定部のそれぞれを個別のハードウェアで実現するようにしてもよい。

［３－９．他の実施の形態９］

さらに、本発明は、上述した第１及び第２の実施の形態とここまで説明した他の実施の形態１～８とに限定されるものではない。すなわち本発明は、上述した第１及び第２の実施の形態とここまで説明した他の実施の形態１～８の一部または全部を任意に組み合わせた形態、もしくは一部を抽出した形態も適用範囲とする。例えば、上述した第２の実施の形態と他の実施の形態３とを組み合わせるようにしてもよい。

産業上の利用可能性

本発明の情報処理装置、情報処理方法及び情報処理プログラムは、例えば、携帯型オーディオプレイヤ、ＰＤＡ(Personal Digital Assistant)、携帯電話機等

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のその他種々の電子機器に適用することができる。

符号の説明

１……音楽再生装置、３……表示部、３Ａ……ＬＣＤ、３Ｂ……感圧センサ、３Ｃ……タッチパネル、１１……ＣＰＵ、１０１、２０１……操作部、１０２、２０２……接触検出部、１０３……圧力検出部、１０４、２０３……操作認識部、１０５、２０４……座標軸設定部、１０６、２０５……座標変換部、１０７、２０６……命令入力部、Ｐ１、Ｐ２、Ｐ３、Ｐ４……接触位置、Ｒ１、Ｒ２、Ｒ３、Ｒ４……接触範囲、ＰＢ……中点、ＰＦ……点

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請 求 の 範 囲

［請求項１］

操作部の操作面に対して指が接触した位置を検出する接触検出部と、

上記操作面に設定された座標軸に基づいて、上記接触検出部が検出した上記位置を座標に変換する座標変換部と、

上記座標変換部から得られる座標に基づいて、命令を入力する命令入力部と、

上記操作面に対して、指を接触させたまま、接触部分を指の腹から先へ、もしくはその逆に変える操作が行われたことを認識する操作認識部と、

上記操作認識部により上記操作が認識されると、指の腹が接触した位置から指の先が接触した位置へ向かう方向を上記操作部を操作する手の手首方向と推定し、上記操作面に対して、当該方向に応じて座標軸を設定する座標軸設定部と

を具える情報処理装置。

［請求項２］

上記操作面に対する指の押下圧力を検出する圧力検出部

を具え、

上記操作認識部は、

上記操作面に対して指が接触しているときに、指が接触している位置が移動し且つ上記操作面に対する指の押下圧力が変化したことを検出すると、指を接触させたまま、接触部分を指の腹から先へ、もしくはその逆に変える操作が行われたと認識する

請求項１に記載の情報処理装置。

［請求項３］

上記座標軸設定部は、

上記操作面に対して、上記手首方向を下方向とする座標軸を設定し、上記指の腹が接触した位置と上記指の先が接触した位置とを通る直線を当該座標軸のＹ軸として設定する

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請求項２に記載の情報処理装置。

［請求項４］

上記命令入力部は、

上記座標変換部から得られる座標が上記座標軸のＹ軸に対して右側の領域にあるときは第１の命令を入力し、上記変換部から得られる座標が上記座標軸のＹ軸に対して左側の領域にあるときは第２の命令を入力する

請求項３に記載の情報処理装置。

［請求項５］

上記接触検出部は、

上記操作面に対して指が接触した位置及び指が接触した範囲を検出し、

上記操作認識部は、

上記操作面に対して指が接触しているときに、指が接触している位置が移動し且つ指が接触している範囲の形状が変化したことを検出すると、指を接触させたまま、接触部分を指の腹から先へ、もしくはその逆に変える操作が行われたと認識する

請求項１に記載の情報処理装置。

［請求項６］

操作部の操作面に対して指が接触した位置及び指が接触した範囲を検出する接触検出部と、

上記操作面に設定された座標軸に基づいて、上記接触検出部が検出した上記位置を座標に変換する座標変換部と、

上記座標変換部から得られる座標に基づいて、命令を入力する命令入力部と、

上記操作面に対して、指を接触させたまま回転させる操作が行われたことを認識する操作認識部と、

上記操作認識部により上記操作が認識されると、指が接触した範囲の中から指の根元が接触した位置と指の先が接触した位置とを検出し、当該指の根元が接触した位置から当該指の先が接触した位置へ向かう方向を上記操作部を操作する手

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の手首方向と推定し、上記操作面に対して、当該方向に応じて座標軸を設定する座標軸設定部と

を具える情報処理装置。

［請求項７］

上記操作認識部は、

上記操作面に対して指が接触しているときに、指が接触している位置が移動し且つ指が接触している範囲の形状が変化したことを検出すると、指を接触させたまま回転させる操作が行われたと認識する

請求項６に記載の情報処理装置。

［請求項８］

上記座標軸設定部は、

指が接触した範囲の形状に基づいて、当該指が接触した範囲の中から指の根元が接触した位置と指の先が接触した位置とを検出する

請求項６に記載の情報処理装置。

［請求項９］

接触検出部が、操作部の操作面に対して指が接触した位置を検出し、

操作認識部が、上記操作面に対して、指を接触させたまま、接触部分を指の腹から先へ、もしくはその逆に変える操作が行われたことを認識し、

座標軸設定部が、上記操作認識部により上記操作が認識されると、指の腹が接触した位置から指の先が接触した位置へ向かう方向を上記操作部を操作する手の手首方向と推定し、上記操作面に対して、当該方向に応じて座標軸を設定し、

座標変換部が、上記座標軸に基づいて、上記接触検出部が検出した上記位置を座標に変換し、

命令入力部が、上記座標変換部から得られる座標に基づいて、命令を入力する

情報処理方法。

［請求項１０］

コンピュータに、

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接触検出部が、操作部の操作面に対して指が接触した位置を検出するステップと、

操作認識部が、上記操作面に対して、指を接触させたまま、接触部分を指の腹から先へ、もしくはその逆に変える操作が行われたことを認識するステップと、

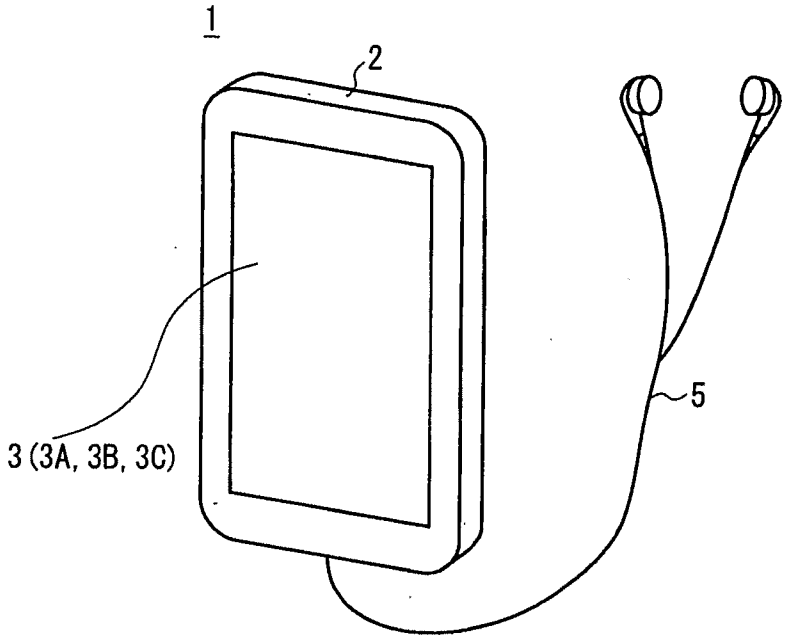
座標軸設定部が、上記操作認識部により上記操作が認識されると、指の腹が接触した位置から指の先が接触した位置へ向かう方向を上記操作部を操作する手の手首方向と推定し、上記操作面に対して、当該方向に応じて座標軸を設定するステップと、

座標変換部が、上記座標軸に基づいて、上記接触検出部が検出した上記位置を座標に変換するステップと、

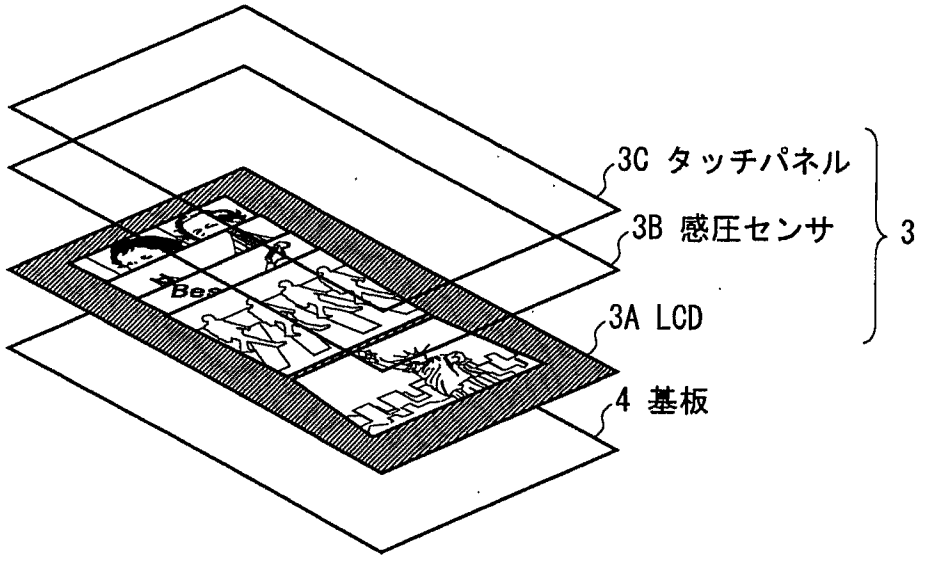
命令入力部が、上記座標変換部から得られる座標に基づいて、命令を入力するステップと

を実行させるための情報処理プログラム。

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(A)



(B)

図 1

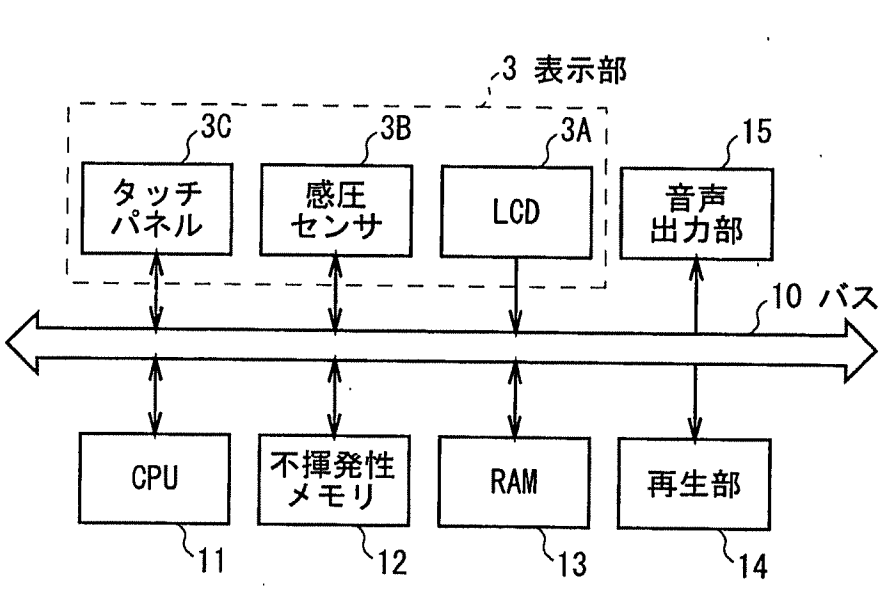
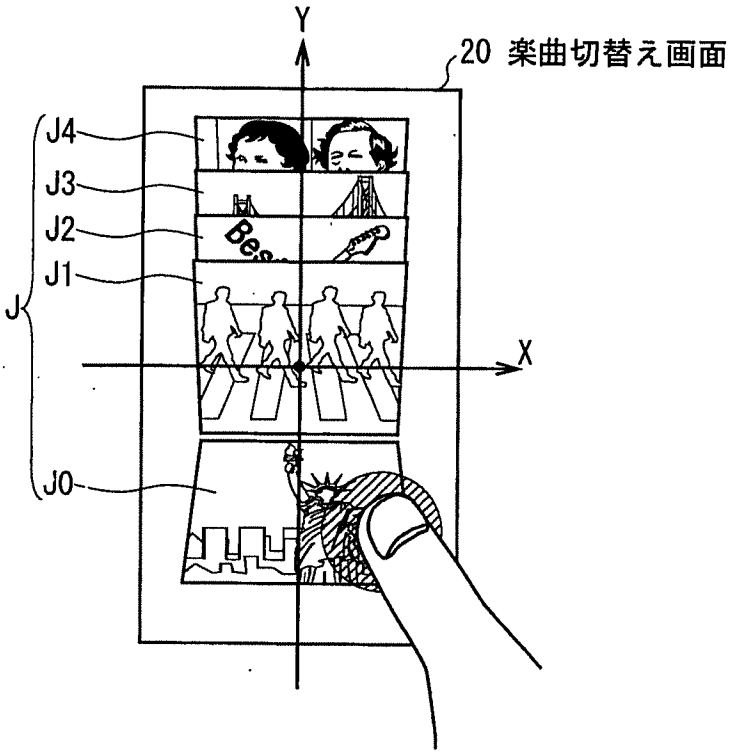
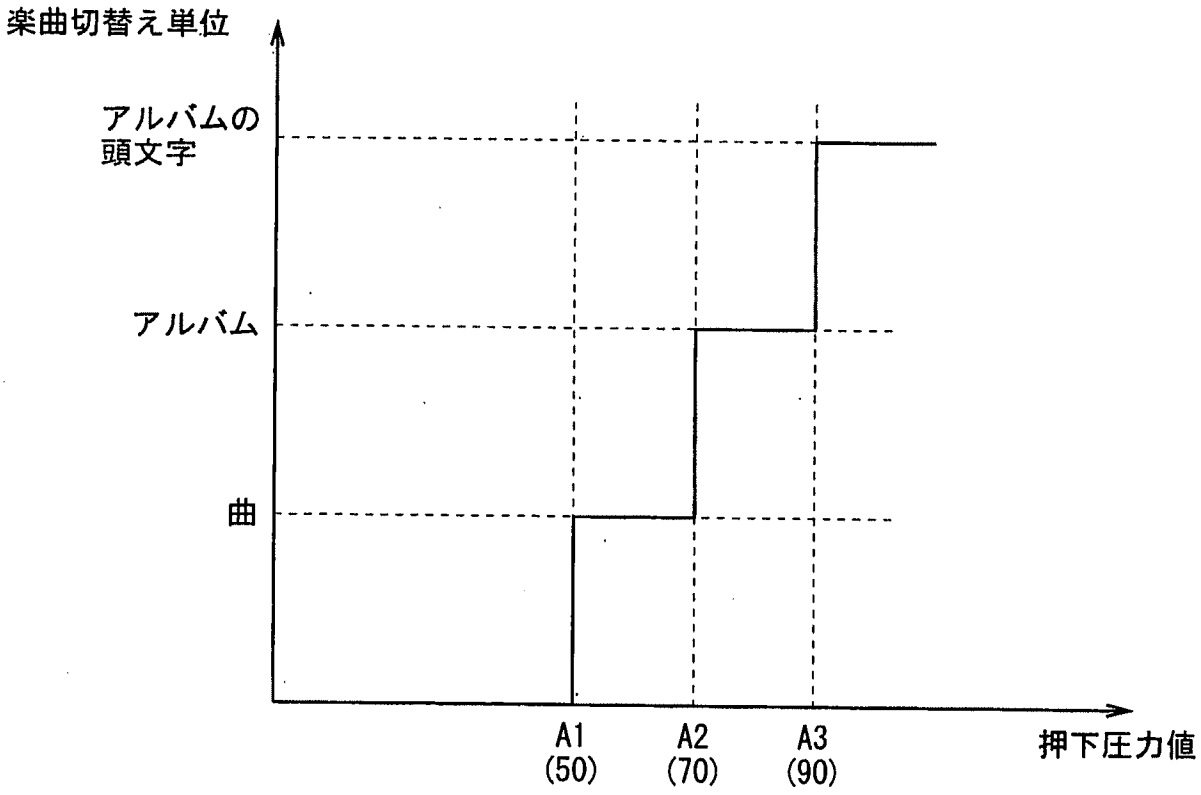

1
3 表示部
3C
タッチ
パネル
3B
感圧
センサ
3A
LCD
15
音声
出力部
10 バス
CPU
11
不揮発性
メモリ
12
RAM
13
再生部
14

図２


Y
20 楽曲切替え画面
J4
J3
J2
J1
J
X
J0

（A）


楽曲切替え単位
アルバムの
頭文字
アルバム
曲
A1
(50)
A2
(70)
A3
(90)
押下圧力値

（B）

図３

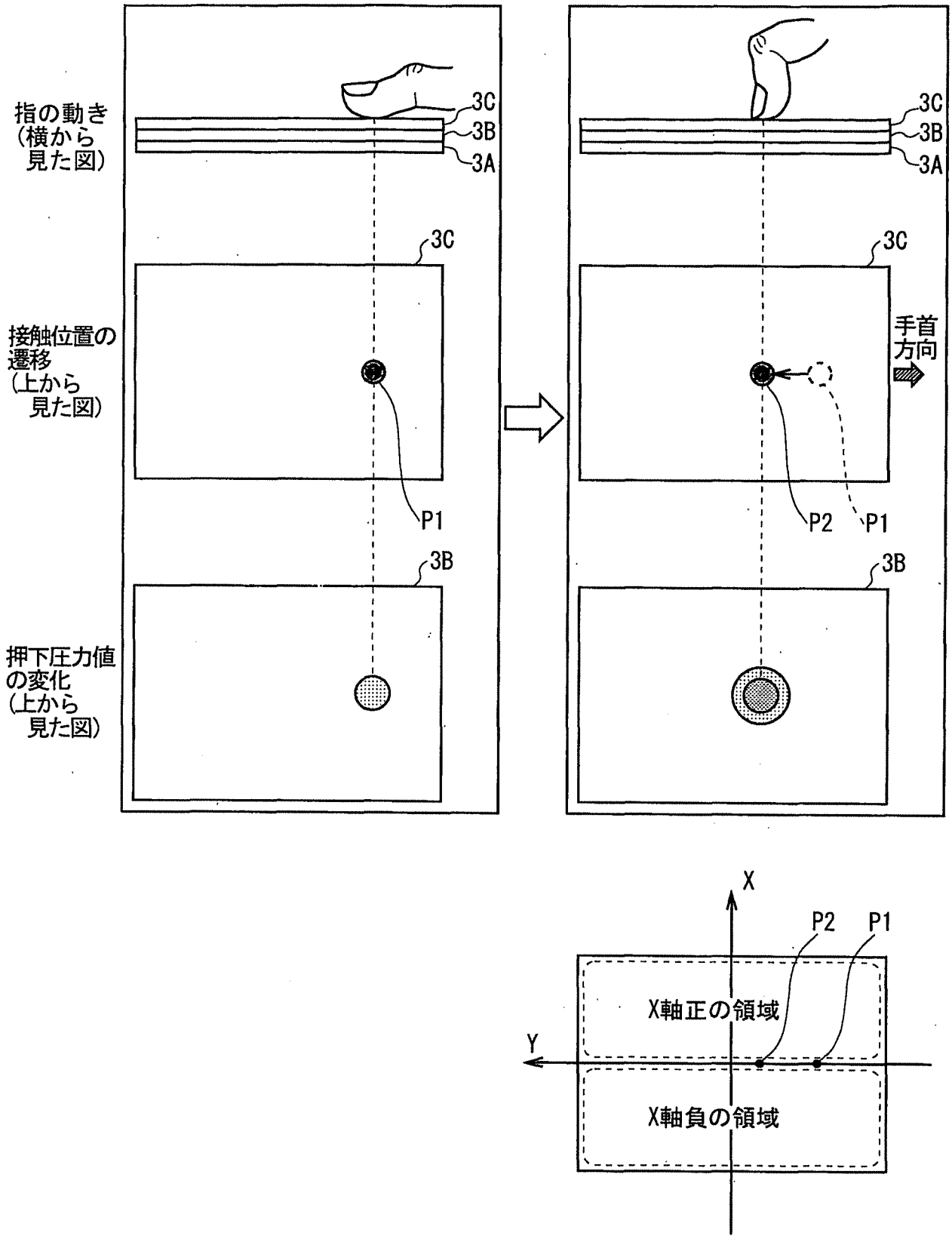

指の動き
(横から
見た図)
接触位置の
遷移
(上から
見た図)
押下圧力値
の変化
(上から
見た図)
3C
3B
3A
P1
P2
手首
方向
X
Y
X軸正の領域
X軸負の領域

図4

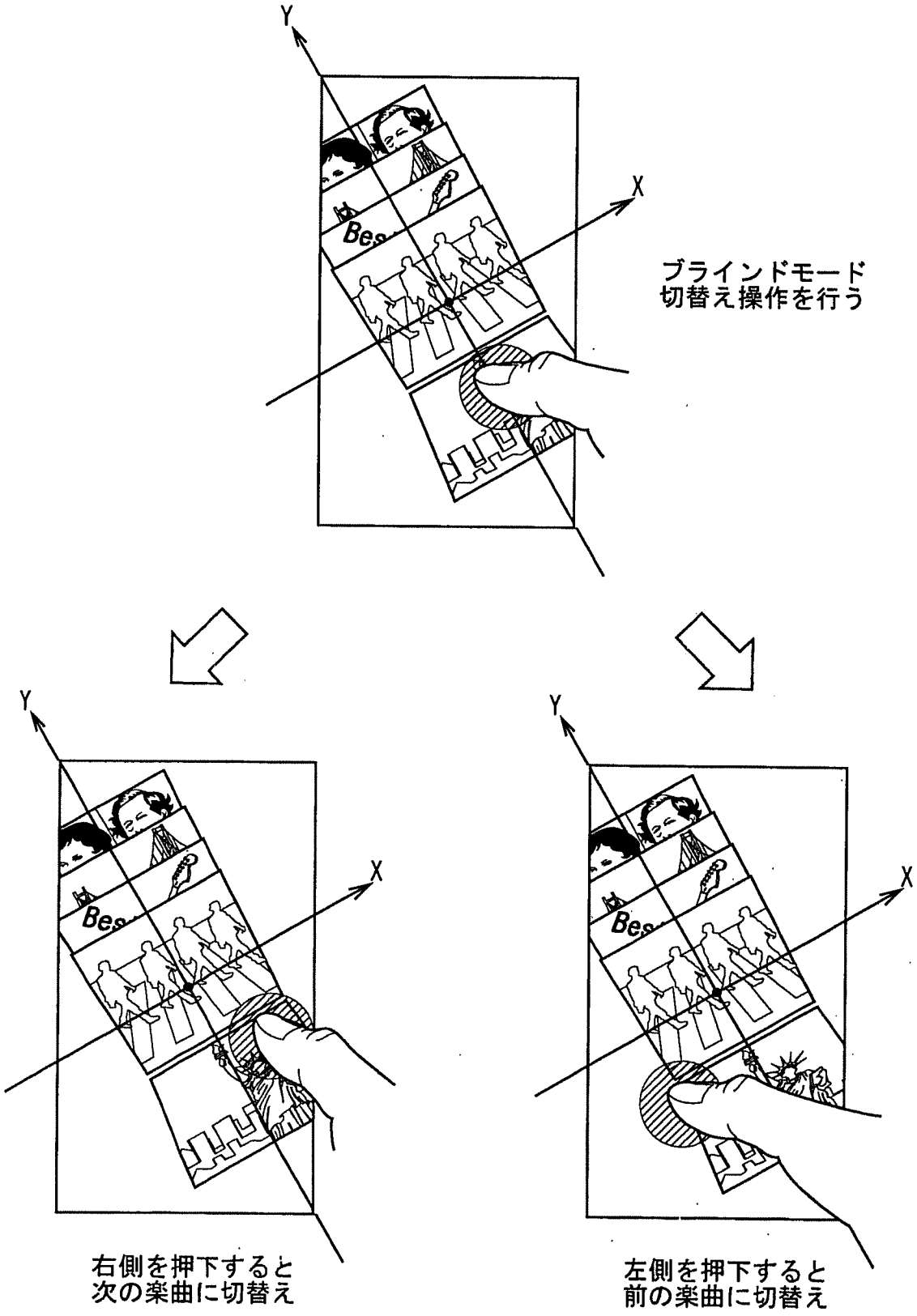

Y
X
ブラインドモード
切替え操作を行う
Y
X
右側を押下すると
次の楽曲に切替え
Y
X
左側を押下すると
前の楽曲に切替え

図５

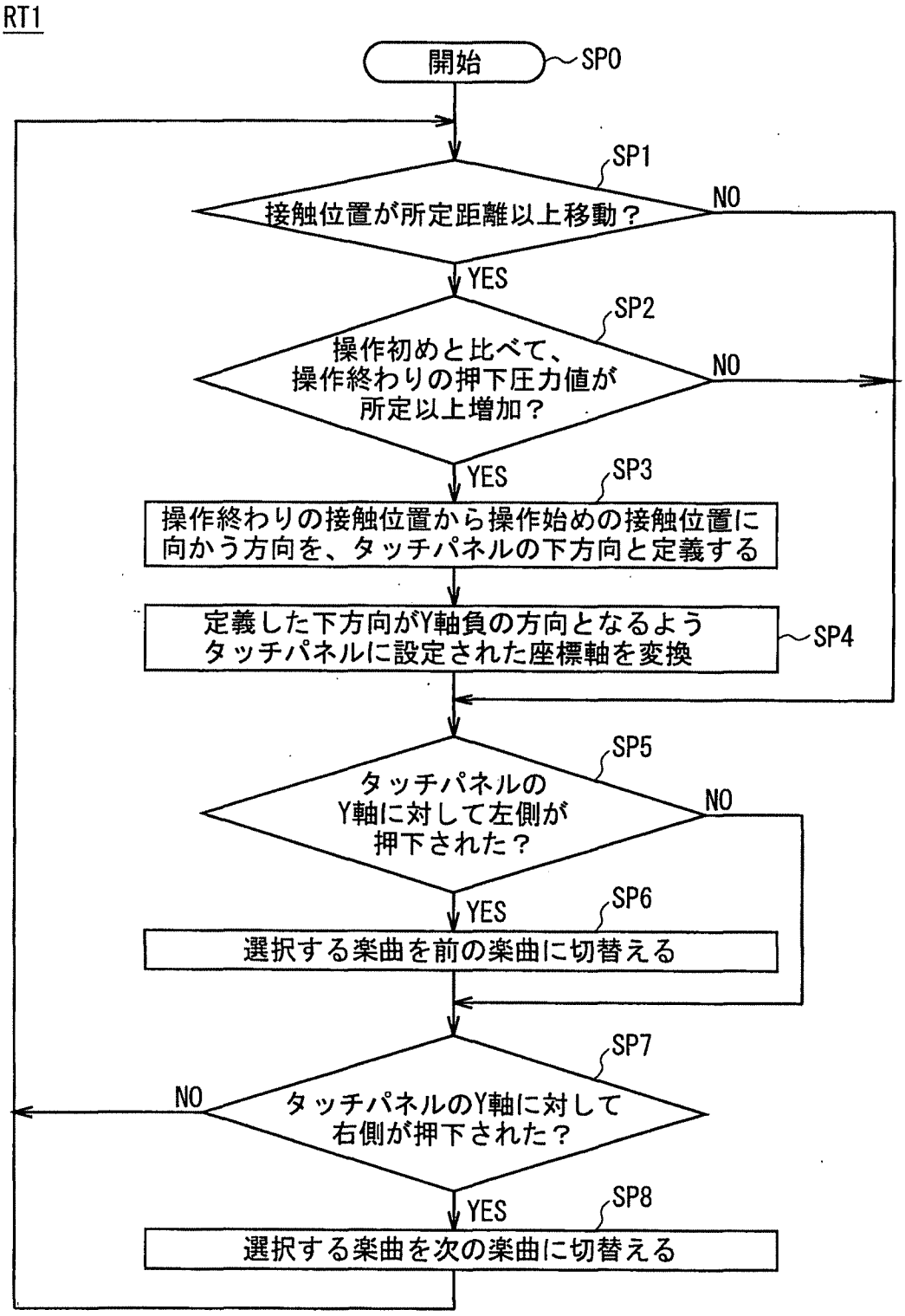

RT1
開始
SP0
SP1
接触位置が所定距離以上移動？
NO
YES
SP2
操作初めと比べて、
操作終わりの押下圧力値が
所定以上増加？
NO
YES
SP3
操作終わりの接触位置から操作始めの接触位置に
向かう方向を、タッチパネルの下方向と定義する
定義した下方向がY軸負の方向となるよう
タッチパネルに設定された座標軸を変換
SP4
SP5
タッチパネルの
Y軸に対して左側が
押下された？
NO
YES
SP6
選択する楽曲を前の楽曲に切替える
SP7
NO
タッチパネルのY軸に対して
右側が押下された？
YES
SP8
選択する楽曲を次の楽曲に切替える

図６

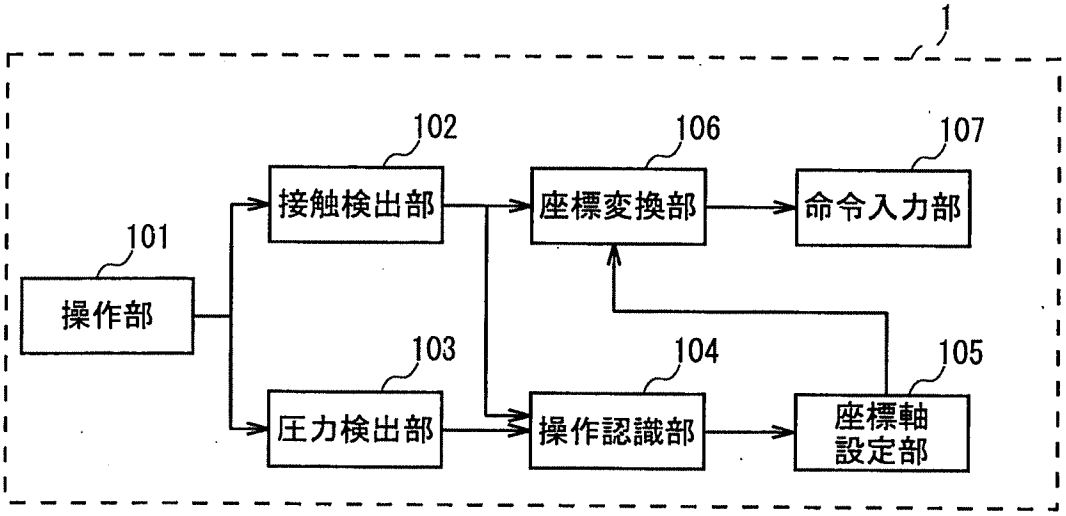

1
101
操作部
102
接触検出部
103
圧力検出部
104
操作認識部
105
座標軸
設定部
106
座標変換部
107
命令入力部

図 7

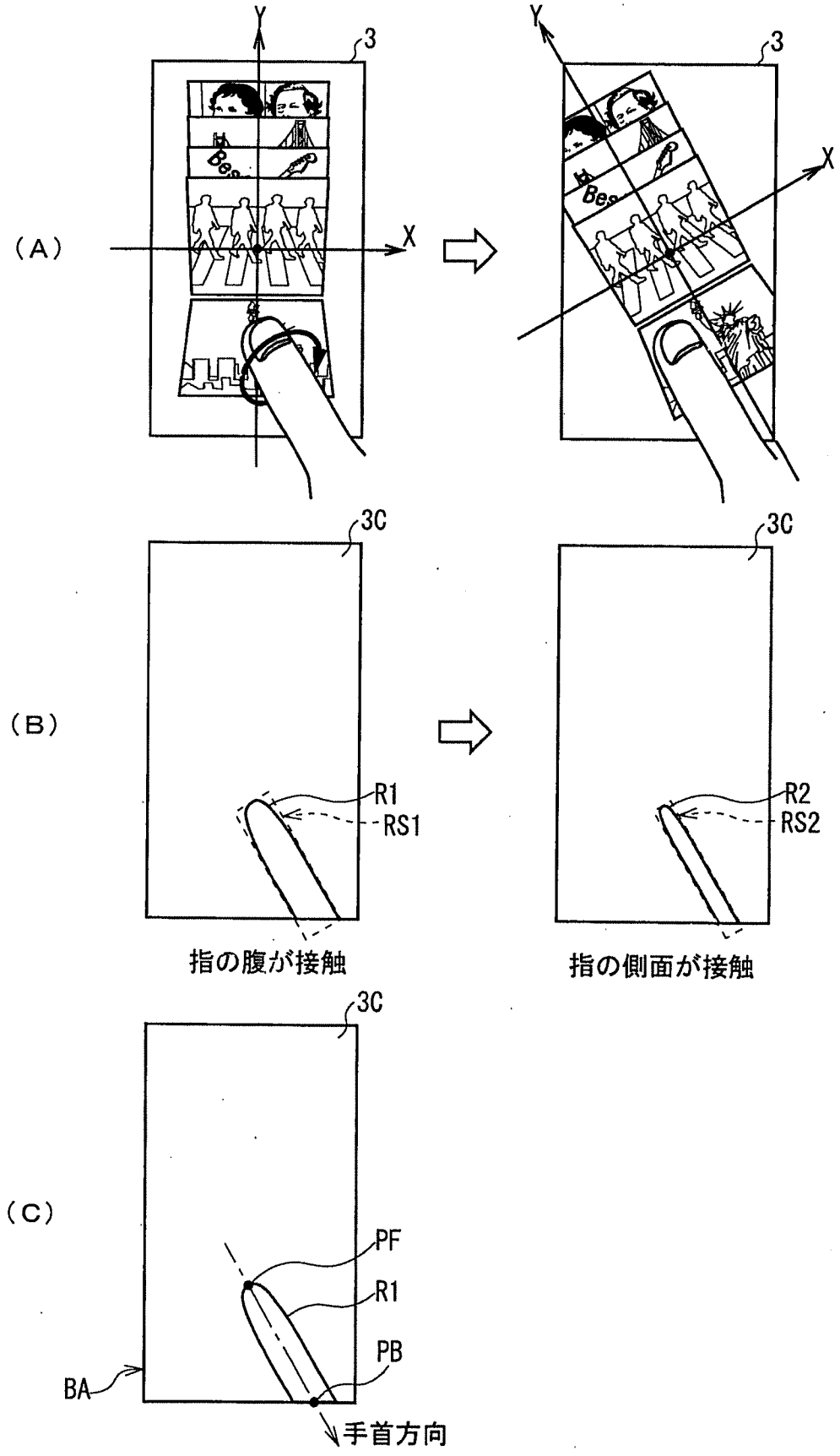


図８

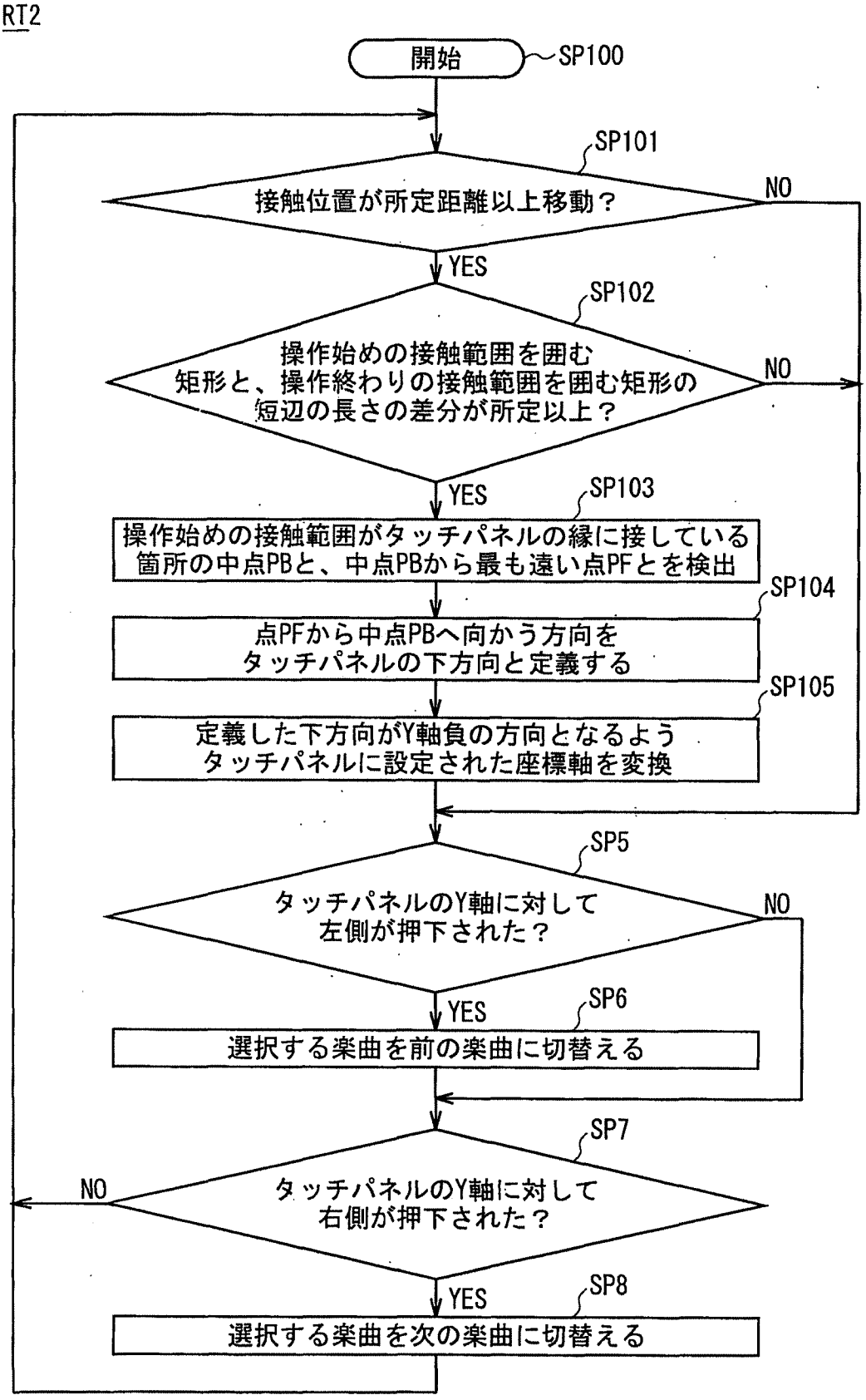

RT2
開始
SP100
SP101
接触位置が所定距離以上移動？
NO
YES
SP102
操作始めの接触範囲を囲む
矩形と、操作終わりの接触範囲を囲む矩形の
短辺の長さの差分が所定以上？
NO
YES
SP103
操作始めの接触範囲がタッチパネルの縁に接している
箇所の中点PBと、中点PBから最も遠い点PFとを検出
SP104
点PFから中点PBへ向かう方向を
タッチパネルの下方向と定義する
SP105
定義した下方向がY軸負の方向となるよう
タッチパネルに設定された座標軸を変換
SP5
タッチパネルのY軸に対して
左側が押下された？
NO
YES
SP6
選択する楽曲を前の楽曲に切替える
SP7
NO
タッチパネルのY軸に対して
右側が押下された？
YES
SP8
選択する楽曲を次の楽曲に切替える

図９

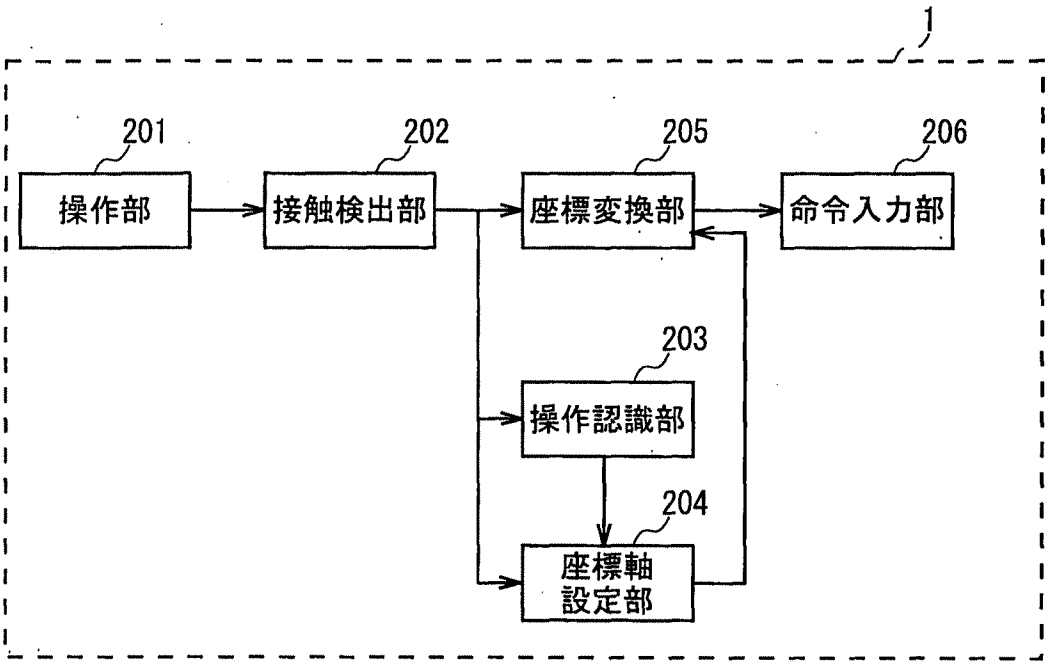


図１０

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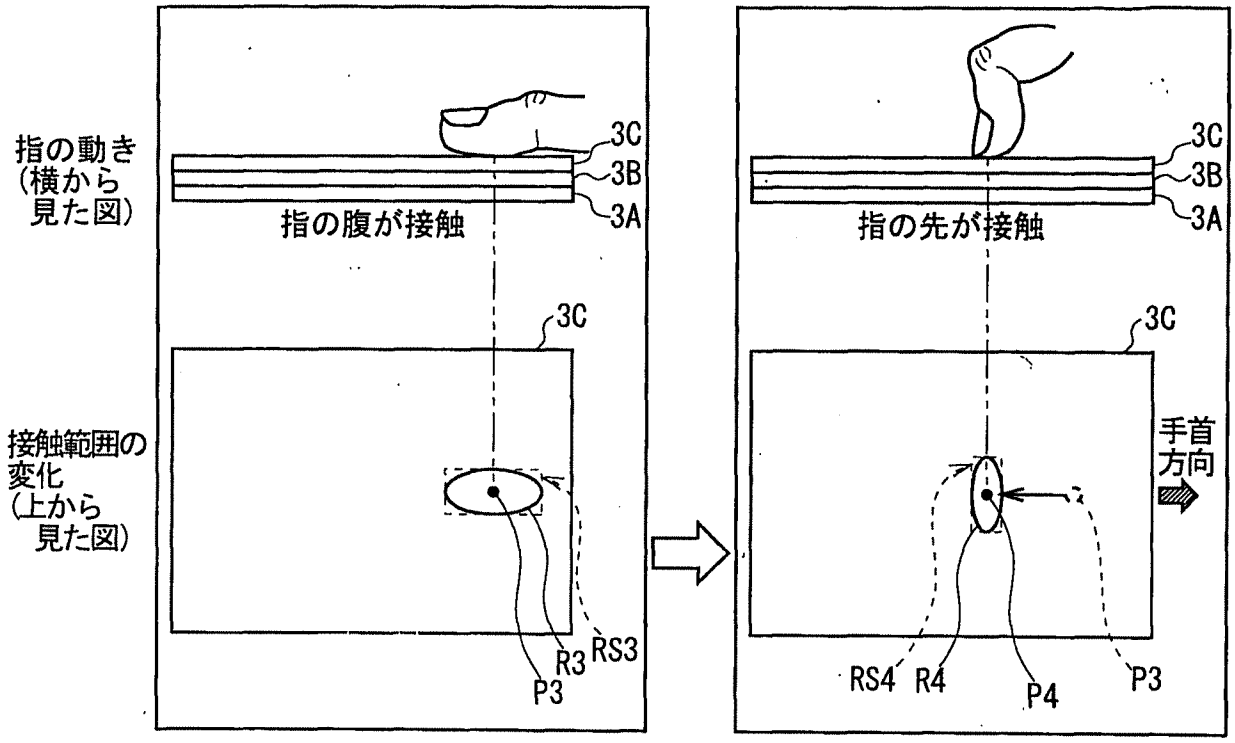


図１１

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/053706

A. CLASSIFICATION OF SUBJECT MATTER
G06F3/048(2006.01)i, *G06F3/041*(2006.01)i

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)
G06F3/048, G06F3/041

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2010
Kokai Jitsuyo Shinan Koho 1971-2010 Toroku Jitsuyo Shinan Koho 1994-2010

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	JP 2008-191791 A (Sharp Corp.), 21 August 2008 (21.08.2008), paragraphs [0055] to [0110]; fig. 3 to 6 (Family: none)	1-10
A	JP 2009-9252 A (Panasonic Corp.), 15 January 2009 (15.01.2009), paragraph [0020]; fig. 3 (Family: none)	1-10
A	JP 2000-300543 A (Fuji Xerox Co., Ltd.), 31 October 2000 (31.10.2000), paragraph [0145] & US 6657614 B1	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
28 May, 2010 (28.05.10)	08 June, 2010 (08.06.10)
Name and mailing address of the ISA/	Authorized officer

国際調査報告

国際出願番号　ＰＣＴ／ＪＰ２０１０／０５３７０６

Ａ．　発明の属する分野の分類（国際特許分類（ＩＰＣ））

Int.Cl.　G06F3/048(2006.01)i, G06F3/041(2006.01)i

Ｂ．　調査を行った分野

調査を行った最小限資料（国際特許分類（ＩＰＣ））

Int.Cl.　G06F3/048, G06F3/041

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	１９２２－１９９６年
日本国公開実用新案公報	１９７１－２０１０年
日本国実用新案登録公報	１９９６－２０１０年
日本国登録実用新案公報	１９９４－２０１０年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

Ｃ．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求項の番号
A	JP 2008-191791 A（シャープ株式会社）2008.08.21, 【００５５】～【０１１０】、図３～６（ファミリーなし）	１－１０
A	JP 2009-9252 A（パナソニック株式会社）2009.01.15, 【００２０】、図３（ファミリーなし）	１－１０
A	JP 2000-300543 A（富士ゼロックス株式会社）2000.10.31, 【０１４５】 & US 6657614 B1	１－１０

☐　Ｃ欄の続きにも文献が列挙されている。

☐　パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー

「Ａ」特に関連のある文献ではなく、一般的技術水準を示すもの

「Ｅ」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの

「Ｌ」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）

「Ｏ」口頭による開示、使用、展示等に言及する文献

「Ｐ」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献

「Ｔ」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの

「Ｘ」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの

「Ｙ」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの

「＆」同一パテントファミリー文献

国際調査を完了した日 ２８．０５．２０１０	国際調査報告の発送日 ０８．０６．２０１０
国際調査機関の名称及びあて先 日本国特許庁（ＩＳＡ／ＪＰ） 郵便番号１００－８９１５ 東京都千代田区霞が関三丁目４番３号	特許庁審査官（権限のある職員）　５Ｅ　９１７４ 山崎　慎一 電話番号　０３－３５８１－１１０１　内線　３５２１

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Espacenet

Bibliographic data: CN1567288 (A) — 2005-01-19

Method for multiple encryption of file and simultaneous sealing/unsealing

Inventor(s): LI TAO [CN] ± (TAO LI)

Applicant(s): UNIV SICHUAN [CN] ± (SICHUAN UNIVERSITY)

Classification: - international: ***G06F17/00; H04L9/00;*** (IPC1-7): G06F17/00; H04L9/00
- cooperative:

Application number: CN2003135741 20030902

Priority number(s): CN2003135741 20030902

Also published as: CN1226691 (C)

Abstract of CN1567288 (A)

This invention provides a kind of simultaneous encrypting and decrypting method of file multiple encryptions. It belongs to the information security realm. It features that when encrypting the file, it adopts the asymmetric encryption algorithm to nesting encrypt by using public key of multiple participants, so to realize the function of file encryption. If the file needs to be decrypted, each participant must attend simultaneously and provide their private key to decrypt one after another. This method can be applied to the field not only with high security and confidentiality but also needs publicity and justness.

[19] 中华人民共和国国家知识产权局

[51] Int. Cl[7]
G06F 17/00
H04L 9/00

[12] 发明专利申请公开说明书

[21] 申请号 03135741.5

[43] 公开日 2005 年 1 月 19 日

[11] 公开号 CN 1567288A

[22] 申请日 2003.9.2 [21] 申请号 03135741.5

[71] 申请人 四川大学

地址 610065 四川省成都市一环路南一段 24 号

[72] 发明人 李 涛

权利要求书 2 页 说明书 5 页 附图 5 页

[54] 发明名称 一种文件多重加密同时封存/开封方法

[57] 摘要

本发明提出一种文件多重加密同时封存/开封方法，属于信息安全领域。其特征在于对文件进行加密时，使用多方参与者的公钥采取非对称加密算法进行嵌套加密，实现将文件进行封存的功能。当该文件需要开封时，每个参与者都必须同时在场并提供各自的私钥以进行依次解密。本方法对于一些保密性和安全性要求很高，并需要公开性和公证性的场合有着重要的应用价值。

ISSN1008-4274

1. 一种文件多重加密同时封存/开封方法，其特征包括以下步骤：多重加密同时封存文件的结构；对文件进行多重加密同时封存的步骤；封存的文件进行开封的步骤；封存的文件完整性验证的步骤。

2. 权利要求 1 所述的文件多重加密同时封存/开封方法，其特征在于多重加密同时封存文件的结构包含以下内容：

多重加密同时封存的文件包括文件头、封存的密文和多重加密密钥三部分；

文件头包含六部分内容：封存者标识符、摘要算法标识符、签名算法标识符、文件加密算法标识符、参与人数标识符和参与者标识符；

封存的密文包含一个部分，即经过加密的数据；

多重加密密钥包含两部分内容：非对称算法标识符和密钥信息。

3. 权利要求 1 所述的文件多重加密同时封存/开封方法，其特征在于对文件进行多重加密同时封存的步骤包括以下步骤：

使用摘要算法对原始文件进行散列运算，生成散列值的步骤；

使用私钥加密散列值，生成加密值的步骤；

使用一次性随机会话密钥加密原始文件和签名，生成加密数据的步骤；

把加密的数据写入封存文件的密文部分的步骤；

使用多个公钥嵌套加密会话密钥，生成加密密钥的步骤；

把加密的密钥写入封存文件的多重加密密钥部分的步骤。

4. 权利要求 1 所述的文件多重加密同时封存/开封方法，其特征在于封存的文件进行开封的步骤包括以下步骤：

从封存文件的多重加密密钥部分取出加密密钥的步骤；

使用多个私钥依次解密密钥，得到会话密钥的步骤；

从封存文件的密文部分取出加密数据的步骤；

使用会话密钥解密密文，得到原始文件和签名的步骤。

5. 权利要求 1 所述的文件多重加密同时封存/开封方法，其特征在于封存文件的完整性验证的步骤包括以下步骤：

用公钥解密签名数据，得到散列值的步骤；

使用摘要算法，对原始文件进行散列运算，得出新的散列值的步骤；

比较两个散列值，得出验证结果的步骤。

一种文件多重加密同时封存/开封方法

技术领域

本发明提出一种文件多重加密同时封存及开封的方法，属于信息安全领域，实现文件保存的安全性、保密性、完整性以及公开公证性。

背景技术

目前，文件保密大都采用数字签名和加密技术，首先使用文件所有者的私钥对文件进行签名并附在文件上；然后用随机生成的一次性会话密钥对文件及签名进行加密形成密文；再用文件查看者的公钥对会话密钥进行加密形成加密密钥；最后将密文和加密密钥合成要传送的文件。这样产生的文件只需由文件查看者单独就可解密，不能满足一些要求多方介入的场合的要求（例如必须多方同时到场才能进行阅读文件）。

中国专利公开号为 CN1109187A 的申请案是将源文件进行加密，产生的可执行文件写入软盘提供给用户。由于软盘介质的不可靠性，这种方法的应用范围有很大的局限性。中国专利公开号为 CN1186277A 的申请案是利用分层加密的方法确保文件的机密性，在传送或储存加密文件的同时，将对应的解压缩和解密运算附加于加密文件的档案中。这样的文件只需接收端输入正确的密码即可得到原始数据，不具备公开性和公证性，并且不能对原始文件的完整性进行验证。

本发明采用多重加密技术，通过多方参与者将文件进行同时封存来确保文件的安全性、保密性、完整性以及公开公正性。其中多方参与者名单由文件的封存者选择，一旦文件被同时封存，只有所有的参与者都同时在场并提供正确的信息，文件才能被开封。

多重加密同时封存的文件可防止文件内容被单独修改和重构，确保文件的安全性、保密性、完整性以及公开公正性，可广泛应用于各机关单位的文件机密保存以及网站的网上公开

招标和投标等场合。

发明内容

多重加密同时封存的文件是一个顺序的文件，其结构分为三个部分（详细介绍请参见附图 1 说明）：

1) 文件头，包含六个部分：封存者标识符、摘要算法标识符、签名算法标识符、文件加密算法标识符、参与人数标识符和参与者标识符。
2) 封存的密文。
3) 多重加密密钥，包含两个部分：非对称算法标识符和密钥信息。

将原始文件进行同时封存时，首先填写文件头的有关信息，如：封存者标识符、摘要算法标识符、签名算法标识符、参与人数标识符等，其中参与者由文件的封存者决定，一般为三个以上的标识符，其个数与参与人数标识符一致。然后封存者对原始文件产生摘要并用自己的私钥进行加密形成签名，将签名附在原始文件末尾形成签名的文件（详细操作请参见附图 2 说明）。接着封存者随机产生一次性会话密钥，对已经签名的文件进行加密形成要封存的密文内容。接着获取参与者各自的公钥，按照从后至前的顺序使用公钥对一次性随机会话密钥进行嵌套加密，得到多重加密密钥（详细操作请参见附图 3 说明）。

将封存文件进行同时开封时，首先要求参与者标识符中的参与者依次提供相应的私钥。若其中任何一个参与者的私钥错误，则此次文件开封失败。得到相应的私钥后，按照从前至后的顺序使用参与者的私钥对多重加密密钥进行依次解密，得到封存者所生成的一次性随机会话密钥，并按照文件头中描述的文件加密算法，使用该会话密钥对封存的密文进行解密，得到签名的文件（详细操作请参见附图 4 说明）。最后取出文件中的签名数据，按照文件头中描述的摘要算法和签名算法验证其签名的正确性（详细操作请参见附图 5 说明）。若通过签名验证，则说明原始文件没有遭到破坏，文件完整；否则，说明文件已被破坏。原始文件的任何细微变化，均将导致摘要信息的巨大差异，因此，验证此字段的签名信息，可验证文件的

完整性、原始性和不可否认性等。

为了进一步说明本发明的原理及特征，以下结合附图进行说明。

图 1 为多重加密同时封存文件的结构图。

一个多重加密同时封存的文件包括文件头、封存的密文和多重加密密钥三部分。

其中文件头包含六部分内容：

1) 封存者标识符

字符串，标识原始文件的封存者。

2) 摘要算法标识符

字符串，表示封存文件使用的摘要算法。可采用国内外常用的摘要算法，如：***MD2***、***MD5*** 及 ***SHA1*** 等。

3) 签名算法标识符

字符串，表示封存文件使用的签名算法。可采用国内外常用的签名算法，如：***DSS***、***RSA*** 等。

4) 文件加密算法标识符

字符串，表示封存文件使用的对称加密算法。可采用目前国内外常用的对称加密算法，如：***AES***、三重 ***DES***、***RC5*** 及 ***IDEA*** 等。

5) 参与人数标识符

字符串，表示封存文件涉及的参与者的人数。

6) 参与者标识符

字符串，标识封存文件涉及的所有参与者。

封存的密文为二进制串，由文件头中文件加密算法标识符指定的算法对原始文件进行加密后形成。

多重加密密钥包含两部分内容：

1) 非对称算法标识符

字符串，表示会话密钥使用的非对称加密算法。可采用国内外常用的非对称加密算法，如：*RSA*、*DSA*、*ECC* 及 *DH* 等。

2) 密钥信息

二进制串，由上面非对称加密算法标识符指定的算法加密后存储。

图 2 为签名文件的生成模型。

对原始文件进行签名形成签名文件，具体步骤如下：

① 使用摘要算法，对原始文件进行散列运算，求出一个散列值。

② 使用封存者的私钥加密散列值，得到文件的签名。

③ 将签名附在原始文件末尾，形成签名的文件。

图 3 为封存文件的生成模型。

得到签名的文件后，需要对该文件进行同时封存。同时封存后的文件只有在所有的参与者都提供了正确的信息后才能被开封，具有很高的安全性、保密性和公开公证性。具体步骤如下：

① 封存者随机产生一次性的会话密钥 *SK*，按照文件头中文件加密算法标识符指定的算法，对签名的文件进行加密，形成加密的数据。

② 将加密的数据写入封存文件的密文部分。

③ 从文件头的参与者标识符中取出最后一个参与者，获取其公钥 PBK_n，使用指定的非对称加密算法对 *SK* 进行加密，形成临时密钥 TK_1。从参与者标识符中取出倒数第二个参与者，获取其公钥 PBK_{n-1} 并使用指定的非对称加密算法对 TK_1 进行加密，形成临时密钥 TK_2 。这样依次从后至前获取参与者的公钥进行嵌套加密，直至用第一个参与者的公钥 PBK_1 对临时密钥 TK_{n-1} 进行加密，形成多重加密的会话密钥 *EK*。

④ 将使用的非对称加密算法的标识符和 *EK* 写入封存文件的多重加密密钥部分。

图 4 为封存文件的开封模型。

对于一个多重加密同时封存后的文件，对其进行开封的具体步骤如下：

① 从封存的文件中取出多重加密的会话密钥 ***EK***。

② 从文件头的参与者标识符中取出第一个参与者，由该参与者提供其相应的私钥 PVK_1，使用指定的非对称加密算法对 ***EK*** 进行解密，得到临时密钥 TK_{n-1}。从参与者标识符中取出第二个参与者，同样由该参与者提供其相应的私钥 PVK_2，并使用指定的非对称加密算法对 TK_{n-1} 进行解密，得到临时密钥 TK_{n-2}。这样依次从前至后由参与者提供其相应的私钥进行解密，直至最后一个参与者提供其私钥 PVK_n 对临时密钥 TK_1 进行解密，得到封存者所生成的一次性随机会话密钥 ***SK***。

③ 从封存的文件中取出密文部分。

④ 按照文件头中文件加密算法标识符指定的算法，使用会话密钥 ***SK*** 对密文进行解密，得到经过封存者签名的文件，完成文件的开封过程。

图 5 为封存文件完整性的验证模型。

封存的文件经过开封得到原始文件和封存者的签名后，还需进行完整性验证，以防止文件被非法修改。具体步骤如下：

① 按照文件头中签名算法标识符指定的算法，用封存者的公钥对签名进行解密，得到其散列值 ***M1***。

② 按照文件头中摘要算法标识符指定的算法，对原始文件进行散列运算，求出一个散列值 ***M2***。

③ 比较 ***M1*** 与 ***M2***，如果两者相同，则原始文件未被破坏，验证成功；如果不相同，则表明原始文件已被破坏，验证失败。

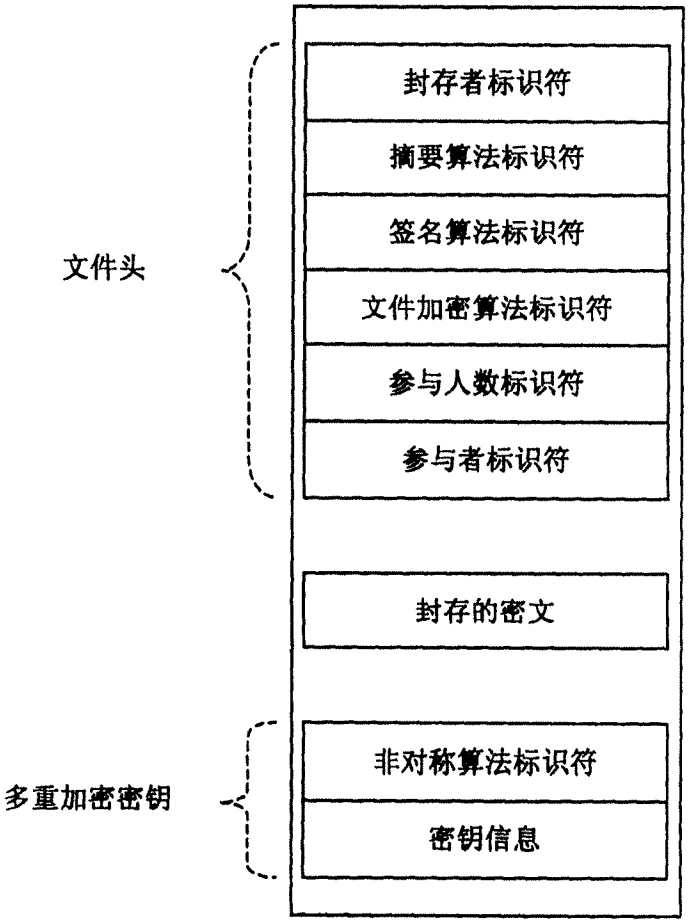

封存者标识符
摘要算法标识符
签名算法标识符
文件加密算法标识符
参与人数标识符
参与者标识符
文件头
封存的密文
非对称算法标识符
密钥信息
多重加密密钥

图 1

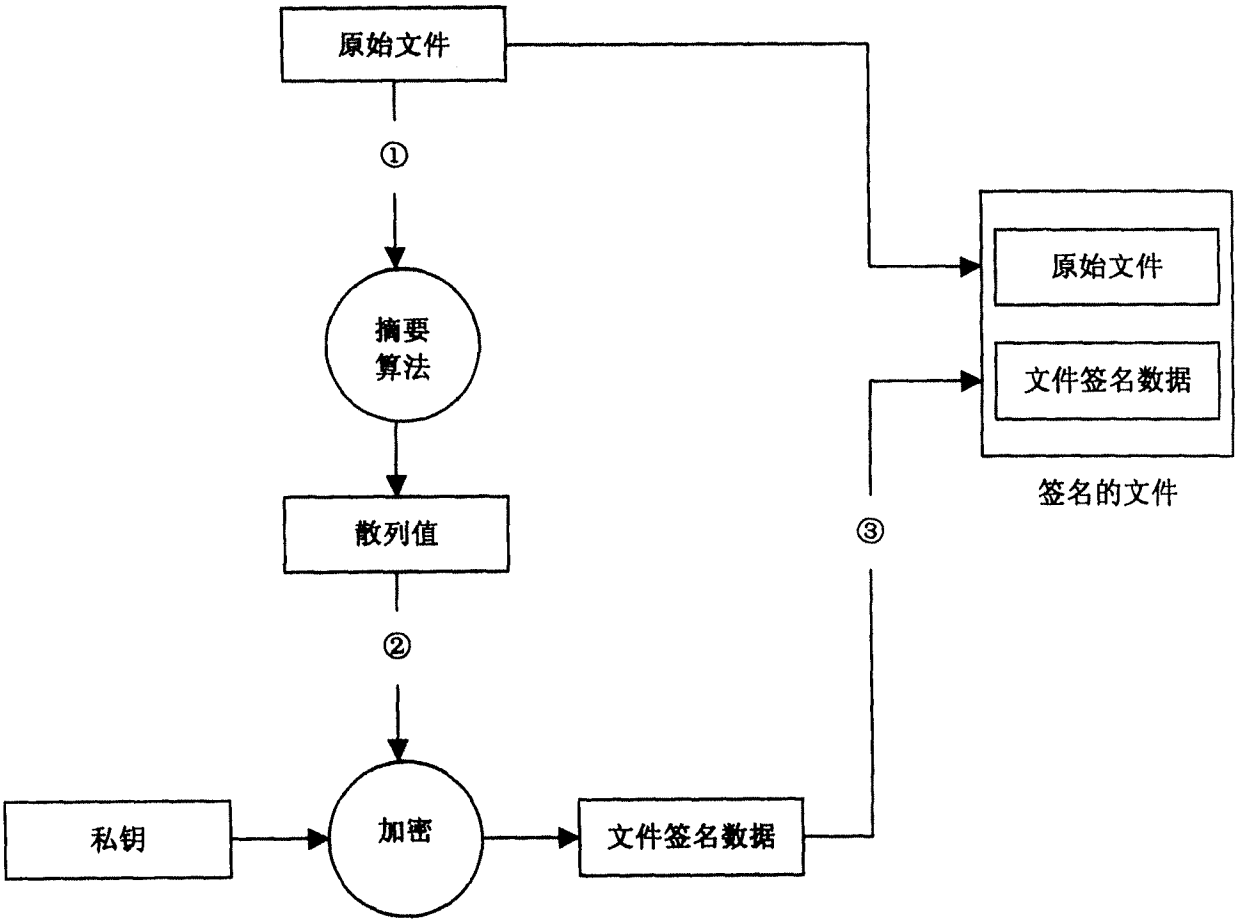


图 2

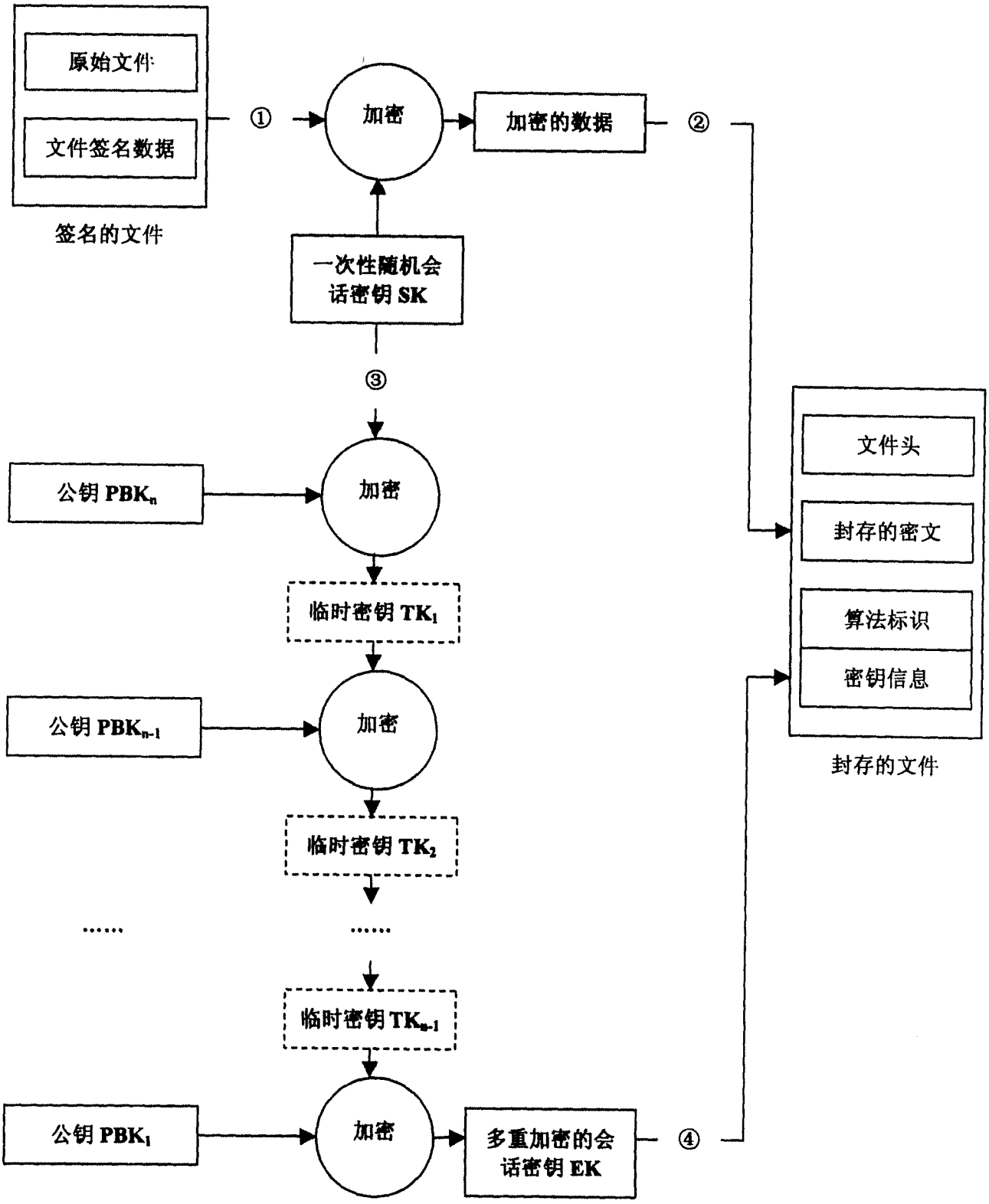

原始文件
文件签名数据
签名的文件
①
加密
加密的数据
②
一次性随机会话密钥 SK
③
公钥 PBK_n
加密
临时密钥 TK_1
公钥 PBK_{n-1}
加密
临时密钥 TK_2
.....
.....
临时密钥 TK_{n-1}
公钥 PBK_1
加密
多重加密的会话密钥 EK
④
文件头
封存的密文
算法标识
密钥信息
封存的文件

图 3

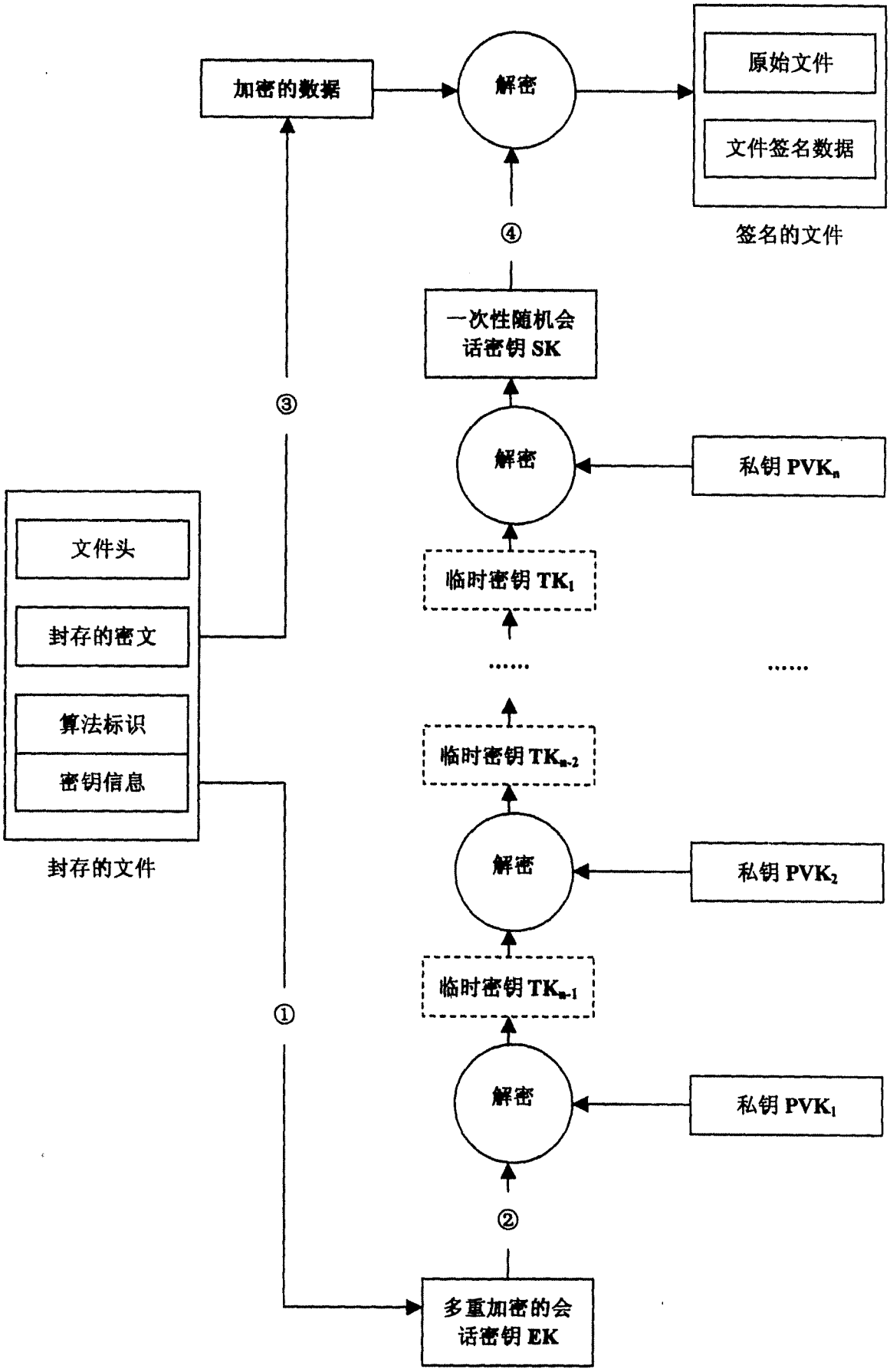

加密的数据
解密
原始文件
文件签名数据
签名的文件
④
一次性随机会话密钥 SK
③
解密
私钥 PVK_n
文件头
封存的密文
算法标识
密钥信息
封存的文件
临时密钥 TK_1
.....
.....
临时密钥 TK_{n-2}
解密
私钥 PVK_2
临时密钥 TK_{n-1}
①
解密
私钥 PVK_1
②
多重加密的会话密钥 EK

图 4

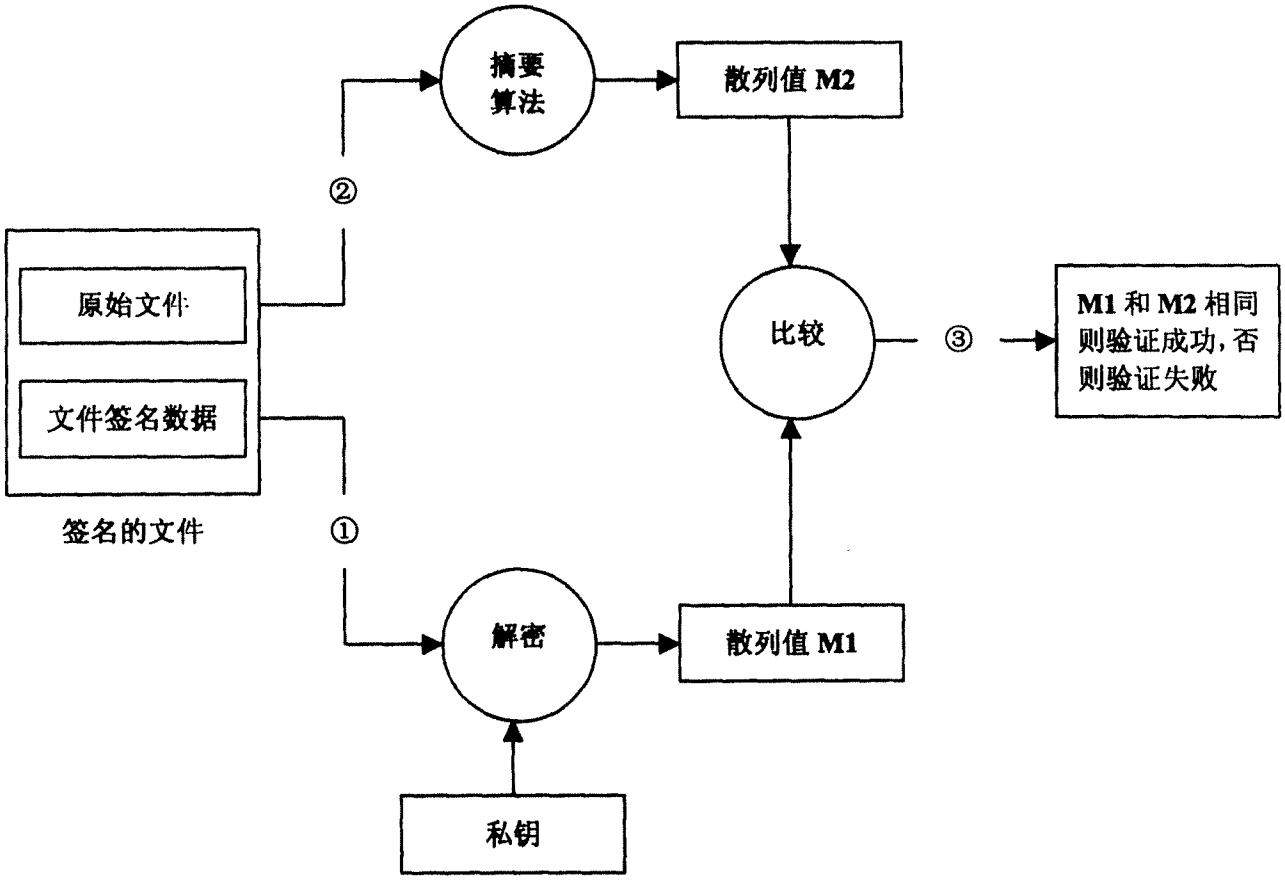

摘要
算法
散列值 M2
②
原始文件
文件签名数据
签名的文件
比较
③
M1 和 M2 相同
则验证成功，否
则验证失败
①
解密
散列值 M1
私钥

图 5

Espacenet

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Input device, microcomputer and information processing method

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Applicant(s): TOKYO SHIBAURA ELECTRIC CO [JP] ± (TOKYO SHIBAURA ELECTRIC CO)

Classification: **- international:** ***G06F3/033; G06F3/041***
- cooperative: **G06F3/0414; G06F3/045; G06F3/04886**

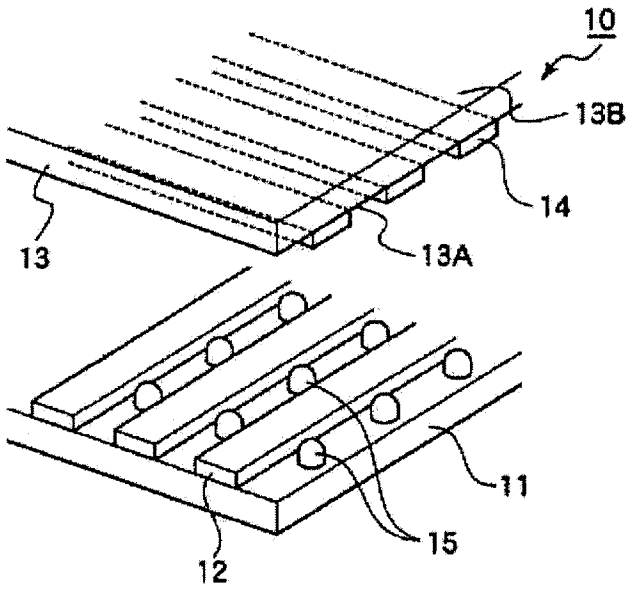
Application number: CN20051107610 20050929

Priority number(s): JP20040285445 20040929

Also published as: CN100432909 (C) US2006066589 (A1)

Abstract not available for CN1755604 (A)
Abstract of corresponding document: US2006066589 (A1)

An input device includes: a display unit indicating an image of an input position; a contact position detecting unit detecting a position of an object brought into contact with a contact detecting layer provided on a display layer of the display unit; a contact strength detecting unit detecting contact strength of the object brought into contact with the contact detecting layer; a feature quantity extracting unit extracting a feature quantity related to the detected contact strength; and a special process executing unit comparing the extracted feature quantity with a predetermined threshold, and executing special processes.



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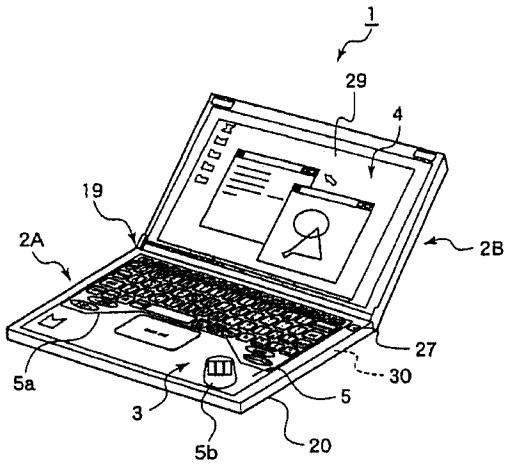
权利要求书 3 页 说明书 35 页 附图 33 页

[54] 发明名称

输入设备、微型计算机以及信息处理方法

[57] 摘要

一种输入设备，包括：显示单元，用于指示输入位置的图像；接触位置检测单元，用于检测与接触检测层接触的对象的位置，其中所述接触检测层设置在显示单元的显示层上；接触强度检测单元，用于检测与所述接触检测层接触的对象的接触强度；特征量提取单元，用于提取与检测到的接触强度相关的特征量；以及特殊处理执行单元，用于把提取出的特征量与预定阈值进行比较，并且执行特殊处理。



1.一种输入设备，包括：

显示单元，用于指示输入位置的图像；

接触位置检测单元，用于检测与接触检测层接触的对象的位置，其中所述接触检测层设置在显示单元的显示层上；

接触强度检测单元，用于检测与所述接触检测层接触的对象的接触强度；

特征量提取单元，用于提取与检测到的接触强度相关的特征量；以及

特殊处理执行单元，用于把提取出的特征量与预定阈值进行比较，并且执行特殊处理。

2.如权利要求1所述的输入设备，其中所述特征量涉及接触强度、接触强度的变化或者接触时间的时段，并且所述特殊处理执行单元在把所提取的特征量与预定阈值进行比较之后验证所述对象。

3.如权利要求1所述的输入设备，其中：所述特征量涉及所述对象的接触强度或者接触位置；所述预定阈值对应于对接触检测层产生不利影响的接触强度；并且当特征量大于预定阈值时，所述特殊处理执行单元发出警告或者使输入设备不起作用。

4.如权利要求1所述的输入设备，其中：所述特征量涉及所述对象的接触强度或者接触位置；所述预定阈值对应于向对象施加不必要负担的接触强度；并且当特征量大于预定阈值时，所述特殊处理执行单元发出警告或者使输入设备不起作用。

5.如权利要求1所述的输入设备，其中：所述输入位置被显示为键盘；所述特征量涉及接触强度、接触强度的变化或者接触时间的时段；并且所述特殊处理执行单元根据特征量是否大于预定阈值来转换按键。

6.如权利要求1所述的输入设备，还包括接触强度检测器，其包括第一和第二基座，所述基座包括设置在其相对表面上的电极层、以

及具有不同高度级别的点间隔物，并且所述接触强度检测器用于检测相接触的对象的接触强度。

7.一种微型计算机，包括：

显示单元，用于指示输入位置的图像；

接触位置检测单元，用于检测与接触检测层接触的对象的位置，其中所述接触检测层设置在显示单元的显示层上；

接触强度检测单元，用于检测与所述接触检测层接触的对象的接触强度；

特征量提取单元，用于提取与检测到的接触强度相关的特征量；以及

特殊处理执行单元，用于把提取出的特征量与预定阈值进行比较，并且执行特殊处理。

8.如权利要求 7 所述的微型计算机，其中所述特征量涉及接触强度、接触强度的变化或者接触时间的时段，并且所述特殊处理执行单元在把所提取的特征量与预定阈值进行比较之后验证所述对象。

9.如权利要求 7 所述的微型计算机，其中：所述特征量涉及所述对象的接触强度或者接触位置；所述预定阈值对应于对接触检测层产生不利影响的接触强度；并且当特征量大于预定阈值时，所述特殊处理执行单元发出警告或者使微型计算机不起作用。

10.如权利要求 7 所述的微型计算机，其中：所述特征量涉及所述对象的接触强度或者接触位置；所述预定阈值对应于向对象施加不必要负担的接触强度；并且当特征量大于预定阈值时，所述特殊处理执行单元发出警告或者使微型计算机不起作用。

11.如权利要求 7 所述的微型计算机，其中：所述输入位置被显示为键盘；所述特征量涉及接触强度、接触强度的变化或者接触时间的时段；并且所述特殊处理执行单元根据特征量是否大于预定阈值来转换按键。

12.一种信息处理方法，包括：

在显示单元上指示输入位置的图像；

检测与显示单元的接触检测层相接触的对象的接触位置；

检测所述对象的接触强度；

提取与检测到的接触强度相关的特征量；以及

把提取出的特征量与预定阈值进行比较，并且基于比较结果来执行特殊处理。

13.如权利要求 12 所述的信息处理方法，其中所述特征量涉及接触强度、接触强度的变化或者接触时间的时段，并且通过把所提取的特征量与预定阈值进行比较来执行对象的验证。

14.如权利要求 12 所述的信息处理方法，其中：所述特征量涉及所述对象的接触强度或者接触位置；所述预定阈值涉及对接触检测层产生不利影响的接触强度；并且当特征量大于预定阈值时，发出警告或者暂停响应于对象接触的处理。

15.如权利要求 12 所述的信息处理方法，其中：所述特征量涉及所述对象的接触强度或者接触位置；所述预定阈值涉及向对象施加不必要负担的接触强度；并且当特征量大于预定阈值时，发出警告或者暂停响应于对象接触的处理。

16.如权利要求 12 所述的信息处理方法，其中：所述输入位置被指示为键盘；所述特征量涉及接触强度、接触强度的变化或者接触时间的时段；并且当所述特征量大于预定阈值时，进行字符转换。

输入设备、微型计算机以及信息处理方法

相关申请的交叉引用

这个申请基于并且要求了于2004年9月29日申请的在先日本专利申请2004-285445的优先权，将该篇申请的全部内容引入于此，以供参考。

技术领域

本发明涉及一种用于把信息馈送到微型计算机等中的输入设备，装备有所述输入设备的微型计算机以及信息处理方法。

背景技术

通常，计算机终端的接口包括键盘以及鼠标作为输入设备，并且包括阴极射线管(CRT)或者液晶显示器(LCD)作为显示单元。

此外，其中显示单元和输入设备一个层叠在另一个之上的所谓的触摸板也作为计算机终端、小型便携式图形输入板类型的计算器等的接口而广泛使用。

公开号为2003-196,007的已公开日本专利(称为"参考文献")公开了一种用于把字符输入具有较小前端表面的移动式电话或者个人数字助理(PDA)的触摸板。(参见参考文献的0037列和图2)

然而到目前为止，获知诸如用户手指或者输入笔之类的对象是否仅仅放置在触摸板上，或者触摸板是否被这种对象按压，这仍然是很难的事情。这势必会导致输入错误。

本发明的目的在于克服相关领域的先前的问题，并且提供一种可以适当地检测输入设备的接触状态的输入设备、包括这种输入设备的计算机、以及信息处理方法和程序。

发明内容

根据本发明实施例的第一个方面，提供了一种输入设备，包括：显示单元，用于指示输入位置的图像；接触位置检测单元，用于检测与接触检测层接触的对象的位置，其中所述接触检测层提供在显示单元的显示层上；接触强度检测单元，用于检测与所述接触检测层接触的对象的接触强度；特征量提取单元，用于提取与检测到的接触强度相关的特征量；以及特殊处理执行单元，用于把提取出的特征量与预定阈值进行比较，并且执行特殊处理。

根据本发明的第二个方面，提供了一种微型计算机，包括：显示单元，用于指示输入位置的图像；接触位置检测单元，用于检测与接触检测层接触的对象的位置，其中所述接触检测层提供在显示单元的显示层上；接触强度检测单元，用于检测与所述接触检测层接触的对象的接触强度；特征量提取单元，用于提取与检测到的接触强度相关的特征量；以及特殊处理执行单元，用于把提取出的特征量与预定阈值进行比较，并且执行特殊处理。

依照本发明的第三个方面，提供了一种信息处理方法，包括：在显示单元上指示输入位置的图像；检测与显示单元的接触检测层相接触的对象的接触位置；检测所述对象的接触强度；提取与检测到的接触强度相关的特征量；并且把提取出的特征量与预定阈值进行比较，并且基于比较结果来执行特殊处理。

依照本发明的最后一个方面，提供了一种信息处理程序，包括：在显示单元上指示输入位置的图像；检测与显示单元的接触检测层相接触的对象的接触位置；检测所述对象的接触强度；提取与检测到的接触强度相关的特征量；并且把提取出的特征量与预定阈值进行比较，并且基于比较结果来执行特殊处理。

附图说明

图1是根据本发明第一实施例的便携式微型计算机的透视图；

图 2 是便携式微型计算机的输入部分的透视图；

图 3A 是便携式微型计算机的触摸板的透视图；

图 3B 是图 3A 的触摸板的俯视图；

图 3C 是图 3A 的触摸板的横截面；

图 4 是示出了所述便携式微型计算机的输入设备的结构的框图；

图 5 是便携式微型计算机的框图；

图 6 是示出了与触摸板接触的对象的接触区域的尺寸变化的图表；

图 7 是示出了与触摸板接触以便输入信息的对象的接触区域的尺寸变化的图表；

图 8A 是把压力转换为电信号的触摸板的透视图；

图 8B 是图 8A 示出的触摸板的俯视图；

图 8C 是所述触摸板的横截面；

图 9 是示出了触摸板的接触检测器的布置的示意图；

图 10 是示出了当通过轻度压力按压它们时检测到的接触检测器的示意图；

图 11 是示出了当通过中等压力按压它们时检测到的接触检测器的示意图；

图 12 是示出了当通过中等压力按压它们时检测到的接触检测器的示意图；

图 13 是示出了当通过较大压力按压它们时检测到的接触检测器的示意图；

图 14 是示出了当通过最大压力按压它们时检测到的接触检测器的示意图；

图 15 是便携式微型计算机的下部壳体的透视图；

图 16 是便携式微型计算机的输入设备的俯视图；

图 17 是输入设备的俯视图；

图 18 是由所述输入设备进行的信息处理步骤的流程图；

图 19 是示出图 18 中示出的步骤 S106 的细节的流程图；

图 20 是由所述输入设备进行的进一步的信息处理步骤的流程图；

图 21 是示出了图 20 中示出的步骤 S210 的细节的流程图；

图 22 示出了输入设备的键顶的敲击部分；

图 23 示出了输入设备的键顶敲击部分的另一个例子；

图 24 是示出了用户验证处理的流程图；

图 25 是示出图 24 中的步骤 S502 的细节的流程图；

图 26 示出了接触区域 A 的尺寸；

图 27A 是示出了当对象在按键上逗留时、接触区域的尺寸变化的图表；

图 27B 是示出了当敲击按键时、接触区域的尺寸变化的图表；

图 28 是示出了设备保护处理的流程图；

图 29 是示出了用户保护处理的流程图；

图 30 是示出了按键转换处理的流程图；

图 31 是在进一步的实施例中的输入设备的透视图；

图 32 是在又一实施例中的输入设备的框图；

图 33 是又一实施例的框图；

图 34 是又一实施例的框图；并且

图 35 是在进一步的实施例中的触摸板的透视图。

具体实施方式

将参考附图来描述本发明的各种实施例。应当注意，相同或者类似的参考标记在整个附图中应用于相同或者类似的部件和元件，并且省略或者简化了对相同或者类似部件和元件的描述。

第一实施例

在此实施例中，本发明涉及一种输入设备，其是一种用于计算机的终端单元的输入－输出设备。

参照图 1，便携式微型计算机 1(称为“微型计算机 1”)包括计算机主要单元 30、下部壳体 2A 和上部壳体 2B。计算机主要单元 30 包括诸如中央处理单元之类的运算和逻辑单元。所述下部壳体 2A 容纳作

为计算机主要单元 30 的用户接口的输入单元 3。上部壳体 2B 容纳具有液晶显示板 29(称为"显示板 29")的显示单元 4。

计算机主要单元 30 使用中央处理单元以便处理经由输入单元 3 接收的信息。处理过的信息在上部壳体 2B 中的显示单元 4 上被指示出来。

下部壳体2A中的输入单元3包括显示单元5和检测单元，所述检测单元用于检测对象(诸如用户手指或者输入笔)在显示单元5的显示板上的接触状态，并且指示表示用于输入信息的虚拟键盘5a、按键、虚拟鼠标5b等的图像。

所述输入单元 3 还包括具有发光区域的背光 6，并且还包括在显示单元 5 上层叠的触摸板 10，如图 2 所示。具体来讲，所述显示单元 5 是层叠在背光 6 的发光区域上的。

背光6可以由荧光灯管和广泛用于微型计算机显示器的光波导管组合而成，或者可以通过设置于一个平面上的多个白光发射二极管(LED)来实现。这种 LED 最近已经投入了实际使用。

背光6和显示单元5两者可以类似于用于常规微型计算机显示单元的那些单元或者用于台式计算机的外部 LCD 显示器的那些单元来构造。如果显示单元 5 是光发射类型的，那么可以省去背光 6。

显示单元 5 包括沿 x 和 y 轴方向设置并且具有矩阵形状的若干像素 5c，通过显示驱动器 22(图 4 中示出)来启动，并且显示诸如键盘等的输入位置的图像。

触摸板 10 位于输入单元 3 的顶层，暴露于下部壳体 2A 上，并且被启动以便接收信息。所述触摸板 10 检测与检测层 10a 接触的对象(用户手指或者输入笔)。

在第一实施例中，触摸板 10 是阻抗薄膜类型的。模拟和数字阻抗薄膜类型的触摸板目前是可得到的。使用四至八线类型的模拟触摸板。基本上，使用平行电极，检测对象和电极接触的点的电势，并且基于检测到的电势来推导接触点坐标。所述平行电极是沿 X 和 Y 方向独立地堆叠的，这将允许能够检测到接触点的 X 和 Y 坐标。然而，采

用模拟类型，很难同时检测到多个接触点。此外，模拟触摸板不适合用于检测接触区域的面积（dimensions）。因此，在第一实施例中使用了数字触摸板，以便既可检测接触点又可检测接触区域的面积。在任何情况下，所述接触检测层 10a 是透明的，因此显示单元 5 从前侧是可见的。

参照图 3A 和 3B，所述触摸板 10 包括基座 11 和基座 13。基座 11 包括多个(n)带状 X 电极 12，其按照规则的间隔沿 X 方向设置。另一方面，基座 13 包括多个(m)带状 Y 电极 14，其按照规则的间隔沿 Y 方向设置。基座 11 和 13 被堆叠，且它们的电极彼此面对。简而言之，X 电极 12 和 Y 电极 14 彼此相互垂直。因此，在 X 电极 12 和 Y 电极 14 的交叉点处以矩阵的形状设置了(n×m)个接触检测器 10b。

在基座 11 上的 X 电极之间提供了多个凸起弯曲的点间隔物（dot spacer）15。所述点间隔物 15 用绝缘材料制成，并且以规则的间隔设置。所述点间隔物 15 具有大于 X 和 Y 电极 12 和 14 的总厚度的高度。所述点间隔物 15 的顶部与 Y 电极 14 之间的基座 13 的裸露区域 13A 接触。如图 3C 所示，所述点间隔物 15 夹在基座 11 和 13 之间，并且不与 X 和 Y 电极 12 和 14 接触。简而言之，所述 X 和 Y 电极 12 和 14 因点间隔物 15 而彼此不接触。当基座 13 被按压至先前状态时，所述 X 和 Y 电极 12 和 14 彼此接触。

基座 13 的与安装有 Y 电极的表面相对的表面 13B 暴露于下部壳体 2A 之上，并且用来输入信息。换言之，当表面 13B 被用户的手指或者输入笔按压时，所述 Y 电极 14 与 X 电极 12 接触。

如果由用户手指或者输入笔施加的压力等于或者小于预定压力，则基座 13 不足以弯曲，这样防止 Y 电极 14 和 X 电极 12 彼此接触。只有当施加的压力超出预定值时，基座 13 才完全地弯曲，以便使 Y 电极 14 和 X 电极 12 彼此接触，并且变为导电。

所述 Y 和 X 电极 14 和 12 的接触点由输入单元 3 的接触检测单元 21(图 4 中示出)进行检测。

采用微型计算机 1，所述下部壳体 2A 不仅容纳输入单元 3，而且

容纳输入设备 20，其中输入设备 20 包括用于检测触摸板 10 的 X 和 Y 电极 12 和 14 的接触点的接触检测单元 21。

参照图 2 和图 4，所述输入设备 20 包括输入单元 3、接触检测单元 21、设备控制 IC 23、存储器 24、扬声器驱动器 25 和扬声器 26。所述设备控制 IC 23 把检测到的接触位置数据转换为数字信号，并且执行与各种处理(将稍后描述)相关的输入/输出控制，并且往返于计算机主要单元 30 进行通信。扬声器驱动器 25 和扬声器 26 用于发出各种口头通知或者用于通知的嘟嘟声。

所述接触检测单元 21 相继向 X 电极 12 施加电压，测量 Y 电极 14 处的电压，并且检测特殊的 Y 电极 14，所述特殊的 Y 电极 14 用于产生等于施加到 X 电极的电压的电压。

所述触摸板 10 包括电压施加单元 11a，其是由电源和开关部件构成的。响应于来自于接触检测单元 21 的电极选择信号，所述开关部件顺序地选择 X 电极 12，并且电压施加单元 11a 把基准电压从电源施加到所选择的 X 电极 12。

此外，所述触摸板 10 包括电压表 11b，其有选择地测量由来自于接触检测单元 21 的电极选择信号指定的 Y 电极 14 的电压，并且把测量结果返回到接触检测单元 21。

当用户手指或者输入笔按下触摸板 10 时，X 和 Y 电极 12 和 14 在按下的位置处彼此接触，并且变为导电。施加到 X 电极 12 的基准电压是经由在其处按下触摸板 10 的 Y 电极 14 测量的。因此，当把基准电压检测为 Y 电极 14 的输出电压时，接触检测单元 21 可以标识出 Y 电极 14，以及被施加基准电压的 X 电极 12。此外，接触检测单元 21 可以基于 X 电极 12 和 Y 电极 14 的组合来标识出由用户手指或者输入笔已经按下的接触检测器 10b。

根据设置的 X 和 Y 电极 12 和 14 的间隔，所述接触检测单元 21 重复地并且迅速地检测 X 和 Y 电极 12 和 14 的接触状态，并且正确地检测被同时按下的多个 X 和 Y 电极 12 和 14。

举例来说，如果触摸板 20 被用户手指用力按下，那么接触区域

扩大了。扩大的接触区域意味着多个接触检测器 10b 被按下。在这种情况下，接触检测单元 21 重复地并且迅速地把基准电压施加至 X 电极 12，且重复地并且迅速地测量 Y 电极 14 处的电压。因此，能够检测每次按下的接触检测器 10b。接触检测单元 21 可以基于检测到的接触检测器 10b 来检测接触区域的尺寸。

响应于来自于设备控制 IC 23 的命令，显示驱动器 22 指示用作输入设备、即用户接口的按钮、图标、键盘、十位小键盘(ten-keypad)、鼠标等的一个或多个图像。由背光 6 发射的光从其背面穿过 LCD，从而使显示单元 5 上的图像可以从前侧看到。

所述设备控制 IC 23 基于虚拟键盘(显示单元 5 上指示的)上的按键位置以及由接触检测单元 21 检测到的接触位置和接触区域，来标识接触点处的按键图像。标识出的按键的信息被通知给计算机主要单元 30。

计算机主要单元 30 控制对从设备控制 IC 23 接收的信息的操作。

参照图 5，在母板 30a(起计算机主要单元 30 的作用)中，北桥 31 和南桥 32 使用专用高速总线 B1 连接。北桥 31 经由系统总线 B2 与中央处理单元 33(称为“CPU 33”)连接，经由存储器总线 B3 与主存储器 34 连接，并且经由加速图形端口总线 B4(称为“AGP 总线 B4”)与图形电路 35 连接。

图形电路 35 向上部壳体 2B 中的显示板 4 的显示驱动器 28 输出数字图像信号。响应于所接收的信号，显示驱动器 28 启动显示板 29。所述显示板 29 在其显示板(LCD)上显示图像。

此外，南桥 32 经由 PCI 总线 B5 与外围部件互连设备 37(称为“PCI 设备 37”)连接，并且经由 USB 总线 B6 与通用串行总线设备 38(称为“USB 设备 38”)连接。南桥 32 可以把各种单元经由 PCI 设备 37 连接至 PCI 总线 35，并且把各种单元经由 USB 总线 B6 连接至 USB 设备 38。

更进一步讲，南桥 32 经由集成驱动器电子电路接口 39(称为“IDE 接口 39”)并且经由 AT 附属总线 B7(称为“ATA 总线 37”)与硬盘设备

41(称为“HDD 41”)连接。另外，南桥 32 经由低管脚计数（low pin count）总线 B8(称为“LCP 总线 B8”)连接至可移动介质设备(磁盘设备)44、串行/并行端口 45 和键盘/鼠标端口 46。所述键盘/鼠标端口 46 向南桥 32 提供从输入设备 20 接收的并且指示键盘或者鼠标操作的信号。因此，所述信号经由北桥 31 被传送到 CPU 33。所述 CPU 33 响应于所接收的信号执行处理。

南桥 32 还经由专用总线与音频信号输出电路 47 连接。所述音频信号输出电路 47 向计算机主要单元 30 中容纳的扬声器 48 提供音频信号。因此，扬声器 48 输出多种声音。

所述 CPU 33 执行 HDD 41 的硬盘和主存储器 34 中存储的各种程序，以便将图像显示在显示单元 4 的显示板 29 上(在上部壳体 2B 中)，并且经由扬声器 48(在下部壳体 2A 中)输出声音。此后，所述 CPU 33 根据来自于输入设备 20 的指示键盘或者鼠标操作的信号来执行操作。具体来讲，所述 CPU 33 响应于涉及键盘或者鼠标操作的信号来控制图形电路 35。因此，所述图形电路 35 向显示单元 5 输出数字图像信号，其指示对应于键盘或者鼠标操作的图像。此外，CPU 33 控制音频信号输出电路 47，其向扬声器 48 提供音频信号。扬声器 48 输出指示键盘或者鼠标操作的声音。

接下来描述输入设备 20 如何操作以便检测手指或者输入笔在接触检测层 10a 上的接触状态。

所述接触检测单元 21(作为接触位置检测器)定期检测对象与触摸板 10 的接触检测层 10a 相接触的位置，并且向设备控制 IC 23 提供检测到的结果。

所述接触检测单元 21(作为接触强度检测器)检测对象在接触检测层 10a 上的接触强度。所述接触强度可以由两个、三个或更多不连续的值或者一个连续的值来表示。所述接触检测单元 21 定期向设备控制 IC 23 提供检测到的强度。

所述接触强度可以基于对象在接触检测层 10a 上的接触区域尺寸来检测，或者基于接触区域的随时间的变化来检测。图 6 和图 7 示出

了检测到的接触区域的尺寸变化。在这些图中，纵坐标和横坐标是无量纲的，并且没有示出单位和比例。在设计实际产品时可以使用实际值。

接触区域的变化将通过使用预定扫描频率、定期地检测对象和接触检测器 10b 之间的接触尺寸数据来推导。扫描频率越高，在预定时间段中将会检测到更多的信号。分辨率可以随时间得以更加精确地改善。为此目的，设备和处理电路的反应速度和性能必须被改善。因此，将采用适当的扫描频率。

具体来讲，图 6 示出了一个例子，其中对象仅仅与接触检测层 10a 接触，即用户仅仅放置他或者她的手指而没有按键的意图。接触区域 A 的尺寸不会发生形状的改变。

相反地，图 7 示出了另一例子，其中当在触摸板 10 上的键盘上敲击按键时，接触区域 A 的尺寸发生改变。在该情况下，接触区域 A 的尺寸迅速从 0 或者基本上是 0 增大到最大，然后迅速地减少。

接触强度可以基于对象在接触检测层 10a 上的接触压力或者接触压力随时间的变化而被检测。在该情况下，把压力转换为电信号的传感器可以用作接触检测层 10a。

图 8A 和图 8B 示出了作为把压力转换为电信号的传感器的触摸板 210(称为接触强度检测器)。

参照这些图，触摸板 210 包括基座 211 和基座 213。基座 211 装备有多个(即，n)透明的电极条 212，其用作 X 电极(称为“X 电极 212”)并且沿方向 X 是等间隔的。基座 213 装备有多个(即，m)透明的电极条 214，其用作 Y 电极(称为“Y 电极 214”)并且沿方向 Y 是等间隔的。基座 211 和 213 被堆叠，且 X 和 Y 电极 212 和 214 彼此面对。因此，在 X 和 Y 电极 212 和 214 的交叉点处以矩阵的形状提供(n×m)个接触检测器 210b 至 210d。

此外，在基座 211 上的 X 电极 212 之间提供有多个凸起间隔物 215，并且具有大于 X 和 Y 电极 212 和 214 的总厚度的高度。凸起间隔物 215 的顶部与暴露在 Y 电极 214 之间的基座 213 相接触。

参照图 8A，在点间隔物 215 中，四个高的点间隔物 215a 构成一组，并且四个短的点间隔物 215b 构成一组。四个高的点间隔物 215a 的组和四个短的点间隔物 215b 的组依照网状的模式设置，如图 8B 所示。每一组中高的点间隔物 215a 的数目和每一组中短的点间隔物 215b 的数目可以根据需要进行确定。

参照图 8C，点间隔物 215 被夹在基座 211 和 213 之间。因此，X 和 Y 电极 212 和 214 不相互接触。因此，接触检测器 210b 至 210e 处于电学上的断开状态。

当基座 213 被弯曲且先前电极不相互接触时，X 和 Y 电极 212 和 214 处于接通状态。

采用触摸板 210，与其中放置 Y 电极 214 的基座 213 的表面相对的表面 213A 被暴露作为输入表面。当表面 213A 被用户手指按下时，基座 213 弯曲，由此使 Y 电极 214 与 X 电极 212 接触。

如果由用户手指施加的压力等于或者小于第一预定压力，那么基座 213 不足以弯曲，这样防止 X 和 Y 电极 214 和 212 彼此接触。

反之，当施加的压力超出第一预定压力时，基座 213 足以弯曲，从而使由四个低的点间隔物 215b(其彼此靠近而无需经由 Y 和 X 电极 214 和 212)围绕的接触检测器 210b 保持接通状态。由两个或更多高的点间隔物 215a 围绕的接触检测器 210c 和 210d 保持断开状态。

如果施加的压力大于第二预定压力，那么基座 213 被进一步弯曲，由两个低的点间隔物 215b 围绕的接触检测器 210c 处于接通状态。然而，由四个高的点间隔物 215a 围绕的接触检测器 210d 保持断开状态。

此外，如果施加的压力大于第三预定压力，其中所述第三预定压力大于所述第二压力，那么基座 213 更加大程度地弯曲，从而使由四个高的点间隔物 215a 围绕的接触检测器 210d 处于接通状态。

三个接触检测器 210b 至 210d 存在于由用户手指按下的区域中，并且起到把检测到的压力转换为三种电信号的传感器的作用。

采用包括触摸板 210 的便携式微型计算机，接触检测单元 21 检测哪个接触检测器处于接通状态。

举例来说，所述接触检测单元 21 将存在于一组处于接通状态的相邻接触检测器的中心的接触检测器检测作为接触检测表面 10a 被按下的位置。

此外，所述接触检测单元 21 把接触检测器 210b 至 210d 分为三个等级，并且在处于接通状态的一组相邻接触检测器中，输出最大等级作为压力。

所述接触检测单元 21 如下所述检测接触区域和压力分布。

当图 8B 中示出的低和高的点间隔物 215b 和 215a 被如图 9 所示那样来设置时，每个接触检测器 210 由四个点间隔物围绕。在图 9 中，数字表示在对应于接触检测器 210a 至 210d 的位置处、高的点间隔物 215a 的数目。

在图 10 中，椭圆示出了用户手指接触的区域，并且将其称为“外部椭圆”。

当接触区域的表面压力(即单位面积的压力)仅仅足以按下由“0”示出的接触检测器时，接触检测单元 21 检测到只有接触检测器“0”(即图 8B 中示出的接触检测器 210b)被按下。

与图 9 中示出的压力相比，如果把更加强大的压力施加到其尺寸与外部椭圆的尺寸相同的区域，那么接触检测单元 21 检测到存在于外部椭圆内部的椭圆(称为“内部椭圆”)中的接触检测器 “2” 、即图 8B 中示出的接触检测器 210c 被按下。

参照所述实施例的操作原理，压力越大，如上所述的外部椭圆越大。然而，假设外部椭圆具有恒定尺寸，以便易于解释。

然而，表面压力实际上并不总是以图 11 中所示的椭圆的形状来分布。在图 12 中，可能检测到外部椭圆之外的一些接触检测器被按下，而且也许没有检测到内部椭圆之内的一些接触检测器“0”或者“2”被按下。在图 12 中用斜体数字描述了那些例外。简而言之，在外部和内部椭圆的边界附近，接触检测器“0”和“2”是混合的。外部和内部椭圆的边界、尺寸、形状或者位置可以被确定以便减少由这些因素引起的错误。在这种情况下，外部和内部椭圆的边界可以是复杂的，以便保证

灵活性。然而，边界实际上是依照适当的曲率半径来构成形状的。这使得所述边界能平滑地改变轮廓并且相对无误差。曲率半径通过实验、机器学习算法等来确定。目标函数是在键输入时由外部椭圆和内部椭圆围绕的区域尺寸，由内部椭圆以及最内部的椭圆围绕的区域尺寸，以及随时间改变的键输入识别错误率。确定最小的曲率半径，以便最小化先前的参数。

上述的边界确定方法适用于图 10、图 11、图 13 和图 14 示出的情况。在图 13 和图 11 中，没有示出接触检测器的边界交叉或者跨越边界存在的接触检测器。

图 13 示出了施加了比图 11 中示出的压力更加强大的压力。在该情况下，最内部的椭圆出现于内部椭圆的内部。在第二内部椭圆中，检测到由“0”、“2”和“4”示出的接触检测器被按下，即图 8B 中示出的接触检测器 210b、210c 和 210d 被按下。

参照图 14，内部椭圆和最内部椭圆的尺寸被扩大了。这意味着施加了远大于图 13 中压力的压力。

如图 10、图 11、图 13 和图 14 所示，通过检测椭圆尺寸随时间的变化和椭圆尺寸比例随时间的变化，能够可靠地检测用户是有意还是无意地按下一个或多个按键。

举例来说，把压力转换为电信号的传感器用于检测对象在接触检测表面 10a 上的接触压力，或者基于接触压力随时间的变化检测接触强度。如果图 6 和图 7 中的纵坐标被改变为“接触压力”，那么就“仅仅放置对象”和“按键敲击”而言，将获得相同的结果。

所述设备控制 IC 23(作为确定部分)接收由接触检测单元 21 检测到的接触强度，提取与接触强度相关的特征量，把所提取的特征量或者根据所提取的特征量计算的值与预定阈值进行比较，并且确定对象的接触状态。所述接触状态可以分类为“未接触”、“接触”或者“按键敲击”。“未接触”表示没有东西与显示单元 5 上的图像接触；“接触”表示对象与显示单元 5 上的图像接触；而“按键敲击”表示显示单元 5 上的图像被对象敲击。稍后将参照图 18 和图 19 详细地描述接触状态的确

定。

用于确定接触状态的阈值是可调节的。举例来说，设备控制 IC 23 指示了按键 20b(弱)、按键 20c(强)、以及等级计（level meter）20a，其中等级计 20a 示出了阈值的级别。参见图 15。此处可以认为等级计 20a 已经为状态“接触”以及“按键敲击”预先设定了某些阈值。如果用户轻轻地敲击图像，那么这种按键敲击往往无法被识别。在这种情况下，“弱”按钮 20b 被按下。设备控制 IC 23 基于按钮 20b 在显示板 5 上的位置以及由接触检测单元 21 检测的接触位置，确定“弱”按钮 20b 是否被按下。当按钮 20b 被识别出被按下时，显示驱动器 22 被启动，以便把等级计 20a 上指示的值移到左侧，由此降低阈值。在此状态中，图像实际上没有被按下，而仅仅是把压力施加到图像上。为了简化起见，术语“按键敲击”表示用户有意按下图像。作为选择，等级计 20a 上的指示可以通过在等级计 20a 附近拖动滑块 20d 来改变。

所述设备控制 IC 23(作为通知部分)向母板 30a(图 5 中示出) 通知作为输入设备被操作的键盘或者鼠标以及从接触检测单元 21 接收的接触状态。简而言之，被按下以便输入信息的按键位置、仅仅在其上放置对象的按键位置被通知给母板 30a。

所述设备控制 IC 23(作为特征量提取器)基于由接触检测单元 21 检测到的接触状态来提取与对象接触强度相关的特征量。所述特征量表示对象的接触强度、接触强度的变化、接触时段的长度、接触位置等等。

此外，设备控制 IC 23(作为特殊处理执行单元)把提取出的特征量与预定阈值进行比较，并且执行特殊处理。所述预定阈值涉及接触强度等等，其会对接触检测层 10a 产生不利影响。

举例来说，设备控制 IC 23 通过比较特征量与预定阈值来验证所述对象(即，用户)。如果特征量超出预定阈值(其会对接触检测层 10a 产生不利影响)，那么设备控制 IC 23 发出警告，或者使输入设备 20 不起作用。此外，如果特征量超出预定阈值，其可以对应于向对象施加了不必要负担的接触强度，那么设备控制 IC 23 经由扬声器 26 发出

口头通知或者嘟嘟声用于进行通知。警告可以在显示单元上进行指示，或者使输入设备 20 不起作用。更进一步，设备控制 IC 23 根据特征量是否超出预定阈值来改变显示单元 5 的虚拟键盘上的字符模式。举例来说，小写字母将被改变为大写字母，反之亦然。

图 4 中示出的设备控制 IC 23(作为显示控制器)根据对象在接触检测层 10a 上的接触状态(“未接触”、“接触”或者“按键敲击”)来改变显示单元 5 上的图像的指示模式。具体来讲，设备控制 IC 23 根据所述接触状态改变亮度、色彩配置文件、轮廓线的模式和厚度、闪烁/稳定发光、图像的闪烁间隔。

此处可以假定显示单元 5 指示虚拟键盘 5a，并且用户将要输入信息。参见图 16。用户把他或者她的手指放在初始位置(home position)，以便开始按键敲击。在此状态中，用户的手指在按键“S”、“D”、“F”、“J”、“K”和“L”上。设备控制 IC 23 例如以黄色来高亮显示上述按键。设备控制 IC 23 例如以蓝色来高亮显示其余没有接触的按键。在图 17 中，当用户敲击按键“0”时，设备控制 IC 23 例如以红色来高亮显示按键“O”。按键“S”、“D”、“F”和“J”保持黄色，这意味着用户的手指在这些按键上。

如果不总是需要标识 “未接触”、“接触”和“按键敲击”，那么用户可以选择接触状态以便改变指示模式。

此外，所述设备控制 IC 23 起声音产生部分的作用，基于由接触检测部 21 检测到的位置和虚拟键盘或者鼠标的图像位置之间的关系、根据接触状态来决定预定的识别声音，控制扬声器驱动器 25，并且经由扬声器 26 发出识别声音。举例来说，假设虚拟键盘 5a 在显示单元 5 上被指示出来，并且用户敲击按键。在这种状态中，设备控制 IC 23 计算由接触检测单元 21 检测的按键的相对位置以及显示单元 5 上指示的按键中心。稍后将参照图 21 至图 23 详细说明这种计算。

当进行按键敲击并且发现所指示的敲击按键的位置和其中心之间的相对距离大于预定值时，设备控制 IC 23 启动扬声器驱动器 25，由此产生通知声音。所述通知声音可以具有与为普通“按键敲击”发出

的识别声音不同的音调、时间间隔、模式等等。

此处可以假定用户使用显示单元 5 上的虚拟键盘输入信息。用户将初始位置预先记录下来。如果用户把他或者她的手指放在不同于初始位置按键的按键上，那么设备控制 IC 23 识别出与用户手指接触的是不同于初始位置按键的按键，并且可以发出不同于当用户触摸初始位置按键时发出的声音的另一通知声音(例如音调、时间间隔或者模式)。

在下部壳体 2A 中设置有光发射单元 27，并且它根据由设备控制 IC 23 确定的接触状态而发光。举例来说，当识别出用户把他或者她的放在初始位置按键上时，设备控制 IC 23 使光发射单元 27 发光。

存储器 24 存储对象在预定时间段内的接触位置和接触强度的历史记录。存储器 24 可以是随机存取存储器(RAM)、诸如闪存之类的非易失存储器、诸如硬盘或者软盘之类的磁盘、诸如压缩光盘之类的光盘、IC 芯片、盒式磁带等等。

接下来描述如何存储各种信息处理程序。所述输入设备 20 在存储器 24 中存储信息处理程序，该程序使接触位置检测单元 21 和设备控制 IC 23 能检测接触位置和接触强度，能确定接触状态并且能执行特殊处理(将稍后描述)。所述输入设备 20 包括信息读取器(未示出)，以便在存储器 24 中存储上述程序。所述信息读取器从诸如软盘之类的磁盘、光盘、IC 芯片或者诸如盒式磁带之类的记录介质获得信息，或者从网络下载程序。当使用记录介质时，所述程序可以被容易地存储、携带或者销售。

输入信息由设备控制 IC 23 等进行处理，所述设备控制 IC 23 等用于执行在存储器 24 中存储的程序。参见图 18 至图 23。根据信息处理程序执行信息处理步骤。

此处可以假定用户使用输入单元 3 的显示单元 5 上显示的虚拟键盘输入信息。

所述信息依照图 18 中示出的步骤来加以处理。在步骤 S101，输入设备 20 在显示单元 5 上示出了输入设备(即，虚拟键盘)的图像。在

步骤 S102，所述输入设备 20 接收触摸板 10 的接触检测层 10a 上的检测区的数据，并且确定是否存在与诸如用户手指之类的对象相接触的检测区。当没有与所述对象相接触的区域时，所述输入设备 20 返回到步骤 S102。否则，输入设备 20 前进到步骤 S104。

在步骤 S104，所述输入设备 20 检测对象与接触检测层 10a 接触的位置，并且在步骤 S105 检测接触强度。

在步骤 S106，输入设备 20 提取对应于检测到的接触强度的特征量，把提取出的特征量或者使用特征量计算的值与预定阈值进行比较，并且标识虚拟键盘上的对象的接触状态。如上所述，所述接触状态可以分类为“未接触”、“接触”或者“按键敲击”。图 7 示出了“按键敲击”，即，接触区域 A 最初基本上是零、但是突然增加。这种状态被识别为“按键敲击”。具体来讲，提取接触区域的尺寸作为特征量，如图 6 和图 7 所示。使用接触区域的尺寸来推导区域速度或者区域加速度，即，计算特征量 $\Delta A/\Delta t$ 或者 $\Delta 2A/\Delta t^2$。当此特征量超出阈值时，接触状态被确定为“按键敲击”。

特征量 $\Delta A/\Delta t$ 或者 $\Delta 2A/\Delta t^2$ 的阈值取决于使用中的用户或者应用程序，或者即使同一用户重复地操作所述输入单元也可以随时间逐渐改变。所述阈值将在适当的时间被学习和重新校准而不是使用预定的并且固定的阈值，以便改善接触状态的精确识别。

在步骤 S107，所述输入设备 20 确定是否进行了按键敲击。如果没有，那么输入设备 20 返回到步骤 S102，并且获得检测区的数据。在“按键敲击”的情况下，输入设备 20 前进到步骤 S108，并且通知计算机主要单元 30 是“按键敲击”。在此状态中，输入设备 20 还返回到步骤 S102，并且获得检测区的数据以便用于后续的接触状态检测。并行执行上述处理。

在步骤 S109，所述输入设备 20 改变虚拟键盘上的指示模式，以便指示“按键敲击”，例如改变敲击按键的亮度、色彩、形状、轮廓线的模式或者厚度，或者按键的闪烁/稳定发光，或者闪烁/稳定发光间隔。此外，输入设备 20 检查预定时间段是否过去。如果没有，则输入

设备 20 保留当前指示模式。否则，输入设备 20 把虚拟键盘的指示模式返回至正常状态。作为选择，输入设备 20 可以判断敲击按键是否闪烁了预定次数。

在步骤 S110，输入设备 20 发出识别声音(即，警报)。稍后将参照图 21 详细地描述这一步骤。

图 19 示出了在步骤 S106 的“按键敲击”的处理。

首先，在步骤 S1061，输入设备 20 提取多元数据(特征量)。举例来说，基于图 7 中示出的图表提取如下内容：接触区域的最大尺寸 A_{max}、通过对接触区域 A 求积分而推导的接触区域 A 的瞬态尺寸 S_A、实现接触区域的最大尺寸 A_{max} 的最大时间 T_P 以及按键敲击从开始到结束的总时间段 T_e。上升斜度 $k = A_{max}/ T_P$ 等是基于上述特征量来计算的。

特征量的上述定性和物理特性示出了如下倾向。用户手指越厚并且按键敲击越强，接触区域的最大尺寸 A_{max} 越大。按键敲击越强，接触区域 A 的瞬态尺寸 S_A 越大。用户手指越软并且按键敲击越强和越慢，接触区域达到最大尺寸的时间 T_P 越长。按键敲击越慢并且用户手指越软，总时间段 T_e 越长。此外，按键敲击得越快和越强，并且用户手指越硬，上升斜度 $k = A_{max}/ T_P$ 越大。

通过平均各个用户的多次按键敲击的值来推导特征量，并且将其用于识别按键敲击。只有识别出的按键敲击的数据才被累积并且分析。此后，设定阈值以便识别按键敲击。在该情况下，由用户取消的按键敲击不计在内。

可以对所有按键测量特征量。有时，识别按键敲击的准确度可以通过对每个手指、每个按键或者每组按键测量特征量来加以改善。

可以为上述变量确定单独的阈值。所述按键敲击可以基于条件分支（例如，当一个或多个变量超出预定阈值时）来加以识别。作为选择，所述按键敲击可以使用更加复杂的技术、诸如多元分析技术来识别。

例如，记录多次按键敲击。基于规定的多元数据集来学习马哈拉

诺比斯（Mahalanobis）空间。按键敲击的马哈拉诺比斯距离是使用马哈拉诺比斯空间计算的。马哈拉诺比斯距离越短，按键敲击被识别得越准确。参见 McGraw-Hill 出版公司出版的 ISBN 号为 0-07-136263-0 的“The Mahalanobis-Taguchi System”等等。

具体来讲，在图 19 中示出的步骤 S1062 中，为多元数据的每个变量计算平均值和标准偏差。原始数据须经过使用平均值和标准偏差的 z-变换(此过程称作“标准化”)。然后，变量之间的相关系数被计算以便推导相关矩阵。有时，此学习过程在收集初始按键敲击数据时只被执行一次，并且不进行更新。然而，如果用户的按键敲击习惯改变，如果输入设备机械地或者电气老化，或者如果按键敲击的识别准确度由于某种原因而下降，那么将执行重新学习，以便改善识别准确度。当多个用户登录时，可以为每个用户改善识别准确度。

在步骤 S1063，使用平均值、标准偏差和一组相关矩阵来计算待识别的按键敲击数据的马哈拉诺比斯距离。

在步骤 S1064，识别所述多元数据(特征量)。举例来说，当马哈拉诺比斯距离小于预定阈值时，将所述对象识别为处于“按键敲击”状态。

当使用马哈拉诺比斯距离越短识别按键敲击越可靠的算法时，与像用于用户识别那样使用特征量的情况相比较，可以进一步改善用户识别。这是因为当使用马哈拉诺比斯距离时，是在考虑到学习的变量之间的相关性的情况下来进行识别、即模式识别的。即使峰值 A_{max} 基本上接近按键敲击数据的平均值，而最大时间 T_P 很长，也将准确地识别出不同于按键敲击的接触状态。

在此实施例中，按键敲击是基于使用马哈拉诺比斯空间的算法来识别的。不用说，使用其它多元分析算法也可以识别多个变量。

接下来参照图 20 描述改变用于指示“未接触”和“接触”状态的指示模式的过程。

步骤 S201 和 S202 与图 18 中示出的步骤 S101 和 S102 相同，并且将不再提及。

在步骤 203，输入设备 20 确定接触检测层 10a 是否被对象触摸。如果没有，输入设备 20 前进到步骤 S212。否则，输入设备 20 转到步骤 S204。在步骤 S212，输入设备 20 识别出所述按键在虚拟键盘上处于“未接触”状态，并且改变按键指示模式(以便指示“待机状态”)。具体来讲，通过改变不同于“接触”或者“按键敲击”状态的亮度、色彩、形状、轮廓线的模式或者厚度来指示未接触状态。输入设备 20 返回到步骤 S202，并且获得检测区的数据。

步骤 S204 至 S206 与步骤 S104 至 S106 相同，并且此处不会再描述。

当在步骤 S207 没有识别出按键敲击时，输入设备 20 前进到步骤 S213。在步骤 S213，所述输入设备 20 识别出对象与虚拟键盘上的按键接触，并且把指示模式改变为用于“接触”状态的指示模式。输入设备 20 返回到步骤 S202，并且获得所检测到的区域的数据。当识别出按键敲击时，输入设备 20 前进到步骤 S208，然后返回到步骤 S202 以便识别后继状态，并且接收检测区域的数据。

步骤 S208 至 S211 与步骤 S108 至 S111 相同，并且此处不会再进行描述。

在步骤 S110(图 18 中示出)，如果实际敲击按键的位置不同于输入设备上指示的图像(即，虚拟键盘)，那么产生警报。

参见图 21，在步骤 S301，输入设备 20 获取按键敲击标准坐标(例如，基于敲击按键的接触检测器 10b 的坐标组近似表示的重心坐标)。

接下来，在步骤 S302，所述输入设备 20 把按键敲击标准坐标和虚拟键盘上敲击的按键的标准坐标(例如，中心坐标)进行比较。计算如下内容：按键敲击标准坐标和标准坐标之间的偏差(称为“按键敲击偏差向量”)，即，在按键敲击标准坐标和敲击按键的标准坐标之间延伸的 x 和 y 平面上的方向和长度。

在步骤 S303，所述输入设备 20 标识敲击按键的坐标存在于虚拟键盘上的每个按键顶端的哪个部分。所述键顶可以被分为两个或者五个部分，如图 22 和图 23 所示。用户可以确定键顶上的各部分。图 22

和图 23 中示出的部分 55 是准确敲击按键的地方。

输入设备 20 基于识别出的部分来确定识别声音。具有各种音调、时间间隔或者模式的识别声音用于图 22 和图 23 中示出的部分 51 至 55。

作为选择，输入设备 20 可以基于按键敲击偏差向量的长度来改变所述识别声音。举例来说，按键敲击偏差向量越长，识别声音具有的音调越高。间隔或者音调可以根据按键敲击偏差向量的方向而改变。

如果用户跨越一个键顶的两个部分来进行触摸，那么可以产生中级声音以便表示两个部分。作为选择，中级声音可以根据接触部分的相对尺寸来产生。可以为较大的部分产生声音。

在步骤 S305，输入设备 20 以预定音量产生所选择的识别声音。输入设备 20 检查预定时间段是否过去。如果没有，则将连续地产生识别声音。否则，输入设备 20 停止所述识别声音。

就步骤 S304 而论，为部分 51 至 55 提供了不同的识别声音。作为选择，用于部分 55 的识别声音可以不同于用于部分 51 至 54 的识别声音。举例来说，当敲击部分 55 时，输入设备 20 识别适当的按键敲击，并且产生不同于用于其他部分的识别声音的识别声音。作为选择，在该情况下将不产生声音。

用户可以根据部分 55 在键顶上的百分比或者比例来根据需要确定部分 55 的尺寸或者形状。此外，部分 55 可以基于击中率或者按键敲击偏差向量的 x 和 y 分量的分布来自动地加以确定。

作为选择，可以根据敲击部分是处于部分 55 中还是处于部分 55 之外来为部分 51 至 54 产生不同的识别声音。

所有按键的部分 55 可以独立地或者同时被调节，或者所述按键可以被分为多个组，其中每个组将分别地被调节。举例来说，主要按键的按键敲击偏差向量可以一次全部地被累积。这种按键的形状和尺寸可以同时被改变。

输入设备 20 使用信息处理方法和程序，并且执行用于验证用户、保护设备、保护用户和选择字符模式的特殊处理。假定用户使用虚拟

键盘输入信息。

当用户敲击按键以便输入一串特殊的字符(构成“密码”)时执行用户验证。参见图 24 和图 25。只有当用户的按键敲击特性数据(诸如按键敲击压力、接触区域的尺寸变化或者按键敲击时间的历史记录)和字符串数据与预定的数据一致时，才对用户进行验证。密码和按键敲击特性数据已经存储在存储器 24(图 4 中示出)中。

在步骤 S501，所述输入设备 20 基于输入的密码来识别按键敲击。

然后，在步骤 S502，输入设备 20 标识字符串，如稍后描述的那样。

在步骤 S503， 输入设备 20 检查输入的密码是否与存储的密码一致。当它们相同时，输入设备 20 前进到步骤 S503。否则，输入设备 20 跳转到步骤 S507，以便执行不一致的处理，例如使输入设备 20 无法操作。

输入设备 20 提取与按键敲击特性数据(即，按键敲击压力、接触区域的尺寸变化或者按键敲击时间的历史记录)相关的特征量。把提取出的特征量与预定的特征量进行比较，并且当它们相同时对其进行识别。

平均按键敲击压力势必随各个用户而改变，并且势必会发生波动。此外，按键敲击强度随各个按键和用户手指而改变。对每个用户分析这些特性，存储用于精确定位（pinpoint）用户的特征量，并且把所存储的特征量与按键敲击数据比较。因此，执行用户验证。

接触区域的尺寸变化取决于用户手指的厚度和灵活性、按键敲击强度和用于按键敲击的手指。因此，接触区域的尺寸以及接触区域尺寸随时间变化的历史记录也势必改变。参照图 26，用户手指经由区域 A(称为“接触区域 A”)和键顶接触。如图 27A 所示，当用户手指在敲击的按键上逗留时，接触区域 A 的尺寸改变。当按键敲击之后立即把手指远离按键时，接触区域 A 改变其尺寸，如图 27B 所示。在后者情况中，用户轻轻地敲击按键。按键敲击时段取决于用户。接触区域 A 的尺寸不同地改变，如通过图 27A 中示出的曲线 a、b、c 和 d 示出的

那样。在图 27A 和图 27B 中，没有示出比例或者单位。当安装部件时可以使用实际值。

特征量是如参照图 19 中示出的步骤 1061 至 1064 所描述的那样而提取的，并且此处不再描述。

在步骤 S506，输入设备 20 检查提取出的特征量是否与预定的特征量一致。当它们相同时，输入设备 20 前进到步骤 S509。否则，输入设备 20 转到步骤 S508，并且停止起作用。

当在步骤 S509 验证用户时，将执行起动处理。作为选择，将激活电源开关。在确保微型计算机的安全性、降低功耗或防止当微型计算机被错误启动同时被携带时造成的单元损坏、以及防止如果微型计算机在手提袋或外壳中因受热或其它情况而产生的问题等方面，这种措施是十分有效的。

诸如验证错误的次数和时段之类的预定条件被存储。当重复地检测到验证错误时，将它们与存储的数据进行比较。如果它们与所存储的数据冲突，那么可能由于密码被第三方故意误用而使得微型计算机不能工作，或者没有数据可以被读取。

参照图 25 详细说明步骤 S502(图 24 中)。在步骤 S5021，输入设备 20 获得由用户敲击的按键的坐标数据，并且把获得的坐标与字符的预定坐标进行比较。

在步骤 S5023，推导表示敲击按键的坐标和字符的预定坐标之间的差异的差量向量组。所述差量向量组包括对应于输入字符(构成密码)的向量。基于只由各个差量向量的起点组成的起点组和只由各个差量向量的终点组成的终点组，使用最小二乘法来创建初级（primary）直线。

$$y = a_1x + b_1$$

$$y = a_2x + b_2$$

在步骤 S5024，将 a_1 和 a_2 进行比较。因此，检查当敲击按键时从 xy 平面中的基准点的旋转角度是多少。计算角度校正量。否则，密码中的字符被分成其中字符在一条线中可以具有相同 y 坐标的组。因

此，沿 x 轴方向的角度被平均。使用所述平均角度作为角度校正量，就像当密码字符处于一条线时那样。

接下来，在步骤 S5025，将起点组的键盘标准位置与基于终点组估计的键盘标准位置进行比较，由此计算用于校正 x 间距和 y 间距的量。对于此计算可以想到各种方法。举例来说，可以仅仅比较起点组坐标的中点和终点组坐标的中点，由此导出 x 轴方向和 y 轴方向之间的差异。

在步骤 S5026，独立地调节沿 x 方向的扩展的进度（pace of expansion）(kx)以及沿 y 方向扩展的进度(ky)，以便最小化起点组和终点组的 x 坐标和 y 坐标之间的误差。此外，用于校正标准原点的量可以说明式地推导(使用数值计算方法)，以便最小化误差的平方和，或者算术上使用最小二乘法。

在步骤 S5027，输入设备 20 验证密码的字符串，即，确定输入的密码是否与预先存储的密码一致。

在步骤 S5028，所述输入设备 20 根据在步骤 S5024 至 S5026 计算的角度校正量、x 间距以及 y 间距校正量以及标准原点校正量来指示校正的输入范围(即，虚拟键盘 25)。

在步骤 S5024、S5025 以及 S2056 的计算是分别进行的，以便把适当的变换 T 应用于当前键盘布局，从而将向用户提供优选的键盘布局。当前键盘布局可以是当微型计算机发货时提供的键盘布局或者是过去校正的键盘布局。

作为选择，变换 T 可以如下被导出。首先，请求用户敲击由 N 个字符组成的字符串 S。把触摸板上的 N 个二维坐标的集合 U(其与键顶中心坐标偏离)与用于字符串 S 的按键的键顶中心坐标 C 相比较。确定变换 T，以便最小化上述坐标之间的差异，如以下将描述的那样。对于此计算将使用任意方法。二维坐标或者二维向量由[x, y]表示。

由 N 个二维坐标组成的集合 U 可以表示为[xi, yi](i = 1, 2,..., N)。变换 T 之后的中心坐标 C '可以表示为[ξi,ηi](i = 1,2,..., N)。总体上，变换 T 通过坐标组的平行位移、旋转、扩展或者收缩来实现，[e, f]表

示用于代表平行位移的向量。θ表示旋转角度。λ表示放大/收缩系数，可以基于作为整体的当前键盘布局的中点[a, b]以及平均坐标 U[c, d] =[(x1 +x2... +xN) /N,(y1 +y2... +yN) /N]来计算[e, f] =[c- a, d- b]。当所述当前键盘布局根据旋转角度θ以及放大/收缩系数λ变换时，变换后的坐标将是[ξi,ηi] =[λ{(Xi- e) cosθ -(Yi- f)sinθ},λ{(Xi -e) sinθ+(Yi -f) cosθ}]，(i =1, 2,...,N)。假定θ和λ的初始项被分别设置为 0 和 1。参数 θ 和 λ(其最小化平方的距离 Δi=(ξi -xi)^2+(ηi-yi)^2 的和 Δ1+Δ2+...,ΔN)是使用顺序二次规划(SQP)方法数学推导出来的。通过应用计算的θ和λ推导的已变换坐标集[ξi,ηi](i = 1,2,..., N)表示新的键盘布局。当变换后的坐标集 C'由于错误键入等而具有较大误差量时，可以不必集中 θ 和 λ。在这种情况下，不执行字母串的验证，并且不应该调节键盘布局。因此，再次请求用户敲击字母串 S 的按键。

作为选择，有时当分别沿 x 和 y 方向调节λ时，可以实现更加合适的结果，从而可以优化横截间距和垂直间距。

此外，当适当地设计变换 T 时，可以在其中依照弯曲状态设置有按键的键盘上、在其中可以在独立的地方设置由左手敲击的一组按键和由右手敲击的一组按键的键盘上调节键盘布局。

可以把上述布局调节独立地应用于由左右手敲击的按键。可以采用上述算法，以便像市场上的一些计算机中那样，以扇形形状不规则地设置左手和右手的按键。

上述校正只有在验证时才使用。校正后的按键布局半不会被指示在显示单元上，或者部分校正或者修改的键盘布局只有当进行间距调节时才被指示。当把按键偏离下部壳体的边缘而设置时，或者当不对称地设置它们时，使用键盘会感到不舒服。在这种情况下，不再设置旋转角度，或者将对称地设置按键。

就其便利性和外观而论，通过如上所述运用各种几何限制将改善键盘布局。

参照图 28，检测接触到触摸板的对象的接触强度，并且当接触强度对触摸板产生不利影响时，发出警告或者使输入设备 20 不能工作。

根据存储在存储器 24 中的接触强度或者接触位置的历史记录来计算接触强度影响触摸板的指标。当所述指标超出预定阈值时，将发出警告，或者使输入设备 20 不能工作。

在步骤 S601，输入设备 20 识别用户在虚拟键盘 25 上敲击按键。

在步骤 S602，输入设备 20 提取与接触强度相关的特征量。举例来说，基于图 7 中示出的图表提取如下内容：接触区域的最大尺寸 A_{max}、接触区域 A 的瞬态尺寸 S_A、实现接触区域的最大尺寸 A_{max} 的达到接触区域最大尺寸的时间 T_P、以及总时间段 T_e、上升斜度 k、按键敲击次数、微型计算机的操作长度等等。在步骤 S603，输入设备 20 在存储器 24 中存储特征量的历史记录。

在步骤 S604，输入设备 20 使用一个或者多个特征量来计算所述指标，所述特征量即：接触区域 A 的最大尺寸 A_{max}、接触区域 A 的瞬态尺寸 S_A、实现接触区域 A 的最大尺寸 A_{max} 的最大时间 T_P、以及总时间段 T_e、上升斜度 k、按键敲击次数、微型计算机的操作长度等等。所述指标可以取决于上述特征量的最大值，或者可以基于微型计算机的物理特性来确定。对于所计算的指标设置警告阈值，并且它是可能损坏触摸板的最小值。

在步骤 S605，输入设备 20 检查特征量是否超出警告阈值。如果没有，输入设备 20 返回到步骤 S601。否则，输入设备 20 前进到步骤 S606。

在步骤 S606，输入设备 20 检查所述指标是否超出警告阈值达预定倍数。如果没有，输入设备 20 前进到步骤 S608。否则，输入设备 20 转到步骤 S607。

在步骤 S608，输入设备 20 发出警告，所述警告例如是“你的按键触摸过强，请轻轻地敲击按键以便保护输入设备”之类的消息，并将其指示在微型计算机的显示单元上。

在步骤 S607，输入设备 20 进行设备保护处理。举例来说，显示单元示出另一消息“你的按键触摸过强。由于微型计算机会被损坏，所以将启动按键敲击限制器”。然后，在预定时间段内将无法输入任何信

息。

在警告的情况下，用户可以继续敲击按键。另一方面，在微型计算机保护处理期间，输入设备 20 可被强制地暂停。在要求用户轻轻地敲击按键的过程中这是十分有效的。

图 29 示出了被执行以便提取用户敲击触摸板上的按键的强度的处理。如果接触强度为用户施加了不必要的负担，那么将发出警告，或者将使输入设备 20 不能工作。具体来讲，会令用户背负不必要负担的接触强度的指标是基于存储在存储器 24 中的接触强度和接触位置的历史记录来计算的。

在步骤 S701，输入设备 20 识别用户在虚拟键盘上敲击按键。

在步骤 S702，输入设备 20 使用与所述接触强度相关的特征量来计算所述指标，所述特殊量即：接触区域的最大尺寸 A_{max}、接触区域 A 的瞬态尺寸 S_A、实现接触区域最大尺寸 A_{max} 的最大时间 T_P、以及总时间段 T_e、上升斜度 k、按键敲击次数、微型计算机的操作长度等等。在步骤 S703，输入设备 20 在存储器 5 中存储特征量的历史记录。

在步骤 S704，输入设备 20 使用与所述接触强度相关的特征量来计算所述指标，所述特殊量即：接触区域的最大尺寸 A_{max}、接触区域 A 的瞬态尺寸 S_A、实现接触区域最大尺寸 A_{max} 的最大时间 T_P、以及总时间段 T_e、上升斜度 k、按键敲击次数、微型计算机的操作长度等等。所述指标可以取决于上述特征量的最大值，或者可以基于微型计算机的物理特性来确定。对于所计算的指标设置警告阈值，并且它是所述接触强度令用户背负不必要负担的最小值。

在步骤 S705，输入设备 20 检查特征量是否变得大于警告阈值。如果没有，输入设备 20 返回到步骤 S701。否则，输入设备 20 前进到步骤 S706。

在步骤 S706，输入设备 20 检查所述指标是否超出警告阈值达预定倍数。如果没有，输入设备 20 前进到步骤 S708。否则，输入设备 20 转到步骤 S707。

在步骤 S708，所述输入设备 20 发出警告。举例来说，将指示消

息“你的按键触摸过强。请轻轻地敲击按键或者给你带来不必要的负担”。

在步骤 S707，输入设备 20 执行用户保护处理。举例来说，将指示诸如“你的按键触摸过强。将启动按键敲击限制器”之类的消息。此后，当识别出非常强的按键敲击时，将在一定的时间段内使输入设备 20 不能工作。

在警告的情况下，用户可以继续敲击按键。另一方面，在用户保护处理期间，输入设备 20 可被强制地中断。在要求用户轻轻地敲击按键的过程中这是十分有效的。

在先前的描述中，假设用户使用他或者她的手指作为对象来敲击按键。此外，通过执行警告处理还将保护诸如输入笔之类的对象。

在图 30 中示出的处理中，根据接触强度把字符从大写字母转换为小写字母，反之亦然。为了使第一个字符大写，只要求用户强烈地敲击按键。输入设备 20 根据接触强度使第一个字符的按键大写。通常，还会在键盘或者输入/单词转换程序的模式上敲击诸如“Crtl”键之类的特殊按键，为此目的改变所谓的前端处理器。具体来讲，用户强烈地敲击应该被大写的按键，并且以正常强度敲击其它的按键。

在步骤 S801，输入设备 20 识别出用户敲击虚拟键盘 25 上的按键，并且如参照图 28 中示出的步骤 S602 和 S603 所述的那样提取特征量。

在步骤 S802，输入设备 20 使用一个或者多个特征量来计算按键敲击强度指标，所述特征量即：接触区域的最大尺寸 A_{max}、接触区域 A 的瞬态尺寸 S_A、实现接触区域最大尺寸 A_{max} 的最大时间 T_P、以及总时间段 T_e、上升斜度 k、按键敲击次数、微型计算机的操作长度等等。所述指标可以取决于上述特征量的最大值，或者可以使用由多个特征量组成的指标计算公式来加以确定。为所计算的指标设置阈值。

在步骤 S803，输入设备 20 把所计算的指标与阈值进行比较。当所述指标大于阈值时，输入设备 20 前进到步骤 S804。否则，输入设备 20 转到步骤 S805。

在步骤 S804，输入设备 20 识别出强烈地敲击按键表示特殊字符，即大写字母字符。

所述输入设备 20 识别出以普通强度敲击的按键表示普通字符(小写字母字符)。

采用微型计算机，所述输入设备 20 包括接触检测单元 21(起接触位置检测器和接触强度检测器的作用)和设备控制 IC 23(作为确定单元)，并且可以检测用户手指是仅仅放置在触摸板的接触检测层 10a 上，还是有意放置在接触检测层 10a 上以便输入信息。为此目的，使用了与接触强度相关的特征量。此外，使用了信息处理方法和程序。

所述接触强度可以根据接触区域的尺寸或者接触压力来进行检测。此外，与在使用常规压力传感器类型的触摸板时根据敲击按键的压力和强度检测到接触状态的情况相比较，根据接触区域的尺寸准确地检测接触强度是可能的。

当使用相关领域的红外线类型或者图像传感器类型的触摸板时，只检测接触区域的尺寸或者形状，从而会难以区别“按键敲击”和“接触”。上述实施例的输入设备 20 可以非常容易并且准确地检测到对象的接触状态。

此处可以假定相对硬并且小于手指的输入笔与接触检测层接触。在该情况下，接触区域的尺寸非常小，并且不管接触压力如何，保持基本不变。然而，通过估计接触区域尺寸随时间的变化可以可靠地检测到输入笔的接触强度。

到目前为止，很难迅速地识别多个敲击的按键。上述实施例的输入设备 20 可以准确地识别敲击的按键以及用户手指仅仅放置在其上面的按键。因此，即使当娴熟的用户非常快速地敲击按键时，即，在细微的时间间隔内依照重叠方式敲击多个按键时，也可准确识别出所敲击的按键的接触状态。

设备控制 IC 23(作为确定部分)把与接触强度或者值(基于特征量计算的)相关的特征量与预定阈值进行比较，借此能够使接触状态被识别。用户可以根据他或者她的按键敲击习惯来调节阈值。如果多个用