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(54) Title: PANEL ASSEMBLY

(57) Abstract: The present invention discloses a panel assembly for use in building a furniture unit, the assembly comprising a first panel (1) having at least one projecting tongue (2) for slidably engaging with, and being retained in, a complementary groove (3) formed in a second panel (4), wherein the tongue (2) is provided with a laminate (5) on at least one surface of the tongue (2) for providing improved structural integrity to the tongue (2) while nevertheless allowing relative sliding movement between the tongue (2) and the groove (3).

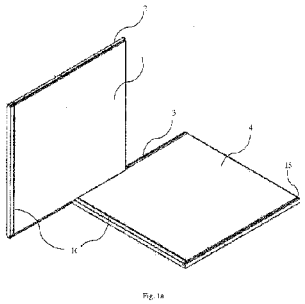

Fig. 1a

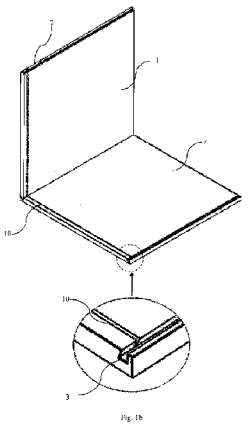

Fig. 1b

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PANEL ASSEMBLY

FIELD OF INVENTION

The invention relates to a panel assembly for use in building a furniture unit. More particularly, the invention relates to a panel assembly with reinforced connectors for easy assembly into different furniture configurations.

BACKGROUND OF THE INVENTION

Conventionally, a furniture unit is assembled from a plurality of panels with each panel having a hole which aligns with a corresponding hole of another panel when the panels are assembled together. The aligned holes may have a fastening means insertion therethrough for ensuring the panels are secured firmly as an assembly to form the furniture unit. However, such furniture unit is not desirable as it would often require more than one person to assemble the furniture unit. Therefore, such inconvenience causes consumers to gradually shift from conventional furniture unit to furniture unit which does not require fasteners or tools and which is easily assembled while still being stable. By way of example, the furniture unit may have the panels configured with built-in connectors such as plug and tongue, which can be secured by a corresponding hole or groove of another panel to form the furniture unit without an external fastening means.

Although various configurations of the panels are available, yet, the panels heretofore used to assemble the furniture units without involving the external fastening means have not been fully satisfactory. It is common for the panels to be manufactured from wood chips. Therefore, it is inevitable for the built-in connectors to suffer from damages such as cracks and fractures as most of the built-in connectors are formed integrally with the panels. The tongue may be damaged during its manufacture, for

example, sharp edges of the tongue may be fractured when a cutting means removes part of the panels to form the tongue. Furthermore, the built-in connectors of the panels may not be able to withstand stresses within the assembled furniture unit and cause significant physical damage to the built-in connectors.

There are a few patented technologies over the prior art relating to the panel assembly. US4869564A discloses a readily assemblable furniture composed of plural, precision sized, covered, panels and a module assembly. The module assembly comprises releasably secureable connector members and a precision sized, covered, support panel having an end surface. At least a first one of the plural panels is secured to the support panel by at least one pair of the connectors consisting of a plug member and a rod-like member. The plug member has a recess in its periphery and is adapted to be disposed within a respective cylindrical bore in the support panel. The rod-like member has a threaded end for securement to the first panel and an oppositely disposed end having a head for disposition within the recess in the plug member.

Another panel assembly is disclosed in CN103565136B. The patent discloses a method of assembling wooden boards and a method of assembling the furniture, the profile column is mainly used, and a multi-angle fastener wood block structure, assembled to form a tubular polygonal pillar of the frame, and is fitted on the polygon structural members, wood furniture board is constituted. Wherein the upright profile, the appearance of a hollow cylindrical section, the outer wall is provided with at least one mounting slot and a slot knotting, its visible surface, with a layer of the coating layer.

However, the connectors for panel assembly disclosed in US4869564A and CN103565136B are not equipped with any feature to strengthen its structural integrity. Therefore, the furniture assembly in the above-mentioned prior art is susceptible to the problems highlighted above.

Accordingly, it would be desirable to provide a panel assembly with reinforcement feature for providing structural integrity to the connectors during its manufacture and assembly of furniture unit into different furniture configurations.

SUMMARY OF INVENTION

The invention provides a panel assembly for use in building a furniture unit, the assembly comprising a first panel having at least one projecting tongue for slidably engaging with, and being retained in, a complementary groove formed in a second panel, wherein the tongue is provided with a laminate on at least one surface of the tongue for providing improved structural integrity to the tongue while nevertheless allowing relative sliding movement between the tongue and the groove.

Preferably, the first panel may be slid substantially perpendicularly relative to the second panel to bring the tongue into engagement with the groove.

Preferably, the laminate may be in the form of a cover adapted to be slidably received along the tongue to cover the at least one surface of the tongue.

Preferably, the laminate may be attached onto the at least one surface of the first panel with a bonding material disposed therebetween, with at least a portion of the laminate with its underlying surface of the first panel being removed to form the tongue.

Preferably, the tongue may extend continuously along one side of the first panel and is slidably inserted into the groove extending continuously along one side of the second panel.

Preferably, the tongue may have an upright side wall and a slanted side wall extending

parallel to a longitudinal direction of the tongue.

Preferably, the groove may provide an upright side wall and a slanted side wall extending parallel to a longitudinal direction of the groove, whereby the slanted side wall of the groove is juxtaposed the slanted side wall of the tongue when the first and second panels are connected together.

Preferably, the slanted side wall of the tongue may be frictionally engaged by the juxtaposed slanted side wall of the groove during engagement of the tongue within the groove.

Another aspect of the invention provides a furniture unit comprising a plurality of first panels each configured with at least one laminated tongue on one side and a like number of second panels each configured with at least one complementary groove on one side, wherein each first panel is slidably engaged with a mating second panel through the laminated tongue and its corresponding groove to form the furniture unit.

Preferably, the first panel and the second panel each may be provided with a slot, in which the respective slot in the first panel and the second panel aligns with one another to slidably receive a third panel to interlock the first panel and the second panel.

One skilled in the art will readily appreciate that the invention is well adapted to carry out the objects and obtain the ends and advantages mentioned, as well as those inherent therein. The embodiments described herein are not intended as limitations on the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawing the preferred embodiments from an inspection of which when considered in connection with the following description, the invention, its construction and operation and many of its advantages would be readily understood and appreciated.

Fig. 1a – 1b is a diagram illustrating a panel assembly having a first and second panel of the present invention.

Fig. 2 is a diagram illustrating first embodiment of a tongue for the first panel according to the present invention.

Fig. 3 is a diagram illustrating a first embodiment of a furniture unit constructed by the panel assembly.

Fig. 4a – 4b is a diagram illustrating the furniture unit attached with a support rib.

Fig. 5a – 5b is a diagram illustrating the furniture unit for receiving a top panel.

Fig. 6a – 6c is diagram illustrating a locking means for engaging with and disengaging from the top panel.

Fig. 7a – 7b is a diagram illustrating a second embodiment of a furniture unit constructed by the panel assembly.

Fig. 8 is a diagram illustrating a third embodiment of a furniture unit constructed by the panel assembly.

Fig. 9a – 9b is a diagram illustrating an inclined slot of the panel assembly for

securing a furniture unit with reaction forces.

DETAILED DESCRIPTION OF THE INVENTION

Although, the invention can be presented in a number of different embodiments, and incorporating a variety of different components and technologies, the various embodiments of the invention have some common elements. According to the concept of the invention, a panel assembly is provided with a first panel slidably engageable with a second panel with through a tongue-and-groove configuration in which the tongue is provided with a reinforcement feature that strengthens the tongue.

The invention will now be described in greater detail, by way of example, with reference to the drawings.

Fig. 1a and **Fig. 1b** depict a panel assembly for use in building a furniture unit. In this particular embodiment, the assembly comprises a first panel **1** having at least one projecting tongue **2** for slidably engaging with, and being retained in, a complementary groove **3** formed in a second panel **4**. By way of example, the first **1** and second panel **4** are usually manufactured from wood fibres, wood chips or wood that may involve the use of elevated temperatures, pressures and binding resins or adhesives. These materials are generally brittle which cause the panels to suffer from fractures and cracks upon sudden impact or elevation of stresses on the panels. To enable these materials to withstand stresses within the assembled furniture unit, the tongue **2** is provided with a laminate **5** on at least one surface of the tongue **2**. Advantageously, the laminate **5** may be attached onto the surface of the tongue **2** to reduce deflection induced within the tongue **2** during its manufacture or assembling of the furniture unit. Therefore, the laminate **5** reduces occurrence of fractures in the surface of the tongue **2**.

Further, the laminate **5** provides improved structural integrity to the tongue **2** and the groove **3** while nevertheless allowing relative sliding movement between the tongue **2** and the groove **3**. In this preferred embodiment, the first panel **1** is slid substantially perpendicularly relative to the second panel **4** to bring the tongue **2** into engagement with the groove **3**. Hence, during the engagement of the tongue **2** and groove **3**, the laminate **5** is sandwiched between the tongue **2** and groove **3**. The laminate **5** according to this invention, by ways of example but not by limitation, may be a plastic laminate or a veneer which is a wood laminate.

The laminate **5** may be constructed in various embodiments. In a first embodiment (**Fig. 2**), the laminate **5** is firstly attached onto the at least one surface of the first panel **1** and the second panel **4** with a bonding material disposed therebetween. Preferably, each surface of the first panel **1** is attached with the laminate **5** in such a way that the first panel **1** and the second panel **4** are fully encased within the laminate **5**. Then, each laminate **5** is then heat-treated so as to bond together and to hold the laminate **5** onto its surface of the first panel **1** and second panel **4**. Preferably, the heat-treated laminated surface is given a certain duration to cure the bonding material.

Advantageously, each laminate **5** produces prestressing forces over its attached surface respectively so that each surface of the first panel **1** and second panel **4** is prestressed inwardly. At least a portion of the laminate **5** with its underlying surface of the first panel **1** is removed with a cutting means to form the tongue **2** from the laminated surface of the first panel **1**, forming at least one exposed surface **13** over the cut portion. Similarly, at least a portion of the laminate **5** with its underlying surface of the second panel **4** is removed with the cutting means to form the groove **3** from the laminated surface of the second panel **4**. During its manufacture, the prestressing forces produced by the laminate **5** strengthens the first panel **1** and also reduces stresses induced by the cutting means onto the surface of the first panel **1**. The exposed surface **13** may be provided with sharp edges **16** that may fracture easily with

induced stress. However, the sharp edges **16** still remain intact after the portion of the first panel **1** is removed as the sharp edges **16** are bounded by the laminate **5**, in which the laminate **5** reduces the stresses induced by the cutting means therefore reduces the occurrence of fractures on the sharp edges **16**. Therefore, the exposed surface **13** is produced with a smooth profile along its longitudinal direction with reduced risk of fractures. Similarly, while forming the groove **3** on the second panel **4**, the laminate **5** also reduces the stresses induced by the cutting means therefore reduces the occurrence of fractures on sharp edges **16** around the groove **3**. The sharp edges **16** remain intact after the material removal process.

Meanwhile, remaining portion of the laminate **5** that is not removed by the cutting means still induces prestressing forces on the surface of the first panel **1**. This feature allows the tongue **2** to remain intact when the tongue **2** is engaged by the groove **3**. The prestressing forces also may counter stresses induced to the engaged tongue **2** when the first panel **1** is tilted, pushed or pull. The exposed surface **13** of the tongue **2** may still be attached with the laminate **5** for enhanced rigidity and strength. The first embodiment of the present invention is suitable to manufacture the tongue **2** with reduced occurrence of fractures on the surface of the first panel **1**. However, the bonding material may not require heat-treatment as the bonding material may readily adhere the laminate **5** onto the surface of the first panel **1** upon contact of the laminate **5** with the surface of the first panel **1**.

In a second embodiment (not shown), the laminate **5** is in the form of a cover adapted to be slidably received along the tongue **2** to cover the at least one surface of the tongue **2**. In this particular embodiment, the surface of the first panel **1** is formed with the tongue **2**, and then the cover is manufactured in accordance to a shape of the tongue **2**. The cover may cover one surface or every surface of the tongue **1**. The boning material may be disposed between the cover and the tongue **2** and then undergo heat treatment to secure the cover onto the tongue **2**. Advantageously, the

cover produces prestressing forces over the tongue **2** so that each surface of the tongue **2** is prestressed inwardly. Such feature allows the tongue to withstand stresses caused by movement of the first panel **1** such as tilting, pushing and pulling when the tongue **2** is received by the groove **3**.

Referring to the present invention, the tongue **2** extends continuously along one side of the first panel **1** and is slidably inserted into the groove **3** extending continuously along one side of the second panel **4**. However, the tongue **2** may be formed by several segments of tongue **2**, such as to form a tongue **2** that is interrupted at points. Preferably, the tongue **2** provides the exposed surface **13** having an upright side wall **6** and a slanted side wall **7** extending parallel to a longitudinal direction of the tongue **2**. Therefore, to allow for the tongue **2** slidably along the groove **3**, the groove **3** also provides an upright side wall **8** and a slanted side wall **9** extending parallel to a longitudinal direction of the groove **3**. When the first **1** and the second panels **4** are connected together, the slanted side wall **9** of the groove **3** is juxtaposed the slanted side wall **7** of the tongue **2**. Therefore, the slanted side wall **7** of the tongue **2** is frictionally engaged by the juxtaposed slanted side wall **9** of the groove **3** during engagement of the tongue **2** within the groove **3**. However, the configuration of the tongue **2** and groove **3** may be varied, by way of example, the tongue **2** and groove **3** may be configured with only slanted side walls instead of a combination of slanted side walls and upright side wall.

Fig. 3 through **Fig. 6** depict a first embodiment of the furniture unit constructed from the panel assembly. In this particular embodiment, the furniture unit may comprise a plurality of first panels **1** each configured with at least one laminated tongue **2** on one side and a like number of second panels **4** each configured with at least one complementary groove **3** on one side. Each first panel **1** is slidably engaged with a mating second panel **4** through the laminated tongue **2** and its corresponding groove **3** to form the furniture unit. By way of example, the tongue **2** may be attached with a

laminate **5** with a bonding material therebetween, or slid with a cover to form the laminated tongue **2**. Furthermore, the first panel **1** and the second panel **4** each is provided with a slot **10**, in which the respective slot **10** in the first panel **1** and the second panel **4** aligns with one another to slidably receive a third panel **11** to interlock the first panel **1** and the second panel **4**. Preferably, when the first panel **1** and the second panel **4** are interlocked by the third panel **11**, the first panel **1** is flush with the second panel **4** as to prevent uneven surfaces on the furniture unit. In this particular embodiment, the third panel **11** is sufficiently thin to be inserted through the aligned slots **10**. The third panel **11** is generally resilient in nature and provided with a spine at a middle portion of the third panel **11** so that it can be flexibly moved. A support rib **12** is attached onto the third panel **11** to strengthen its structure.

By way of example, one second panel **4** may be a base panel of the furniture unit for slidably receiving two first panels **1**. Therefore, the first panels **1** are erected vertically and oppositely spaced apart by the base panel. The third panel **11** is inserted through the aligned slots **10** when the first panels **1** are engaged by the base panel. The support rib **12** is then attached onto the third panel **11**. Another second panel **4**, acting as a top panel, is slidably received by the oppositely spaced apart first panels **1**. The support rib **12** may provided with a locking means **14** which engages with one slot **13** formed beneath the top panel when the top panel is slid along the first panels **1** to cover the support rib **12**. In this particular embodiment, the locking means **14** may be disengaged by a twisting motion on the locking means **14**. Preferably, one end **15** of the groove **3** may be covered by the laminate **5** as to prevent the tongue **2** from sliding beyond the end of the groove **3**.

Fig. 7a and **Fig. 7b** show a second embodiment of the furniture unit, in which the second embodiment is an improvement of its first embodiment. In this particular embodiment, the top panel is formed with opposing grooves **3**, on a top and a bottom surface of the top panel, so that additional first panels **1** may be slidably stacked onto

the top panel for forming the furniture unit with multiple partitions. The panel assembly may also be constructed as a third embodiment of the furniture unit as shown in **Fig. 8**. In this particular embodiment, the second panel **4** may be configured with a plurality of grooves **3** for receiving more first panels **1** in order to create more partitions within the furniture unit.

Referring to **Fig. 9a** and **Fig, 9b** the slots **10** in the first panel **1** and the second panel **4** may in the form of inclined slots, which the slots **10** of the first panel **1** and the second panel **4** may be configured with an inclination angle with respect to the first panel **1** and the second panel **4** respectively. Once the slots **10** in the first panel **1** and the second panel **4** align with one another, the third panel **11** is slid therethrough to interlock the first panel **1** and the second panel **4**. Advantageously, the slot **10** bends a portion of the third panel **11** and thereby resiliently secures the bent portion by reaction force resulting from the bent portion within the slot **10**.

Furthermore, each surface of the first **1** and second panel **4** may be attached with the laminate **5** to provide improved structural integrity to the furniture unit. Another advantage of such furniture unit is that it does not need to be secured by an external fastening means, while maintaining its rigidity and strength.

The present disclosure includes as contained in the appended claims, as well as that of the foregoing description. Although this invention has been described in its preferred form with a degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangements of parts may be resorted to without departing from the scope of the invention.

CLAIMS

1. A panel assembly for use in building a furniture unit, the assembly comprising a first panel (1) having at least one projecting tongue (2) for slidably engaging with, and being retained in, a complementary groove (3) formed in a second panel (4), wherein the tongue (2) is provided with a laminate (5) on at least one surface of the tongue (2) for providing improved structural integrity to the tongue (2) while nevertheless allowing relative sliding movement between the tongue (2) and the groove (3).

2. The panel assembly according to claim 1, wherein the first panel (1) is slid substantially perpendicularly relative to the second panel (4) to bring the tongue (2) into engagement with the groove (3).

3. The panel assembly according to claim 1, wherein the laminate (5) is in the form of a cover adapted to be slidably received along the tongue (2) to cover the at least one surface of the tongue (2).

4. The panel assembly according to claim 1, wherein the laminate (5) is attached onto the at least one surface of the first panel (1) with a bonding material disposed therebetween, with at least a portion of the laminate (5) with its underlying surface of the first panel (1) being removed to form the tongue (2).

5. The panel assembly according to claim 1, wherein the tongue (2) extends continuously along one side of the first panel (1) and is slidably inserted into the groove (3) extending continuously along one side of the second panel (4).

6. The panel assembly according to claim 1, wherein the tongue (2) has an upright side wall (6) and a slanted side wall (7) extending parallel to a longitudinal direction of the tongue (2).

7. The panel assembly according to claim 6, wherein the groove (3) provides an upright side wall (8) and a slanted side wall (9) extending parallel to a longitudinal direction of the groove (3), whereby the slanted side wall (9) of the groove (3) is juxtaposed the slanted side wall (7) of the tongue (2) when the first (1) and second (4) panels are connected together.

8. The panel assembly according to claim 7, wherein the slanted side wall (7) of the tongue (2) is frictionally engaged by the juxtaposed slanted side wall (9) of the groove (3) during engagement of the tongue (2) within the groove (3).

9. A furniture unit comprising a plurality of first panels (1) each configured with at least one laminated tongue (2) on one side and a like number of second panels (4) each configured with at least one complementary groove (3) on one side, wherein each first panel (1) is slidably engaged with a mating second panel (4) through the laminated tongue (2) and its corresponding groove (3) to form the furniture unit.

10. The furniture assembly according to claim 9, wherein the first panel (1) and the second panel (4) each is provided with a slot (10), in which the respective slot (10) in the first panel (1) and the second panel (4) aligns with one another to slidably receive a third panel (11) to interlock the first panel (1) and the second panel (4).

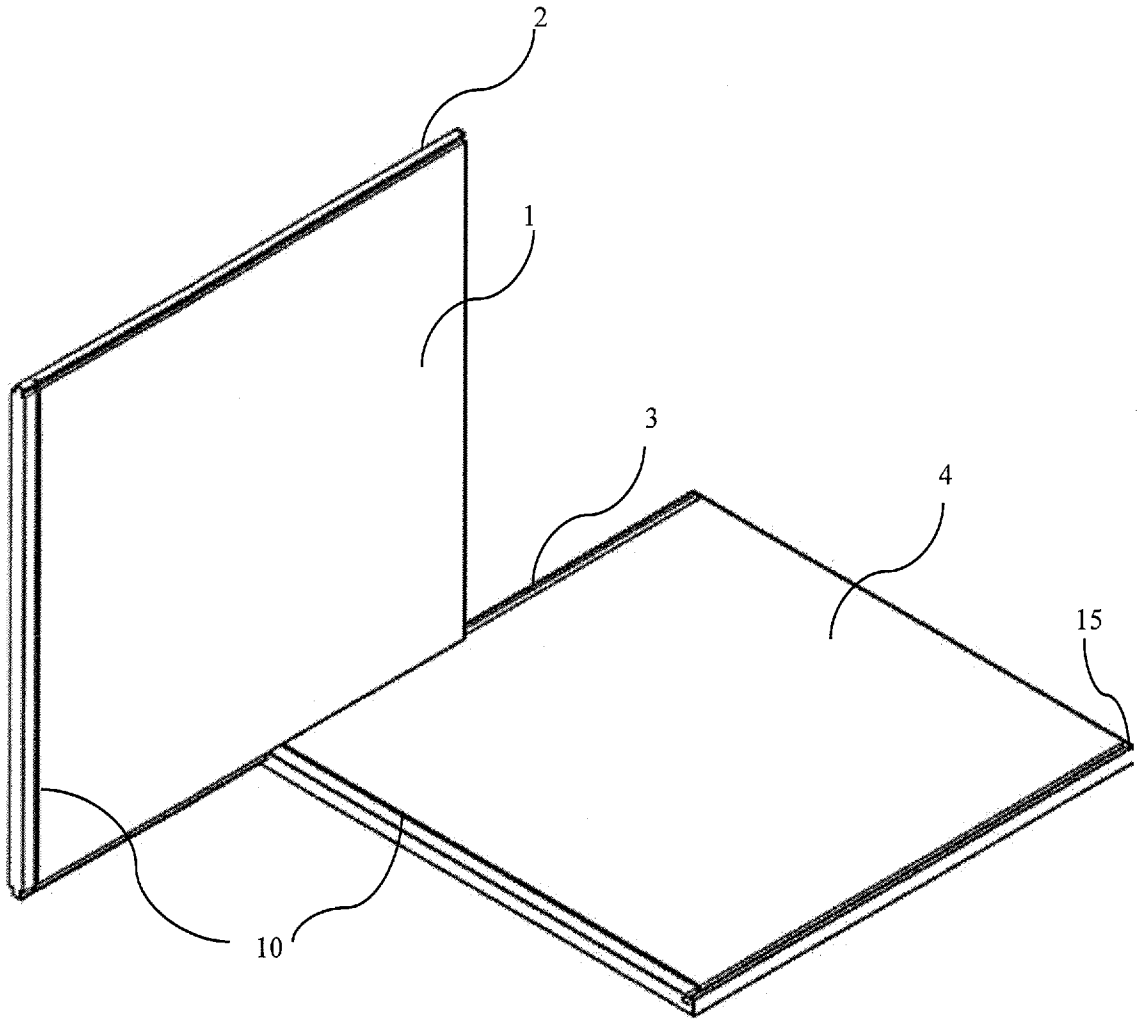

Fig. 1a

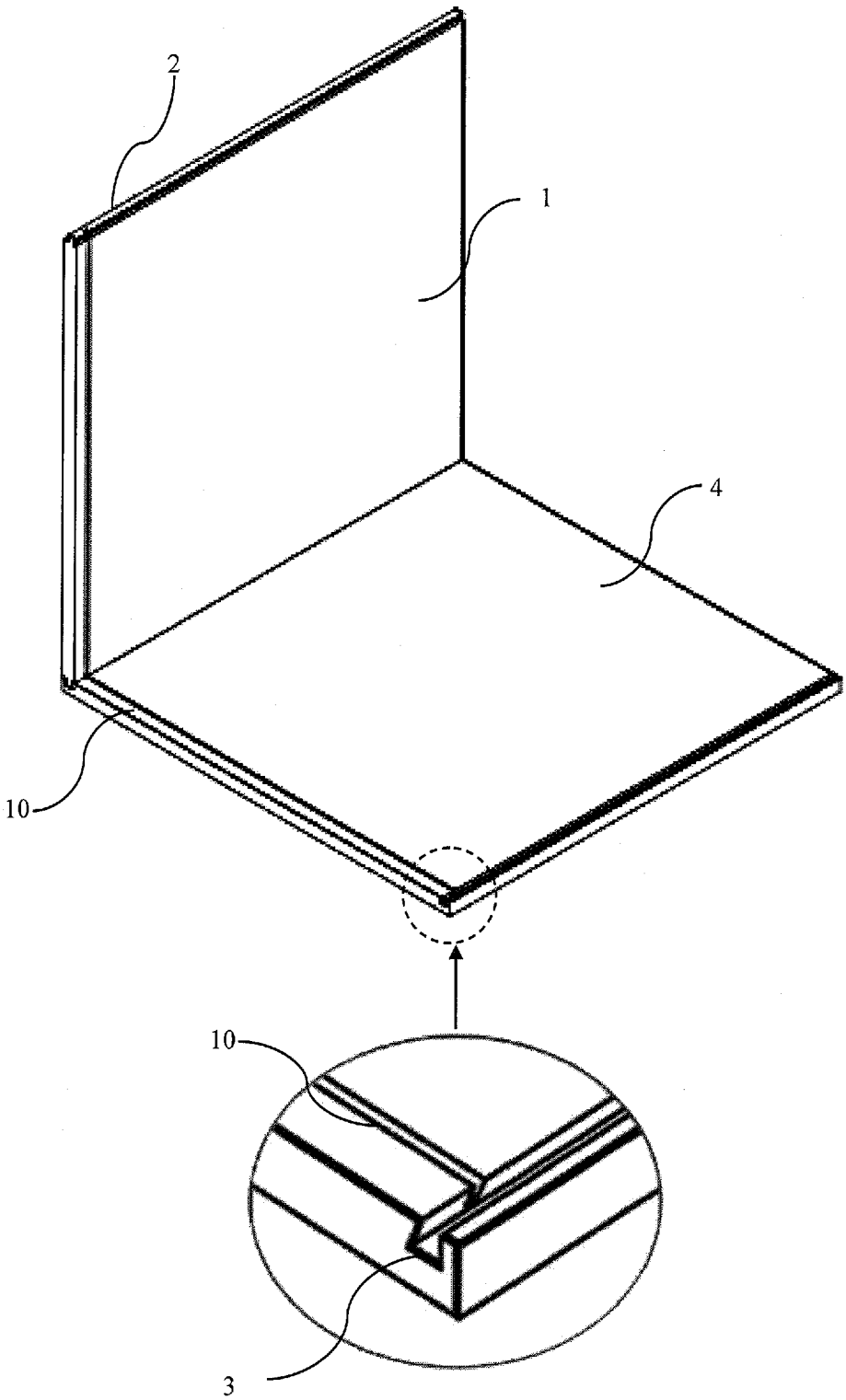

Fig. 1b

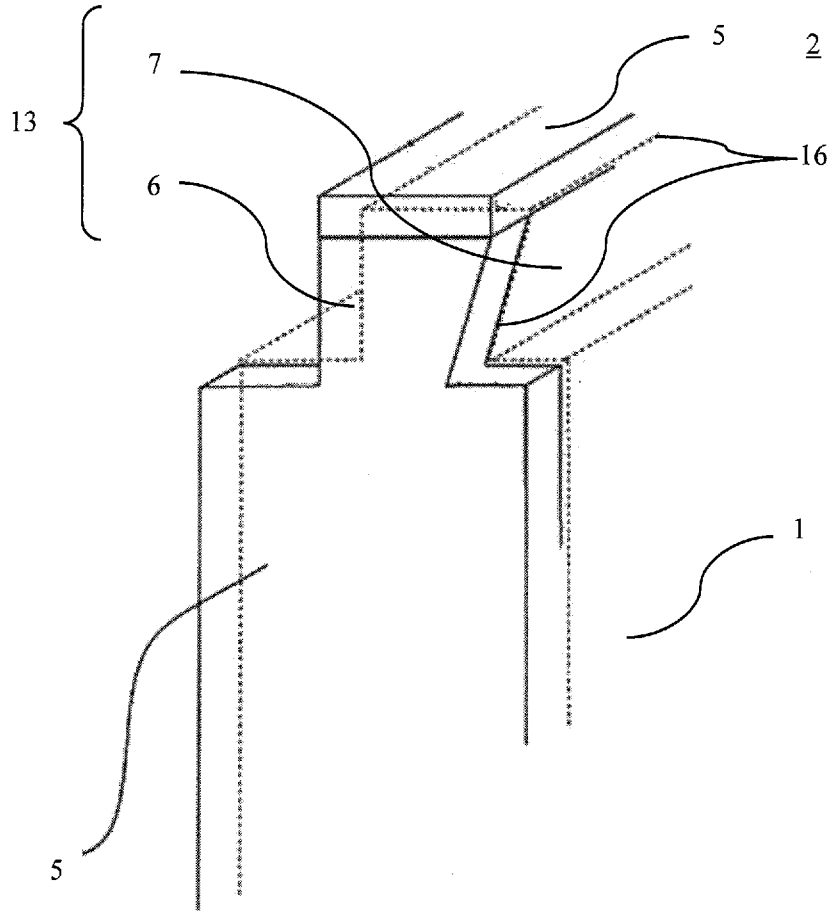

Fig. 2

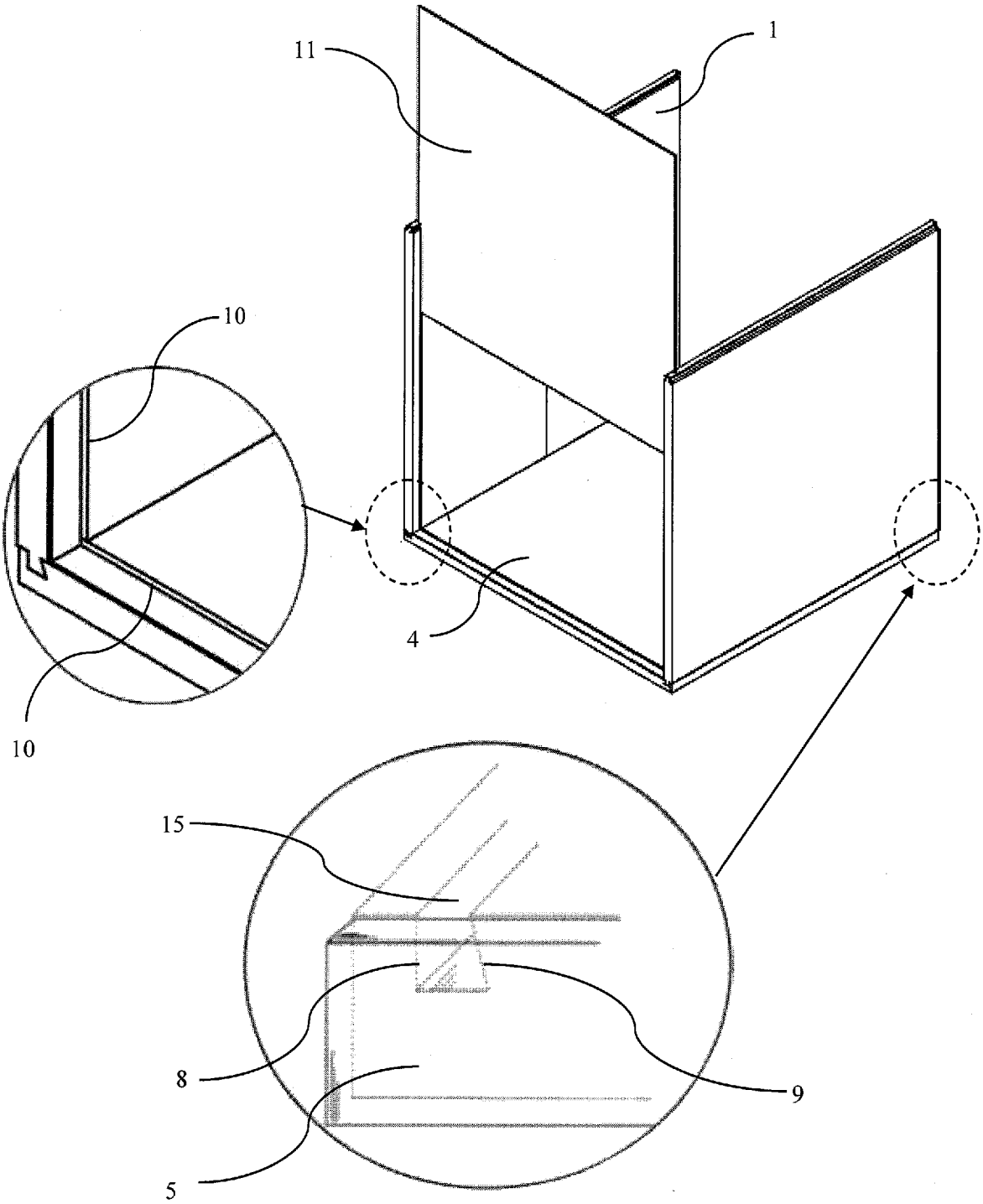

Fig. 3

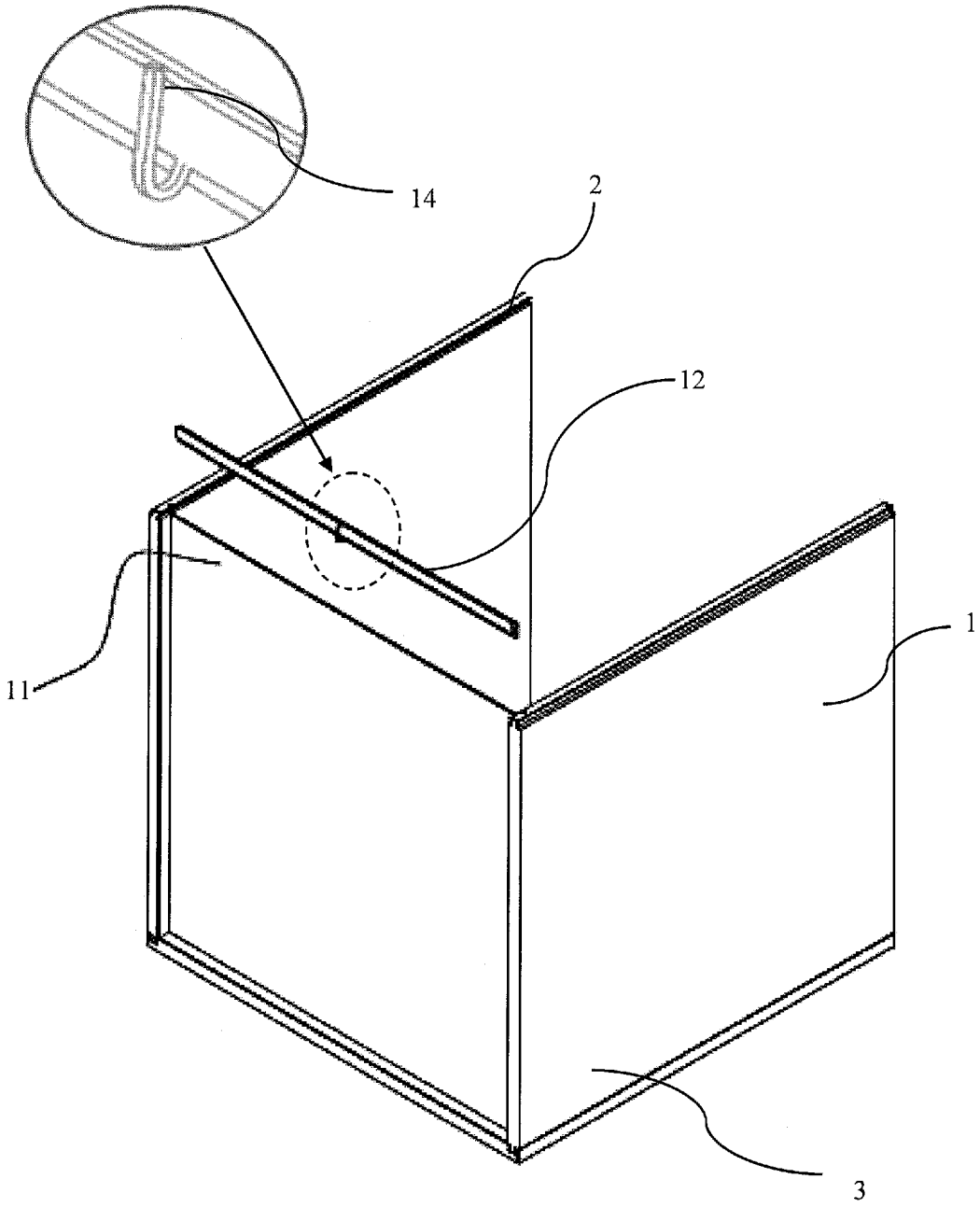

Fig. 4a

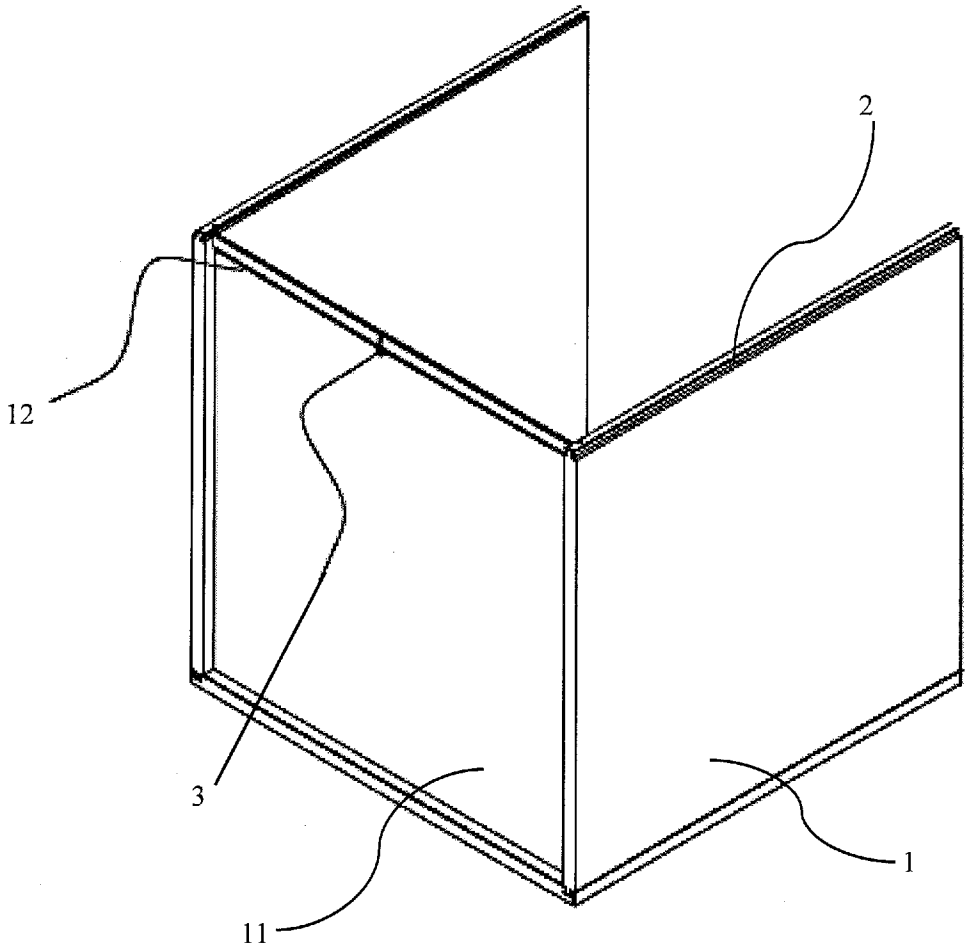

Fig. 4b

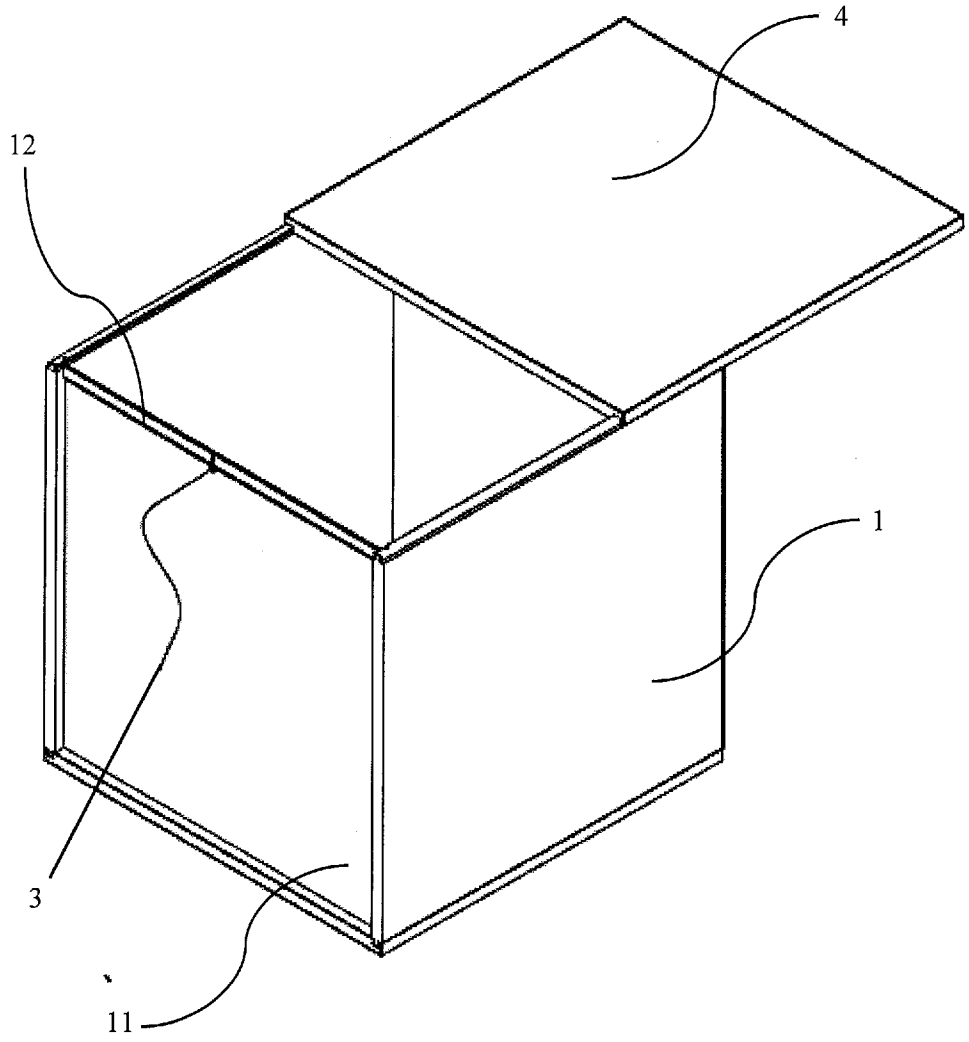

Fig. 5a

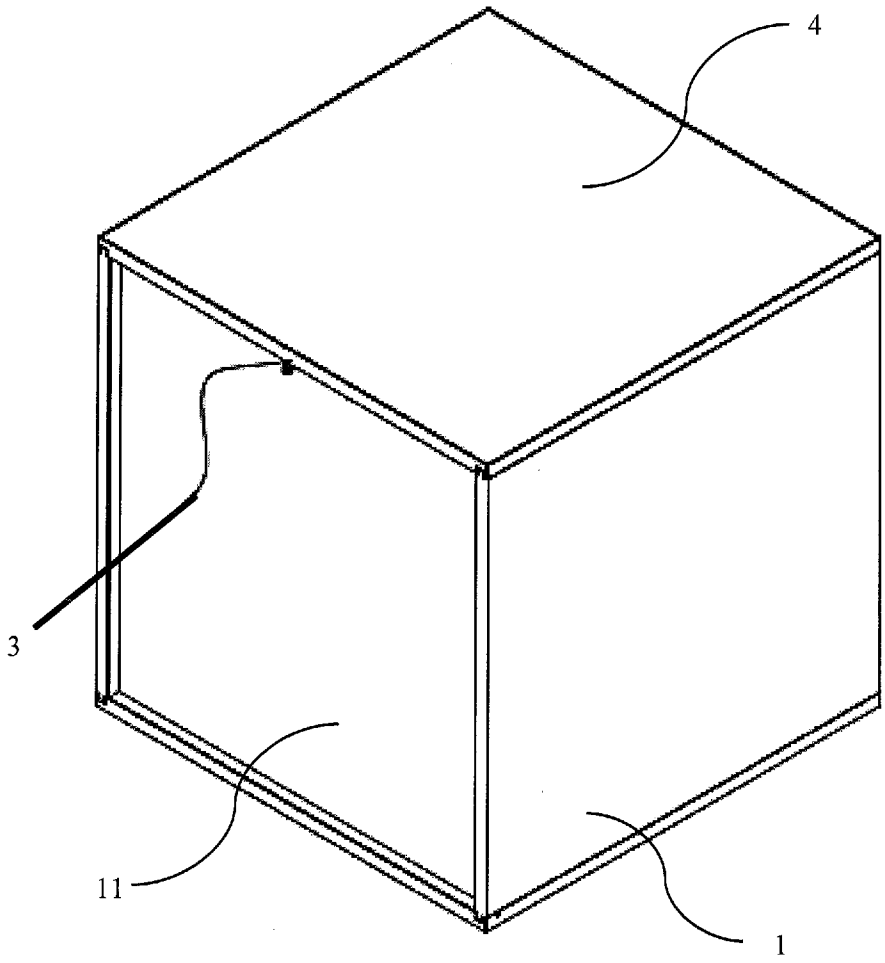

Fig. 5b

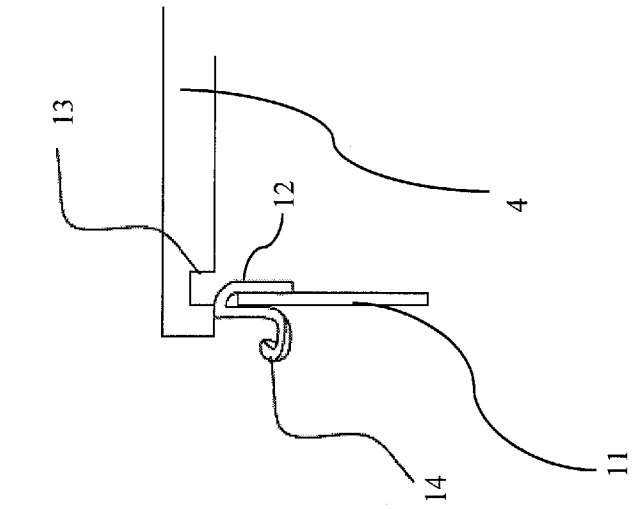

Fig. 6c

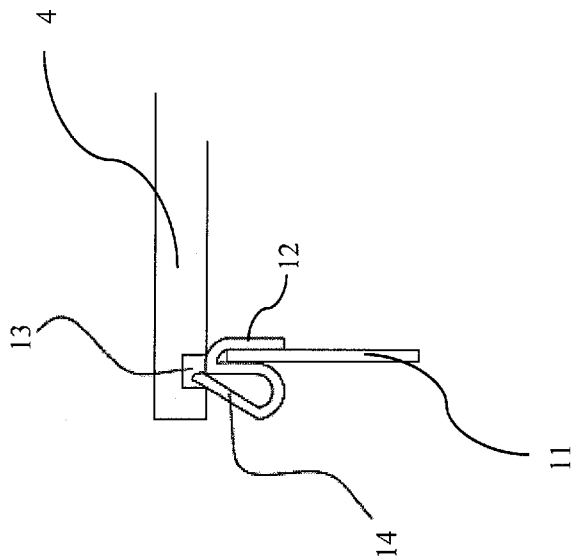

Fig. 6b

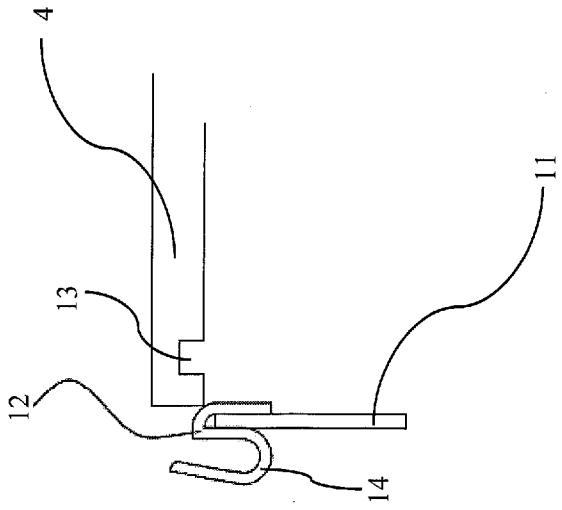

Fig. 6a

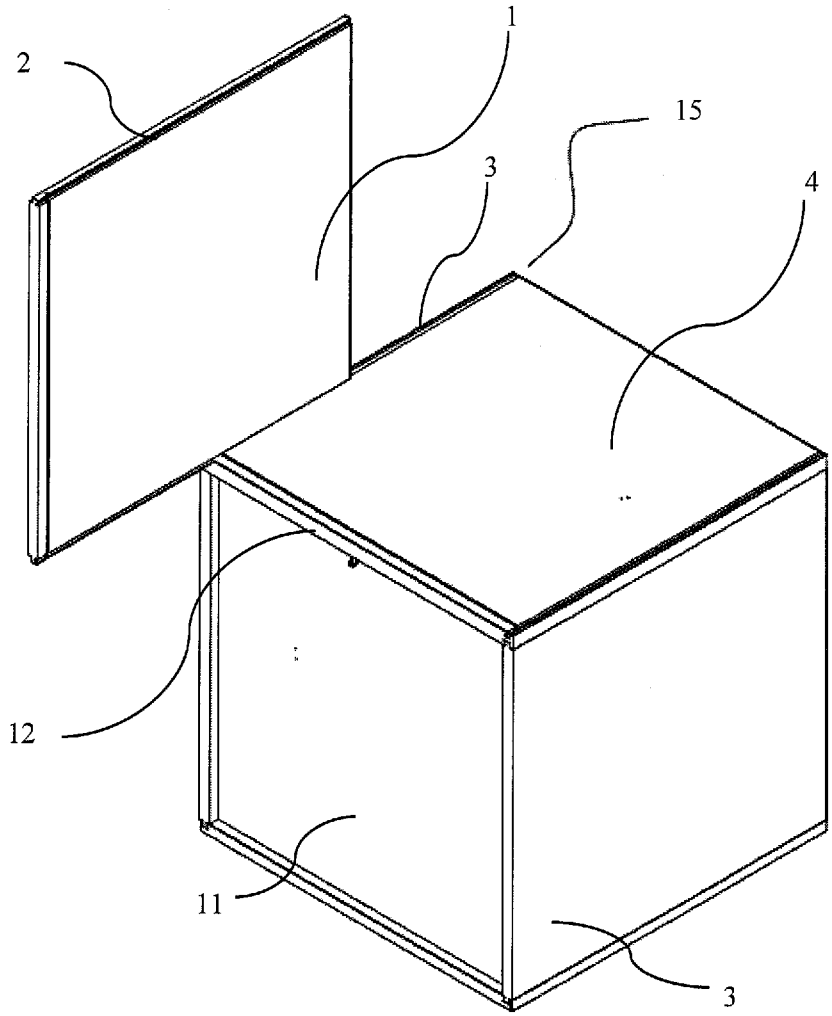

Fig. 7a

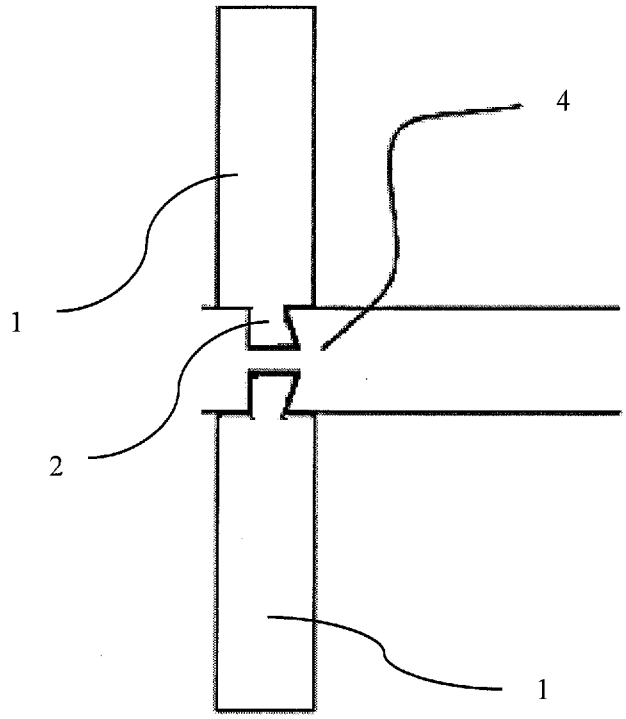

Fig. 7b

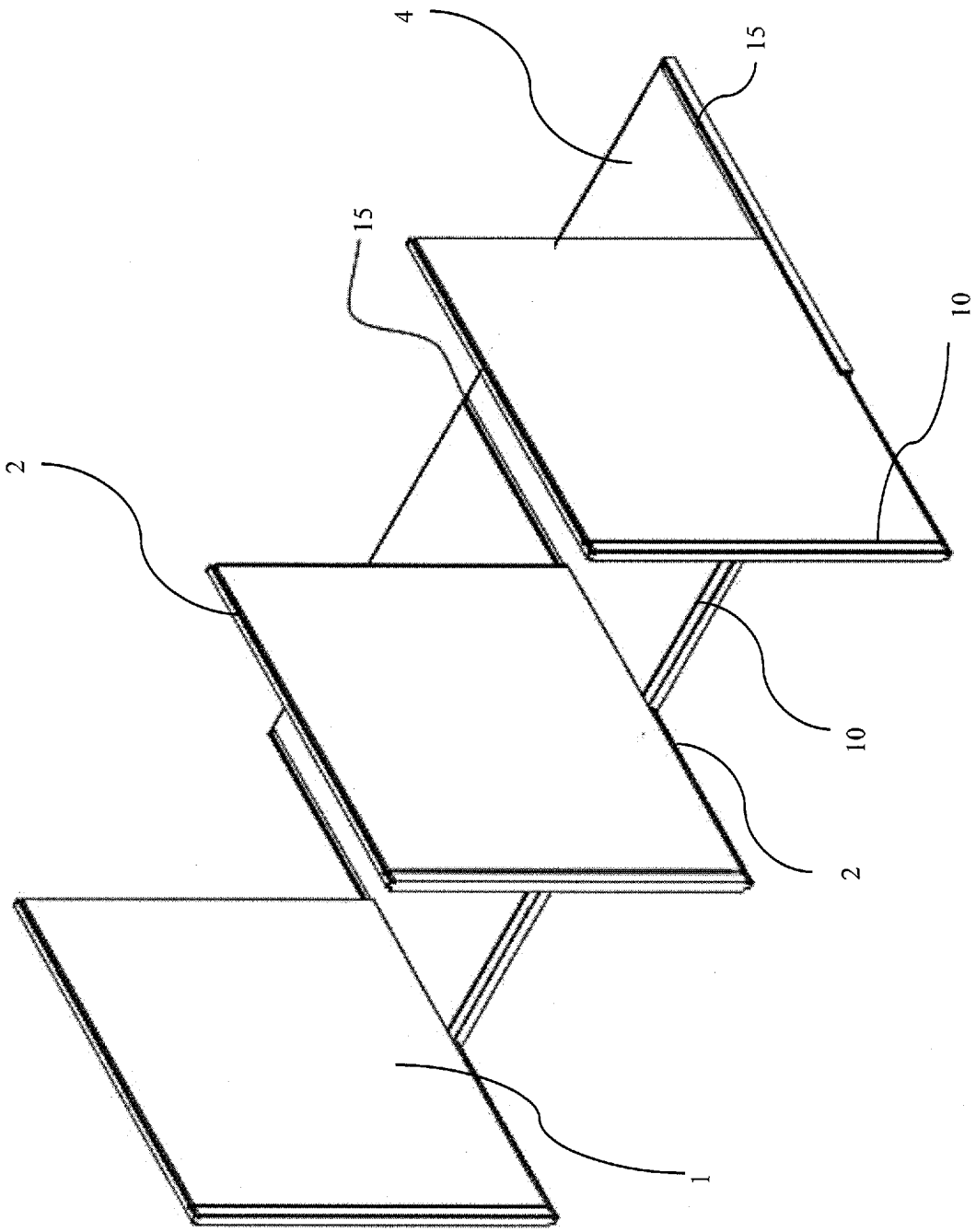

Fig. 8

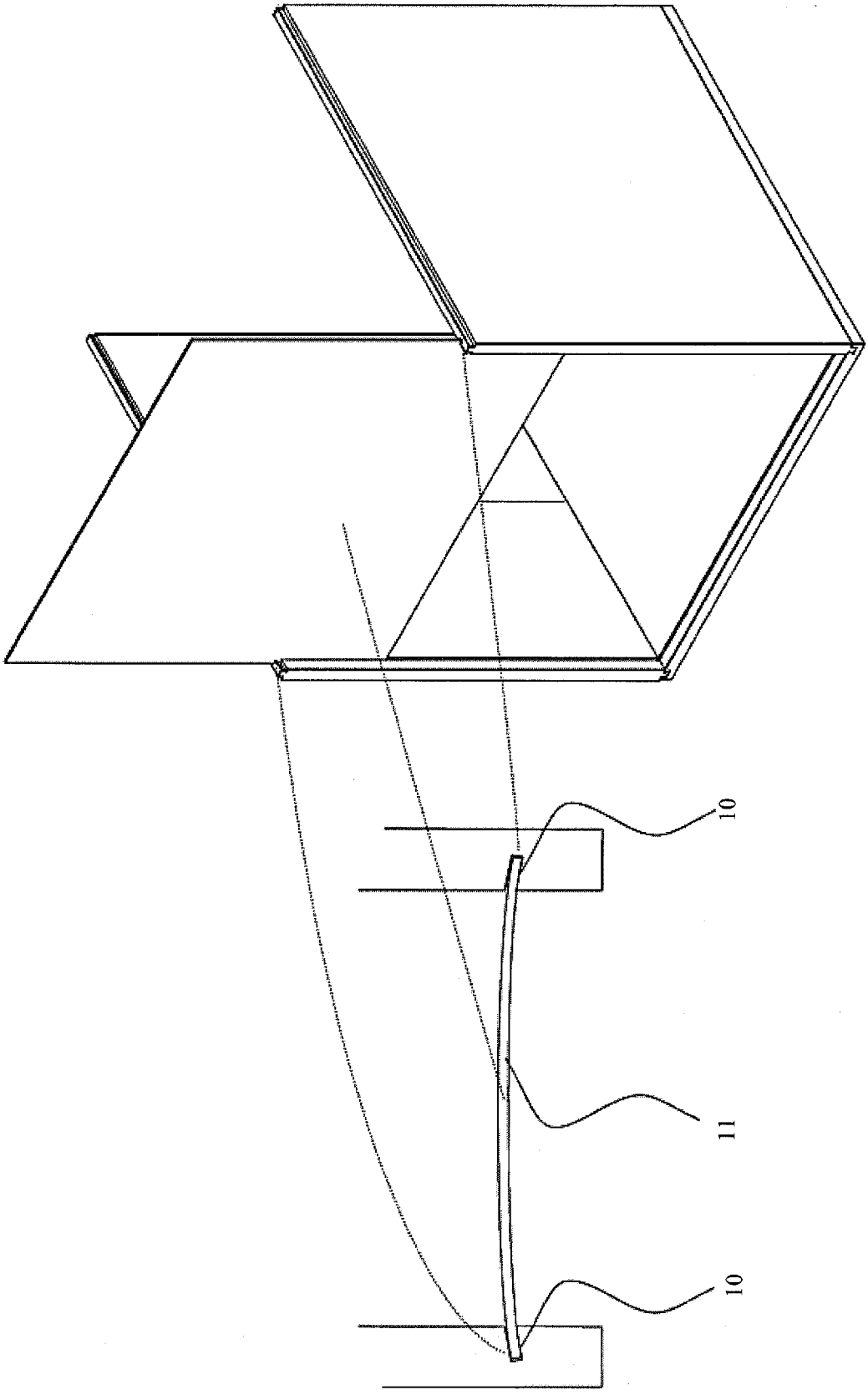

Fig. 9a

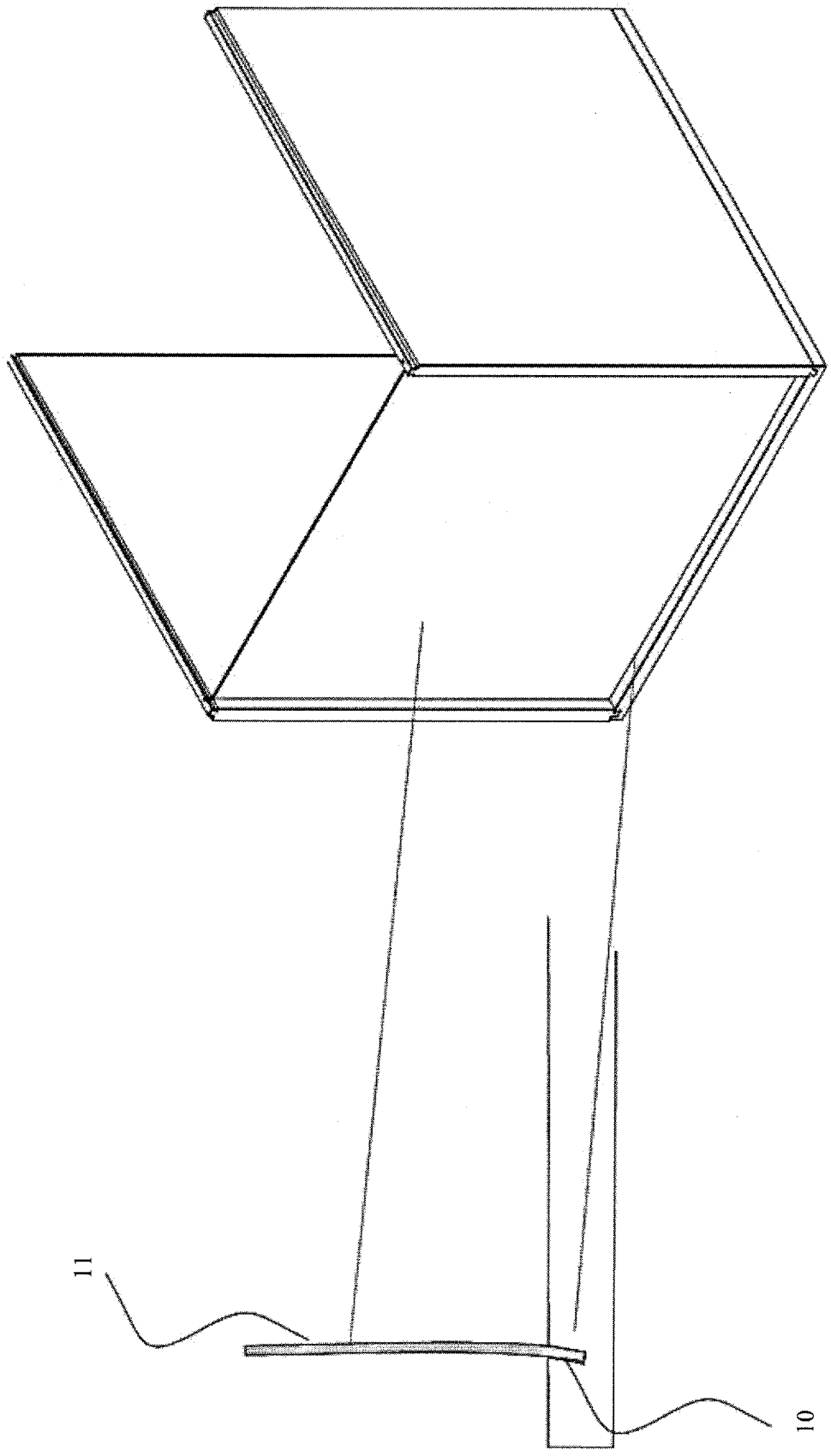

Fig. 9b

INTERNATIONAL SEARCH REPORT

International application No.
PCT/MY2019/050013

A. CLASSIFICATION OF SUBJECT MATTER

A47B 47/04 (2006.01)

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)

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

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

Database WPIAP, EPODOC search with IPC/CPC marks: A47B47/04, A47B47/0066, A47B47/0075, A47B96/20, A47B2220/0052, F16B12/12, F16B5/0004/LOW, F16B5/06/LOW and keywords: tongue, groove, laminate, dove-tail, connect panel, board and similar terms. Auspat inventor search: “NG, Teck Lai" as the inventor; Auspat applicant search: "LEYO HOLDINGS SDN BHD " as the applicant; Espacenet inventor search with keyword:"NG, Teck Lai "as the inventor; Espacenet applicant search with keywords" LEYO HOLDINGS SDN BHD”; Espacenet search with above marks and keywords: furniture, panel, groove, tongue, laminate and like terms. Google patents search with keywords: furniture, panel, groove, tongue, laminate & similar terms. Inventor/Applicant search done in internal databases of IP Australia

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	Documents are listed in the continuation of Box C	

[X] Further documents are listed in the continuation of Box C

[X] 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

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"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
12 June 2019	12 June 2019
Name and mailing address of the ISA/AU	**Authorised officer**
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA Email address: pct@ipaustralia.gov.au	Gang Shen AUSTRALIAN PATENT OFFICE (ISO 9001 Quality Certified Service) Telephone No. +61262832458

INTERNATIONAL SEARCH REPORT C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		International application No. **PCT/MY2019/050013**
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 4097100 A (SAUDER) 27 June 1978 see figure 2 and col.2 lines 28-40, lines 52-56 of the description see the figures 1-2 and the description	1-5, 9,10 6-8
Y	WO 2016/059549 A2 (UNILIN BVBA) 21 April 2016 see the figures and the description	6-8

INTERNATIONAL SEARCH REPORT Information on patent family members	International application No. **PCT/MY2019/050013**

This Annex lists known patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document/s Cited in Search Report		Patent Family Member/s	
Publication Number	**Publication Date**	**Publication Number**	**Publication Date**
US 4097100 A	27 June 1978	US 4097100 A	27 Jun 1978
		CA 1086367 A	23 Sep 1980
WO 2016/059549 A2	21 April 2016	WO 2016059549 A2	21 Apr 2016

End of Annex

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.