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(71) Applicant (for all designated States except US):
HEWLETT-PACKARD DEVELOPMENT COMPANY, L.P. [US/US]; 20555 S.H. 249, Houston, Texas 77070 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **MASSARO, Kevin L** [US/US]; 20555 Tomball Parkway, Houston, Texas 77070 (US). **GRALEWSKI, William Adam** [US/US]; 20555 Tomball Parkway, Houston, Texas 77070 (US).

DAVIS, Brittany [US/US]; 20555 Tomball Parkway, Houston, Texas 77070 (US).

(74) Agents: **O'MEARA, William P.** et al.; Hewlett-Packard Company, Intellectual Property Administration, P.O. Box 272400, Mailstop 35, Fort Collins, Colorado 80527-2400 (US).

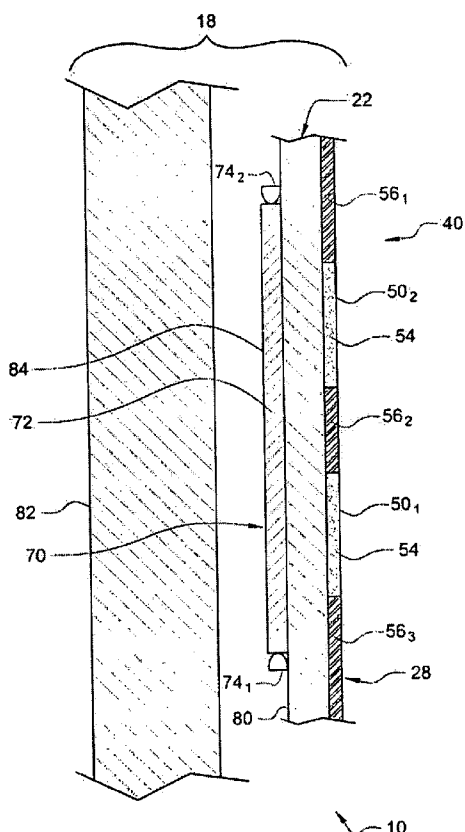
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(54) Title: ELECTRONIC DEVICE WITH BACKLIT DISPLAY

FIG. 2



(57) Abstract: An electronic device (10) comprises a housing (20, 22) having a half-mirror region (50) molded into the housing (20, 22), and a light source (70, 82) disposed within the electronic device (10) and configured to transmit light through the half-mirror region (50) to an exterior of the housing (20, 22).



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ELECTRONIC DEVICE WITH BACKLIT DISPLAY

BACKGROUND

[0001] Electronic devices sometimes contain images or logos indicating the source or manufacturer of the electronic device. For example, one type of electronic device comprises a frame having a translucent panel that is attachable to a display enclosure of a portable computer and that may be illuminated to display the logo/symbol. However, such types of displays require additional space to be allocated in the electronic device for such attachable elements, require additional assembly to manufacture, and result in additional cost.

BRIEF DESCRIPTION OF THE DRAWINGS

[0002] FIGURE 1 is a diagram illustrating an electronic device in which a backlit display is employed to advantage;

[0003] FIGURE 2 is a diagram illustrating a section view of the electronic device and backlit display of FIGURE 1 taken along the line 2-2 of FIGURE 1; and

[0004] FIGURE 3 is a flow diagram illustrating an embodiment of a method for manufacturing a backlit display for an electronic device.

DETAILED DESCRIPTION OF THE DRAWINGS

[0005] FIGURE 1 is a diagram illustrating an embodiment of an electronic device 10 in which a backlit display 12 is employed to advantage. In the embodiment illustrated in FIGURE 1, electronic device 10 comprises a notebook computer 14 having a base member 16 rotatably coupled to a display member 18. However, it should be understood that electronic

device 10 may comprise other types of devices such as, but not limited to, a tablet computer, a personal digital assistant, a gaming device, a media player, a desktop computer, a cellular telephone and/or any other type of portable or non-portable electronic device. In the embodiment illustrated in FIGURE 1, base member 16 and display member 18 each comprise a housing 20 and 22, respectively, formed by a plurality of walls for supporting and/or otherwise storing various types of components of electronic device 10 therein. For example, in the embodiment illustrated in FIGURE 1, housing 22 is used to support a display screen for providing and/or otherwise displaying image content. In FIGURE 1, housing 22 comprises a front cover 26 and a back cover 28. However, it should be understood that housing 22 and/or display member 18 may be otherwise configured.

[0006] In the embodiment illustrated in FIGURE 1, backlit display 12 comprises a display element 40 located on a back wall 42 of housing 22. However, it should be understood that display element 40 may be otherwise located on electronic device 10 (e.g., located elsewhere on housing 22 and/or on housing 20). Display element 40 may comprise any type of logo, design, picture, illustration, graphic element or other type of illustrative element. In some embodiments, housings 20 and/or 22 are formed at least partially as a molded plastic component. For example, at least a portion of housings 20 and/or 22 may be formed from a plastic molded process such as, but not limited to, an in-mold-roll (IMR) or in-mold-decoration (IMD) process. In the embodiment illustrated in FIGURE 1, display element 40 is molded into housing 22 such that display element 40 is an integral component and/or embedded design in housing 22.

[0007] In some embodiments, display element 40 is formed and/or otherwise molded into housing 22 as a half-mirror region 50 of housing 22 such that light emitted by a light source disposed within display member 18 is emitted through half-mirror region 50 to an exterior of electronic device 10. However, in some embodiments, half-mirror region 50 is configured such that in the absence of a light being transmitted through half-mirror region 50 from an interior of electronic device 10, housing 22 appears as an ordinary plastic housing 22 (e.g., in some embodiments, without any appearance of display element 40). In FIGURE 1, two half-mirror regions 50₁ and 50₂ are illustrated; however, it should be understood that a greater or fewer quantity of discrete and/or joined half-mirror regions 50 may be used. Further, it should be

understood that in some embodiments, even in the absence of a light being transmitted through half-mirror region 50 from an interior of electronic device 10, display element 40 may be visible from an exterior of electronic device.

[0008] FIGURE 2 is a diagram illustrating a section view of electronic device and backlit display 12 of FIGURE 1 taken along the line 2-2 of FIGURE 1. In the embodiment illustrated in FIGURE 2, half-mirror regions 50₁ and 50₂ comprise an opaque particles 54 molded into housing 22. For example, in some embodiments, half-mirror region(s) 50 are formed by having opaque particles 54 molded into back cover 28 using an IMD or IMR process. In operation, a film or other type of carrier having opaque particles 54 disposed thereon on is threaded inside a mold cavity of an injection molding tool. In some embodiments, a clear and/or transparent thermoplastic or resin is then injected into the mold cavity, and the injection molding tool applies pressure and heat to change the thermoplastic or resin into a plastic component shaped according to the mold cavity (e.g., the shape of back cover 28). As the heat is applied, opaque particles 54 is transferred from the film to the thermoplastic or resin forming back cover 28. In transferring, opaque particles 54 is either folded into the thermoplastic or resin or applied to one edge or surface 42 (FIGURE 1) of back cover 28. Opaque particles 54 may comprise any type of opaque material including metal such as, but not limited to, tin, gold, aluminum, chromium, a metal alloy, or any combination thereof.

[0009] In some embodiments, the film and/or carrier carrying opaque particles 54 for the molding process may also be used to carry inks and/or other materials used to provide color and/or a desired surface finishes to housing 22. For example, in the embodiment illustrated in FIGURE 2, inks 56₁-56₃ are molded into housing 22 (e.g., at the same time half-mirror regions 50₁ and 50₂ are formed). However, it should be understood that colors and/or surface finishes may be applied and/or otherwise formed during different stages of housing 22 formation. In some embodiments, opaque particles 54 and inks 56₁-56₃ comprise the same or similar color, thereby resulting in half-mirror region(s) 50 being indiscernible (or at least partially indiscernible) from a remaining portion of housing 22 when a light is not being transmitted through half-mirror region(s) 50 from an interior of electronic device 10. However, it should be understood that housing 22 may be otherwise configured.

[0010] In some embodiments, half-mirror region(s) 50 are formed by providing opaque particles 54 at a density less than an opaque-level density such that light can be emitted through half-mirror region(s) 50 from a light source 70 disposed within display member 18. For example, in some embodiments, opaque particles 54 are disposed and/or otherwise molded into housing 22 at a predetermined density (e.g., 75%-85%) relative to the clear/transparent polymer/resin such that light can be emitted through half-mirror region(s) 50 from light source 70. Thus, in some embodiments, opaque particles 54 are transferred and/or otherwise molded into housing 22 at a partial and/or reduced density to enable light from light source 70 to pass therethrough. Thus, in some embodiments, half-mirror region(s) 50 is/are integral with housing 22 (e.g., formed as a unitary piece).

[0011] In the embodiment illustrated in FIGURE 2, light source 70 comprises a light guide 72 configured to direct light received from one or more light emitting diodes (LEDs) 741 and 742 through half-mirror region(s) 50. In FIGURE 2, light guide 72 is disposed between an internal surface 80 of back cover 28 and a display screen 82 of display member 18. Additionally, in FIGURE 2, two LEDs 74 are illustrated; however, it should be understood that a greater or fewer quantity of LEDs may be used, or a type of light source different than LEDs may be used (e.g., light from display screen 82). In some embodiments, light guide 72 comprises a reflective and/or diffusive layer 84 disposed on a side thereof opposite half-mirror region(s) 50 to facilitate directing light emitted by LEDs 74 through half-mirror region(s) 50. However, it should be understood that light guide 72 may be otherwise configured. Further, in FIGURE 2, light guide 72 is illustrated as being spaced apart from display screen 82; however, it should be understood that in some embodiments, light guide 72 and display screen 82 and/or other components within display member 18 may abut each other. Light source 70 may be affixed and/or attached to back cover 28, attached to other structure residing in display member 18, or otherwise positioned/secured within display member 18. It should be understood that in some embodiments, light guide 72 may be omitted such that light from a different light source is used to pass through half-mirror region(s) 50, such as, but not limited to, light from display screen 82.

[0012] FIGURE 3 is a flowchart illustrating an embodiment of a method of manufacturing electronic device 10 with backlit display 12. The method begins with block 300 in which a film comprising a desired design using opaque particles 54 is feed into a mold cavity for an injection molding tool. Vacuum metallization is a process of applying a thin coat of metal to a plastic. Thus, in some embodiments, metallic, or a combination of metallic and non-metallic, opaque particles 54 are vacuum metalized and applied to the film in the form of a desired design which is then feed into the mold cavity. In this embodiment, the mold cavity is used to form at least a portion of back cover 28 for electronic device 100. It should be noted, however, that the mold cavity can be used to form any component for electronic device 10.

[0013] A vacuum assist is then applied to the mold cavity such that the film comprising the desired design is drawn into the core side of the injection molding tool (block 310). The core side is the female component of the mold cavity. The injection molding tool is then closed (block 320) and a plastic material is injected into the mold cavity (block 330). In some embodiments, the plastic material is a clear/transparent polymer (transparent or substantially transparent) to enable light to pass therethrough in the locations of half-mirror region(s) 50; however, it should be understood that plastics/resins being somewhat translucent when cured may also be used such that a sufficient level of transmissivity is provided to enable light to pass therethrough in the locations of half-mirror region(s) 50. Pressure and heat are then applied to the plastic material such that desired design is transferred to the cavity side of the plastic material (block 340). Opaque particles 54 are either folded into or melted into the thermoplastic or resin, thereby forming a permanent bond between the thermoplastic or resin and opaque particles 54. Back cover 28 is then formed.

[0014] The injection molding tool is then opened (block 350) and back cover 28 is removed from the injection molding tool (block 360). Back cover 28 is then placed in an ultraviolet oven (block 370). Back cover 28 is then removed from the ultraviolet oven and prepared for further assembly in electronic device 100 (block 380), such as the placement or assembly of light source 70 to back cover 28 and/or the assembly of back cover 28 with front cover 26 to form housing 22.

[0015] Thus, embodiments of backlit display 12 enable any type of graphical/design element 40 to be molded into and/or otherwise form part of housing 20 and/or 22 to enable such display element 40 to be backlit using light source 70. In some embodiments, display element 40 is formed as a half-mirror region 50 that enables light to pass therethrough in one direction (e.g., from an interior area of electronic device through regions(50) to an exterior of electronic device 10) while, because of the density of opaque particles 54, the lack of light within display member 18 or other element of electronic device 10 to which region(s) 50 are located when light source 70 is not illuminated, or otherwise, the visibility through region(s) 50 from an exterior of electronic device is substantially impeded and/or otherwise resulting in negligible recognition of anything located within electronic device 10.

WHAT IS CLAIMED IS:

1. An electronic device (10), comprising:
a housing (20, 22) having a half-mirror region (50) molded into the housing (20, 22); and
a light source (70, 82) disposed within the electronic device (10) and configured to transmit light through the half-mirror region (50) to an exterior of the housing.
2. The device (10) of Claim 1, wherein the light source (70, 82) comprises a light guide (72).
3. The device (10) of Claim 1, wherein the half-mirror region (50) comprises a metal molded into the housing (20, 22) at a density less than an opaque-level density.
4. The device (10) of Claim 1, wherein the half-mirror region (50) is formed in the housing (20, 22) using an in-mold decoration (IMD) process.
5. The device (10) of Claim 1, wherein the light source (70, 82) comprises at least one light emitting diode (LED) (74).
6. The device (10) of Claim 1, wherein the light source (70, 82) comprises a light guide (72) configured to direct light from at least one LED (74) through the half-mirror region (50).
7. The device (10) of Claim 1, wherein the housing (20, 22) comprises a display housing (22) of a notebook computer (14).
8. A method for manufacturing an electronic device (10), comprising:
providing a housing (20, 22) having a half-mirror region (50) molded into the housing (20, 22); and
disposing a light source (70, 82) within the electronic device (10) configured to transmit light through the half-mirror region (50) to an exterior of the housing (20, 22).

9. The method of Claim 8, further comprising providing the housing (20, 22) having the half-mirror region (50) formed of a metal material.

10. The method of Claim 8, further comprising providing the housing (20, 22) having the half-mirror region (50) formed by an in-mold decoration (IMD) process.

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FIG. 1

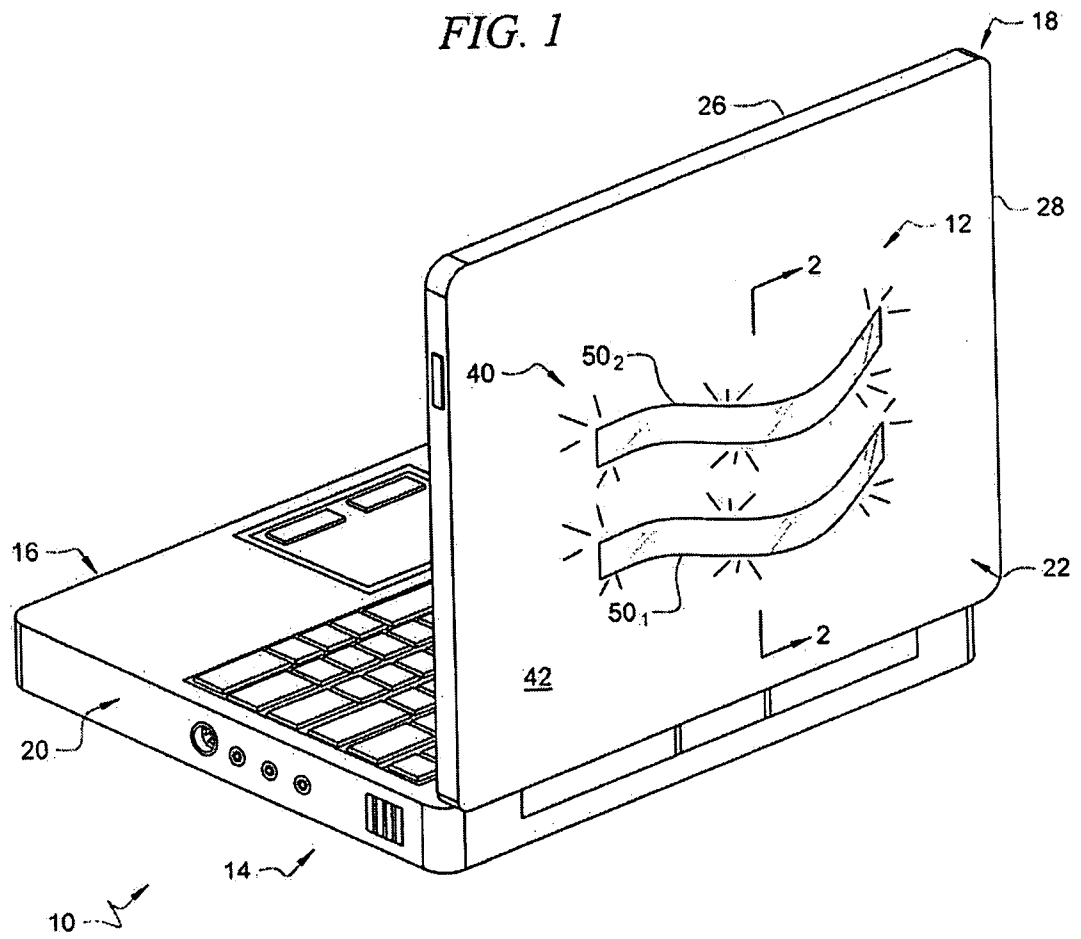
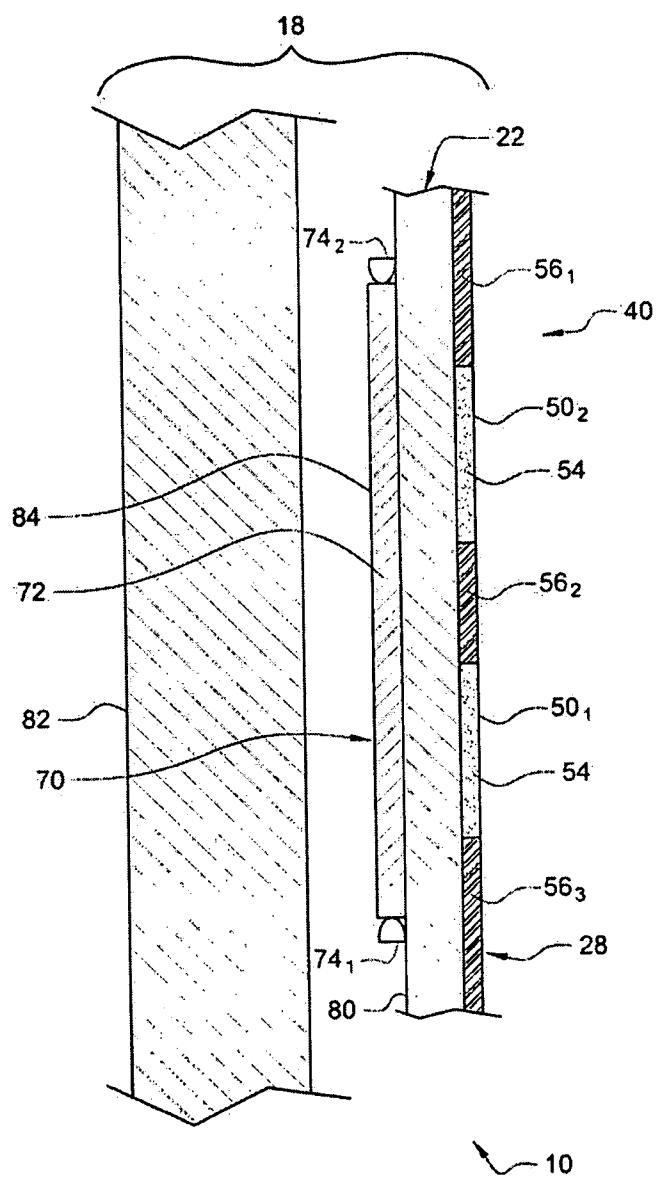
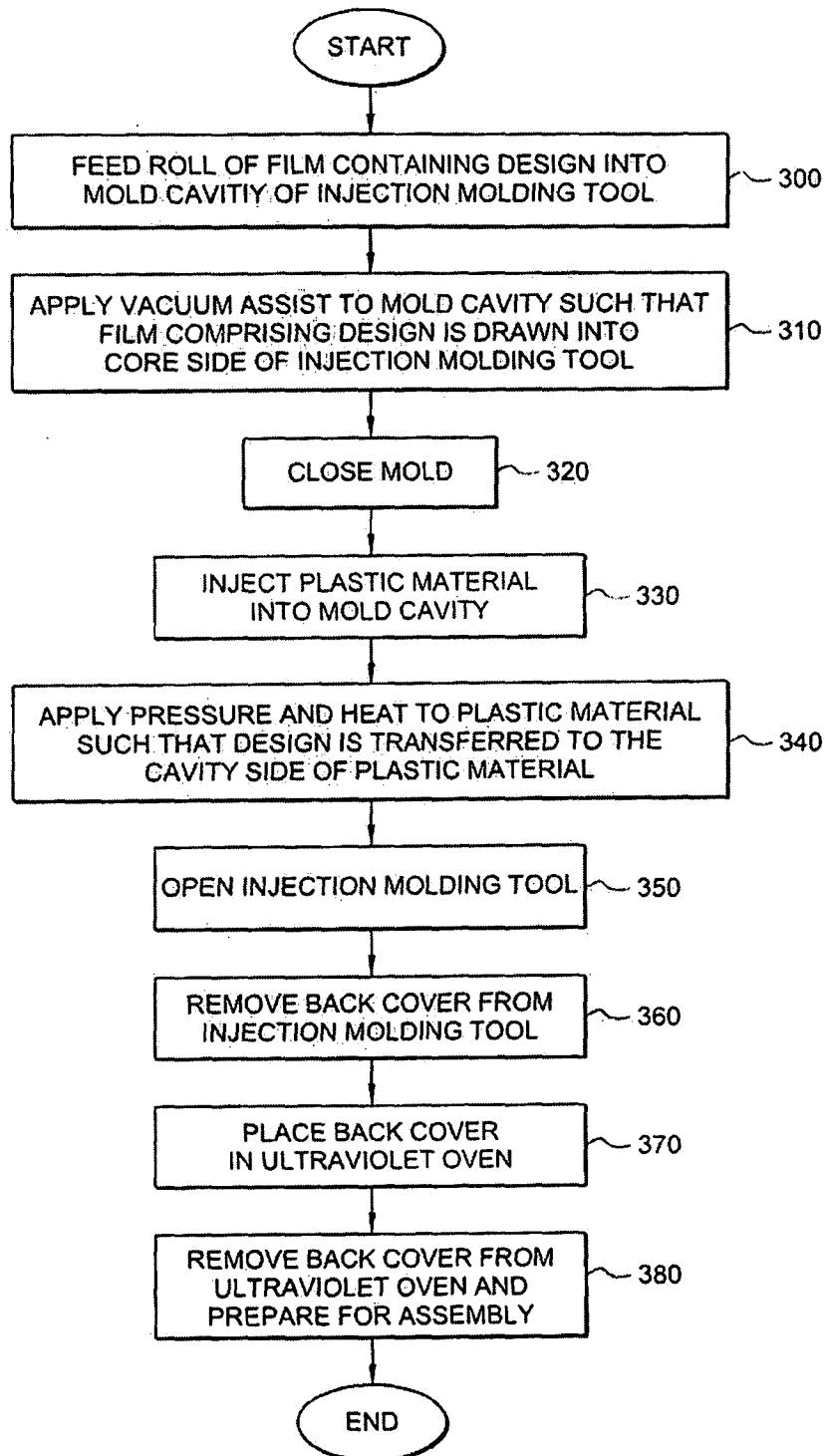


FIG. 2



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FIG. 3



A. CLASSIFICATION OF SUBJECT MATTER**G06F 1/16(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)

IPC 8 G06F 3/00 , G06F1/16 , H04B 1/38

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

KOREAN UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975

JAPANESE UTILITY MODELS AND APPLICATIONS FOR UTILITY MODELS SINCE 1975

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

KIPASS(KIPO internal) "LED" "back light" "transmit" "transparent" "IMD"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	KR 10-2001-0068683 A (LG Electronics Co., LTD) 23 July 2001 (23.07.2001) see the detailed description , fig. 2 and fig. 3	1, 8 2-7, 9-10
Y	JP 11-338590 A (FUJITSU TAKAMISAWA COMPONENT LTD) 10 December 1999 (10.12.1999) see the detailed description 0020-0033, fig. 4 and fig. 5	2-7, 9-10
Y	WO 2003/015298 A1 (SIEMENS INFORMATION AND COMMUNICATION MOBILE LLC) 20 February 2003 (20.02.2003) see the detailed description page 4.	4, 10



Further documents are listed in the continuation of Box C.



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* Special categories of cited documents:

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Date of the actual completion of the international search

14 OCTOBER 2008 (14.10.2008)

Date of mailing of the international search report

14 OCTOBER 2008 (14.10.2008)

Name and mailing address of the ISA/KR

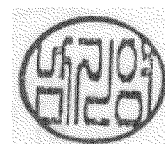
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NAM, Ki Young

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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