(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 901 408 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
27.10.2021 Bulletin 2021/43

(21) Application number: **19900810.3**

(22) Date of filing: **29.03.2019**

(51) Int Cl.:
E21D 11/04 *(2006.01)*

(86) International application number:
PCT/JP2019/014039

(87) International publication number:
WO 2020/129272 (25.06.2020 Gazette 2020/26)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **17.12.2018 PCT/JP2018/046285**

(71) Applicant: **Hiro Corporation Ltd.**
Ibaraki 319-1111 (JP)

(72) Inventors:
- **TAJIMA, Hiroshi**
  Hitachi-shi, Ibaraki 319-1224 (JP)
- **ONUKI, Katsuyo**
  Ibaraki 319-1109 (JP)

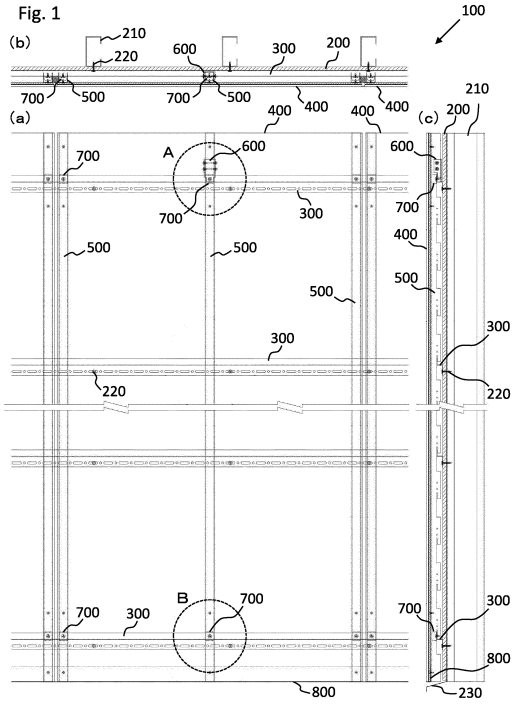
(74) Representative: **Strehl Schübel-Hopf & Partner**
Maximilianstrasse 54
80538 München (DE)

(54) TILE PANEL SUPPORT STRUCTURE

(57) To make it possible to follow swinging caused by such as the earthquake in the installation of large tiles in a dry method.

The invented tile panel support structure includes:
a horizontal frame extending in crosswise direction fixed to the front face of a wall material at a vertical spacing from top to bottom;
a vertical frame extending vertically fixed to the left and right ends and the center on the rear face of said tile panel so as to be hung on said horizontal frame;
a supporting bracket fixed to either or both of the uppermost and lowermost position of the horizontal frames at the position where at least the vertical frame is fixed;
a load-bearing bracket fixed to the vertical frame positioned in the center of positions where the uppermost-positioned horizontal frame is fixed,
wherein
the supporting bracket supports the vertical frame so that the tile panel does not horizontally deviate; and
the load-bearing bracket is positioned on the horizontal frame so that a downward-convex shaped lug part of the load-bearing bracket rests on the horizontal frame to bear the weight of the tile panel at one point.

Fig. 1



EP 3 901 408 A1

Description

{Technical Field}

[0001] The present invention relates to a tile panel support structure that can follow the swinging of a building induced by the earthquake or similar movement when construction of the building intends to employ a method for installing a large tile panel by a dry method.

{Background}

[0002] As materials for a building outer wall, PC Plate (Precast Concrete Plate) plate, ALC Panel (Autoclaved Lightweight Concrete Panel), and ECP (Extruded Cement Plate) are usually used. The outer walls are finished by sticking tiles or stone on the outer wall surface. As the method for finishing, a wet method or a dry method is usually employed. In the wet method, tiles or similar finishing materials are stuck directly on the outer wall using mortar. In the dry method, the tiles or similar materials are hanged on the supporting bracket fixed to the outer walls then adhered thereto using elastic glue.

[0003] In the wet method, construction time is long and work quality varies depending on the skill of the worker engaged. In the dry method, however, the construction time can be shortened and the work quality will satisfy a certain level. As described in Patent Literature 1, an invention has been disclosed on a dry method for constructing outer wall tiles.

[0004] In addition, if the building is tilted due to vibration such as the earthquake, an unreasonable force is imposed on the attached tiles, and even if the tiles can be relaxed from such force to some extent by the elastic adhesive there is a risk that the tiles may peel off or crack to fall. As described in Patent Literature 2, an invention on a securing method has been disclosed, wherein the foundation material, to which the tiles are secured, itself is attached movable in the horizontal direction relative to the building frame.

{Literature of Conventional Art}

{Patent Literature}

[0005]

{Patent Literature 1} Japanese Unexamined Patent Application No. 05-018088
{Patent Literature 2} Japanese Patent No. 3171567

{Summary of Invention}

{Technical Problem}

[0006] However, where one large tile or a tile panel having small tiles glued thereon is installed on the outer wall of a building, the amplitude of shaking of the building induced by the earthquake at higher floors is larger than that of at lower floors. This causes a large distortion at the upper and lower portions of the tile panel. This problematical distortion cannot be absorbed even the panel is installed movable in the horizontal direction.

[0007] An object of the present invention is therefore to provide a tile panel support structure that is able to follow the building-swinging induced by the earthquake or similar movement for the case where a large-size tile is installed by a dry method.

{Solution to Problem}

[0008] As a solution to this problem, the present invention provides a large tile panel support structure to be attached to a building wall by a dry method.

[0009] The feature of the invented tile panel support structure includes the following:

a horizontal frame extending in the crosswise direction that is intermittently fixed to the front face of the wall material in multiple positions from top to bottom,
a vertical frame extending vertically which is fixed to the left and right ends and the center of the rear face of the tile panel so that it can be hung on the horizontal frame,
a supporting bracket fixed to either or both of the uppermost- and lowermost-positioned the horizontal frames at the position where at least the vertical frame is fixed,
a load-bearing bracket fixed to the vertical frame positioned in the center of positions where the uppermost-positioned horizontal frame is fixed;
wherein
the supporting bracket supports the vertical frame so that the tile panel will not horizontally deviate; and
the load-bearing bracket is positioned on the horizontal frame so that a downward-convex shaped lug part of the load-bearing bracket rests on the horizontal frame to bear the weight of the tile panel at one point.

[0010] The further feature of the tile panel support structure of the present invention includes an arrangement in which the tile receiving bracket that supports the bottom of the tile is fixed to the tile panel.

[0011] The feature of the tile panel support structure of the present invention includes an arrangement that the vertical frame has an engaging slit for hanging on the horizontal frame and the horizontal frame is made up of an upper fin and a middle web connected from the upper fin. On the middle web, the load-bearing bracket rests.

[0012] Further, a feature of the tile panel support structure includes an aspect that the supporting bracket of the support structure is given a cut-off at its corners so that the corners do not hit the vertical frame when the wall material tilts.

[0013] The tile panel support structure of the present

invention for attaching plural tile panels to building wall material further includes the following features.

[0014] The invented structure is comprised of:

a horizontal frame extending in the crosswise direction that is intermittently fixed to the front face of the building wall material, of which unevenness is adjusted, in the multiple positions from top to down;
a vertical frame extending vertically which is fixed to the rear of the tile panel so that the vertical frame can be hung on the horizontal frame;
a supporting bracket fixed to the horizontal frame so as to sandwich the vertical frame; and
a load-bearing bracket placed on the horizontal frame fixed to the vertical frame, wherein the load-bearing bracket has a lug part, the end of which has a shape of downward convex to support the weight of the tile panel at one point.

[0015] The feature of the tile panel support structure described above further includes the following: the horizontal frame is arranged between one tile panel and another tile panel immediately above and has a rise prevention plate fixed to prevent the above-stated one tile panel from rising toward that another tile panel.

[0016] In the tile panel support structure, the tile panel is a fireproof panel.

{Advantageous Effects of Invention}

[0017] According to the present invention, even when a large tile is installed by a dry method, it can follow swinging induced by earthquakes. Even a tile panel is large and heavy, the distortion occurred in the tile panel can be absorbed even if the amplitude of the swinging becomes larger because the invented supporting structure supports the tile panel at one point which allows right-to-left oscillation.

{Brief Description of Drawings}

[0018]

{Figure 1} This Figure illustrates a general view of the tile panel support structure of the present invention. The Figure includes a front view, a plan view, and a side elevation.

{Figure 2} This Figure illustrates an enlarged view of the part A of the tile panel support structure of the present invention. The enlarged view includes a front view, a plan view, and a side elevation.

{Figure 3} This Figure is a perspective rear view of the state in which the vertical frame is hung on the horizontal frame of the tile panel support structure of the present invention.

{Figure 5} This Figure is a perspective rear view to show the state in which a load is supported by the load-bearing bracket of the tile panel support structure of the present invention.

{Figure 4} This Figure is a perspective front view to show the state in which the supporting bracket is arranged at the vertical frame position on the tile panel support structure of the present invention.

{Figure 6} This Figure is a front view to show the state in which distortion occurs in the building that is provided with the tile panel support structure of the present invention.

{Figure 7} This Figure shows the horizontal frame of the tile panel support structure of the present invention. The frame is shown in a front view, a plan view, and a side elevation.

{Figure 8} This Figure shows the vertical frame of the tile panel support structure of the present invention. The frame is shown in a front view, a plan view, and a side elevation.

{Figure 9} This Figure shows the load-bearing bracket of the tile panel support structure of the present invention. The bracket is shown in a front view, a plan view, and a side elevation.

{Figure 10} This Figure shows the supporting bracket of the tile panel support structure of the present invention. The bracket is shown in a front view, a plan view, and a side elevation.

{Figure 11} This Figure shows the portion B in the tile panel support structure of the present invention. The portion B is shown in an enlarged front view, a plan view, and a side elevation.

{Figure 12} This Figure shows the tile receiving bracket in the tile panel support structure of the present invention. The bracket is shown in a front view, a plan view, and a side elevation.

{Figure 13} This Figure shows an example in which a fireproof panel is used in the tile panel support structure of the present invention. The example is shown in a front view, a plan view, and a side elevation.

{Figure 14} This Figure shows the horizontal frame when a fireproof panel is used in the tile panel support structure of the present invention. The horizontal frame is shown in a front view, a plan view, and a side elevation.

{Figure 15} This Figure shows the load-bearing bracket when a fireproof panel is used in the tile panel support structure of the

present invention. The load-bearing bracket is shown in a front view, a plan view, and a side elevation.

{Figure 16} This Figure shows the supporting bracket when a fireproof panel is used in the tile panel support structure of the present invention. The supporting bracket is shown in a front view, a plan view, and a side elevation.

{Figure 17} This Figure shows the rise prevention plate when the fireproof panel is used in the tile panel support structure of the present invention. The rise prevention plate is shown in a front view, a plan view, and a side elevation.

{Description of Embodiments}

[0019] The following describes embodiments of the present invention in detail referring to the drawings. It should be noted that the elements having the same function are denoted by the same reference numerals, and repeated description thereof may be omitted.

{Example 1}

[0020] First, described below is the outline of the tile panel support structure of the present invention. Figure 1 shows a general view of the tile panel support structure, where the sketch (a) is a front view, (b) is a plan view, and (c) is a right-side elevation. Further note that the outward direction of the building is denoted as "front" (outside) and inward direction "rear" (backside). In addition, in the front view (a), the tile panel is shown as if transparent (this also applies to Figure 2 and Figure 11).

[0021] As Figure 1 shows, a tile panel 400 is installed by a dry method on a wall material 200 of a building 100. The wall material 200 is a construction material to be used as an outer wall of the building body 100. For this purpose, PC plate (precast concrete plate), ALC panel (Autoclaved Lightweight Concrete Panel), and ECP (Extruded Cement Plate) can be used. The wall material 200 is fixed with a screw 220 using a furring strip 210 as a foundation. The furring strip 210 is a longitudinally extended shape steel having a C-shaped cross-section (such as C-channel). At the bottom end of the wall material 200, a creasing 230 may be installed.

[0022] On the front of the wall material 200, plural horizontal frames 300 are secured. On the rear of the tile panel 400, plural vertical frames 500 are fixed. The tile panel 400 is attached to the wall material 200 by hanging the vertical frame 500 on the horizontal frame 300.

[0023] The horizontal frame 300 is hardware that extends in the crosswise direction and is fixed to the front face of the wall material 200 in the multiple positions from top to bottom. Between the uppermost horizontal frame 300 installed around the top of the tile panel 400 and the lowermost horizontal frame 300 installed around the bottom of the tile panel 400, any number of horizontal frames 300 can additionally be installed. The horizontal frame 300 may be fixed to the wall material 200 at the position of the furring strip 210 using the screw 220 that fixes the wall material 200.

[0024] The tile panel 400 is a decorative material, to which one large tile or plural number of small tiles are glued. The tile in this purpose includes stone formed in a thin sheet other than plate materials such as ceramic plates. The tile panel 400 may be manufactured by gluing tiles in advance, or alternatively, tiles may be glued when installing the panel on the wall material 200. Note that, when the tile panel 400 becomes large, it will be greatly affected when the building 100 is distorted by shaking such as the earthquake.

[0025] The vertical frame 500 is hardware extending vertically, they are arranged in plurality on the rear of the tile panel 400. The vertical frame 500 is arranged at least at the left end and in the middle and at the right end of the tile panel 400. The vertical frame 500 may be arranged further at any position between these left-, middle-, and right-position.

[0026] To the vertical frame 500, a load-bearing bracket 600 is fixed. The load-bearing bracket 600 is attached to the center-positioned the vertical frame 500 in alignment with the position where the horizontal frame 300 of the uppermost is fixed. One load-bearing bracket 600 is enough for one tile panel 400. The load-bearing bracket 600 rests on the horizontal frame 300 when the vertical frame 500 is hung on the horizontal frame 300. The load of the tile panel 400 is imposed on the load-bearing bracket 600 and that load is borne at one-point on the contact point with the horizontal frame 300.

[0027] On the horizontal frame 300, a supporting bracket 700 fixed. The supporting bracket 700 is attached to the horizontal frames 300 of the uppermost and lowermost position. The attaching position of the supporting plate 700 is the location matched at least with the vertical frame 500 on the left end, in the middle, and on the right end. Alternatively, the attaching position can be the place in alignment with the fixing position of the vertical frame 500 located in the middle or can be the horizontal frame 300 located in the middle. The vertical frame 500 is held by the supporting plate 700 so that the tile panel 400 will not deviate crosswise when the vertical frame 500 is hung on the horizontal frame 300.

[0028] To the tile panel 400, a tile receiving hardware 800 which supports the underside of the tile is fixed. The tile receiving hardware 800 is hardware having a fin sticking out toward the near side so that the bottom face of the tile rests thereon. The tile receiving hardware 800 is required only to be fixed to the underside of the tile panel 400 using the screw fixing the vertical frame 500 to the tile panel 400.

[0029] Next, description follows about the structure of the upper part of the tile panel support structure. Figure 2 shows the enlarged view of the portion A (which appears in the upper middle part of Figure 1 encircled with

a dotted circle) and its vicinity showing the tile panel support structure. In Figure 2, the sketch (a) is an enlarged front view, (b) a plan view, and (c) a right-side elevation.

[0030] As shown in Figure 2, the tile panel 400 is not secured to the wall material 200 and supported at one-point by the load-bearing bracket 600. The tile panel 400 is held by the supporting bracket 700 so as not to deviate positionally.

[0031] The tile panel 400 is comprised of a foundation 420 like a magnesium plate and a tile 410 glued thereon by a glue 430 such as an elastic adhesive. When sheet-like stone made by thinly shaving natural stone is used in a large size, the size of the tile panel 400 should be enlarged to the matched size.

[0032] The vertical frame 500 is fixed to the rear of the foundation 420 by penetrating a screw from its front side to the rear side. On the rear side of the vertical frame 500, the load-bearing bracket 600 is fixed with a screw 440a. On the front of the horizontal frame 300, the supporting bracket 700 is fixed using a screw 440b.

[0033] Figure 3 is a perspective rear view to show the state in which the vertical frame is hung on the horizontal frame of the tile panel support structure. (The wall material is not shown for simplicity.) Figure 4 is a perspective front view to show the state in which the supporting bracket is arranged at the position of the vertical frame of the tile panel support structure. (The tile panel is not shown for simplicity.) Figure 5 is a perspective rear view to show the state of one-point supporting by the load-bearing bracket of the tile panel support structure. (The wall material is not shown for simplicity.)

[0034] As Figure 3 shows, the vertical frame 500 is hung on the horizontal frame 300. This is only for the prevention of the tile panel 400 from back and forth deviation, therefore lifting the tile panel 400 easily releases from the hung state.

[0035] As Figure 4 shows, the vertical frame 500 is hung at the position of the horizontal frame 300 where the supporting bracket 700 is attached to. The supporting bracket 700 is hung on the front side and the load-bearing bracket 600 on the rear side.

[0036] As Figure 5 shows, the horizontal frame 300 and the vertical frame 500 are not engaged fully to the inner part, but resting the load-bearing bracket 600 on the horizontal frame 300 works as a support. The load of the tile panel 400 is borne only at the contact point between the load-bearing bracket 600 and the horizontal frame 300.

[0037] Figure 6 is a front view to show states of distortion occurred in the building that has the tile panel support structure, wherein the sketch (a) shows a state no distortion occurred and (b) shows a state distortion occurred. If the earthquake occurs, a building shakes and the amplitude of shaking of the building induced by the earthquake at higher floors is larger than that of at lower floors as Figure 6 shows. This shaking causes a tilt of the building 100 resulting in distortion, which produces a large positional deviation difference 240 between the top and bottom of the tile panel 400.

[0038] Where the wall material 200 is glued by elastic glue to the tile panel 400, the distortion occurred in the building 100 cannot be absorbed only by the elastic glue, and the tile panel 400 may be damaged. Therefore, the tile panel 400 is not glued to the wall material 200 but supported with load-bearing bracket 600 positioned in the center of the tile panel 400 so as to allow following the shaking. The tile panel 400 tilts so that the vertical frame 500 fixed to the tile panel 400 matches to the position of the supporting bracket 700 on the horizontal frame 300 fixed to the wall material 200. That is, the tile panel 400 tilts following the tilt of the building 100.

[0039] Each member will be described. Figure 7 shows the horizontal frame of the tile panel support structure, wherein the sketch (a) shows a front view, (b) a plan view, and (c) a right-side elevation. Figure 8 shows the vertical frame of the tile panel support structure, wherein the sketch (a) shows a front view, (b) a plan view, and (c) a right-side elevation. Figure 9 shows the load-bearing bracket of the tile panel support structure, wherein the sketch (a) shows a front view, (b) a plan view, and (c) a right-side elevation. Figure 10 shows the supporting plate of the tile panel support structure, wherein the sketch (a) shows a front view, (b) a plan view, and (c) a right-side elevation.

[0040] As Figure 7 shows, the horizontal frame 300 is a metalwork of horizontally-long plate material, which is folded to have a crank-shape cross-section. The horizontal frame 300 is made up of an upper fin 310 that perpendicularly rises formed on the front, a lower fin 330 that perpendicularly hung down formed on the rear, and a middle web 320 that connects the bottom end of the upper fin 310 and the top end of the lower fin 330.

[0041] The upper fin 310 is a separating portion to give an allowance between the wall material 200 to hang the vertical frame 500 thereon and the supporting bracket 700 also can be fixed thereto. The middle web 320 is a part on which the load-bearing bracket 600 rests.

[0042] The lower fin 330 is a portion to be fixed to the wall material 200. The lower fin 330 has alternately an elongated securing hole 340 and a circular securing hole 340a allowing a securing screw to be passed at any position.

[0043] As Figure 8 shows, the vertical frame 500 is a metalwork of vertically-long plate material, which is bent to form a U-shape cross-section. The vertical frame 500 is made up of a vertical side fin 510 formed on the left, a vertical side fin 510 formed on the right, and a bottom web 520 that connects the front ends of vertical side fins 510 on the left and right.

[0044] The vertical side fin 510 is the portion that protrudes rearward for hanging on the horizontal frame 300. The load-bearing bracket 600 also can be attached. The vertical side fin 510 has an engaging slit 530 for hanging on the horizontal frame 300 thereon. The engaging slit 530 is a cut-out portion of the vertical frame 500, which is provided so that its position will match the position of

the horizontal frame 300. The cut-out portion has a slit in the upper part thereof to form a lug part which extends down in a hook shape so as to be hung on the upper fin 310 of the horizontal frame 300.

[0045] On the vertical side fin 510, a securing hole 540 is drilled in the location around the upper portion of the engaging slit 530. This hole allows the screw 440a penetration tightening when the load-bearing bracket 600 is installed so as to cross behind from the vertical fin 510 on the left to the vertical fin 510 on the right. The bottom web 520 is the portion that is fixed to the tile panel 400.

[0046] As Figure 9 shows, the load-bearing bracket 600 is a metalwork of plate material, of which cross-section is an inverted U-shape. The load-bearing bracket 600 is made up of a vertical side fin 610 formed on the left, a vertical side fin 610 formed on the right, and a rear web 620 that connects the rear ends of the vertical side fins 610 on the left and right, and made up of a lug part 630 that protrudes downward from the rear web 620.

[0047] The vertical side fin 610 is the part to be fixed to the vertical frame 500. The space between the vertical side fins 610 on the left side and on the right side is the same as the width of the vertical frame 500 (including its plate thickness). The load-bearing bracket 600 is put over the rear of the vertical frame 500 so as to be covered with the rear web 620.

[0048] A securing hole 660 is drilled also on the vertical side fin 610 in alignment with the position of the securing hole 540 in the vertical frame 500 so as to make the screw 440a can pass through. Further, to prevent the engaging slit 530, which is for hanging the vertical side fin 500 on the horizontal frame 300, from being closed by the vertical side fin 610, a cutout 650 is provided in the vertical side fin 610 in alignment with the position of the engaging slit 530 of the vertical frame 500.

[0049] The lower end of the lug part 630 has a curvature part 640 having protruding shape. The curvature part 640 of the lug part 630 rests on the middle web 320 of the horizontal frame 300, wherein only one point on the curvature part 640 rests on the horizontal frame 300. The load of the tile panel 400 concentrates at that point. The curvature part allows the tile panel 400 to tilt.

[0050] The vertical length of the lug part 630 is determined to be such a length as the load of the tile panel 400 will not be imposed when the vertical frame 500 is hung on the horizontal frame 300 making the engaging slit 530 of the vertical frame 500 sit on the top end of the upper fin 310 of the horizontal frame 300.

[0051] As Figure 10 shows, the supporting plate 700 is a folded metalwork having a U-shaped vertical cross-section. The supporting bracket 700 is made up of horizontal side fins 710 on the top side and on the bottom side, and a rear web 720 that connects their rear ends.

[0052] The horizontal side fins 710 are the portion made to protrude toward the front side from the horizontal frame 300. The width of the horizontal side fins 710 is a width that can be inserted between the vertical side fins 510 on the left and on the right. In the rear web 720, a securing hole 740 is drilled. The screw 440b can pass through the securing hole 740 when fixing on the upper fin 310 of the horizontal frame 300.

[0053] Fitting the horizontal side fin 710 into the vertical frame 500 prevents the crosswise positional deviation of the tile panel 400. On the horizontal side fin 710, a cut-off 730 is formed so that the corner of the wall material 200 does not hit the vertical frame 500 when the wall material 200 tilts. The cut-off 730 can be formed in a style of either diagonal cut or rounding.

[0054] Next, the structure of the lower part of the tile panel support structure is described. Figure 11 shows the enlarged view of the portion B (which appears in the lower center part of Figure 1 encircled with a dotted circle) and its vicinity showing the tile support structure. In Figure 11, the sketch (a) is a front view, (b) a plan view, and (c) a right-side elevation. The sketch (a) shows the tile panel transparently for simplicity. Figure 12 shows the tile receiving hardware of the tile panel support structure. The sketch (a) is a front view, (b) is a plan view, and (c) is a right-side elevation.

[0055] As Figure 11 shows, fitting the supporting plate 700 fixed to the horizontal frame 300 into the vertical frame 500 prevents the crosswise positional deviation of the tile panel 400. Note that the supporting bracket 700 is movable along with the vertical frame 500. The supporting bracket 700 is fixed to either or both the uppermost-positioned and the lowermost-positioned horizontal frames 300 on which position at least the vertical frame 500 is fixed.

[0056] The tile panel 400 is made up of the tile 410 simply stuck on the foundation 420 with the glue 430. Therefore, the tile panel 400 is supported at its bottom by the tile receiving hardware 800. The tile receiving hardware 800 is put between the foundation 420 and the vertical frame 500 using a screw 440 that is also used for fixing the vertical frame 500 on the tile panel 400.

[0057] As Figure 12 shows, the tile receiving hardware 800 is a metalwork of plate metal longitudinally-long, which is bent to have an L-shape cross-section. The tile receiving hardware 800 is made up of a vertical rear fin 810 that perpendicularly rises on the rear and a lower horizontal fin 820 connected thereto protruding frontward from the lower end of the vertical rear fin 810. The tile receiving hardware 800 may have the same width as that of the tile panel 400.

[0058] The vertical rear fin 810 is the part that is fixed to the tile panel 400. The lower horizontal fin 820 is the part on which the tile 410 rests. That fin is required to protrude frontward only by the thickness of the tile 410. The protrusion may be provided partly or at intervals since the fin is only for supporting the tile 410.

{Example 2}

[0059] Next, the tile panel support structure is described in an example where a fireproof panel is used.

Figure 13 shows the fireproof panel, wherein the sketch (a) is a front view (where the tile is regarded transparent for simplicity), (b) a plan view cut along the cutting line A-A, and (c) a side elevation.

Figure 14 shows the horizontal frame, wherein the sketch (a) is a front view, (b) a plan view, and (c) a side elevation.

Figure 15 shows the load-bearing bracket, wherein the sketch (a) is a front view, (b) a plan view, and (c) a side elevation.

Figure 16 shows the supporting bracket, wherein the sketch (a) is a front view, (b) a plan view, and (c) a side elevation.

Figure 17 shows a rise prevention plate, wherein the sketch (a) is a front view, (b) a plan view, and (c) a side elevation.

[0060] As Figure 13 shows, plural tile panels 950 and 950a of fireproof property are attached to a fireproof panel 900 after the unevenness of the wall material 990 is adjusted using an unevenness adjusting hardware 980. A joint 950b between the tile panels 950 and 950a can be filled with a material such as a fireproof sealant.

[0061] The wall material 990 is a material such as concrete or cement plate, into which bolts or anchor bolts are then driven, and the unevenness adjusting hardware 980 is attached to the wall material 990. The unevenness adjusting hardware 980 is arranged to bridge vertically adjacent tile panels 950 and 950a to form them in one series of panels and is used as hardware for installing the tile panels 950 and 950a by a dry method.

[0062] The tile panel 950 is a porcelain ceramic tile or similar material, where arrayed plural tiles can also be employable. On the back of the tile panel 950, a fireproof plate 960 and 960a are glued (using elastic or mineral glue) to give fireproof property. Note that the fireproof plates 960 and 960a are magnesium plates for example. Using such plates in a stack is also an employable style.

[0063] The fireproof panel 900 is comprised of the following:

a horizontal frame 910 extending in crosswise direction fixed in plurality on the front face of the wall material 990 at intermittent intervals from top to bottom after adjustment of unevenness,

a vertical frame 970 extending in vertical direction fixed to the rear face of the fireproof panel 900 so that the fireproof panel 900 can be hung on the horizontal frame 910,

a supporting bracket 930 fixed to the horizontal frame 910 so as to sandwich the vertical frame 970, and

a load-bearing bracket 920 fixed to the vertical frame 970 and resting on the horizontal frame 910.

[0064] The horizontal frame 910 is arranged between tile panel 950 adjacent below and the tile panel 950a adjacent above and is fixed with a screw on the unevenness adjusting hardware 980. The lower part of the horizontal frame 910 supports the tile panel 950 adjacent below, and the upper part of the horizontal frame 910 supports the tile panel 950a adjacent above. The horizontal frame 910 and the tile panels 950 and 950a are fixed removably, not fixed directly.

[0065] The vertical frame 970 uses a square pipe of metal or resin and fixed at the center of the tile panel 950 (950a) with glue. The horizontal frame 910 and the vertical frame 970 are secured at the position where they intersect or near such intersection position.

[0066] The supporting bracket 930 holds the vertical frame 970 to prevent the positional crosswise deviation of the tile panel 950 (950a). The supporting bracket 930 is fixed to the horizontal frame 910 with screws on the positions, for example, immediate right and immediate left of the vertical frame 970 so that the vertical frame 970 is sandwiched between supporting brackets 930. In addition, the supporting bracket 930 for the prevention of crosswise positional deviation of tile panel 950 immediate below and a supporting bracket 930a for the prevention of crosswise positional deviation the tile panel 950a immediate above may be provided.

[0067] The load-bearing bracket 920 is fixed to the vertical frame 970 with screws or the like near the position where the vertical frame 970 and the horizontal frame 910 intersect. The load-bearing bracket 920 is attached to the upper part of the tile panel 950 below and rests on the horizontal frame 910 to support at one point the load of the tile panel 950 imposed on the horizontal frame 910. A fixing bracket 920a may be attached to the lower part of the panel 950a above.

[0068] A rise prevention plate 940 is fixed to the horizontal frame 910 with screws or the like at a position between the tile panel 950 below and the tile panel 950a above. The tile panel 950 below is held down so as not to rise toward the tile panel 950a above, and even if the tile panel 950 hits causing tilt, it can rotate accordingly.

[0069] As Figure 14 shows, the horizontal frame 910 is a folded metalwork of laterally long metal plate. The horizontal frame 910 is made up of a lower side receiver 911 in the lower part, an upper side receiver 912 in the upper part, and an intermediate part 913 in the center.

[0070] The lower side receiver 911 is a portion in which the lower portion of the horizontal frame 910 is folded back in a hook shape toward the near side, and the load-bearing bracket 920 is hung inside of the hook shape bent back. The supporting bracket 930 is fixed to a lower front bend 911a.

[0071] The upper side receiver 912 is a portion in which the upper part of the horizontal frame 910 is bent toward the near side in a crank shape, and the fixing bracket 920a is hung on the inner part of the crank shape. Further, the supporting bracket 930a is fixed to an upper front bend 912a.

[0072] The intermediate part 913 is a flat portion in the middle portion of the horizontal frame 910 and is in contact with the unevenness adjustment hardware 980. Plural securing holes 914 and 914a such as elongated holes

or round holes penetrate at an interval in the intermediate part 913, which is fixed to the unevenness adjusting metal hardware 980 through screws or the like.

[0073] As Figure 15 shows, the load-bearing bracket 920 is metalwork having a cross-section of an inverted U shape made by bending sheet metal. The load-bearing bracket 920 is made up of wings 921 on the left and right side, and an intermediate part 922.

[0074] The wing 921 is a part to be fixed to the vertical frame 970, and the spacing between the left-wing and the right-wing is the same as the width of the vertical frame 970 and is attached so as to cover the vertical frame 970. Plural securing holes 926 are drilled-through in the wings 921 on the right and left, which are fixed to the vertical frame 970 through screws or the like.

[0075] The intermediate part 922 is a part connecting the wings 921 on the left and right. The lower part of the intermediate part 922 extends downward below the wing 921 to form a lug part 923. The bottom end of the lug part 923 is formed into a curvature part 924 that has a downward-convex shape.

[0076] The lug part 923 is a portion that enters the lower side receiver 911 of the horizontal frame 910 and rests on the lower side receiver 911 with any one point on the curvature part 924 as a tip. Further, the lower portion of the wing 921 is also a portion that enters the lower side receiver 911 of the horizontal frame 910, and at least the portion that overlaps with the vertical frame 970 is formed in a cut-off 925.

[0077] The load of the tile panel 950 imposed on the horizontal frame 910 concentrates on the contact point between the curvature part 924 and the lower side receiver 911. Since the horizontal frame 910 bears the load of the tile panel 950 at one point, the tile panel 950 can swing following shaking such as the earthquake, and the strain incurred in the tile panel 950 is absorbed.

[0078] The fixing bracket 920a has a similar shape as the load-bearing bracket 920, but it is not necessary for the upper side receiver 912 of the horizontal frame 910 to bear the load of the tile panel 950a. Therefore, it is enough that the lower part of the fixing bracket 920a is fit in the upper side receiver 912, thus the lug part 923 is not formed.

[0079] As Figure 16 shows, the supporting bracket 930 is metalwork made by bending sheet metal, of which cross-section is a U shape. The supporting bracket 930 is made up of a side fins 931 on the upper side and lower side and an intermediate part 932 of that. The same applies to the supporting bracket 930a.

[0080] The side fin 931 is a part that protrudes toward the near side. The supporting hardware 930 is provided on the right and left sides of the position where the vertical frame 970 is arranged, that is, they are attached to the horizontal frame 910 with the same spacing as the width of the vertical frame 970. By arranging the support bracket 930 to sandwich the vertical frame 970 from the left and right sides, lateral displacement of the vertical frame 970 is prevented.

[0081] Further, to prevent the corner of the side fin 931 from hitting the vertical frame 970 incurred by vibration or similar movement, a curvature part 933 is formed on the side in contact with the vertical frame 970. Therefore, the left and right fins 930 are arranged in left-right symmetry.

[0082] The intermediate part 932 is a portion for connecting the side fins 931 on the upper and lower sides. A securing hole 934 penetrates through the intermediate part 932, and for the supporting bracket 930, the bracket is fixed to the lower front bend 911a of the lower side receiver 911 of the horizontal frame 910 through screws. Further, for the supporting bracket 930a, it is fixed to the upper front bend 912a of the upper side receiver 912 of the horizontal frame 910.

[0083] As Figure 17 shows, the rise prevention plate 940 is hardware having the vertical cross-section of L shape made of bent sheet metal. The rise prevention plate 940 is made up of a vertical fin 941 at the upper part thereof and a lower horizontal fin 942 at the lower part thereof.

[0084] The vertical fin 941 is a flat portion to be fixed to the horizontal frame 910. A securing hole 944 penetrates the vertical fin 941. The vertical fin 941 is fastened below the upper side receiver 912 of the horizontal frame 910 through the securing hole 914a with a screw or the like. The securing hole 914a is an upper hole among holes made in the horizontal frame 910.

[0085] The lower horizontal fin 820 is a portion that protrudes toward the near side. The lower horizontal fin 820 is arranged to extend above the load-bearing plate 920. Even if the tile panel 950 rises due to vibration or other similar motion, the load-bearing plate 920 hits the lower horizontal fin 820 and prevents the tile panel 950 from further rising.

[0086] Since the securing hole 944 is an elongated hole and is fastened at one point, the rise prevention plate 940 can slide slightly up and down or rotated if a strong force is applied. Further, by forming the upper edge of the vertical fin 941 as a curvature part 943, the rise prevention plate 940 is ensured to rotate even when it rises to hit the upper side receiver 912 and can follow vibration or the like.

[0087] According to the present invention, even when a large tile is to be installed by a dry method, the tile can be made to follow vibrations incurred by such as the earthquake. Since the tile panel is supported at one point against the wall surface and can swing left and right, even in the case of a large and heavy tile panel, the distortion generated in the tile panel can be absorbed even if the swing amplitude due to vibration becomes large.

[0088] Embodiment examples of the present invention have been described as above; the present invention is however not limited thereto. For example, in the tile panel 400, the foundation 420 may be manufactured first and one large or plural small tiles 410 may be attached later thereon, or the tile panel 400 may be manufactured with large or plural small tiles 410 stuck on the foundation 420

in advance.

[0089] Further, since the support bracket is required only to be capable of holding the vertical frame, it may have another shape as long as it has a convex shape such as a disk-shape.

[0090] Even if there is no wall material on the wall of a building, it is possible to close an opening with a large tile panel that reaches from the first floor to the second floor.

{Reference Signs List}

[0091]

100: Building
200: Wall material
210: Furring strip
220: Screw
230: Drip
240: Deviation
300: Horizontal frame
310: Upper fin
320: Middle web
330: Lower fin
340: Elongated securing hole
400: Tile panel
410: Tile
420: Foundation
430: Glue
440: Screw
500: Vertical frame
510: Vertical side fin
520: Bottom web
530: Engaging slit
540: Securing hole
600: Load-bearing bracket
610: Vertical lateral fin
620: Rear web
630: Lug part
640: Curvature part
650: Cutout
660: Securing hole
700: Supporting bracket
710: Horizontal side fin
720: Rear web
730: Cut-out
740: Securing hole
800: Tile receiving hardware
810: Vertical rear fin
820: Lower horizontal fin
900: Fireproof panel
910: Horizontal frame
911: Lower side receiver
911a: Lower front bend
912: Upper side receiver
912a: Upper front bend
913: Intermediate part
914: Securing holes
914a: Securing hole
920: Load-bearing brackets
920a: Fixing bracket
921: Wing
922: Intermediate part
923: Lug part
924: Curvature part
925: Cut-off
926: Securing hole
930: Supporting bracket
930a: Supporting bracket
931: Side fin
932: Intermediate part
933: Curvature part
934: Securing hole
940: Rise prevention plate
941: Vertical fin
942: Horizontal fin
943: Curvature part
944: Securing hole
950: Tile panel
950a: Tile panel
950b: Joint
960: Fireproof plate
960a: Fireproof plate
970: Vertical frame
980: Unevenness adjusting hardware
990: Wall material

Claims

1. A tile panel support structure for attaching a large tile panel to a building wall by a dry method, comprising:

a horizontal frame extending in the crosswise direction that is intermittently fixed to the front face of the wall material in multiple positions from top to bottom;
a vertical frame extending vertically which is fixed to the left and right ends and the center of the rear face of said tile panel so that it can be hung on said horizontal frame;
a supporting bracket fixed to either or both of the uppermost- and lowermost-positioned said horizontal frames at the position where at least said vertical frame is fixed;
a load-bearing bracket fixed to said vertical frame positioned in the center of positions where said uppermost-positioned horizontal frame is fixed;
wherein
said supporting bracket supports said vertical frame so that said tile panel will not horizontally deviate; and
said load-bearing bracket is positioned on said horizontal frame, wherein a downward-convex

shaped lug part of said load-bearing bracket rests on said horizontal frame to bear the weight of said tile panel at one point.

2. The tile panel support structure according to claim 1, wherein said tile panel includes a tile receiving bracket fixed to support a bottom of a tile.

3. The tile panel support structure according to claim 1 or claim 2, wherein

said vertical frame has an engaging slit for hanging on said horizontal frame;
said horizontal frame is made up of an upper fin and a middle web connected from said upper fin; and
said load-bearing bracket rests on said middle web.

4. The tile panel support structure according to any one of claim 1 to claim 3, wherein
said supporting bracket of said support structure is given a cut-off at its corners so that said corners do not hit said vertical frame when said wall material tilts.

5. The tile panel support structure for attaching plural tile panels to building wall material, comprising:

a horizontal frame extending in the crosswise direction that is intermittently fixed to the front face of a building wall material, of which unevenness is adjusted, in the multiple positions from top to bottom;
a vertical frame extending vertically which is fixed to the rear of said tile panel so that said vertical frame can be hung on said horizontal frame;
a supporting bracket fixed to said horizontal frame so as to sandwich said vertical frame; and
a load-bearing bracket placed on said horizontal frame fixed to said vertical frame, wherein said load-bearing bracket has a lug part, the end of which has a shape of downward convex to support the weight of said tile panel at one point.

6. The tile panel support structure according to claim 5, wherein said horizontal frame is arranged between one tile panel and another tile panel immediately above and has a rise prevention plate fixed to prevent said above-stated one tile panel from rising toward said another tile panel.

7. The tile panel support structure according to any one of claim 1 to claim 6, wherein said tile panel is a fireproof panel.

Fig. 1

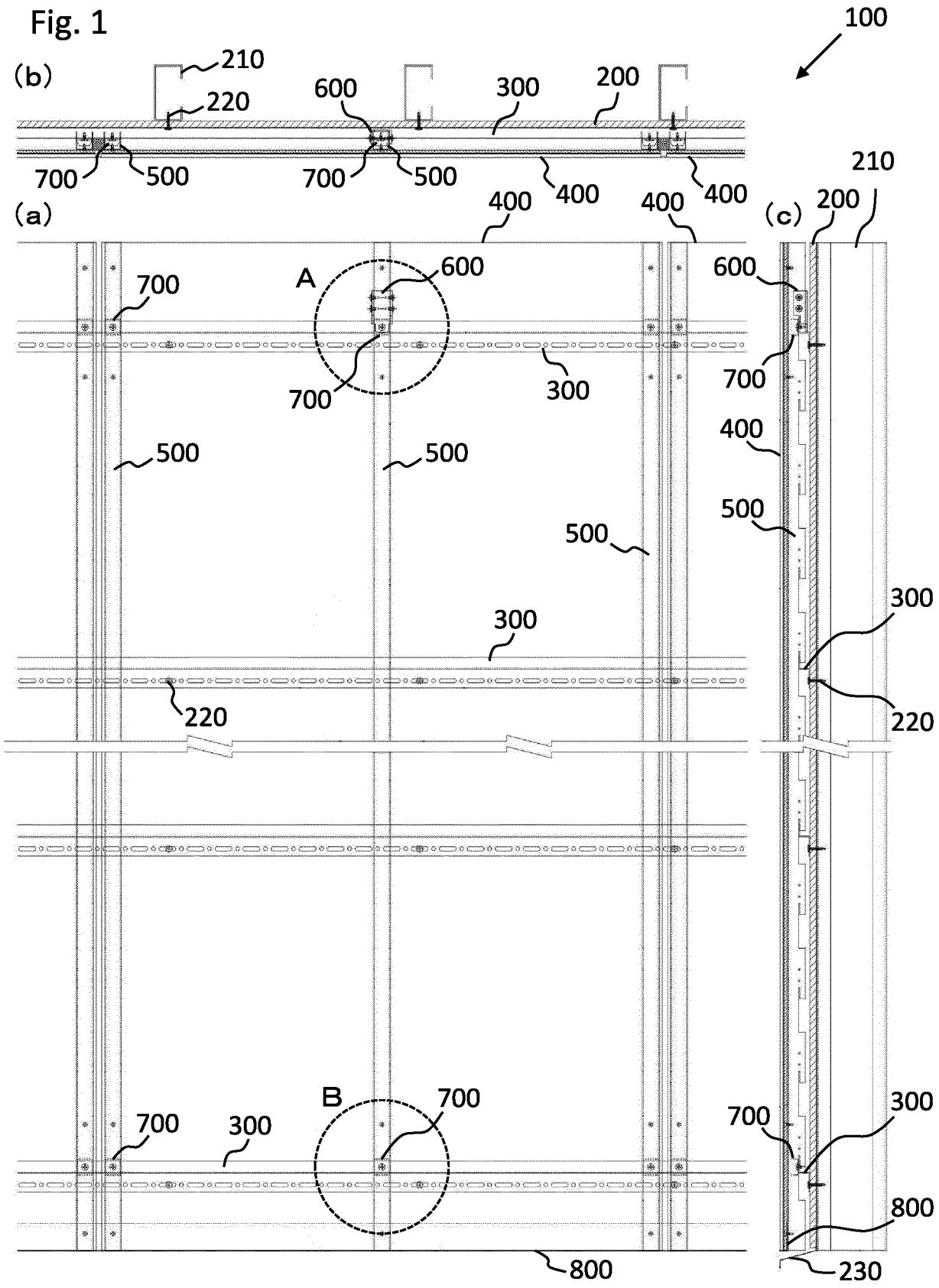

100
(b)
210
220
600
300
200
700
500
700
500
400
400
400
(a)
(c)
200
210
A
600
700
700
300
600
700
400
500
500
500
300
300
220
220
B
700
700
300
700
300
800
800
230

Fig. 2

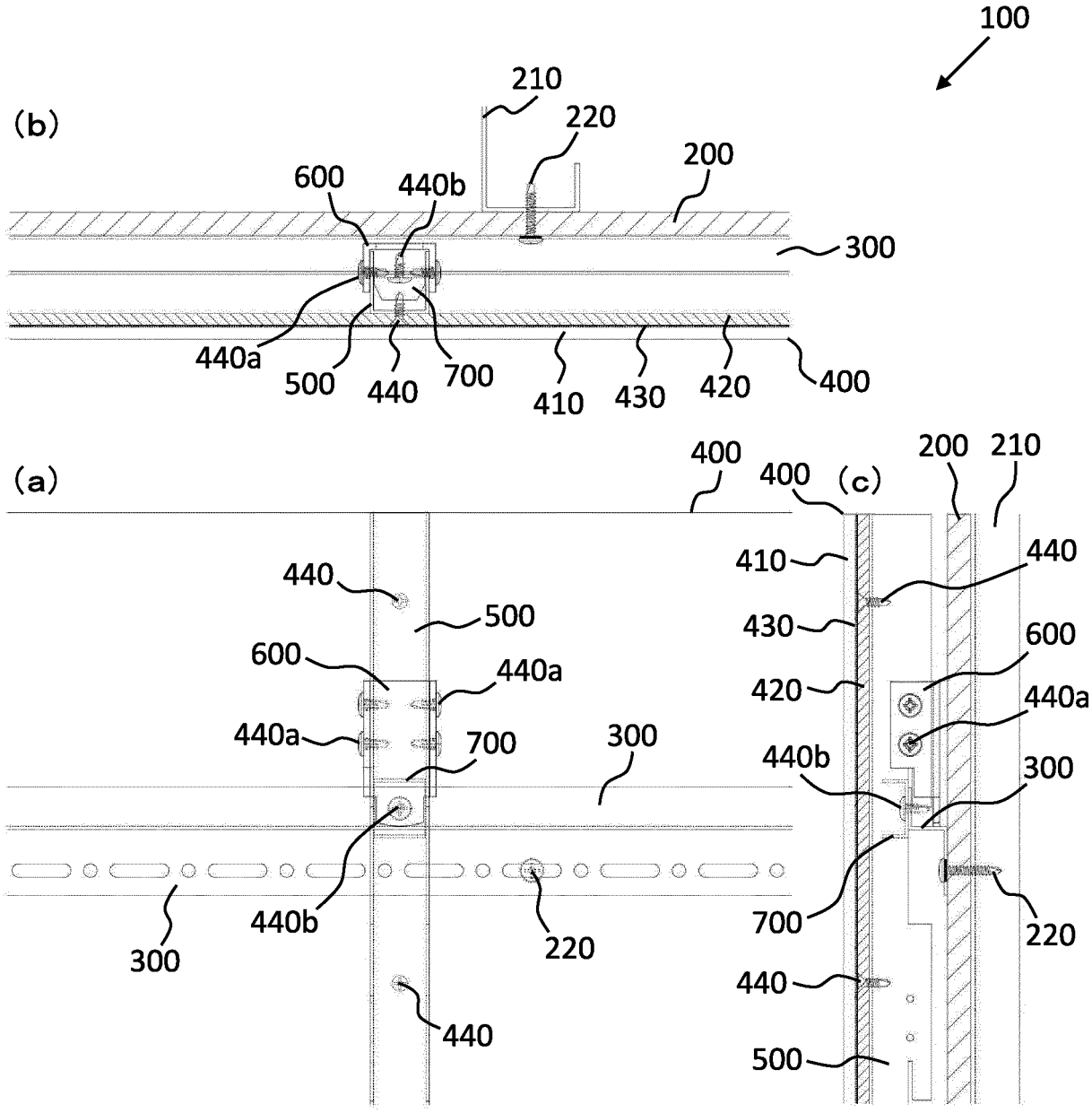

100
(b)
210
220
200
600
440b
300
440a
500
440
700
410
430
420
400
(a)
400
440
500
600
440a
440a
700
300
440b
300
220
440
(c)
400
200
210
410
440
430
600
420
440a
440b
300
700
220
440
500

Fig. 3

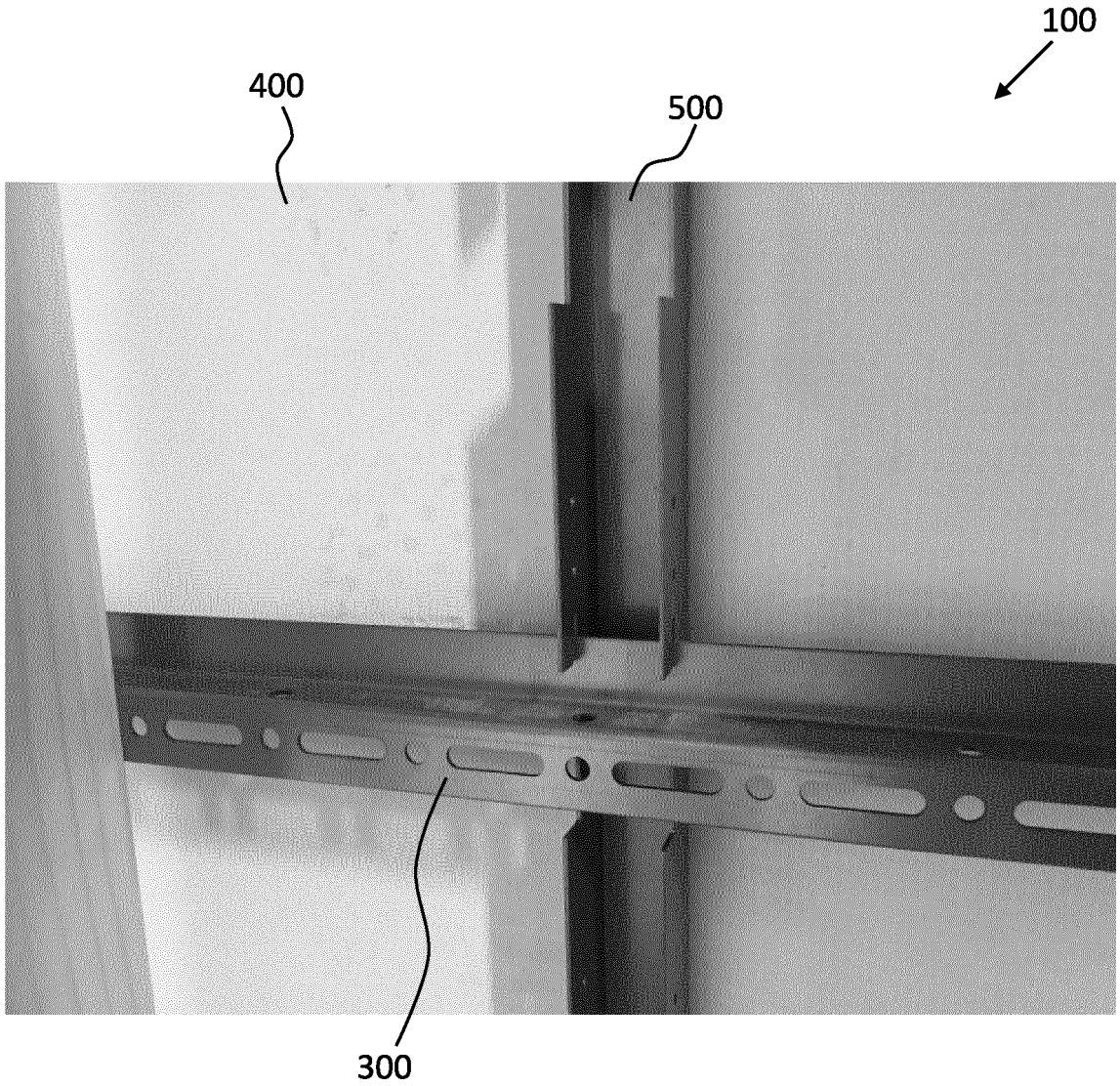


Fig. 4

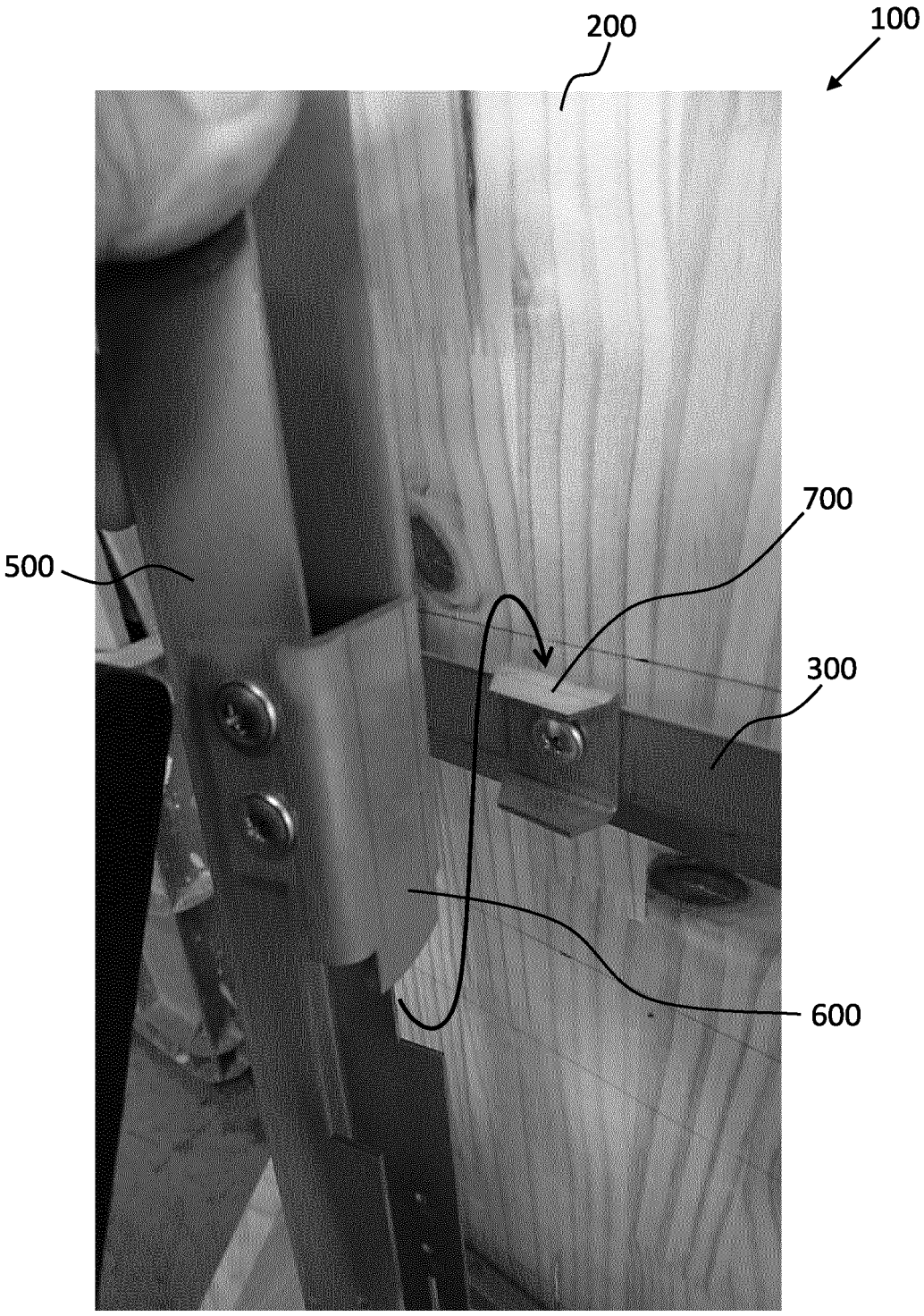


Fig. 5

Fig. 6

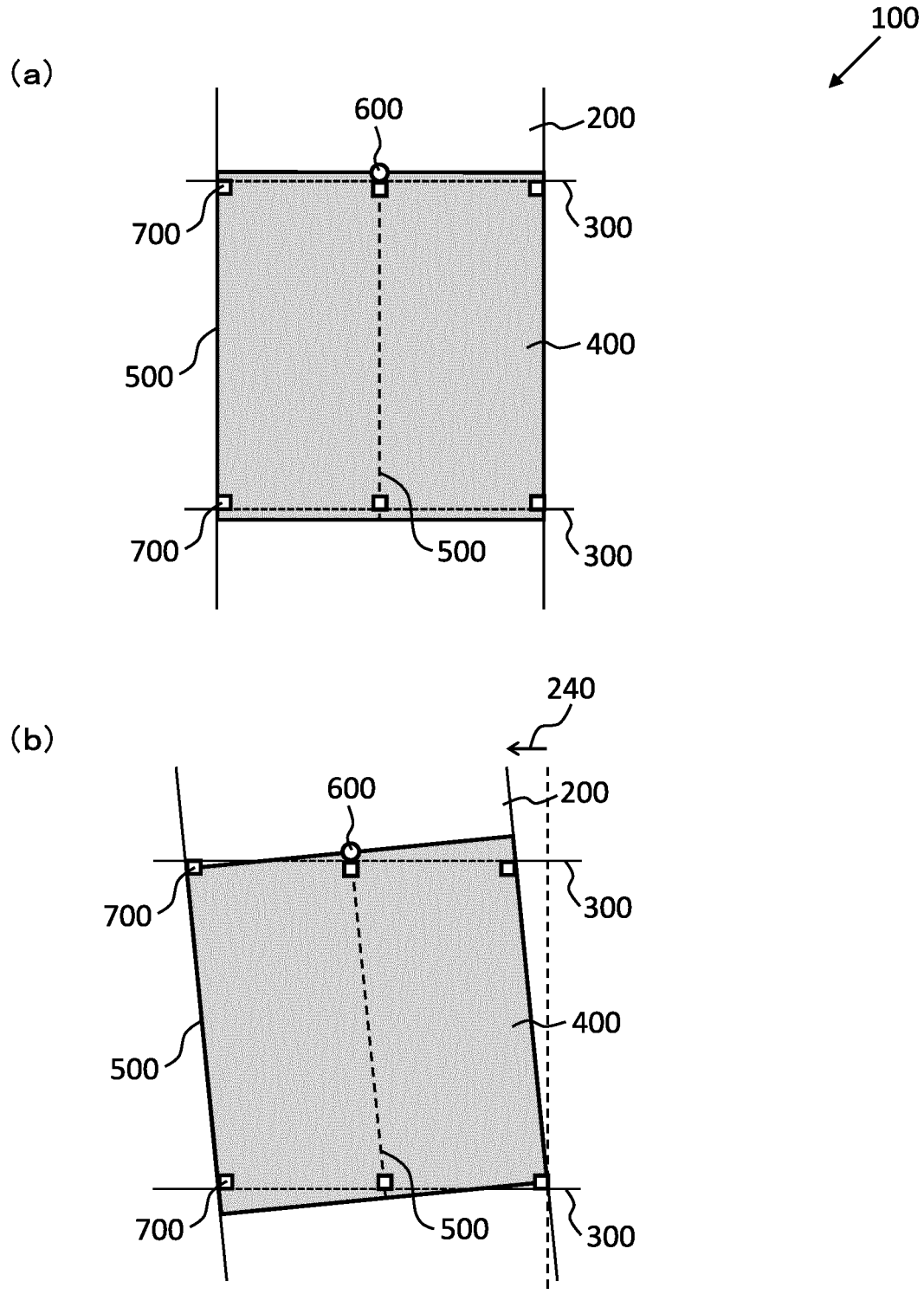

100
(a)
600
200
700
300
400
500
700
500
300
(b)
240
600
200
700
300
400
500
700
500
300

Fig. 7

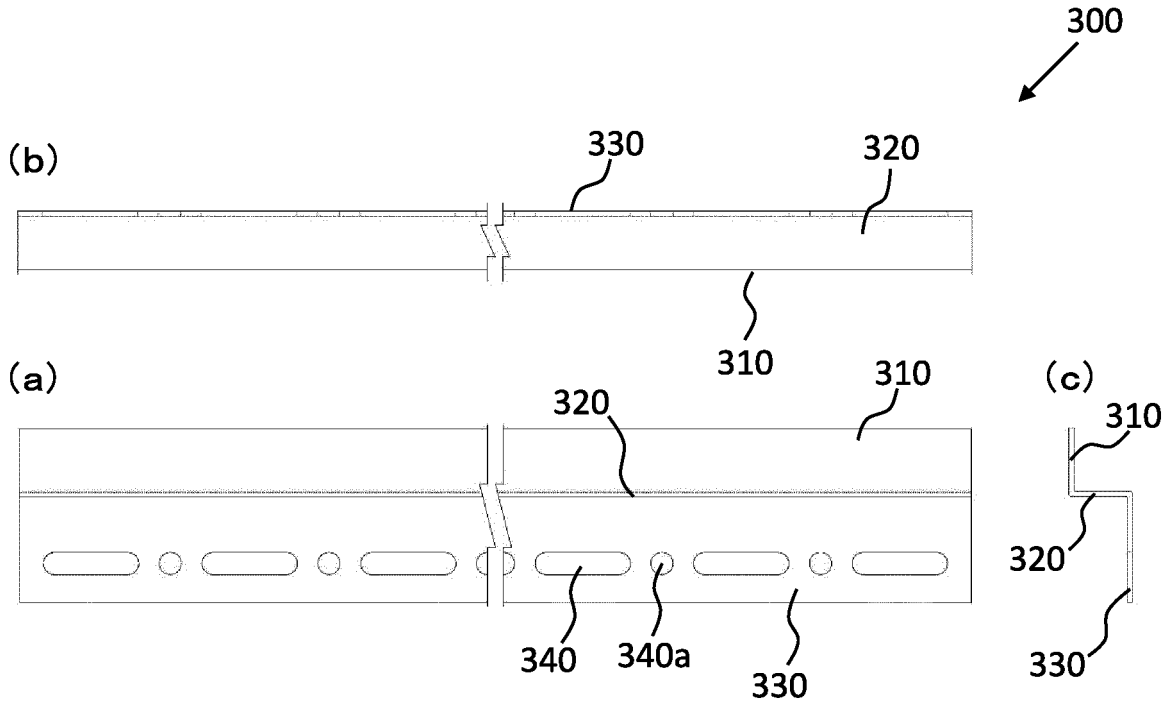


Fig. 8

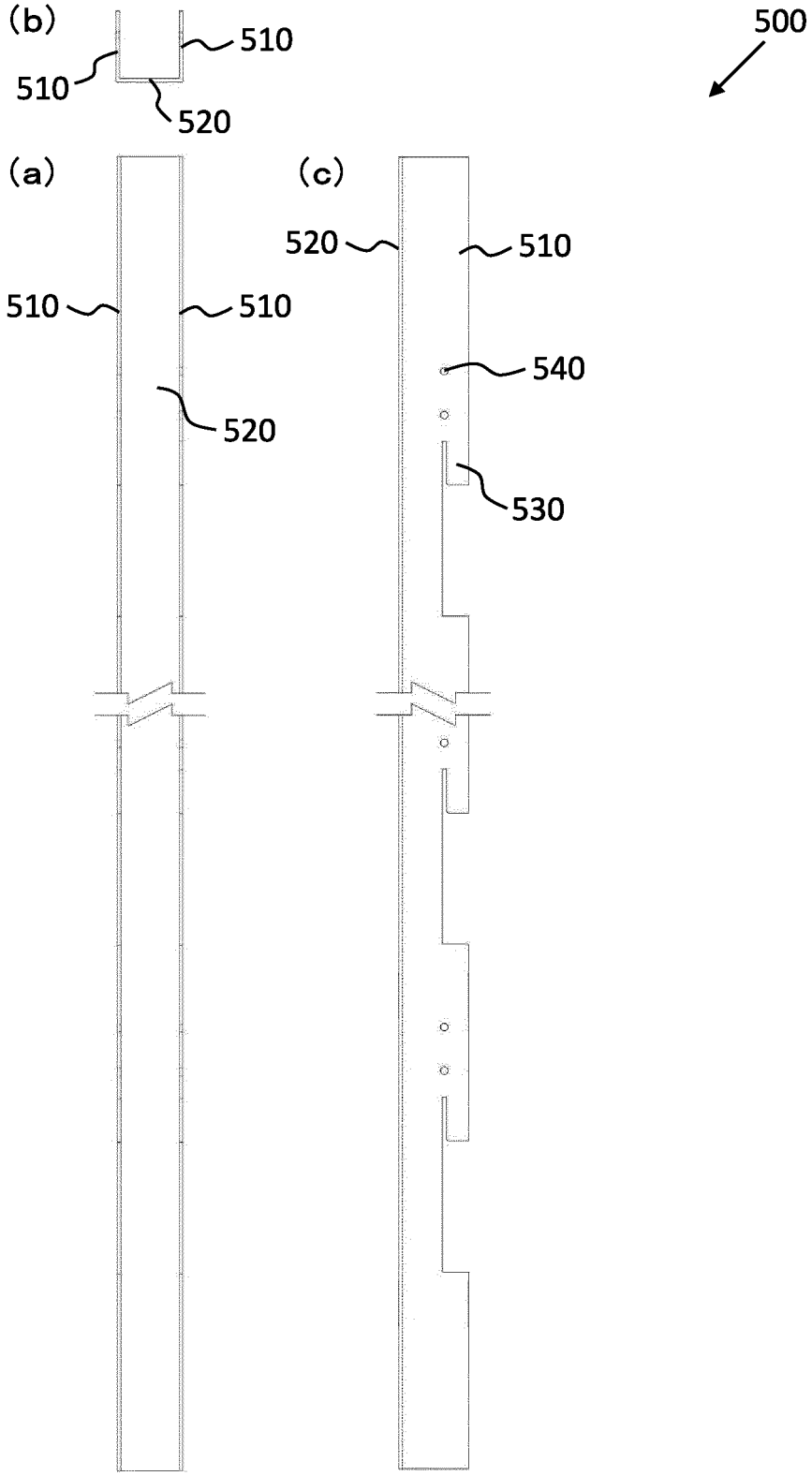


Fig. 9

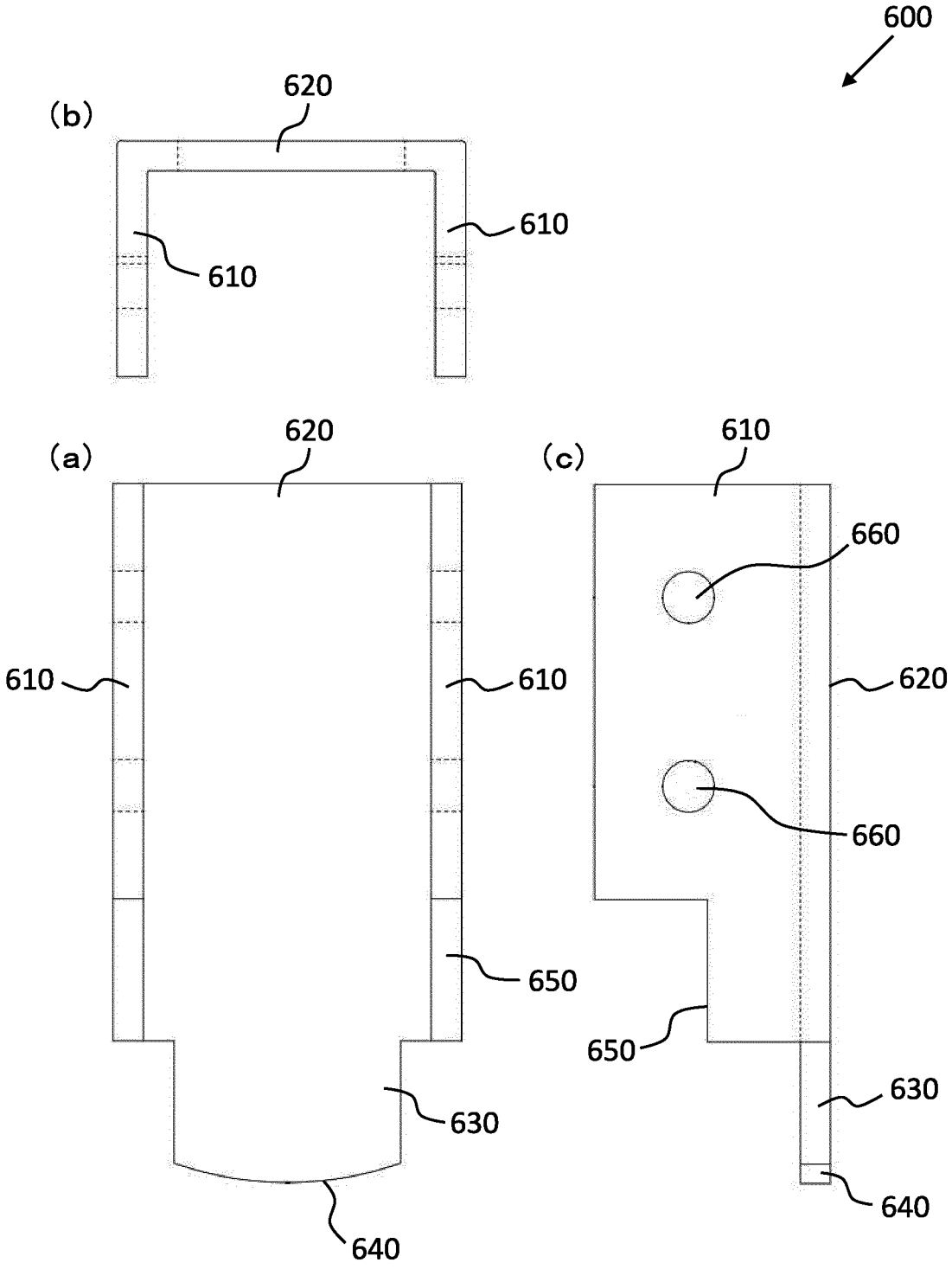

600
(b)
620
610
610
(a)
620
610
610
650
630
640
(c)
610
660
620
660
650
630
640

Fig. 10

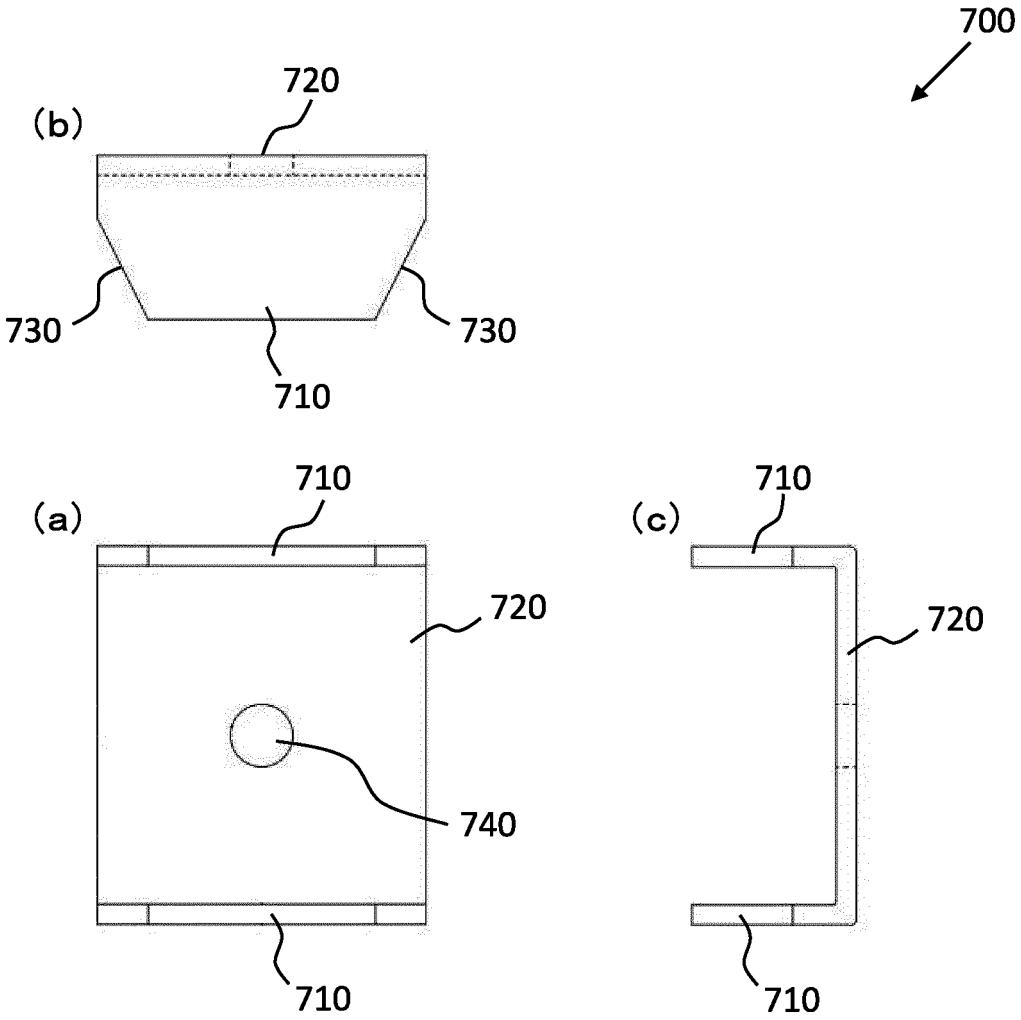


Fig. 11

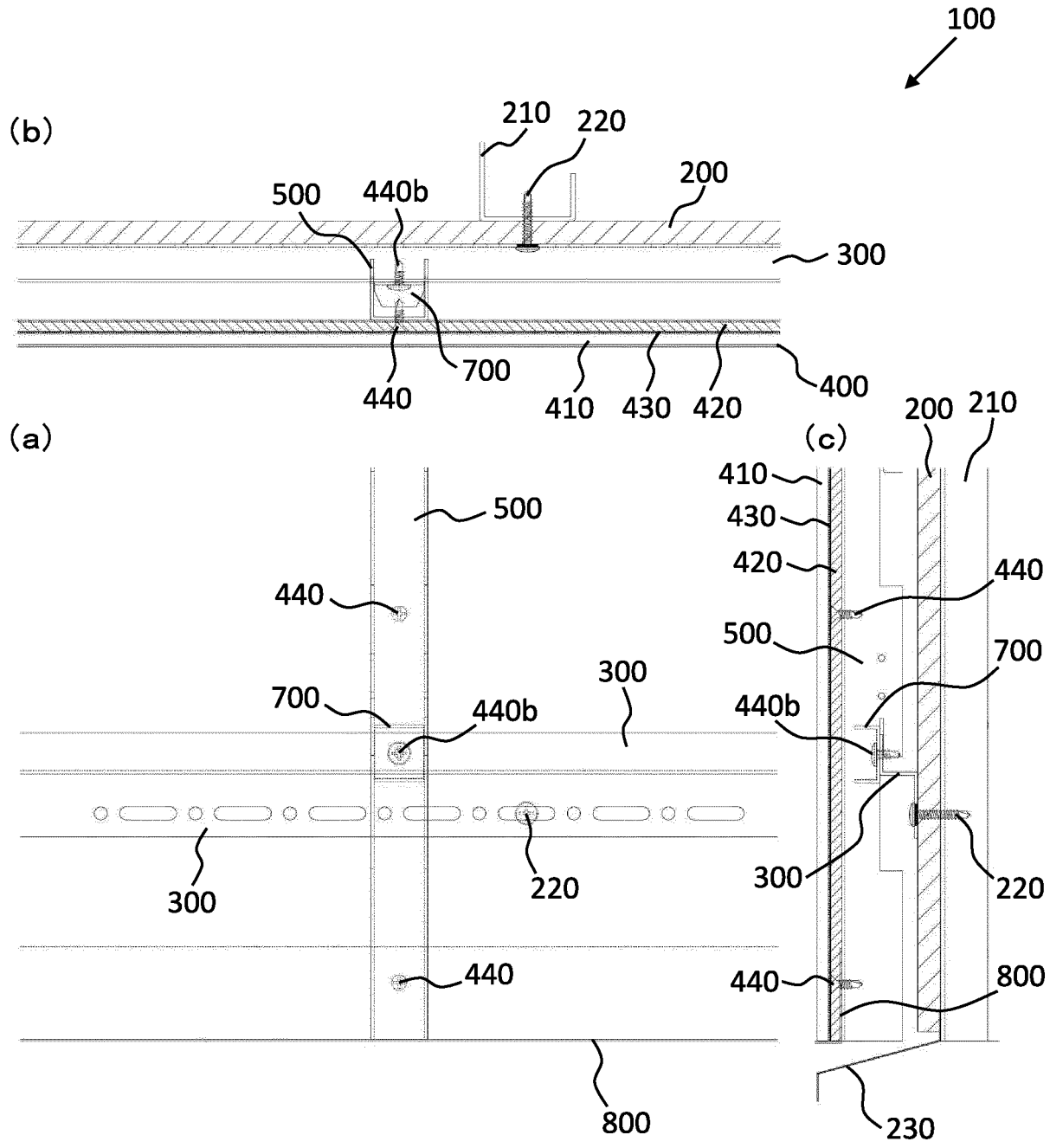

100
(b)
210
220
200
500
440b
300
700
440
410
430
420
400
(a)
(c)
500
440
700
440b
300
220
800
230

Fig. 12

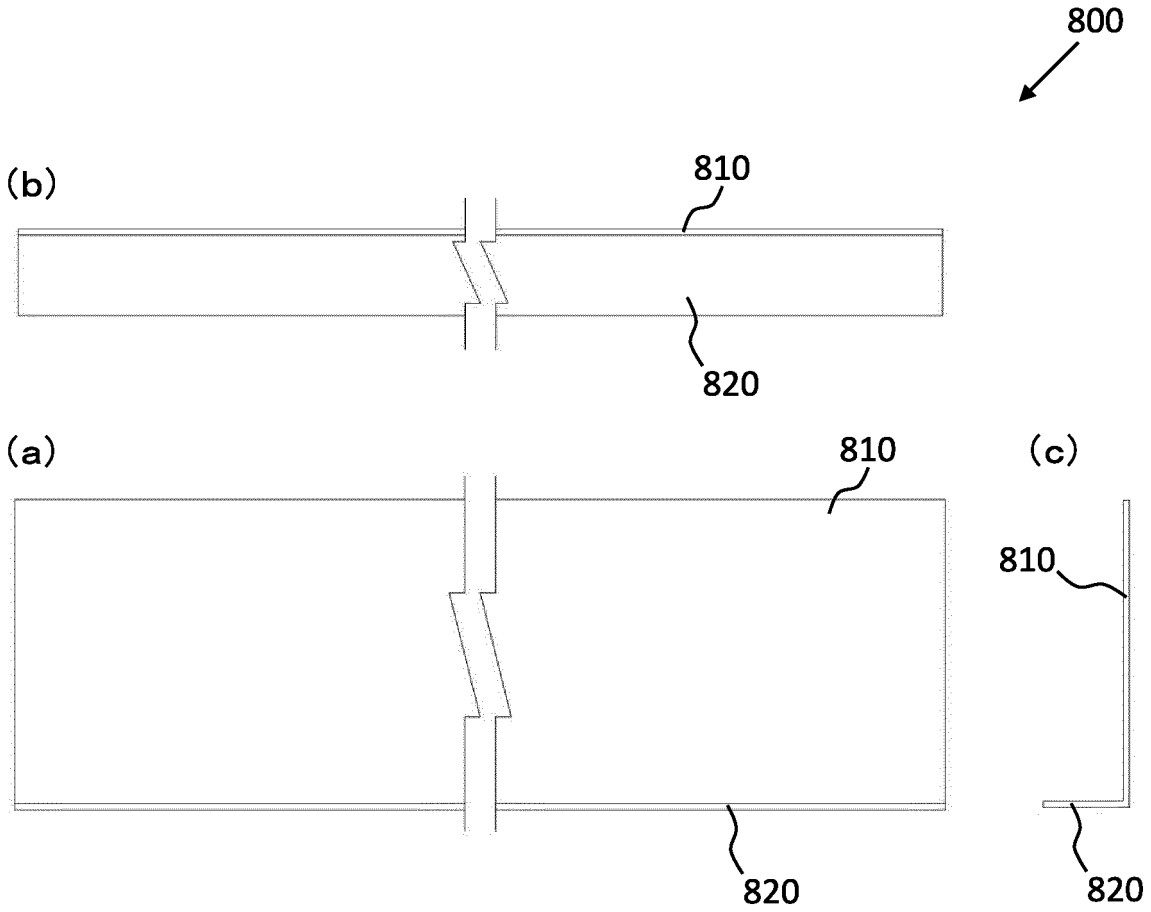


Fig. 13

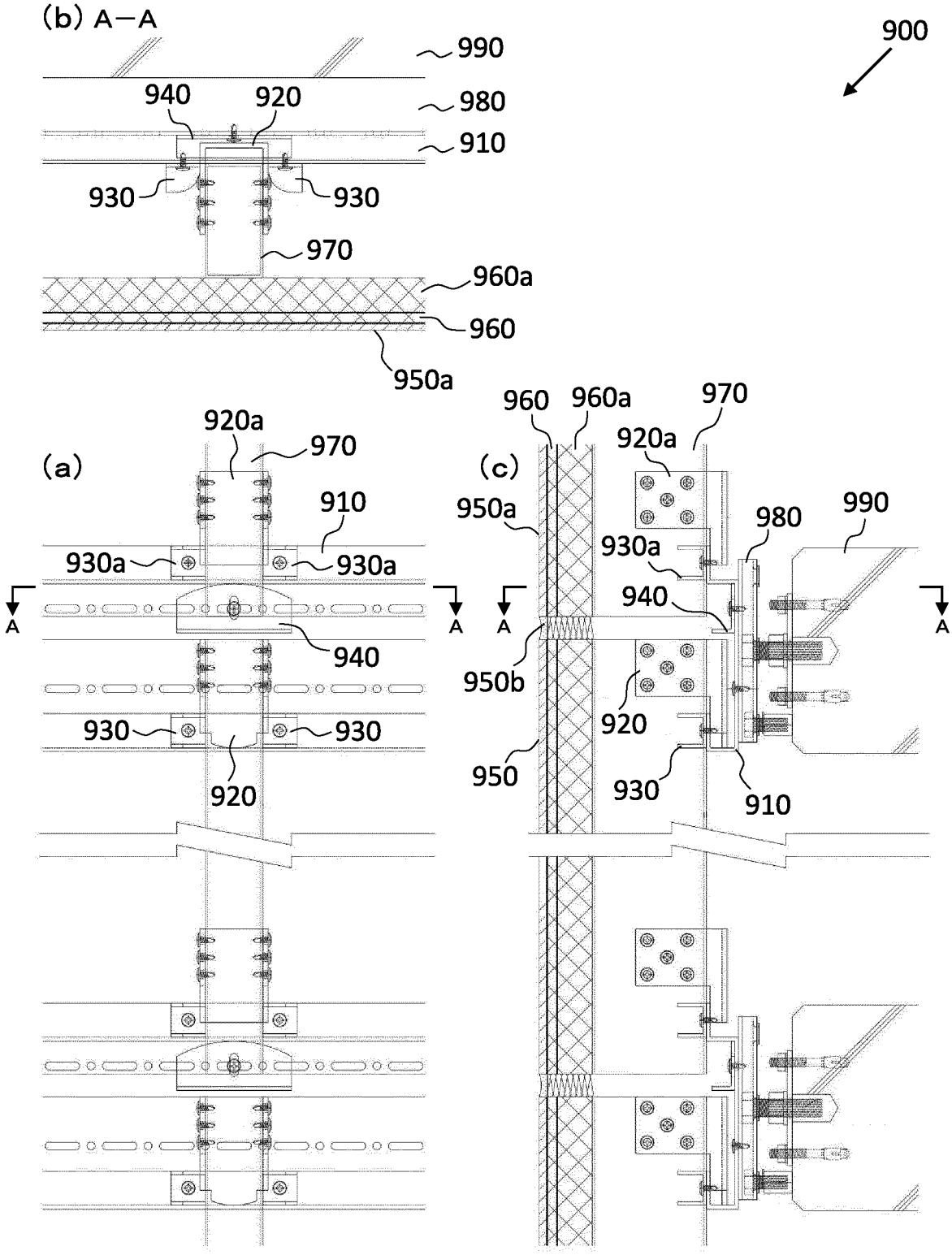

(b) A−A
900
990
940
920
980
910
930
930
970
960a
960
950a
(a)
920a
970
910
930a
930a
A
A
940
930
930
920
(c)
960
960a
970
920a
950a
980
990
930a
940
A
A
A
950b
920
950
930
910

Fig. 14

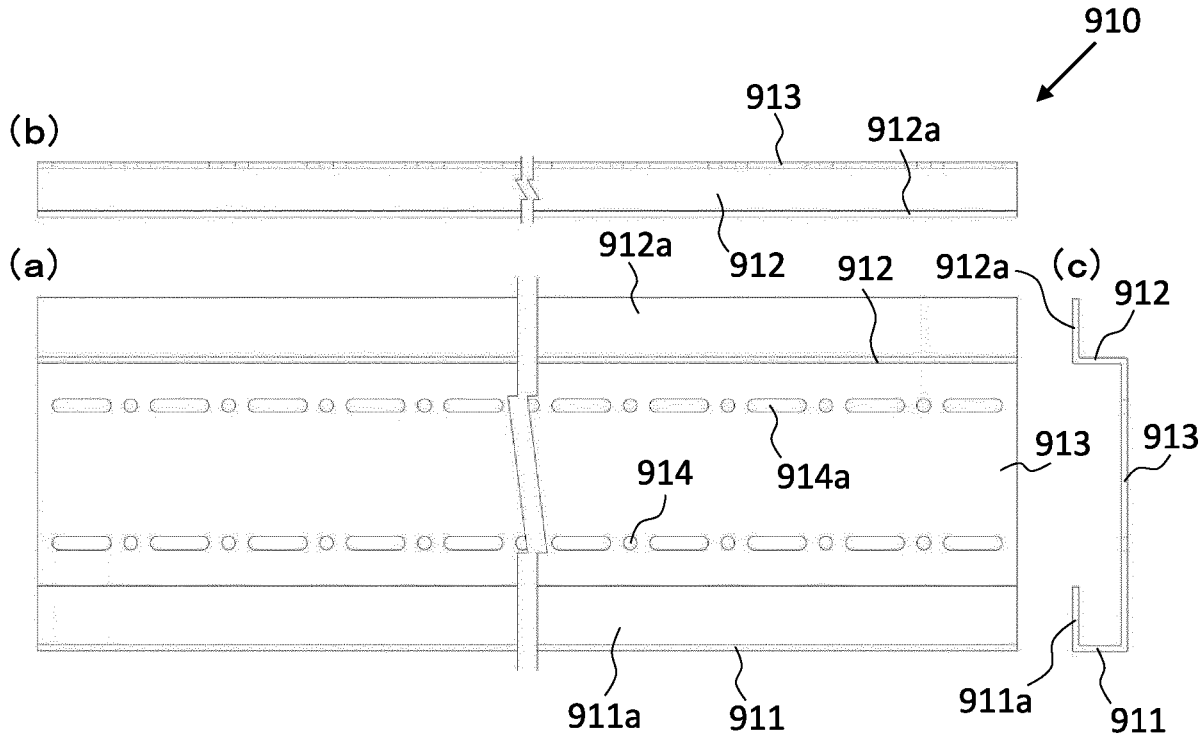

910
913
(b)
912a
912a
912
912
912a
(c)
(a)
912
913
913
914
914a
911a
911
911a
911

Fig. 15

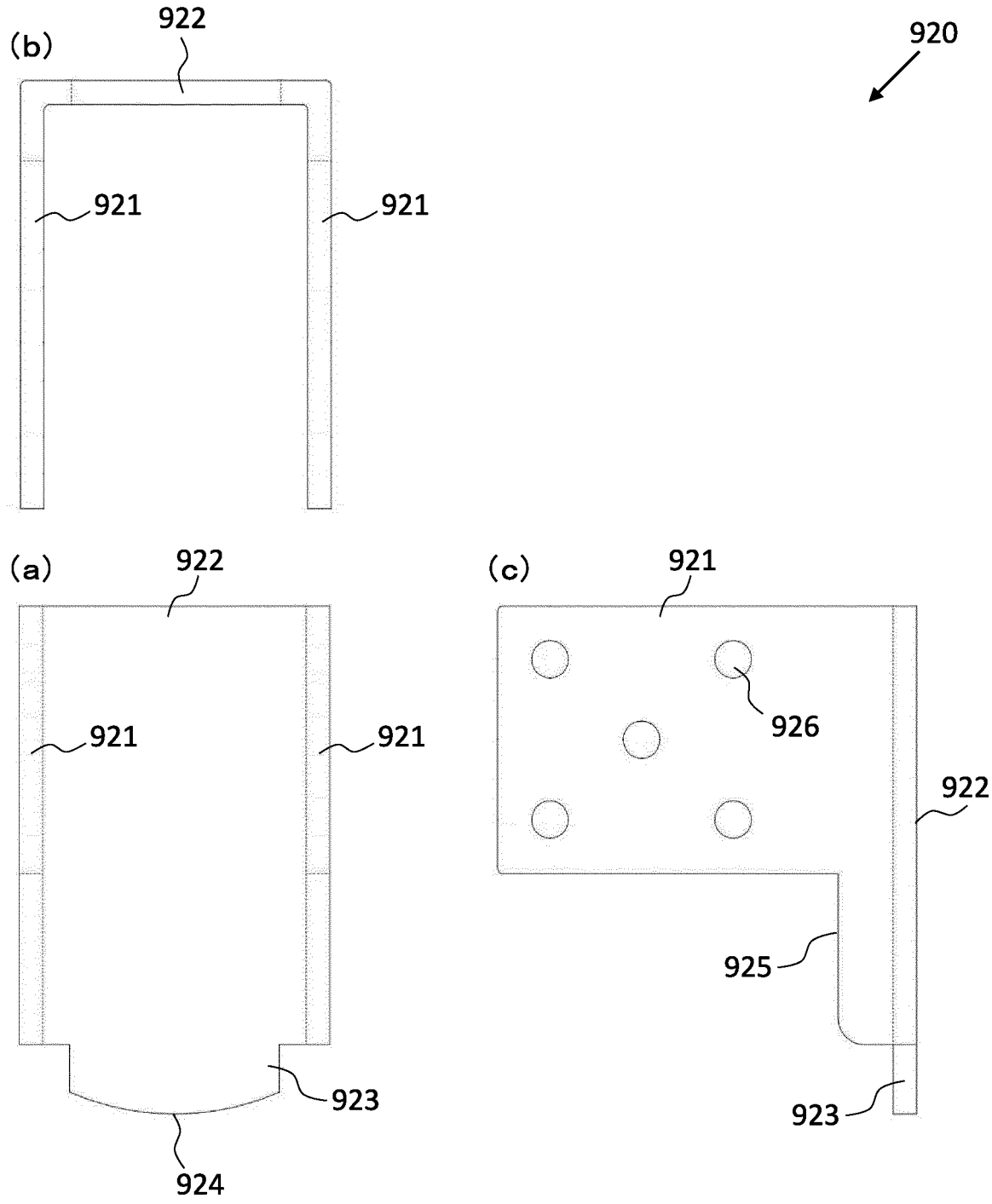


Fig. 16

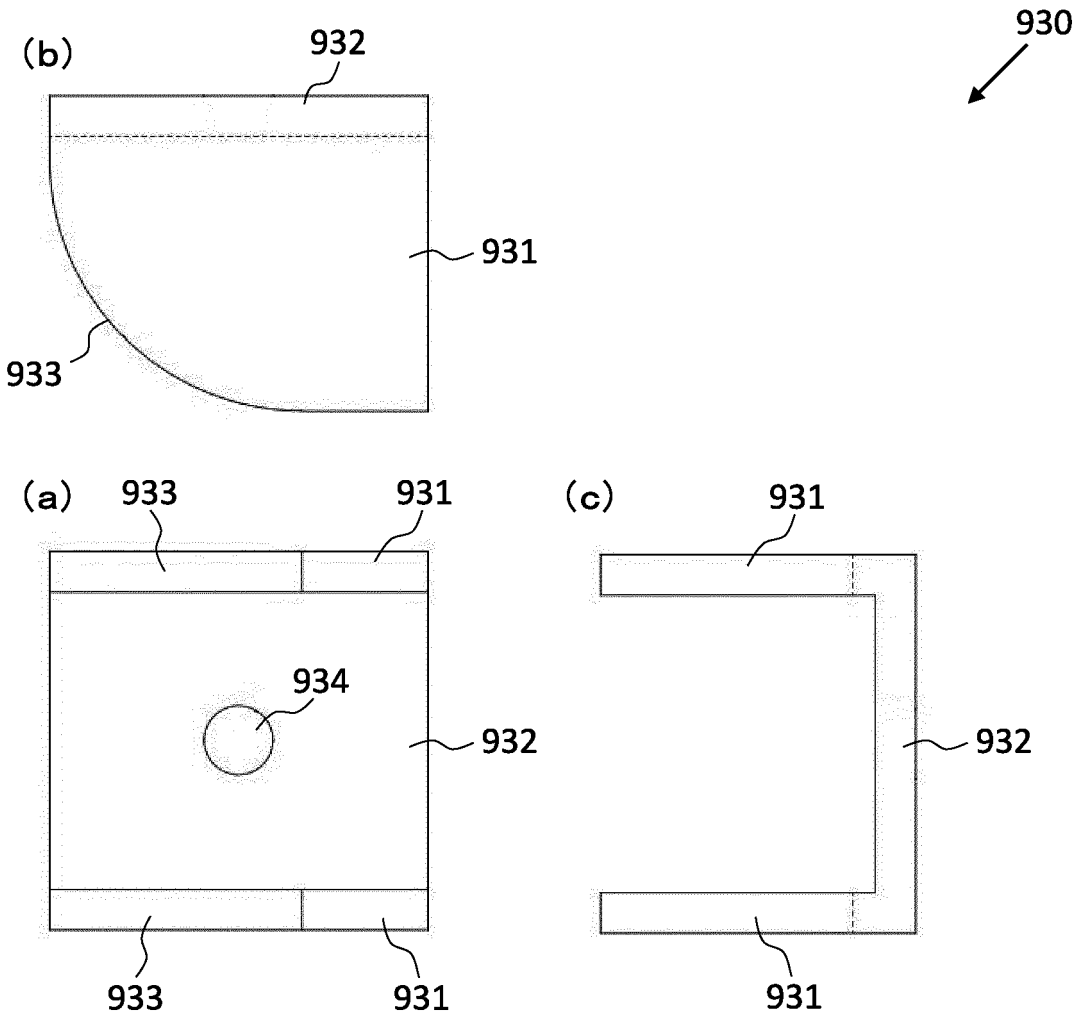
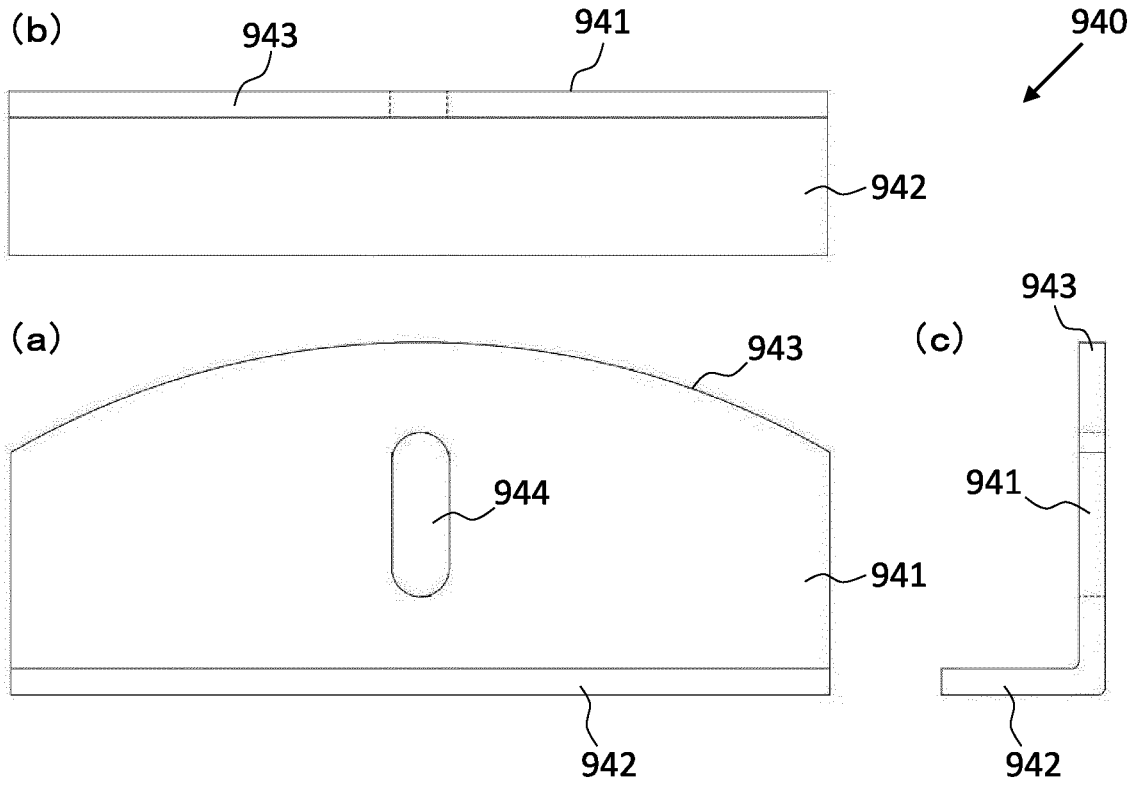


Fig. 17



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/014039

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl. E21D11/04(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. E21D11/04, E04F13/08, E04B2/00

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	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 4-034169 A (INAX CORP.) 05 February 1992, page 2, upper section, to page 3, upper section, fig. 1-8 (Family: none)	1-7
A	JP 11-062103 A (INAX CORP.) 05 March 1999, paragraphs [0011]-[0025], fig. 1-6 (Family: none)	1-7
A	JP 2004-308259 A (NOZAWA KK) 04 November 2004, paragraphs [0018]-[0031], fig. 1-6 (Family: none)	1-7
A	JP 11-241478 A (SEKISUI HOUSE KK, ALMETAX MFG, CO., LTD.) 07 September 1999, paragraphs [0012]-[0021], fig. 4 (Family: none)	1-7

☒ 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
15.04.2019	07.05.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/014039

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 6284113 B1 (HIRO CORPORATION) 28 February 2018, paragraphs [0022]-[0054], fig. 1-10 (Family: none)	1-7
A	JP 06-185148 A (ASAHI CHEMICAL INDUSTRY CO., LTD.) 05 July 1994, paragraphs [0010]-[0014], fig. 1-8 (Family: none)	1-7
A	JP 09-053285 A (MISHINA, Seishi) 25 February 1997, paragraphs [0008]-[0016], fig. 3-6 (Family: none)	1-7
A	JP 2015-140617 A (HORYO SANGYO KK) 03 August 2015, paragraphs [0026]-[0042], fig. 1 (Family: none)	1-7
A	JP 61-106858 A (INAX CORP.) 24 May 1986, page 2, lower section, to page 3, upper section, fig. 1-4 (Family: none)	1-7
A	EP 2945282 A1 (STAFIER HOLLAND B. V.) 18 November 2015, paragraphs [0024]-[0031], fig. 1-10 & NL 2012801 B	1-7
A	EP 0479733 A1 (TILEGRES S. P. A.) 08 April 1992, column 2, line 27 to column 3, line 40, fig. 1 & IT 9042530 A & IT 9042530 D0	1-7
A	JP 06-280370 A (GANTAN BEAUTY KOGYO KK) 04 October 1994, paragraphs [0009]-[0015], fig. 1-6 (Family: none)	1-7

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 5018088 A **[0005]**
- JP 3171567 B **[0005]**