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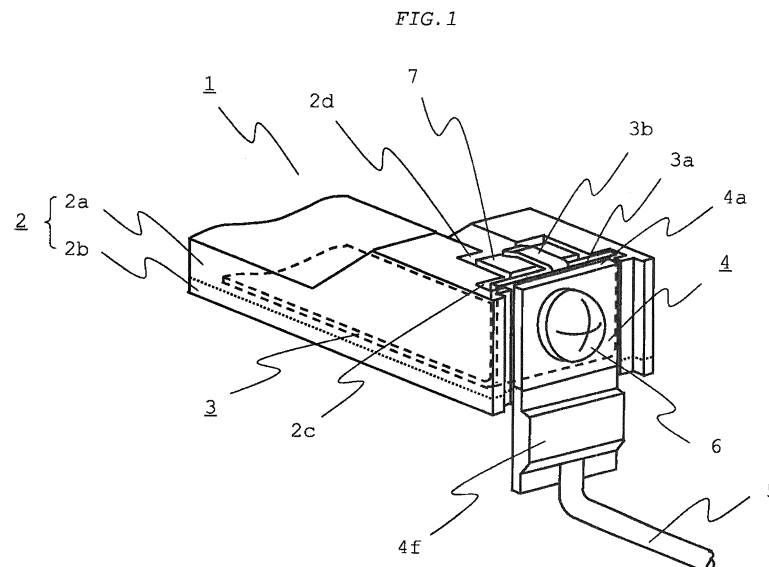
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(54) **STRUCTURE FOR CONNECTING WIRING CONDUCTOR**

(57) A connection structure of a wiring conductor is formed of: a case (2) of an electronic device; a plate-like wiring conductor (3) insert-molded in the case (2) using resins (2a) and (2b); a wiring terminal surface (3a) formed by bending a tip end of the wiring conductor (3); a hook-like protrusion (3b) provided to the wiring terminal surface (3a); a wiring terminal surface (4a) of an outside wiring terminal (4) fixed by bringing an edge into contact with

the hook-like protrusion (3b); a press-fit portion (4f) that bonds a flexible wiring (5) to the outside wiring terminal (4); and a bolt (6) and a nut (7) that fasten the wiring terminal surface (3a) and the wiring terminal surface (4a). When a plurality of wiring terminals are electrically interconnected, a positioning work becomes easier and hence working hours can be shorter.



Description

Technical Field

5 **[0001]** The present invention relates to a connection structure of a wiring conductor that electrically interconnects a plurality of wiring terminals of an electronic device.

Background Art

10 **[0002]** In a case where one wiring terminal and the other wiring terminal of an electronic device are connected, a structure typically used in the related art is to firmly fix the terminals by sandwiching the both terminals using a male screw (for example, a bolt) and a female screw (for example, a nut) so that the terminals are electrically and mechanically connected in a reliable manner. In such a structure, however, it is crucial to hold the female screw in a reliable manner when the male screw is fastened and the terminals cannot be connected satisfactorily unless the female screw is stopped from rotating and further the female screw is positioned accurately. Workability is therefore poor.

15 **[0003]** To overcome this problem, PTL 1 describes a power-supply supply terminal, an electronic component with a conductor member, and a structure body including the power-supply supply terminal. The power-supply supply terminal 2 is formed of a first terminal block 4 and a second terminal block 20. The first terminal block 4 is provided with a plurality of slits 6 to insert press-fit terminals 12 bent in the shape of a capital U and an insert-molded female screw 8. Also, a back wiring board (BWB) 44 has a conductor pattern for a supply of the power supply and a plurality of through-holes connected to the conductor pattern. The power-supply supply terminal 2 is installed to the BWB 44 by inserting press-fit pins 14 of the press-fit terminals 12 into the through-holes of the BWB 44. An outside wiring can be firmly fixed to the first terminal block 4 by screwing a male screw 16 into the female screw 8 with a press-fit terminal 18 attached to the tip end of the outside wiring sandwiched in between.

Citation List

Patent Literature

30 **[0004]** PTL 1: JP-A-2009-43730

Summary of Invention

Technical Problem

35 **[0005]** With the structure body in the related art including the power-supply supply terminal, positioning accuracy is required for the insert-molded female screw. Hence, there is a problem that component dimensional accuracy and attachment accuracy need to be enhanced. Further, although the female screw itself is fixed in a reliable manner, workability has a problem. The structure body in the related art therefore has another problem that operational costs are increased as working hours become longer.

40 **[0006]** The invention was devised to solve the problems discussed above, and has an object to provide a connection structure of a wiring conductor with which working hours can be shorter by making a positioning work easier when a plurality of wiring terminals are electrically interconnected.

Solution to Problem

45 **[0007]** In order to solve the problems, a connection structure of a wiring conductor of the invention is a connection structure of a wiring conductor that electrically interconnects bonding surfaces of wiring terminals of a plurality of wiring conductors using a fastening member, which is characterized in that at least one wiring terminal is provided with a hook-like protrusion in an edge of the bonding surface, and that the other wiring terminal or the fastening member is pressed and locked by the hook-like protrusion.

Advantageous Effects of Invention

55 **[0008]** According to the connection structure of the wiring conductor of the invention, by providing the hook-like protrusion to the edge of the bonding surface of at least one wiring terminal, a positioning mechanism can be simpler when the wiring terminals are interconnected. Hence, not only can assembling workability be enhanced, but also dimensional accuracy is not required for the wiring terminals. It thus becomes possible to provide the connection structure at lower

costs.

Brief Description of Drawings

[0009]

[Fig. 1] Fig. 1 is a schematic perspective view showing a major portion of a connection structure of a wiring conductor according to a first embodiment of the invention.

[Fig. 2] Fig. 2 is an exploded perspective view of the connection structure of the wiring conductor of Fig. 1.

[Fig. 3] Fig. 3 is a top view with a cross section taken on the line A-A of the connection structure of the wiring conductor of Fig. 1.

[Fig. 4] Fig. 4 is a partial view of a bonding surface portion of a wiring terminal of Fig. 1.

[Fig. 5] Fig. 5 is a schematic perspective view showing a major portion of another example of the connection structure of the wiring conductor according to the first embodiment of the invention.

[Fig. 6] Fig. 6 is a schematic perspective view showing a major portion of a connection structure of a wiring conductor according to a second embodiment of the invention.

[Fig. 7] Fig. 7 is a top view with a cross section taken on the line B-B of the connection structure of the wiring conductor of Fig. 6.

[Fig. 8] Fig. 8 is a schematic perspective view showing a major portion of another example of the connection structure of the wiring conductor according to the second embodiment of the invention.

Description of Embodiments

[0010] Hereinafter, a connection structure of a wiring conductor according to embodiments of the invention will be described with reference to Fig. 1 through Fig. 8.

First Embodiment

[0011] Fig. 1 is a schematic perspective view showing a major portion of a connection structure of a wiring conductor of a first embodiment. Fig. 2 is an exploded perspective view of the connection structure of the wiring conductor. Fig. 3 is a top view with a cross section taken on the line A-A of the connection structure of the wiring conductor. Also, Fig. 4 is a partial view of a bonding surface portion of a wiring terminal.

[0012] As are shown in Fig. 1 and Fig. 2, a connection structure 1 of a wiring conductor of the first embodiment is formed of a case 2 of an electronic device, a plate-like wiring conductor 3 (hereinafter, referred to as the wiring conductor) insert-molded in the case 2 using resins 2a and 2b, a bonding surface 3a of a wiring terminal (hereinafter, referred to as the wiring terminal surface) formed by bending a tip end of the wiring conductor 3, a concave portion 2c provided to the case 2 so as to hold and store the wiring terminal surface 3a, a hook-like protrusion 3b provided to an edge of the wiring terminal surface 3a by bending, a wiring terminal surface 4a of an outside wiring terminal 4 oppositely fixed to the wiring terminal surface 3a, a press-fit portion 4f that bonds a flexible wiring 5 to the outside wiring terminal 4, and a bolt (male screw) 6 and a nut (female screw) 7 pressed and locked by the hook-like protrusion 3b, which are a fastening member that bonds the wiring terminal surface 3a and the wiring terminal surface 4a. Also, the case 2 is provided with a concave portion 2d to store the nut 7. In the exploded view of the connection structure 1 of the wiring conductor of Fig. 2, a major portion of the case 2 relevant to the invention alone is shown for ease of description, and other wiring conductors and structure bodies are omitted. Also, the case 2 in which is embedded the wiring conductor 3 is shown by dividing the case 2 to the resin 2a in an upper part and the resin 2b in a lower part for ease of description. However, the case 2 is actually formed in such a manner that the resins 2a and 2b wrap the wiring conductor 3 by insert-molding and the resins 2a and 2b are indistinguishable.

[0013] A function and an effect of the connection structure of the wiring conductor of the first embodiment will now be described. As is shown in the schematic perspective view of Fig. 1 and the exploded perspective view of Fig. 2, the wiring terminal surface 4a of the outside wiring terminal 4 to which is bonded the flexible wiring 5 by the press-fit portion 4f is abutted against the wiring terminal surface 3a exposed from the case 2. The bolt 6 is inserted through a bonding hole 4h of the wiring terminal surface 4a and a bonding hole 3h of the wiring terminal surface 3a and screwed into the nut 7 installed in the concave portion 2d in advance. The wiring terminal surface 4a and the wiring terminal surface 3a are thus bonded to each other. In this instance, the nut 7 is locked by being softly pressed by the hook-like protrusion 3b of the wiring terminal surface 3a. Accordingly, the nut 7 is substantially positioned and at the same time the nut 7 is prevented from rotating while the bolt 6 is screwed therein. The need to keep pressing the nut 7 during a work of bonding the wiring terminals to each other is therefore eliminated. Also, the wiring conductor 3 and the flexible wiring 5 can be electrically connected with good work efficiency. Fig. 3 shows the top view (A) and the cross section (B) taken on the

line A-A when the connection is completed.

[0014] In Fig. 1 through Fig. 3, the wiring terminal surface 3a of the wiring conductor 3 is stored in the concave portion 2c of the case 2 with a clearance in between. However, the wiring terminal surface 3a may be of a structure by which the wiring terminal surface 3a is fixed by insert-molding using resin except for a portion bonded to the wiring terminal surface 4a of the outside wiring terminal 4. Also, the concave portion 2d provided to the case 2 so as to store the nut 7 therein has a clearance large enough to insert and move the nut 7. Also, as has been described above, it is sufficient that the hook-like protrusion 3b can press the nut 7 softly so that the nut 7 does not come out of the concave portion 2d and strength is not required. Hence, the hook-like protrusion 3b can be narrow and therefore can be processed easily. Further, it is necessary to position the bolt 6 with respect to the screw hole of the nut 7 when the bolt 6 is fastened by inserting the bolt 6 through the bonding hole 4h and the bonding hole 3h and screwing the bolt 6 into the screw hole of the nut 7. Herein, because the nut 7 is not fixed in the concave portion 2d and in a loose-fit state, the nut 7 can be fine-tuned so that the center thereof falls on a predetermined position when the bolt 6 is inserted. Hence, it becomes easy to insert the bolt 6 into the screw hole of the nut 7 and positional accuracy as to where the nut 7 is installed is not required.

[0015] Also, as is shown in Fig. 4, notch portions 3k are provided to the edge of the wiring terminal surface 3a at the bottom where the hook-like protrusion 3b is formed. Owing to this configuration, there can be achieved an advantage that not only is the hook-like protrusion 3b bent easily, but also the occurrence of strain in the wiring terminal surface 3a and the hook-like protrusion 3b is prevented during the processing.

[0016] The first embodiment above has described a case where the wiring conductor is embedded in the case. However, a connection structure 10 of the wiring conductor is also applicable to a case where a wiring conductor 13 is provided on a wiring board 12 as in another example of the first embodiment shown in Fig. 5. Herein, a wiring terminal surface 13a of the wiring conductor 13 processed so as to have an air gap between the self and the wiring board 12 and the outside wiring terminal 4 are connected. As in the first embodiment above, hook-like protrusions 13b are provided to front and rear edges of the wiring terminal surface 13a (the hook-like protrusion 13b in the rear edge is hidden behind the outside wiring terminal 4), and the nut 7 is pressed softly by these hook-like protrusions 13b. Then, by fastening the bolt 6 with the nut 7 by screwing the former into the latter, the wiring conductor 13 on the wiring board 12 and the outside wiring terminal 4 are electrically connected. It is sufficient for the wiring conductor to be thick enough to self-stand and bend. Hence, this embodiment is particularly effective when applied to a wiring conductor in a power-supply system, which is thick because of a need to flow a large current.

[0017] As has been described, according to the connection structure of the wiring conductor of the first embodiment, for the connection between the wiring terminal of the wiring conductor and the outside wiring terminal to which the flexible wiring is press-fit, by providing the hook-like protrusion to the edge of the wiring terminal surface of the wiring conductor and by pressing and locking the nut, which is the fastening member, with the hook-like protrusion, the need for positioning accuracy of the nut can be eliminated when the bolt is inserted and screwed into the nut. A fastening and bonding work therefore becomes easier. Hence, there can be achieved a significant advantage that work efficiency is enhanced and component costs and operational costs can be reduced.

Second Embodiment

[0018] Fig. 6 is a schematic perspective view showing a major portion of a connection structure of a wiring conductor of a second embodiment. Fig. 7 is a top view with a cross section taken along the line B-B of the connection structure of the wiring conductor. A difference from the connection structure of the wiring conductor of the first embodiment above is that in contrast to the first embodiment above in which one wiring terminal is a wiring terminal provided to the case or the wiring conductor on the wiring board and the other wiring terminal is a wiring terminal of the outside wiring terminal to which the flexible wiring is connected and these wiring terminals are interconnected, wiring terminals provided to wiring conductors on two wiring boards are interconnected in the second embodiment.

[0019] As is shown in Fig. 6, in a connection structure 20 of the wiring conductor of the second embodiment, wiring conductors 23 and 33 are provided on two wiring boards 22 and 32, respectively, and wiring terminal surfaces 23a and 33a are provided by bending tip ends of the wiring conductors 23 and 33, respectively, upright. Hook-like protrusions 23b and 33b are provided to edges of the wiring terminal surfaces 23a and 33a, respectively. By engaging the hook-like protrusions 23b and 33b with each other when the wiring terminal surface 23a and the wiring terminal surface 33a are abutted against and bonded to each other, the wiring terminal surface 23a and the wiring terminal surface 33a are pressed and locked and therefore substantially positioned. Normally, when the wiring terminal surface 23a and the wiring terminal surface 33a are bonded, it is difficult to position the one with respect to the other unless a specific tool is used. However, by providing the hook-like protrusions 23b to a plurality of points in the edges of the wiring terminal surfaces 23a and suppressing movements of the other wiring terminal surface using the hook-like protrusions 23b, positioning can be performed easily. Then, the bolt 6 is inserted into the bonding hole (hidden in the drawing) of the wiring terminal surface 23a and screwed into the female screw 8 provided to the wiring terminal surface 33a by burring. The wiring terminal surface 23a and the wiring terminal surface 33a are thus bonded. Accordingly, as in the first embodiment above,

it becomes possible to interconnect the wiring conductors provided on the wiring boards. The above described a case where the hook-like protrusions 23b and 33b are extended by bending from the edges of the wiring terminal surfaces 23a and 33a, respectively. It should be appreciated, however, that the hook-like protrusions may be extended from one wiring terminal surface alone.

[0020] As has been described, it becomes possible to suppress all movements of the both wiring terminal surfaces to be connected by a plurality of the hook-like protrusions. Hence, because there is no need to use tools and to perform positioning with a high degree of accuracy, the assembling workability can be enhanced.

[0021] The second embodiment has described a case where the wiring conductors are provided on the wiring boards. However, according to another example of the second embodiment shown in Fig. 8, a connection structure 40 of a wiring conductor has wiring terminal surfaces 43a and 53a formed in a convex shape by bending to be parallel to wiring conductors 43 and 53, respectively. Herein, the wiring terminal surface 43a of the wiring conductor 43 on the wiring board 42 and the wiring terminal surface 53a of the wiring conductor 53 on the wiring board 52 are connected. Two hook-like protrusions 43b are provided to an edge of the wiring terminal surface 43a and the nut 7 is pressed softly by one hook-like protrusion 43b. Also, the wiring terminal surface 53a is pressed and locked as the other hook-like protrusion 43b and the edge of the wiring terminal surface 53a come into contact with each other. The wiring terminal surface 53a is thus substantially positioned and fixed. Then, by fastening the bolt 6 with nut 7 by screwing the former into the latter, the wiring conductor 43 on the wiring board 42 and the wiring conductor 53 on the wiring board 52 are electrically connected.

[0022] The above has described a case with reference to Fig. 8 where the wiring terminal surfaces 43a and 53a are formed in a convex shape by bending so as to be parallel to the wiring conductors 43 and 53, respectively. However, the wiring conductors can be electrically interconnected in a case where one wiring terminal surface is bent upright with respect to the wiring conductor and the wiring boards are installed perpendicularly to each other. Also, even in a case where one wiring conductor is provided to the case of the electronic device and the other wiring conductor is provided on the wiring board, it is also possible to interconnect these wiring conducts.

[0023] The female screw used in the second embodiment can be a nut as in the first embodiment above or, a method of directly applying screw-cutting to the wiring terminal surface by burring as has been described above and a method of embedding a helical-insert screw can be used as well.

[0024] As has been described, the connection structure of the wiring conductor of the second embodiment is for a case where wiring conductors provided to the case of the electronic device or on the wiring boards are interconnected, and by providing the hook-like protrusions to the edge of the wiring terminal surface of the wiring conductor, and by pressing and locking the other wiring terminal surface by the hook-like protrusions, the bolt is screwed into the nut, both of which are a fastening member. Hence, positional accuracy of the wiring terminal surfaces with respect to each other is not required, and a fastening and bonding work becomes easier. Accordingly, there can be achieved a significant advantage that work efficiency is enhanced and component costs and operational costs can be reduced.

[0025] The embodiments above have described cases where the wiring terminal surfaces are bonded and electrically connected to each other by screwing the bolt into the nut. However, the invention is not limited to the case of fastening the wiring terminal surfaces by screwing. For example, in a case where the wiring terminal surfaces are bonded by welding, the invention can be also used to temporarily fix the wiring terminal surfaces until welding is applied. Further, even in a case where the wiring terminal surfaces are connected using another component, such as a clip, the invention can be used to temporarily fix the wiring terminal surfaces as well. Furthermore, by forming the tip end of the hook-like protrusion into a fork shape divided to a plurality of branches, the hook-like protrusions can abut against the edge of the other wiring terminal surface at more points and can thereby fix the wiring terminal surface firmly.

[0026] The respective embodiments above can be combined without any restriction or the respective embodiments can be modified or omitted as the need arises within the scope of the invention.

[0027] In the respective drawings, the same reference numerals denote same or equivalent portions.

Reference Signs List

[0028]

1, 10, 20, and 40:	connection structure of wiring conductor
2:	case
3, 13, 23, 33, 43, and 53:	wiring conductor
3a, 13a, 23a, 33a, 43a, and 53a:	wiring terminal surface
3b, 13b, 23b, 33b, 43b:	hook-like protrusion
3k:	notch portion
4:	outside wiring terminal
4a:	wiring terminal surface

5:	flexible wiring
6:	bolt
7:	nut
8:	female screw provided by burring
5 12, 22, 32, 42, and 52:	wiring board

Claims

- 10 1. A connection structure of a wiring conductor that electrically interconnects bonding surfaces of wiring terminals of a plurality of wiring conductors using a fastening member, **characterized in that:**
- at least one wiring terminal is provided with a hook-like protrusion in an edge of the bonding surface; and the other wiring terminal or the fastening member is pressed and locked by the hook-like protrusion.
- 15 2. The connection structure of the wiring conductor according to claim 1, **characterized in that:**
- at least the one wiring conductor is integrally molded with a case of an electronic device.
- 20 3. The connection structure of the wiring conductor according to claim 1, **characterized in that:**
- at least the one wiring conductor is provided on a wiring board.
- 25 4. The connection structure of the wiring conductor according to any one of claim 1 through claim 3, **characterized in that:**
- the fastening member includes a bolt and a nut.
- 30 5. The connection structure of the wiring conductor according to any one of claim 1 through claim 4, **characterized in that:**
- the hook-like protrusion is formed of the edge of the bonding surface of the wiring terminal by bending.
- 35 6. The connection structure of the wiring conductor according to claim 5, **characterized in that:**
- a notch portion is provided to the edge of the bonding surface of the wiring terminal at a bottom where the hook-like protrusion is provided.

FIG. 1

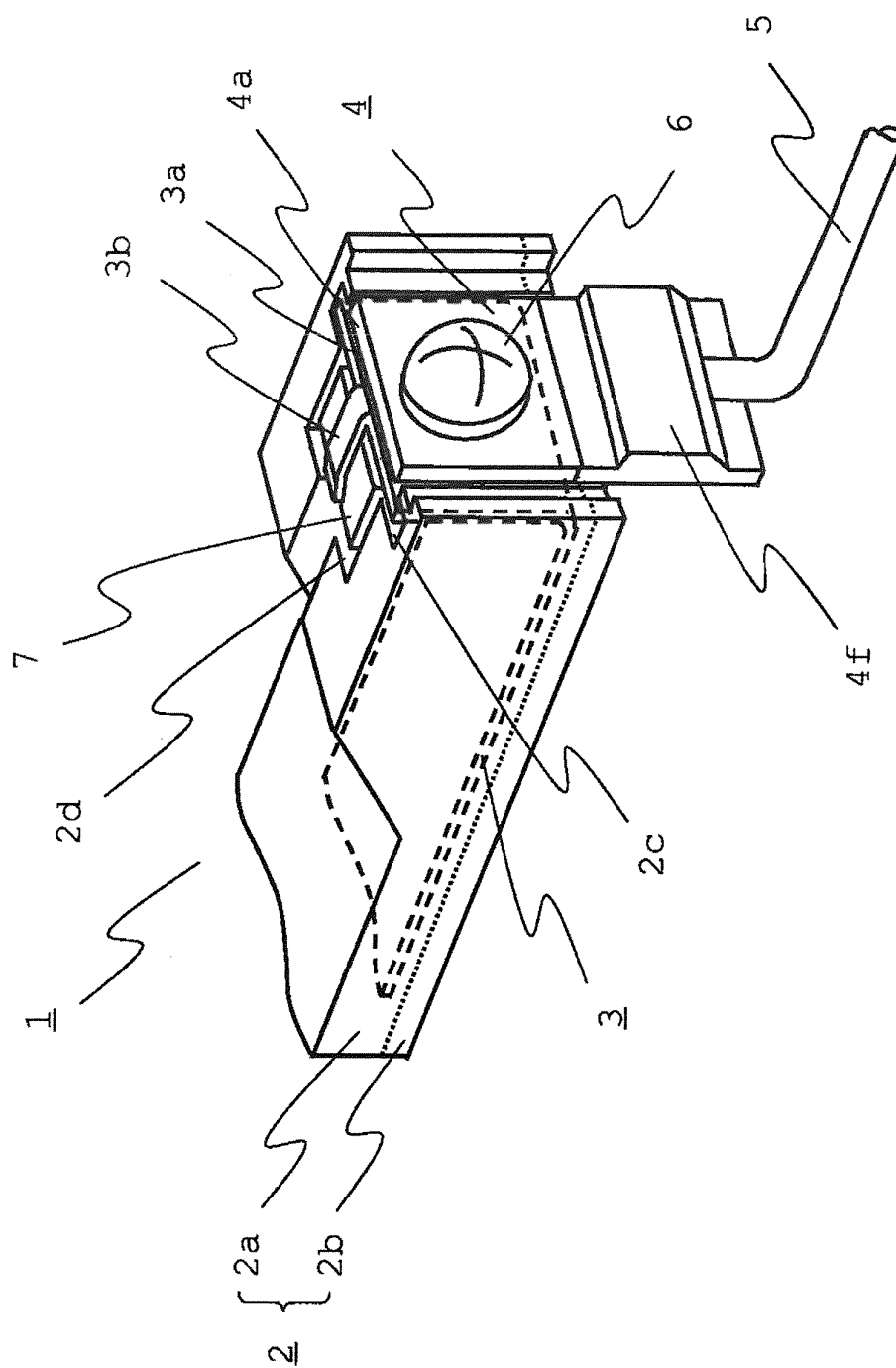


FIG. 2

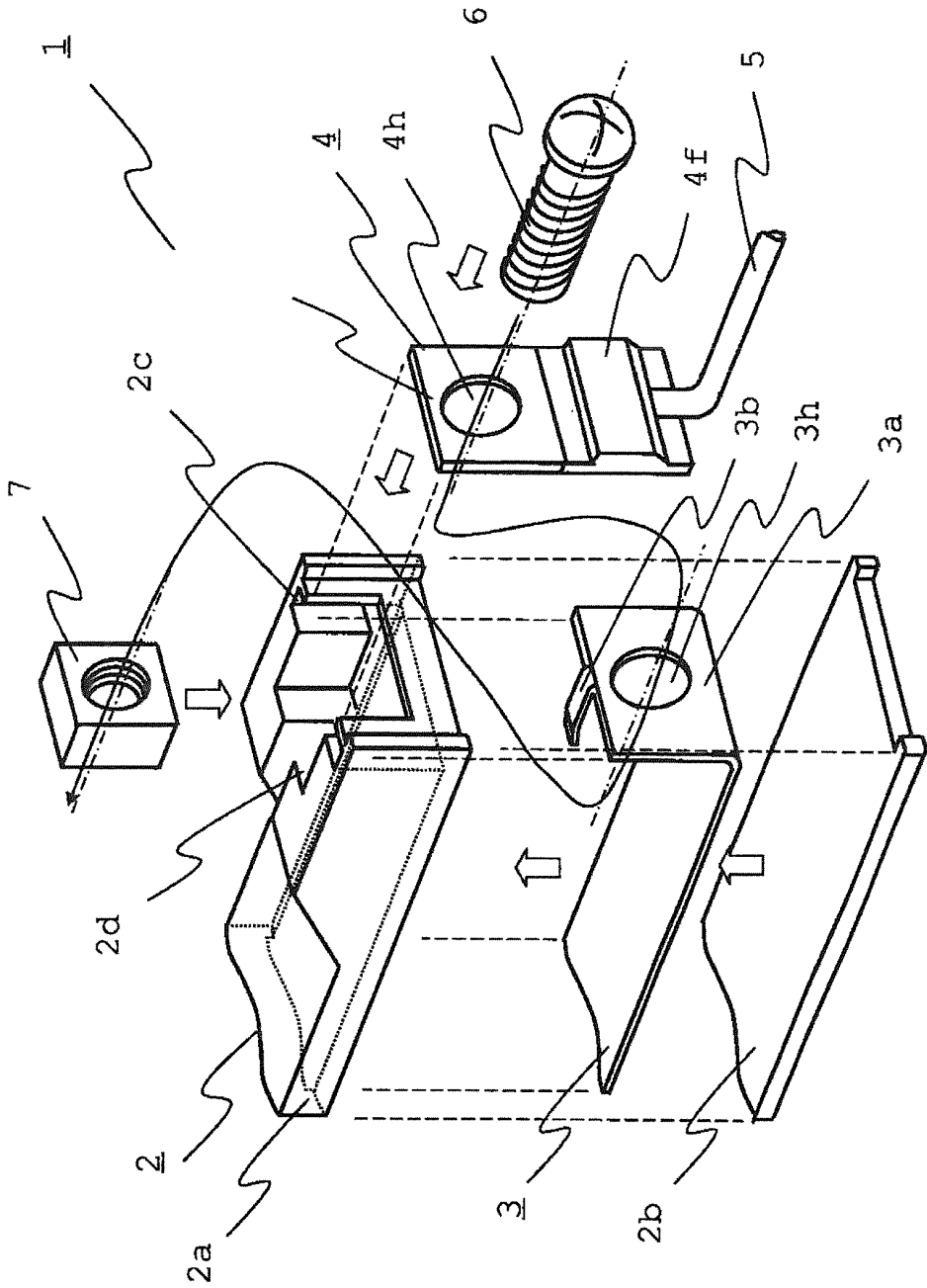


FIG. 3

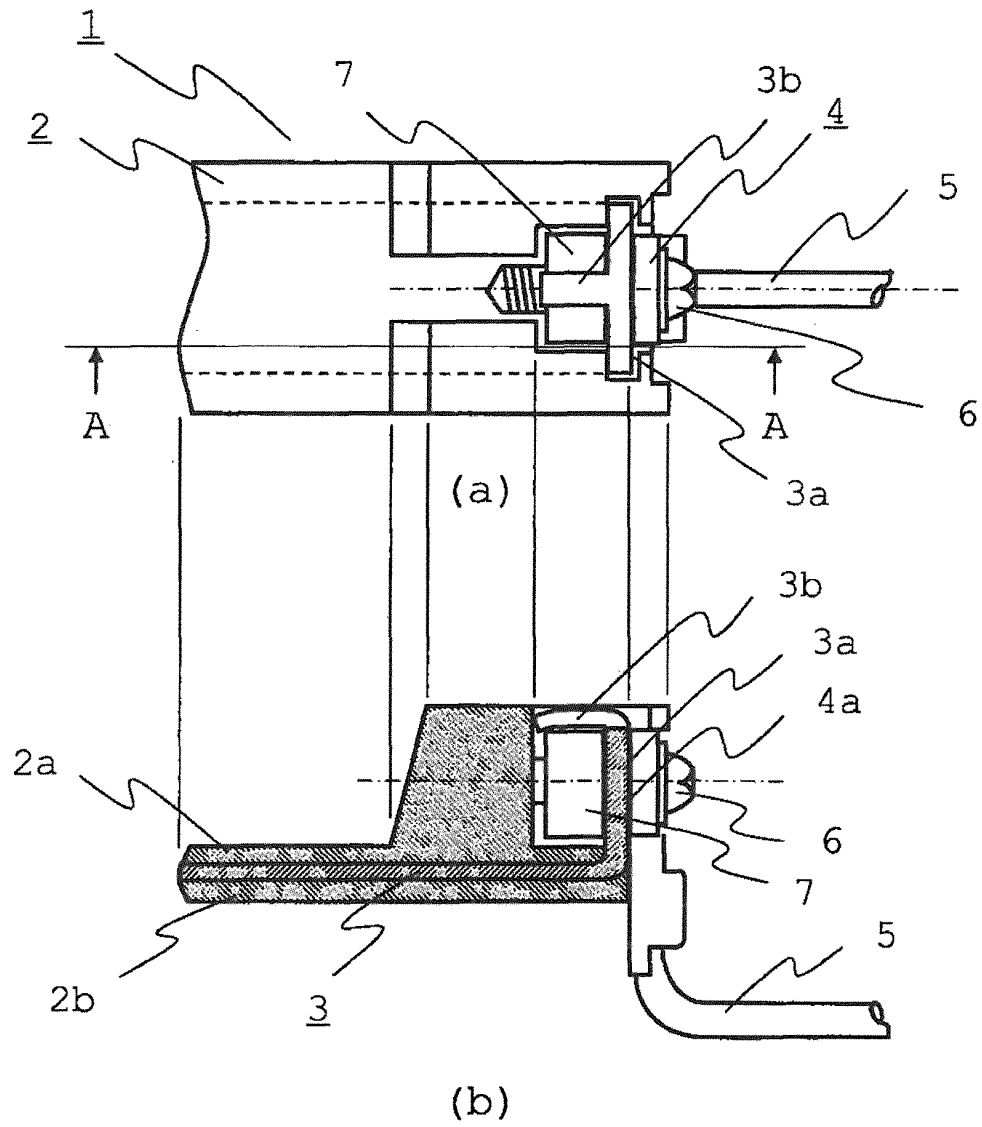
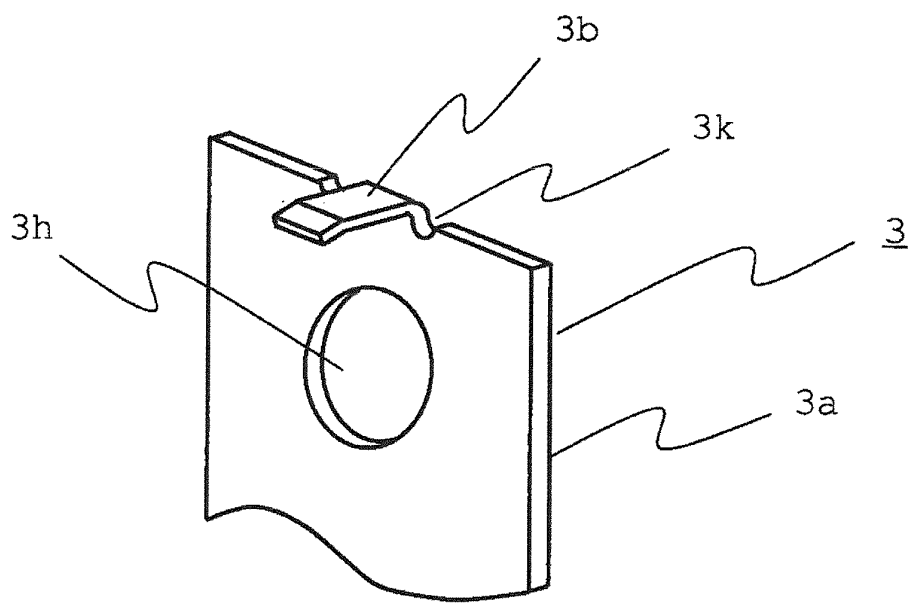


FIG. 4



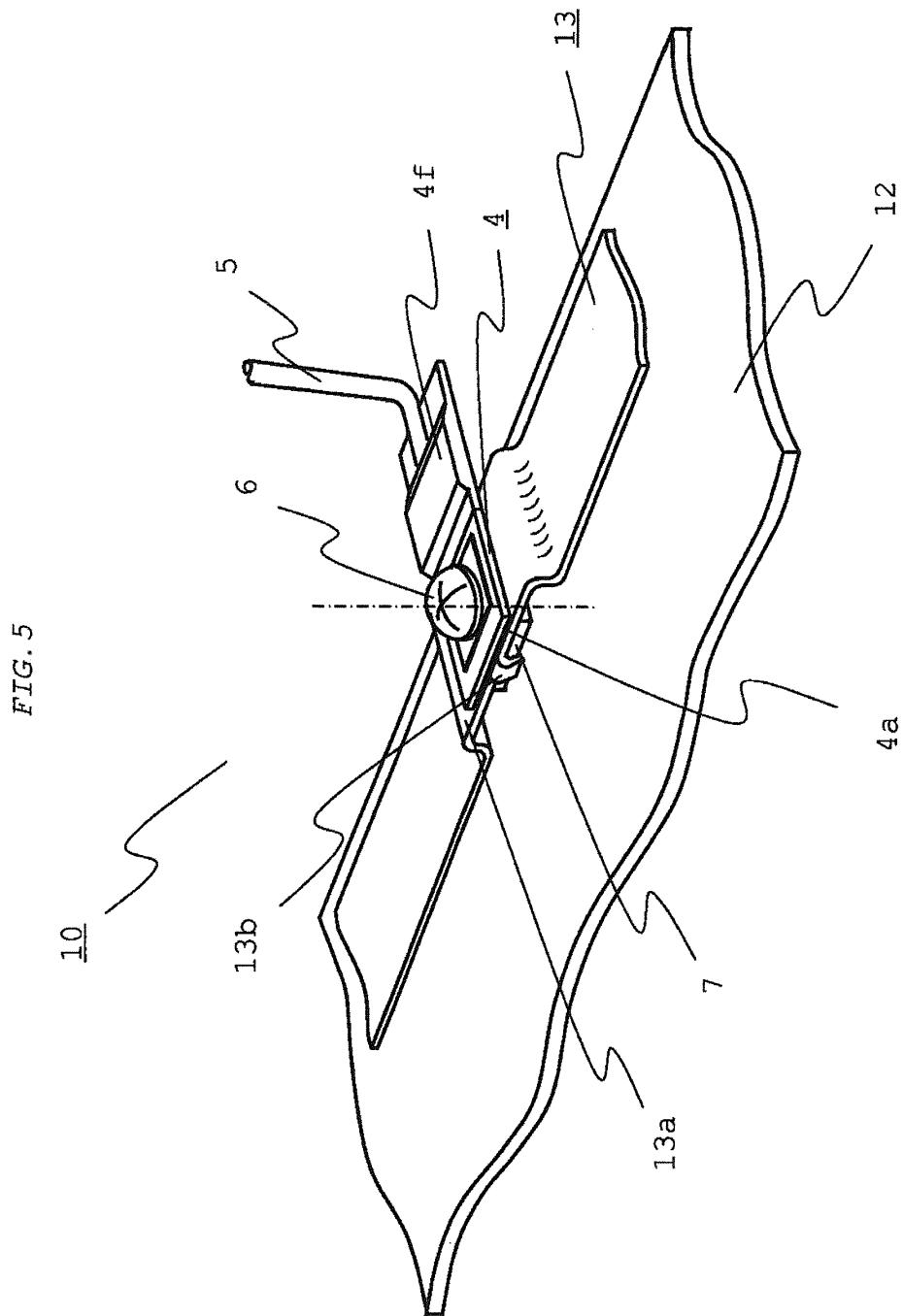
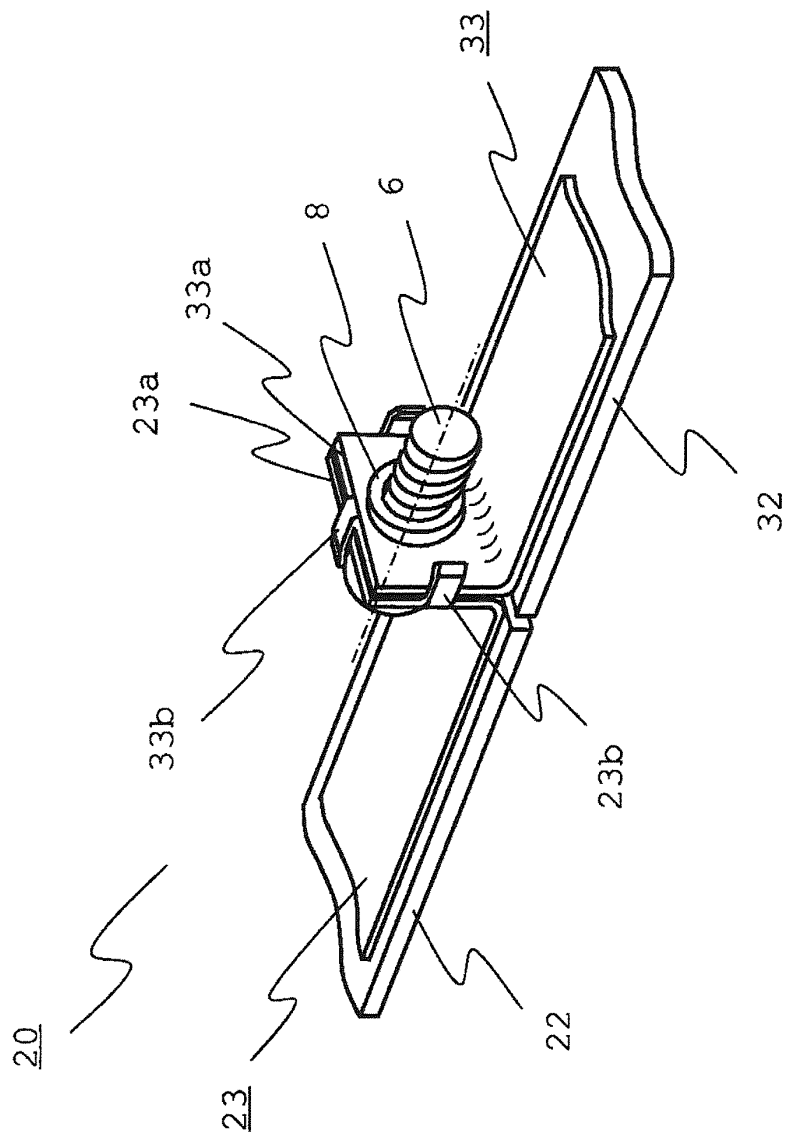


FIG. 6



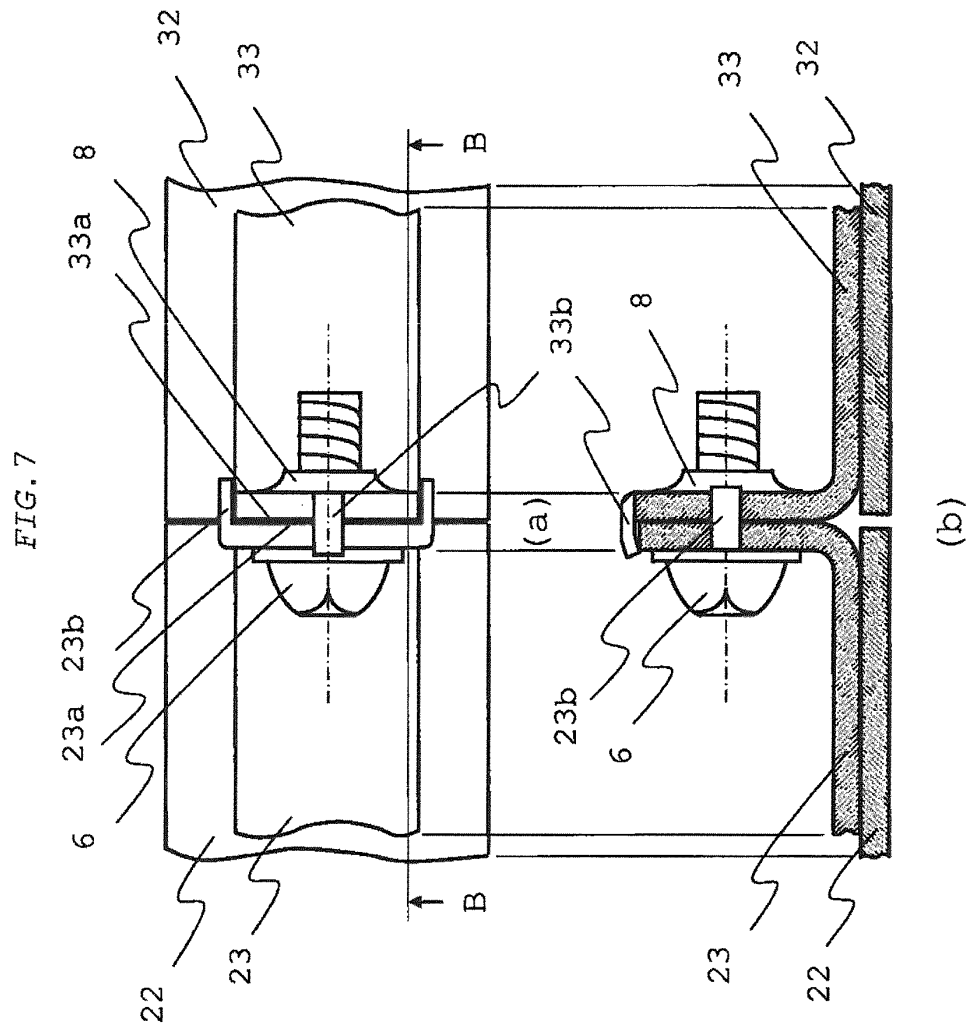
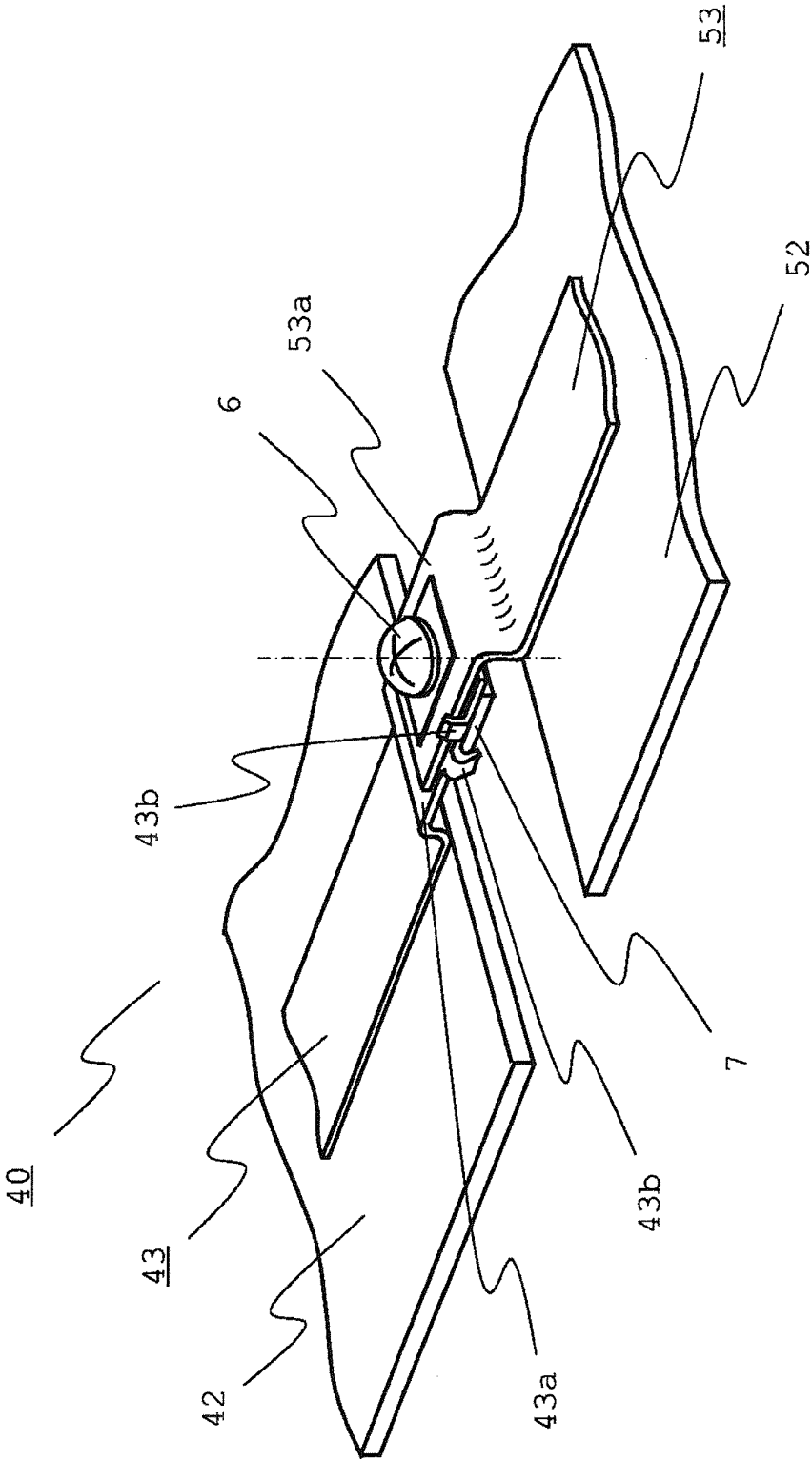


FIG. 8



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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/073380

A. CLASSIFICATION OF SUBJECT MATTER

H01R9/22(2006.01) i

10

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)

H01R9/22

15

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 1996-2011

Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

25

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2010-27410 A (U, Shan Tsai), 04 February 2010 (04.02.2010), entire text; all drawings (Family: none)	1-6

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☐ Further documents are listed in the continuation of Box C.
☐ See patent family annex.

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* 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

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Date of the actual completion of the international search
01 November, 2011 (01.11.11)Date of mailing of the international search report
15 November, 2011 (15.11.11)

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Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/073380

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

The invention of claim 1 does not have a special technical feature in the light of the contents disclosed in JP 2010-27410 A (U, Shan Tsai), 4 February 2010 (04.02.2010), entire text, all drawings, (Family: none) which is cited in this international search report.

Consequently, any same or corresponding special technical feature cannot be found between the following two groups of inventions.

- (1) claims 1, 2 and 4-6
- (2) claim 3

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

Form PCT/ISA/210 (continuation of first sheet (2)) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009043730 A [0004]