(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 July 2012 (19.07.2012)

WIPO | PCT

(10) International Publication Number
WO 2012/096142 A1

(51) International Patent Classification:
G06F 3/042 (2006.01) *G06F 3/041* (2006.01)
B42D 15/00 (2006.01) *G06F 17/21* (2006.01)

(21) International Application Number:
PCT/JP2011/080579

(22) International Filing Date:
26 December 2011 (26.12.2011)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2011-002916 11 January 2011 (11.01.2011) JP
61/438,437 1 February 2011 (01.02.2011) US

(71) Applicant *(for all designated States except US)*: **NITTO DENKO CORPORATION** [JP/JP]; 1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, 5678680 (JP).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: **SHIMIZU, Yusuke** [JP/JP]; c/o NITTO DENKO CORPORATION, 1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, 5678680 (JP). **NAKAMURA, Kei** [JP/JP]; c/o NITTO DENKO CORPORATION, 1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, 5678680 (JP). **NINOMIYA, Akito** [JP/JP]; c/o NITTO DENKO CORPORATION, 1-2, Shimohozumi 1-chome, Ibaraki-shi, Osaka, 5678680 (JP).

(74) Agents: **SAITOH, Yukihiko** et al.; City Corp. Minamimorimachi 802, 2-7, Minamimorimachi 2-chome, Kita-ku, Osaka-shi, Osaka, 5300054 (JP).

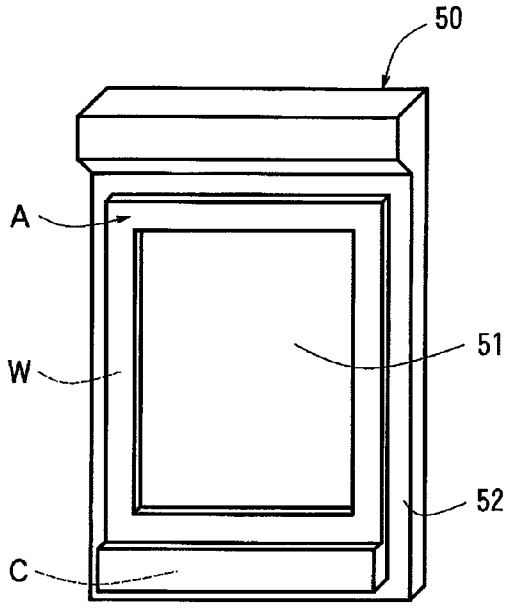
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK,

[Continued on next page]

(54) Title: DESK NOTEPAD DEVICE

FIG. 1



(57) Abstract: A desk notepad device is provided which allows a user to write a note on a paper sheet, which is capable of properly converting and storing the note in electronic form, and which allows the user's writing operation on the paper sheet in a natural manner even when such storage in electronic form is achieved. The desk notepad device includes: a desk notepad tool having paper sheets bound together, the paper sheets capable of being written upon with a writing implement; a rectangular frame-shaped optical waveguide W surrounding at least part of the paper sheets; and a storage means C for storing therein the path of movement of a tip of the writing implement as electronic data when a writing operation is performed on part of the paper sheets revealed within the frame of the optical waveguide with the writing implement.

WO 2012/096142 A1

SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*

Description

DESK NOTEPAD DEVICE

Technical Field

The present invention relates to a desk notepad device capable of storing notes and the like as digital data (electronic data) therein at the same time that the notes and the like are written on a paper sheet of a desk notepad tool.

Background Art

There are some notepad tools, such as electronic note processors, that digitally process notes and the like (see, for example, Japanese Patent No. 3746378). Such an electronic note processor includes a display for displaying entered notes and the like, and is configured to allow a user or an inputter to enter notes and the like into the display with a purpose-built stylus. Specifically, the aforementioned display is provided with a touch sensor (to constitute a touch panel). By bringing the tip of the aforementioned purpose-built stylus into contact with the display and then moving the purpose-built stylus, the path of movement of the tip of the purpose-built stylus is inputted as a note and the like to the aforementioned display. Information such as the

note appearing on the aforementioned display is stored as electronic data in the aforementioned electronic note processor.

An optical position detection device including light-emitting elements and light-receiving elements has also been proposed as a device for detecting the path of movement of a pen tip, a finger tip and the like (see, for example, Japanese Patent No. 3682109). This device is in the form of a rectangular frame comprised of a pair of L-shaped sections. The light-emitting elements are disposed in juxtaposition in one of the L-shaped sections constituting the rectangular frame, and the light-receiving elements opposed to the aforementioned light-emitting elements are disposed in juxtaposition in the other L-shaped section. Information such as a note is inputted to the optical position detection device by moving a pen, a finger and the like within the rectangular frame. Specifically, when a pen, a finger or the like is moved within the aforementioned rectangular frame, some light beams emitted from the aforementioned light-emitting elements are intercepted by the pen, the finger or the like. The light-receiving elements opposed to the aforementioned light-emitting elements sense the interception of light beams to thereby detect the path of the aforementioned pen, the finger or the like (input

information such as a note). When the path is outputted as a signal to the aforementioned electronic note processor, it is possible to input the path as a note and the like to the display of the electronic note processor.

Summary of Invention

However, there are cases where the aforementioned electronic note processor itself is damaged or data stored in the electronic note processor is corrupted due to drop impacts and the like. In such cases, the electronic note processor presents a problem such that the data stored therein cannot be reproduced. Also, a demand for a notepad tool of the type in which a user writes on a paper sheet with a writing implement, rather than the aforementioned electronic note processor, is high mainly from elderly people.

When the aforementioned optical position detection device, which itself is in the form of a rectangular frame, is used as an input means, a paper sheet may be placed under the optical position detection device so that part of the paper sheet is revealed within the frame. In this state, a user may write a note and the like directly on the revealed part of the paper sheet with a writing implement, and also may enter the note

and the like into the electronic note processor. Then, the paper sheet with the note and the like written thereon may be left intact. However, the frame of the aforementioned optical position detection device is thick (with a thickness of approximately 6 mm or more) because the light-emitting elements and the light-receiving elements are disposed in juxtaposition in the form of a frame. When an inputter moves an input element such as a pen and a finger within the frame for input operation, the thickness of the aforementioned frame causes unnatural positioning of an inputter's hand used for the input operation, and makes it difficult for the inputter to perform the input operation. In addition, light beams from the light-emitting elements which are thick travel at a somewhat elevated vertical position (approximately 4 mm) from the bottom surface of the aforementioned optical position detection device. For this reason, when the inputter uses a pen, a finger or the like for the input operation, the input position thereof is not detected at the bottom surface within the frame but at a somewhat elevated vertical position. Further, the pen, the finger or the like during the input operation is not at right angles to the bottom surface within the frame but is in general in a slanting position. Thus, the detected path is not the path of the tip of the pen, the finger or the

like (the path at the bottom surface within the frame) but is the path of a position diagonally above the tip. A note, for example, appearing on the display accordingly deviates from the display position intended by the inputter. For these reasons, the input operation becomes unnatural when an inputted note, for example, is caused to appear properly on the display.

A desk notepad device is provided which allows a user to write a note and the like on a paper sheet, which is capable of properly converting and storing the note and the like in electronic form, and which allows the user's writing operation on the paper sheet in a natural manner even when such storage in electronic form is achieved.

The desk notepad device comprises: a desk notepad tool including paper sheets bound together, each of the paper sheets capable of being written upon with a writing implement; a frame-shaped optical waveguide surrounding at least part of the paper sheets; and a storage means for storing therein the path of movement of a tip of the writing implement as electronic data when a writing operation is performed on part of the paper sheets revealed within the frame of the optical waveguide with the writing implement, the optical waveguide being frame-shaped and including first and second sections

opposed to each other in the form of the frame, the first section including a plurality of light-emitting cores formed therein, the second section including a plurality of light-receiving cores formed therein, the cores having respective tips positioned on inner edges of the frame, the tips of the light-emitting cores and the tips of the light-receiving cores being opposed to each other.

The desk notepad device includes: the aforementioned frame-shaped optical waveguide surrounding at least part of the paper sheets of the desk notepad tool; and the storage means for storing therein the path of movement of the tip of the writing implement as electronic data when the writing operation is performed on part of the aforementioned paper sheets revealed within the frame of the optical waveguide with the writing implement. Thus, when a note or the like is written on the part of the paper sheets revealed within the frame of the aforementioned optical waveguide with the writing implement, the desk notepad device is capable of storing the note or the like as electronic data in the aforementioned storage means, as well as leaving the note or the like intact on the aforementioned paper sheets. If the aforementioned paper sheets are damaged, the desk notepad device is capable of taking (reproducing) the information such as the note or the like written on the

paper sheets from the aforementioned storage means by using a personal computer and the like. Further, the optical waveguide, which is reduced in thickness, does not serve as an impediment to a writing operation when a note or the like is written on the aforementioned paper sheets, but allows the positioning of a user's hand which has the aforementioned writing implement in a natural location. This achieves the writing operation on the paper sheets in a natural manner. Since the optical waveguide is thin as mentioned above, light beams emitted from the tips of the light-emitting cores travel in a vertical position slightly above the bottom surface (the surface of the paper sheets) within the frame. Thus, when the writing implement is in a slanting position during the writing operation, the detected path is substantially the same as the path of the tip of the writing implement (the note or the like written on the paper sheets), and is stored in the storage means under proper conditions. Moreover, since the optical waveguide is thin as mentioned above, the aforementioned storage means is also made thin and fits well to the desk notepad tool.

In particular, when the optical waveguide and the storage means are integrally formed as a storage device and the storage device is removable from the desk notepad tool, then the removal of the aforementioned storage

device from the desk notepad tool enables the information such as the note or the like written on the paper sheets of the aforementioned desk notepad tool to be taken (reproduced) from the storage means of the aforementioned storage device by using a personal computer and the like in the event of loss of or damage to the aforementioned desk notepad tool. Also, when the aforementioned storage device is removed from the desk notepad tool and kept, the aforementioned desk notepad tool may be discarded. This eliminates the need for large space sufficient for keeping the aforementioned desk notepad tool.

When each of the tips of the light-emitting cores and the tips of the light-receiving cores is in the form of a lens portion, then the light beams emitted from the lens portions of the light-emitting cores are properly restrained from diffusing, and the emitted light beams introduced into the light-receiving cores are properly converged by the lens portions of the light-receiving cores. This consequently improves light transmission efficiency within the frame of the optical waveguide to achieve the correct detection of the path of the writing implement within the frame.

Further, when an edge portion of an over cladding layer is formed so as to cover the tips of the light-emitting cores and the tips of the light-receiving

cores, and the edge portion of the over cladding layer is in the form of a lens portion, then the light beams emitted from the lens portion of the over cladding layer on the light-emitting side are properly restrained from diffusing, and the aforementioned emitted light beams are caused to enter a wide region of the lens portion of the over cladding layer on the light-receiving side and are caused to enter the end surfaces of the cores while being further narrowed down and converged. This consequently improves light transmission efficiency within the frame of the optical waveguide to achieve the correct detection of the path of the writing implement within the frame.

Brief Description of Drawings

FIG. 1 is a perspective view schematically showing a desk notepad device according to one embodiment.

FIG. 2(a) is a plan view schematically showing a storage device for the aforementioned desk notepad device, (b) is a sectional view taken along the line X1-X1 of (a), and (c) is a sectional view taken along the line X2-X2 of (a).

FIG. 3(a) to (c) are illustrations schematically showing an example of a method of producing an optical waveguide for the aforementioned storage device.

FIGS. 4(a) to (c) are illustrations schematically showing the method of producing the optical waveguide subsequent to the steps shown in Fig. 3 described above.

FIGS. 5(a) and (b) are illustrations schematically showing a method of producing the storage device subsequent to the steps shown in Fig. 4 described above.

FIG. 6(a) is an illustration schematically showing the method of producing the storage device subsequent to the steps shown in Fig. 5 described above, and (b) is a sectional view taken along the line X4-X4 of (a).

FIG. 7 is an illustration schematically showing the method of producing the storage device subsequent to the step shown in Fig. 6 described above.

Description of Embodiments

Next, an embodiment according to the present invention will now be described in detail with reference to the drawings.

FIG. 1 shows a desk notepad device according to one embodiment. As shown in FIG. 1, the desk notepad device according to this embodiment includes: a desk notepad tool 50 having paper sheets 51 bound together,

each of the paper sheets 51 capable of being written upon with writing implements; a rectangular frame-shaped optical waveguide W surrounding part of the aforementioned paper sheets 51; and a storage means C for storing the path of movement of the tip of a writing implement as electronic data when a user writes on part of the aforementioned paper sheets 51 revealed within the frame of this optical waveguide W with the writing implement. In this embodiment, the storage means C, which is strip-shaped, is formed integrally with one end edge of the aforementioned optical waveguide W, so that the optical waveguide W and the storage means C constitute a storage device A. In this manner, the aforementioned storage device A for storing information such as a note written on the paper sheets 51 as electronic data is provided in addition to the desk notepad tool 50 of the type in which a user writes a note and the like on the paper sheets 51 with a writing implement.

In this embodiment, the aforementioned storage device A is placed and used on the aforementioned paper sheets 51 (in FIG. 1, a peripheral portion of the surface of the paper sheets 51). The aforementioned storage device A is upwardly and downwardly movable in such a manner as to move downwardly in accordance with the height of the paper sheets 51 as the aforementioned paper sheets

51 are removed (consumed) one by one and to move upwardly in accordance with the height of the paper sheets 51 when some paper sheets are added to the aforementioned paper sheets 51. Further, the aforementioned storage device A in this embodiment is removable from the aforementioned desk notepad tool 50. Also, the paper sheets 51 of the aforementioned desk notepad tool 50 are fixed on a base 52.

The aforementioned characteristic storage device A will be described in detail.

The aforementioned storage device A, as shown in plan view in FIG. 2(a), includes the aforementioned rectangular frame-shaped optical waveguide W having sides equal in width, and the strip-shaped storage means C formed integrally with one end edge of the optical waveguide W. As shown in FIG. 2(b) which is an enlarged sectional view of part of the aforementioned storage device A corresponding to the aforementioned optical waveguide W (a sectional view taken along the line X1-X1 of FIG. 2(a)) and in FIG. 2(c) which is an enlarged sectional view of part of the aforementioned storage device A corresponding to the aforementioned storage means C (a sectional view taken along the line X2-X2 of FIG. 2(a)), the aforementioned optical waveguide W and the aforementioned storage means C in this embodiment are

fixed on a rectangular frame-shaped retainer plate 30 made of stainless steel and the like, and have respective top surfaces covered with a protective plate 40 made of polycarbonate and the like. The aforementioned retainer plate 30 is provided to make it easy to hold the planarity of the storage device A, and the aforementioned protective plate 40 is provided to protect the storage device A.

The aforementioned rectangular frame-shaped optical waveguide W, as shown in FIGS. 2(a) and (b), includes an under cladding layer 1, cores 2a and 2b, and an over cladding layer 3 to be described below. Specifically, the under cladding layer 1 in the form of a rectangular frame is formed on the aforementioned rectangular frame-shaped retainer plate 30. The rectangular frame of the under cladding layer 1 is comprised of a pair of L-shaped sections. The cores 2a for light emission are disposed in a divided manner on the surface of one of the L-shaped sections, and the cores 2b for light reception are disposed in juxtaposition on the surface of the other L-shaped section. The cores 2a and 2b have respective tips positioned on the inner edges of the aforementioned rectangular frame. The tips of the light-emitting cores 2a are in opposed relation to the tips of the light-receiving cores 2b. The over cladding layer 3 in the form of a rectangular frame is

formed on the surface of the aforementioned under cladding layer 1 so as to cover the aforementioned light-emitting cores 2a and the light-receiving cores 2b. In this embodiment, each of the tips of the cores 2a and 2b positioned on the inner edges of the aforementioned rectangular frame is in the form of a convex lens portion having a substantially semicircular curved surface as seen in plan view, and an edge portion of the over cladding layer 3 covering the lens portions is in the form of a convex lens portion 3a having a substantially quadrantal curved surface as seen in sectional side view. In Fig. 2(a), the cores 2a and 2b are indicated by broken lines, and the thickness of the broken lines indicates the width of the cores 2a and 2b. Also, in FIGS. 2(a) and (b), the number of cores 2a and 2b are shown as abbreviated.

The aforementioned storage means C includes a circuit board, and a battery for providing electricity to the circuit board. As shown in FIGS. 2(a) and (c), the aforementioned circuit board is configured such that a light-emitting element 5 connected to ends of the aforementioned light-emitting cores 2a, a light-receiving element 6 connected to ends of the aforementioned light-receiving cores 2b, an IC for controlling the aforementioned storage means C, a memory for storing therein information (information on the path

of movement of a tip of a writing implement) such as a note written on part of the paper sheets 51 revealed within the frame of the aforementioned optical waveguide W, a connecting module for outputting the information such as a note stored in the memory to a reproducing terminal (such as a personal computer and a mobile machine), and the like are mounted on a flexible printed board 7. In FIG. 2(c), the battery, the IC, the memory, the connecting module and the like described above are shown collectively by a shaded portion designated by the reference numeral 8.

In the storage device A including the aforementioned optical waveguide W and the storage means C (with reference to FIGS. 2(a) to (c)), light beams from the aforementioned light-emitting element 5 pass through the aforementioned light-emitting cores 2a and through the lens portions at the tips of the respective light-emitting cores 2a, and then exit the surface of the lens portion 3a of the over cladding layer 3 covering the lens portions of the respective light-emitting cores 2a. Thus, the light beams travel in a lattice form within the frame of the aforementioned rectangular frame-shaped optical waveguide W. The light beams traveling in a lattice form are restrained from diverging by refraction through the lens portions at the tips of the aforementioned

light-emitting cores 2a and through the lens portion 3a of the over cladding layer 3 covering the lens portions of the light-emitting cores 2a. In this state, when a note or the like is written on part of the paper sheets 51 (with reference to FIG. 1) revealed within the frame of the optical waveguide W with a writing implement, some of the light beams traveling in the aforementioned lattice form are intercepted by the tip of the aforementioned writing implement. The aforementioned light-receiving element 6 senses the interception of light beams to thereby detect the path of the tip of the aforementioned writing implement (written information such as a note). The path, in turn, is stored as digital data (electronic data) in the aforementioned memory. That is, information such as a note or the like is stored in the memory of the aforementioned storage means C at the same time that the note or the like is written on part of the paper sheets 51 revealed within the frame of the optical waveguide W with a writing implement.

In this manner, the aforementioned desk notepad device is capable of storing a note or the like as electronic data in the memory of the aforementioned storage means C, as well as leaving the note or the like intact on the aforementioned paper sheets 51. Also, even when notes or the like are written on different pages

of the aforementioned paper sheets 51, the aforementioned memory is capable of seizing the order in which the notes or the like are stored, and is hence capable of storing notes or the like for each page. Further, the aforementioned storage device A may be used only for a page desired to be stored.

The optical waveguide W is reduced in thickness (to a thickness, at most, of approximately 1 mm). Even when the retainer plate 30 and the protective plate 40 are provided on the front and back surfaces of the optical waveguide W as in this embodiment, the total thickness is approximately 2 mm. Thus, the rectangular frame section including the optical waveguide W together with the retainer plate 30 and the protective plate 40 does not serve as an impediment to the writing operation, but makes it easy to perform the writing operation. Since the optical waveguide W is thin as mentioned above, the light beams emitted from the tips of the light-emitting cores 2a travel in a vertical position slightly (approximately 0.6 mm) above the bottom surface within the frame, even when the thickness of the aforementioned retainer plate 30 is taken into consideration. Thus, when the aforementioned writing implement is in a slanting position during the writing operation, the detected path is substantially the same as the path of the tip of the

writing implement (the note or the like written on the paper sheets 51), and is stored in the memory of the aforementioned storage means C under proper conditions.

The information such as a note stored in the memory of the aforementioned storage means C may be reproduced (displayed) using a reproducing terminal (such as a personal computer and a mobile machine), and may be further stored in the aforementioned reproducing terminal. In this case, the aforementioned reproducing terminal and the aforementioned storage means C are connected to each other with a connecting cable such as a micro USB cable, for example. The information such as a note is stored in a general-purpose file format such as PDF, for example, in the memory of the aforementioned storage means C.

Next, an example of a method of producing the aforementioned storage device A will be described. FIGS. 3 and 4 cited for a description on a method of producing the optical waveguide W in the foregoing description show portions corresponding to a cross section taken along the line X3-X3 of FIG. 2(a).

First, a substrate 10 in the form of a rectangular frame for the formation of the optical waveguide W (with reference to FIG. 3(a)) is prepared. Examples of a material for the formation of this substrate 10 include metal, resin, glass, quartz, and silicon.

Then, as shown in FIG. 3(a), the rectangular frame-shaped under cladding layer 1 identical in shape with the substrate 10 is formed on a surface of the aforementioned rectangular frame-shaped substrate 10. This under cladding layer 1 may be formed by a photolithographic method using a photosensitive resin as a material for the formation thereof. The under cladding layer 1 has a thickness in the range of 5 to 50 μm, for example.

Next, as shown in FIG. 3(b), the light-emitting cores 2a and the light-receiving cores 2b which have the aforementioned pattern are formed by a photolithographic method on a surface of the aforementioned rectangular frame-shaped under cladding layer 1. An example of a material for the formation of the cores 2a and 2b used herein includes a photosensitive resin having a refractive index higher than that of the materials for the formation of the aforementioned under cladding layer 1 and the over cladding layer 3 to be described below (with reference to FIG. 4(b)).

As shown in FIG. 3(c), a rectangular frame-shaped light-transmissive mold 20 for the formation of the over cladding layer is prepared. This mold 20 includes a cavity 21 having a mold surface complementary in shape to the surface of the over cladding layer 3 (with reference

to FIG. 4(b)). The mold 20 is placed on a molding stage (not shown), with the cavity 21 positioned to face upward. Then, the cavity 21 is filled with a photosensitive resin 3A serving as the material for the formation of the over cladding layer 3.

Then, as shown in FIG. 4(a), the cores 2a and 2b patterned on the surface of the aforementioned under cladding layer 1 are positioned relative to the cavity 21 of the aforementioned mold 20. In that state, the aforementioned under cladding layer 1 is pressed against the aforementioned mold 20, so that the aforementioned cores 2a and 2b are immersed in the photosensitive resin 3A serving as the material for the formation of the aforementioned over cladding layer 3. In this state, the aforementioned photosensitive resin 3A is exposed to irradiation light such as ultraviolet light by directing the irradiation light through the aforementioned mold 20 onto the aforementioned photosensitive resin 3A. Thus, the aforementioned photosensitive resin 3A is cured to form the rectangular frame-shaped over cladding layer 3 in which the inner peripheral edge portion of the rectangular frame is formed as the lens portion 3a.

Next, as shown in FIG. 4(b) (shown in an orientation vertically inverted from that shown in FIG. 4(a)), the

aforementioned over cladding layer 3 together with the aforementioned substrate 10, the under cladding layer 1, and the cores 2a and 2b is removed from the aforementioned mold 20 (with reference to FIG. 4(a)).

Then, as shown in FIG. 4(c), the aforementioned substrate 10 (with reference to FIG. 4(b)) is stripped from the under cladding layer 1. This provides the rectangular frame-shaped optical waveguide W including the under cladding layer 1, the cores 2a and 2b, and the over cladding layer 3.

Next, as shown in plan view in FIG. 5(a), the flexible printed board 7 is prepared, and a circuit board is produced by mounting the light-emitting element 5, the light-receiving element 6, the IC (not shown) for controlling the aforementioned storage device A (with reference to FIG. 1), the memory (not shown) for storing therein information such as a note written on part of the paper sheets 51 (with reference to FIG. 1) revealed within the frame of the aforementioned optical waveguide W (with reference to FIG. 1), the connecting module (not shown) for outputting the information to the reproducing terminal, and the like onto the flexible printed board 7.

The rectangular frame-shaped retainer plate 30 is prepared, as shown in plan view in FIG. 5(b). This

retainer plate 30 is in the form of the rectangular frame having one side 31 which is wider than the other sides. Examples of a material for the formation of this retainer plate 30 include metal, resin, glass, quartz and silicon. In particular, stainless steel is preferable in having a good ability to hold the planarity thereof. The retainer plate 30 has a thickness of approximately 0.5 mm, for example.

As shown in plan view in FIG. 6(a) and shown in sectional view (a sectional view taken along the line X4-X4 of FIG. 6(a)) in FIG. 6(b), the aforementioned light-emitting element 5 of the aforementioned circuit board is connected to the light-emitting cores 2a, and the aforementioned light-receiving element 6 is connected to the light-receiving cores 2b. In this state, the aforementioned optical waveguide W is affixed to a surface of the aforementioned retainer plate 30, and the aforementioned circuit board and the battery serving as a power source for this circuit board are fixed thereon. At this time, the aforementioned optical waveguide W is affixed to part of the surface of the aforementioned retainer plate 30 which is other than a strip-shaped portion 31a (with reference to FIG. 5(b)) along the outside edge of the aforementioned one wider side 31, and the aforementioned circuit board and the battery are fixed

(the aforementioned storage means C is fixed) to the aforementioned strip-shaped portion 31a. The reference numeral 8 in FIGS. 6(a) and (b) designates the portion which collectively shows the IC, the memory, the connecting module and the like in the aforementioned circuit board, and the aforementioned battery, as mentioned earlier.

Thereafter, as shown in sectional view in FIG. 7, the top surface of the aforementioned over cladding layer 3 except the lens portion 3a, and the fixed portions of the aforementioned circuit board and the battery are covered with the protective plate 40. Examples of a material for the formation of this protective plate 40 include resin, metal, glass, quartz, and silicon. The protective plate 40 has a thickness of approximately 0.5 mm, for example.

In this manner, the aforementioned storage device A is produced. The part of this storage device A corresponding to the aforementioned optical waveguide W, together with the retainer plate 30 and the protective plate 40 on the front and back surfaces thereof, is as thin as approximately 2 mm in total thickness, as mentioned above. The part of the storage device A where the storage means C including the aforementioned circuit board and the battery is fixed, together with the retainer plate

30 and the protective plate 40 on the front and back surfaces thereof, is as thin as approximately 3 mm in total thickness.

In the aforementioned embodiment, the storage device A is removable from the desk notepad tool 50. However, the storage device A may be used while being held attached to the desk notepad tool 50. Alternatively, the storage device A may be detached from the desk notepad tool 50 and used only when needed.

In the aforementioned embodiment, the rectangular frame-shaped optical waveguide W of the storage device A surrounds part of the paper sheets 51 of the desk notepad tool 50. However, the rectangular frame-shaped optical waveguide W of the storage device A may be configured to surround the entire paper sheets 51.

For the purpose of improving the light transmission efficiency within the frame of the rectangular frame-shaped optical waveguide W for the storage device A according to the aforementioned embodiment, the tips of the light-emitting cores 2a and the tips of the light-receiving cores 2b are formed as the lens portions, and the edge portion of the over cladding layer 3 covering the lens portions of the cores 2a and 2b is formed as the lens portion 3a. However, when the light transmission efficiency within the frame is sufficient,

the aforementioned lens portion(s) may be formed only in either the cores 2a and 2b or the over cladding layer 3, or may be formed in neither the cores 2a and 2b nor the over cladding layer 3. When the aforementioned lens portions are not formed, a separate lens element may be prepared and provided within the frame of the optical waveguide W.

Also in the aforementioned embodiment, the retainer plate 30 is provided on the back surface of the optical waveguide W to hold the planarity of the aforementioned optical waveguide W, and the protective plate 40 is provided on the front surface of the optical waveguide W to protect the optical waveguide W. However, when the holding of the planarity and the protection are sufficient, only one or neither of the retainer plate 30 and the protective plate 40 may be provided.

In the aforementioned embodiment, the retainer plate 30 and the protective plate 40 are provided also on the front and back surfaces of the aforementioned storage means C. However, when information is outputted by radio from the storage means C to the reproducing terminal and the aforementioned protective plate 40 is made of stainless steel, there is a danger that noise is produced in response to radio waves to result in the improper output of the information. It is therefore

preferable that the aforementioned protective plate 40 is made of resin such as polycarbonate.

Next, an inventive example of the present invention will be described. It should be noted that the present invention is not limited to the inventive example.

Example

<Material for Formation of Under Cladding Layer>

Component A: 75 parts by weight of an epoxy resin containing an alicyclic skeleton (EHPE 3150 manufactured by Daicel Chemical Industries, Ltd.).

Component B: 25 parts by weight of an epoxy-group-containing acrylic polymer (MARPROOF G-0150M manufactured by NOF Corporation).

Component C: four parts by weight of a photo-acid generator (CPI-200K manufactured by San-Apro Ltd.).

A material for the formation of an under cladding layer was prepared by dissolving these components A to C together with five parts by weight of an ultraviolet absorber (TINUVIN 479 manufactured by Ciba Japan K.K.) in cyclohexanone (a solvent).

<Material for Formation of Cores>

Component D: 85 parts by weight of an epoxy resin containing a bisphenol A skeleton (157S70 manufactured by Japan Epoxy Resins Co., Ltd.).

Component E: five parts by weight of an epoxy resin containing a bisphenol A skeleton (EPIKOTE 828 manufactured by Japan Epoxy Resins Co., Ltd.).

Component F: 10 parts by weight of an epoxy-group-containing styrenic polymer (MARPROOF G-0250SP manufactured by NOF Corporation).

A material for the formation of cores was prepared by dissolving these components D to F and four parts by weight of the aforementioned component C in ethyl lactate.

<Material for Formation of Over Cladding Layer>

Component G: 100 parts by weight of an epoxy resin having an alicyclic skeleton (EP4080E manufactured by ADEKA Corporation).

A material for the formation of an over cladding layer was prepared by mixing this component G and two parts by weight of the aforementioned component C together.

<Production of Optical Waveguide>

The material for the formation of the aforementioned under cladding layer was applied to a surface of a rectangular frame-shaped substrate made of stainless steel (having a thickness of 50 μm). Thereafter, a heating treatment was performed at 160°C for two minutes to form a photosensitive resin layer. Then, the aforementioned photosensitive resin layer was

exposed to irradiation with ultraviolet light at an integrated dose of 1000 mJ/cm^2. Thus, the rectangular frame-shaped under cladding layer having a thickness of 10 μm (with a refractive index of 1.510 at a wavelength of 830 nm) was formed.

Then, the material for the formation of the aforementioned cores was applied to a surface of the aforementioned rectangular frame-shaped under cladding layer. Thereafter, a heating treatment was performed at 170°C for three minutes to form a photosensitive resin layer. Next, exposure was performed at an integrated dose of 3000 mJ/cm^2 by the irradiation with ultraviolet light through a photomask (with a gap of 100 μm). Subsequently, a heating treatment was performed at 120°C for 10 minutes. Thereafter, development was performed using a developing solution (γ-butyrolactone) to dissolve away unexposed portions. Thereafter, a drying process was performed at 120°C for five minutes. Thus, the cores having a width of 30 μm and a height of 50 μm (with a refractive index of 1.570 at a wavelength of 830 nm) were patterned.

A rectangular frame-shaped light-transmissive mold for the formation of the over cladding layer was prepared. This mold includes a cavity having a mold surface complementary in shape to the surface of the over

cladding layer. The mold was placed on a molding stage, with the cavity positioned to face upward. Then, the cavity was filled with the material for the formation of the aforementioned over cladding layer.

Then, the cores patterned on the surface of the aforementioned under cladding layer were positioned relative to the cavity of the aforementioned mold. In that state, the aforementioned under cladding layer was pressed against the aforementioned mold, so that the aforementioned cores were immersed in the material for the formation of the aforementioned over cladding layer. In this state, exposure was performed at an integrated dose of 8000 mJ/cm^2 by irradiating the material for the formation of the aforementioned over cladding layer with ultraviolet light through the aforementioned mold. Thus, the rectangular frame-shaped over cladding layer was formed in which an inner peripheral edge portion of the rectangular frame was in the form of a convex lens portion. The convex lens portion had a substantially quadrantal curved lens surface (having a radius of curvature of 1.4 mm) as seen in sectional side view.

Next, the aforementioned over cladding layer together with the aforementioned substrate, the under cladding layer and the cores was removed from the aforementioned mold.

Then, the aforementioned substrate was stripped from the under cladding layer. This provided a rectangular frame-shaped optical waveguide (having a total thickness of 1 mm) including the under cladding layer, the cores, and the over cladding layer.

<Production of Storage Device>

Next, a flexible printed board was prepared, and a circuit board was produced by mounting a light-emitting element (SM85-2N001 manufactured by Optowell Co., Ltd.), a light-receiving element (S-10226 manufactured by Hamamatsu Photonics K.K.), a CMOS driving IC, a crystal oscillator, a memory for storing therein information written within the frame of the optical waveguide, a connecting module for connection to a reproducing terminal, and the like onto the flexible printed board. The aforementioned light-emitting element of this circuit board was connected to light-emitting ones of the cores, and the aforementioned light-receiving element was connected to light-receiving ones of the cores. Two coin-type lithium cells (CR1216 having a thickness of 1.6 mm, a diameter of 12.5 mm, and a voltage of 3 V) serving as a power source were connected to the aforementioned circuit board. A storage means including the circuit board and the coin-type lithium cells had a total thickness of 2 mm.

A rectangular frame-shaped retainer plate made of stainless steel (having a thickness of 0.5 mm) was prepared. The hollow frame of the retainer plate was in the form of a rectangle having a vertical dimension of 94.7 mm and a horizontal dimension of 125.7 mm. The rectangular frame included one wider side having a width of 25 mm, and three remaining sides having a width of 7 mm. The aforementioned rectangular frame-shaped optical waveguide was affixed to a portion of the surface of the aforementioned retainer plate which was outside the aforementioned hollow frame, and the aforementioned circuit board and the cells were fixed along an outside edge of the aforementioned one wider side. Thereafter, the top surface of the aforementioned over cladding layer except the lens portion, and the fixed portions of the aforementioned circuit board and the cells were covered with a protective plate made of polycarbonate (having a thickness of 0.5 mm). This provided a storage device. Part of this storage device corresponding to the optical waveguide, together with the retainer plate and the protective plate on the front and back surfaces thereof, had a total thickness of 2 mm. Part of the storage device where the aforementioned circuit board and the cells were fixed (corresponding to the storage means), together with the retainer plate and the protective plate on the front

and back surfaces thereof, had a total thickness of 3 mm.

<Production of Desk Notepad Device>

A desk notepad tool having paper sheets bound together was prepared, each of the paper sheets capable of being written upon with a writing implement. The aforementioned storage device was overlaid on the paper sheets to cause part of the aforementioned paper sheets to be revealed within the frame of the rectangular frame-shaped optical waveguide of the storage device.

<Operation Check of Desk Notepad Device>

A note was written on part of the paper sheets revealed within the frame of the aforementioned optical waveguide with a writing implement. Then, the aforementioned storage means and a personal computer were connected to each other with a micro USB cable. Information stored in the memory of the aforementioned storage means was reproduced using the personal computer. The result was that a note identical with that written on the paper sheets of the aforementioned desk notepad tool appeared on a display of the aforementioned personal computer. The aforementioned note was stored in PDF file format in the aforementioned memory.

Although a specific form of embodiment of the instant invention has been described above and

illustrated in the accompanying drawings in order to be more clearly understood, the above description is made by way of example and not as a limitation to the scope of the instant invention. It is contemplated that various modifications apparent to one of ordinary skill in the art could be made without departing from the scope of the invention which is to be determined by the following claims.

The desk notepad device is applicable to the process of storing information such as a note as electronic data therein at the same time that the information such as a note is written on a paper sheet of a desk notepad tool.

Claims

1. A desk notepad device comprising:

a desk notepad tool including paper sheets bound together, each of the paper sheets capable of being written upon with a writing implement;

a frame-shaped optical waveguide surrounding at least part of the paper sheets; and

a storage means for storing therein the path of movement of a tip of the writing implement as electronic data when a writing operation is performed on part of the paper sheets revealed within the frame of the optical waveguide with the writing implement,

wherein the optical waveguide is frame-shaped and includes first and second sections opposed to each other in the form of the frame, the first section including a plurality of light-emitting cores formed therein, the second section including a plurality of light-receiving cores formed therein, the cores having respective tips positioned on inner edges of the frame, the tips of the light-emitting cores and the tips of the light-receiving cores being opposed to each other.

2. The desk notepad device according to claim 1, wherein the optical waveguide and the storage means are integrally formed as a storage device, and the storage device is removable from the desk notepad tool.

3. The desk notepad device according to claim 1 or 2, wherein each of the tips of the light-emitting cores and the tips of the light-receiving cores is in the form of a lens portion.

4. The desk notepad device according to any one of claims 1 to 3, wherein an edge portion of an over cladding layer is formed so as to cover the tips of the light-emitting cores and the tips of the light-receiving cores, and the edge portion of the over cladding layer is in the form of a lens portion.

FIG. 1

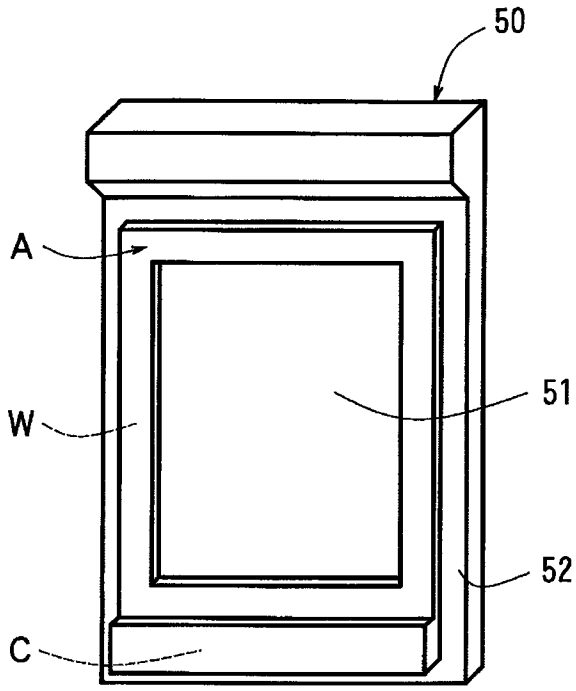


FIG. 2

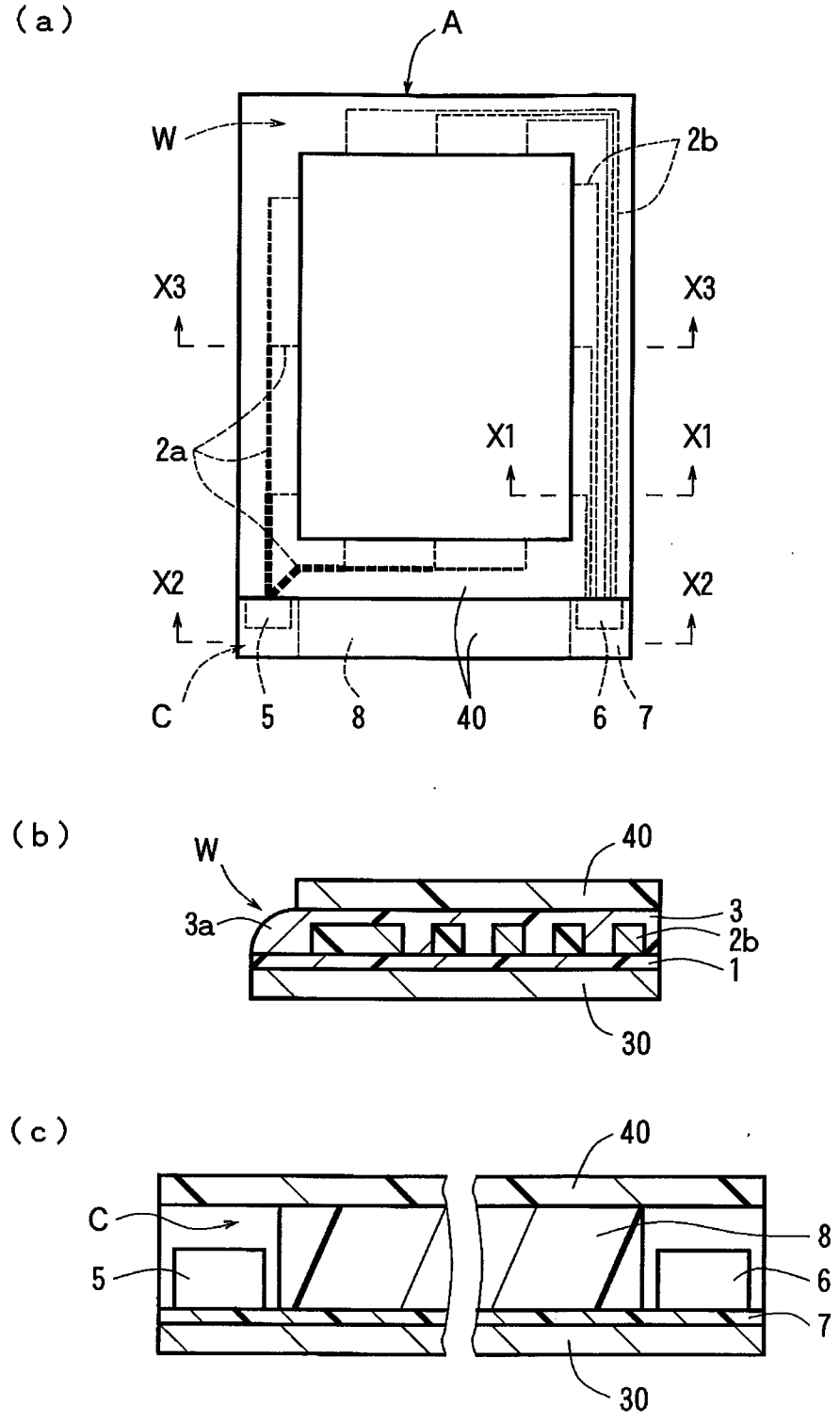


FIG. 3

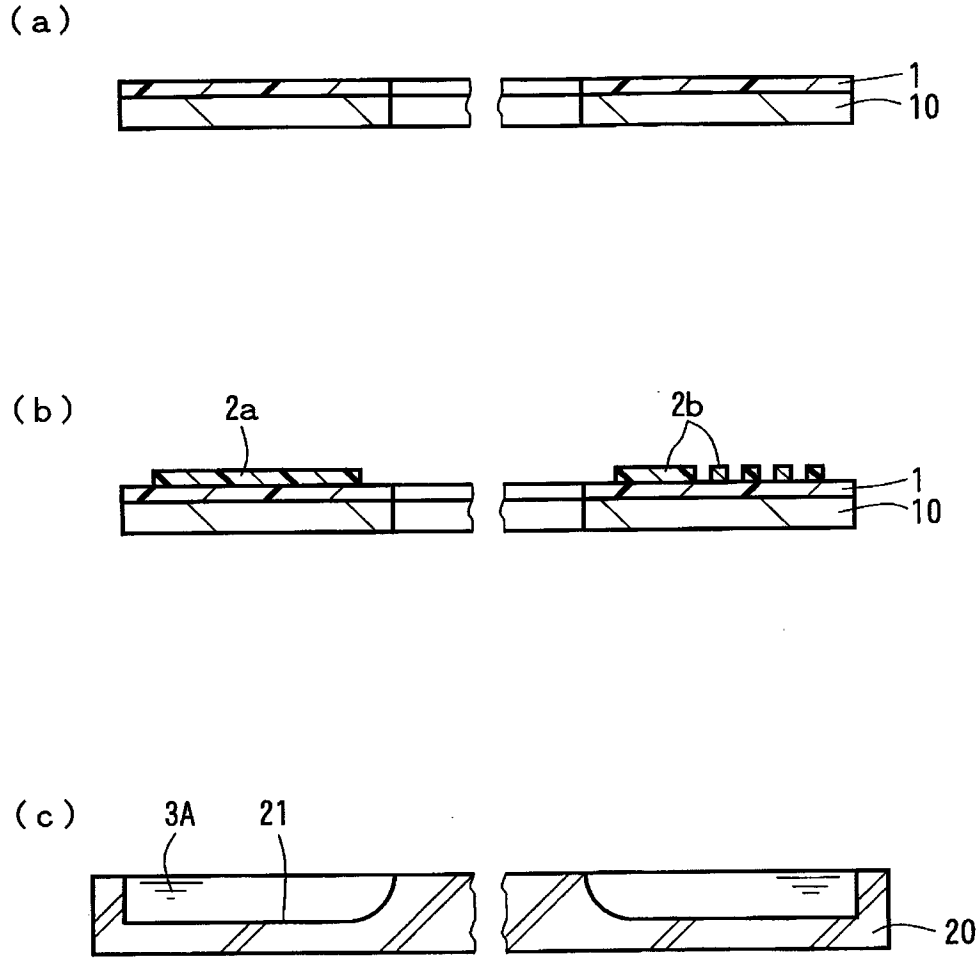


FIG. 4

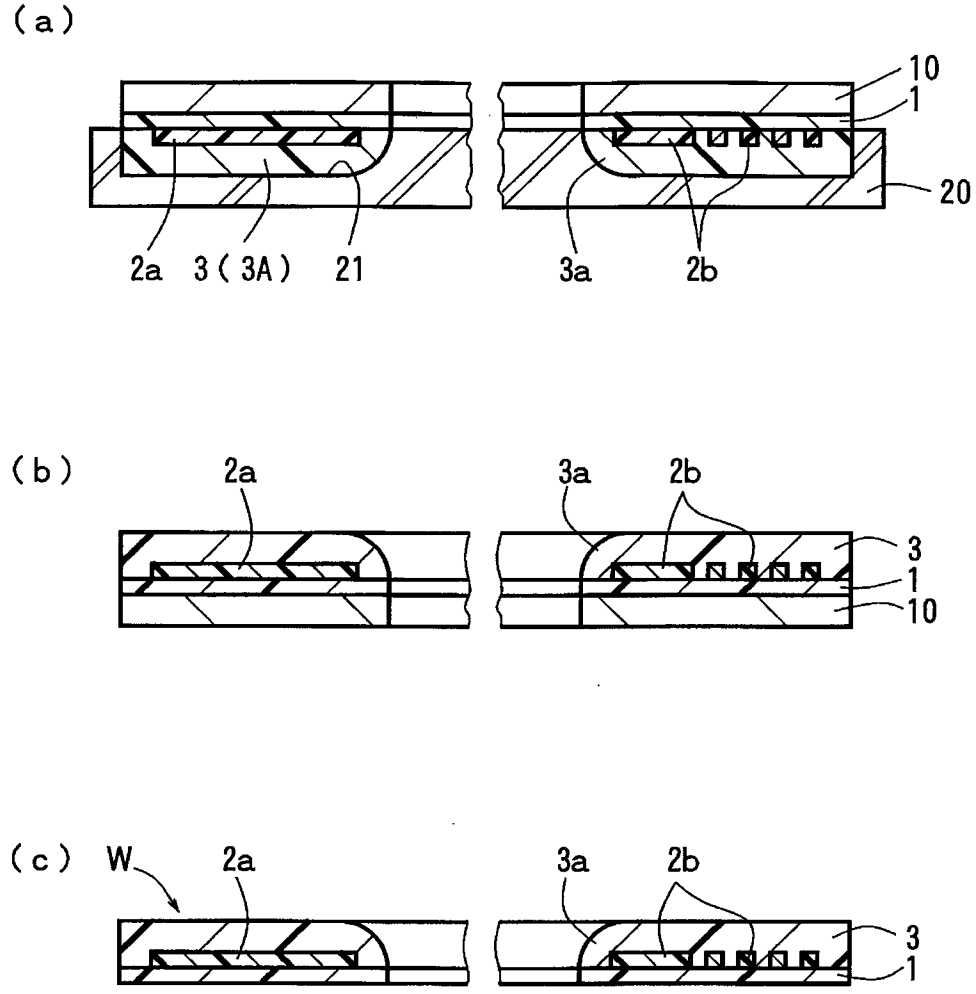
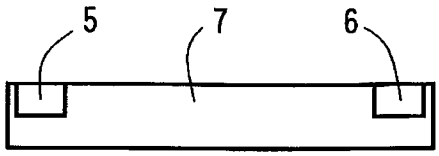


FIG. 5

(a)



(b)

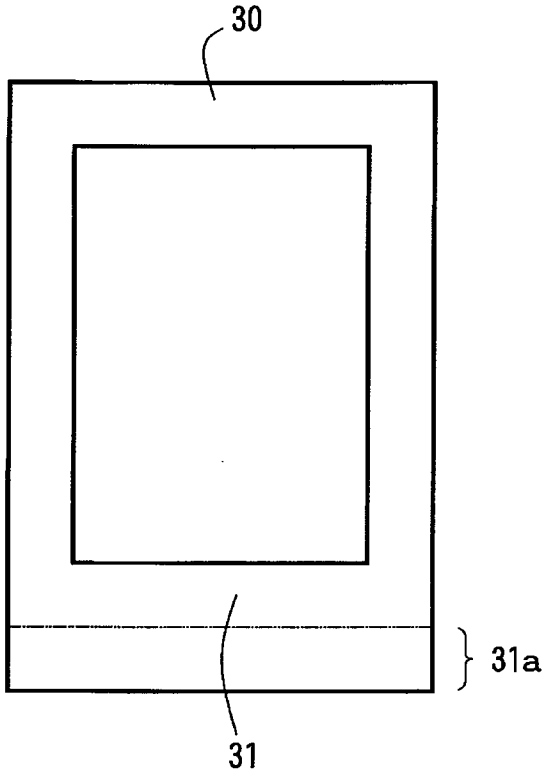


FIG. 6

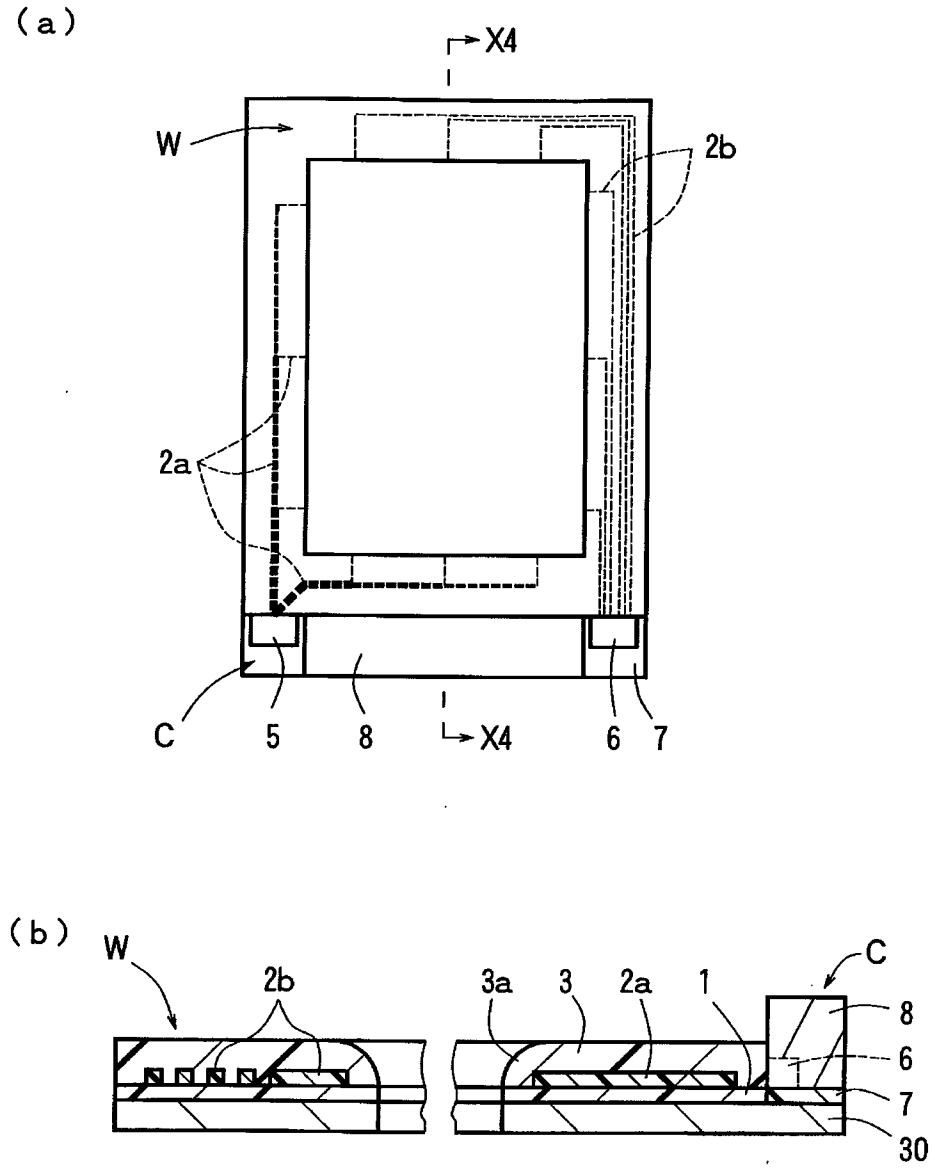
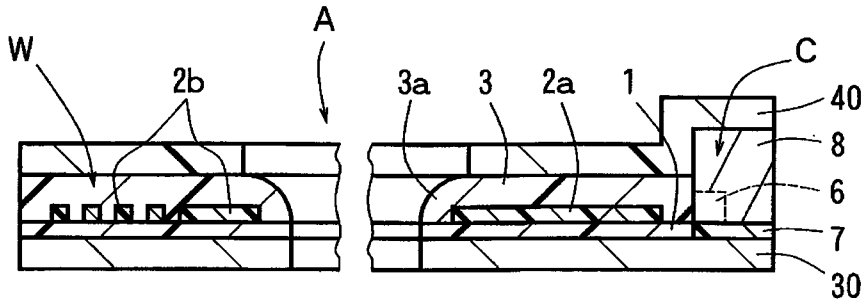


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2011/080579

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. G06F3/042(2006.01)i, B42D15/00(2006.01)i, G06F3/041(2006.01)i, G06F17/21(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)

Int.Cl. G06F3/042, B42D15/00, G06F3/041, G06F17/21

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

Published examined utility model applications of Japan 1922-1996
Published unexamined utility model applications of Japan 1971-2012
Registered utility model specifications of Japan 1996-2012
Published registered utility model applications of Japan 1994-2012

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.
Y	JP 2008-203431 A (NITTO DENKO CORPORATION) 2008.09.04, column【0012】-【0016】,Fig.1-3 & US 2008/0198144 A1 & EP 1959335 A2 & KR 10-2008-0077318 A & CN 101251622 A	1-4
Y	JP 2008-217179 A (PENTEL CO., LTD.) 2008.09.18, Whole document,Fig.1 (No Family)	1-4

☐ 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
02.04.2012	10.04.2012

Name and mailing address of the ISA/JP	Authorized officer
Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Hideki TANAKA Telephone No. +81-3-3581-1101 Ext. 3521

5E 3246