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(54) STRUCTURE FOR MOUNTING PANEL TO BUILDING SKELETON WALL SURFACE

(57) It is an object of the present invention to provide a structure for attaching panels to the wall surface of a building body of a construction in which a preparation work for attaching a plurality of panels which constitute, for instance, an inner wall or an outer wall to the wall surface of the building body of the construction can be carried out easily and any panel in any place after the completion of installment of the panel can be partly removed and replaced by a new panel with ease. In order to attain the above-mentioned object, an attaching structure according to the present invention comprises: two reinforcing members provided at least the upper part and the lower part of a back surface opposed to the wall surface of the building body when the panels are attached to the wall surface of the building body of the construction; a plurality of attaching brackets transversely attached at intervals to the wall surfaces of the building body corresponding to joint portions between the panels when a plurality of the panels are vertically arranged and disposed on the wall surface of the building body of the construction; a receiving plate for regulating in movement the lower end of the upper panel of two vertically adjacent panels; and an adjusting plate for supporting the upper end of the lower panel, and is characterized in that the lower end of the upper panel is restricted in movement by inserting the lower ends of pins suspended from the lower reinforcing member into holes formed in the receiving plate, and the upper end of the lower panel is fixed to the adjusting plate by detachably fastening the upper reinforcing member to the adjusting plate.

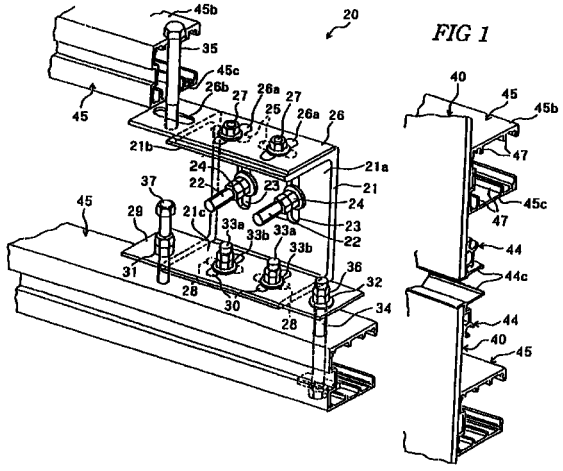

FIG 1

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Description

Technical Field

[0001] The present invention relates to a structure for attaching panels to the wall surface of the building body of a construction, and more particularly to a structure for attaching, for instance, a plurality of panels with holding frame which form an inner wall or an outer wall to the wall surface of the building body of a construction.

Background Art

[0002] In recent years, the outer wall of a construction such as a building has been frequently constituted of the attachment of panels with holding frame, which have been previously manufactured in factories or the like, from the viewpoint of their mass, weather resistance, workability, etc. This can be done because extremely excellent panels with holding frame disclosed in, for example, Japanese Patent Application Laid-Open No. Hei 9-291649 has been proposed. The above-mentioned panels with holding frame have been further improved afterward. As a result, a high evaluation has been given to the improved panels with holding frame as outer wall materials of a construction from various aspects especially in view of the weather resistance, the workability and appearance or the like.

[0003] Now, the structure of the above panel with holding frame will be briefly described hereinafter. The panel with holding frame designated by reference numeral 1 in Fig. 16 comprises a panel main body 4 formed into a square and flat plate shape by laminating metal sheets 3 on both the surfaces of a base 2 made of a non-metallic material, and a holding frame 5 attached to the peripheral edge of the panel main body 4 to protect the peripheral edge of the panel main body 4 and cover an end surface thereof.

[0004] The above-mentioned holding frame 5 comprises a support portion 5a connected and fixed to the back surface of the panel main body 4, a rim portion 5b for surrounding and catching the peripheral edge of the panel main body 4, an attaching leg portion 5c to the construction which stands up substantially perpendicularly from the above described support portion 5a, and an attaching flange 5d formed by bending the end part of the attaching leg portion 5c outward of the panel main body 4. Then, the holding frame 5 is attached to the panel main body under a state in which the peripheral edge of the panel main body 4 is sandwiched between the support portion 5a and the frame edge of the rim portion 5b.

[0005] The panel with holding frames 1 having such a structure are ordinarily attached to the wall surface of the building body of the construction in a below mentioned manner. Specifically, as shown in Fig. 16, on the wall surface of the building body of the construction are previously arranged angle materials 6 in the shape of a grating in order to attach the panels with holding frames 1 to the wall surface of the building body of the construction. Thus, one of the panels with holding frames 1 is arranged in one block of the grating.

[0006] At that time, both the flanges 5d of the opposing holding frames 5 of the two panels with holding frame 1 which are adjacently arranged come into tight contact with the surface 6a of one angle material 6 and are fixed to the surface by means of screws 7 or the like. The space part between the adjacent panels with holding frame 1 serves as a joint portion. In this joint portion, a back-up material 8 and a water-proof sealing material 9 laid thereon are provided as measures for stopping water and improving an appearance. As shown in Fig.16, a gasket 10 for a joint portion may be sometimes provided on the water-proof sealing material 9.

[0007] However, according to the conventional method for attaching the panels with holding frame to the wall surface of the building body of the construction, since the angle materials 6 have been previously arranged in the shape of a grating on the wall surface of the building body of the construction, and the flanges 5d of the attaching leg portions 5c standing up substantially perpendicularly from the support portions 5a in the holding frames 5 have been attached to the angle materials 6 by means of the screws 7, there have been encountered problems that preparation works are needed for attaching the panels with holding frame 1 to the wall surface of the building body of the construction, that is to say, many works for disposing many angle materials 6 on the wall surface of the building body are required, etc. and hence excessive time and labor are required.

[0008] Therefore, various kinds of panel attaching structures have been considered to overcome the above-described problems and to make easy the preparation works for attaching the panels with holding frame to the wall surface of the building body of the construction. However, it has been very difficult to replace many panels with holding frame attached to the wall surface of the building body of the construction by new panels for partly reforming them. Accordingly, it has been difficult to satisfy the both requirements.

[0009] Therefore, it is an object of the present invention to solve the problems of the prior art and to provide a structure for attaching panels to the wall surface of a building body of a construction in which a preparation work for attaching a plurality of panels which constitute, for instance, an inner wall or an outer wall to the wall surface of the building body of the construction can be carried out easily and any panel in any place after the completion of installment of the panel can be partly removed and replaced by a new panel with ease.

Disclosure of Invention

[0010] The present invention concerns a structure

for attaching panels to the wall surface of the building body of a construction and has a following constitution in order to solve the above-mentioned technical problems. Specifically, according to the present invention, a structure for attaching panels that are attached to the building body of a construction to form a wall surface to the wall surface of the building body of the construction comprises: two reinforcing members provided at least the upper part and the lower part of a back surface opposed to the wall surface of the building body when the panels are attached to the wall surface of the building body of the construction; a plurality of attaching brackets transversely attached at intervals to the wall surfaces of the building body corresponding to joint portions between the panels when a plurality of the panels are vertically arranged and disposed on the wall surface of the building body of the construction; a receiving plate supported by the attaching brackets and regulating in movement the lower end of the upper panel of two vertically adjacent panels; and an adjusting plate, supported by the attaching brackets, for supporting the upper end of the lower panel, and is characterized in that the lower end of the upper panel is restricted in movement by inserting the lower ends of pins suspended from the lower reinforcing member into holes formed in the receiving plate, and the upper end of the lower panel is fixed to the adjusting plate by detachably fastening the upper reinforcing member to the adjusting plate.

[0011] A structure for attaching panels to the wall surface of the building body of a construction according to the present invention comprises the above-mentioned essential components. However, the structure may be specifically composed of such essential components as mentioned below. More specifically, the above described structure for attaching panels to the wall surface of the building body of the construction is characterized in that the adjusting plate supported by the attaching brackets is attached so as to be movable along the wall surface of the building body of the construction.

[0012] Further, according to the present invention, a structure for attaching panels to the wall surface of the building body of a construction is characterized in that the receiving plate is supported by the attaching brackets is attached so as to be movable relative to the attaching brackets. Still further, according to the present invention, a structure for attaching panels to the wall surface of the building body of a construction is characterized in that support portions of the attaching brackets for supporting the adjusting plate are located in the joint portion between the panels, and fastening means for detachably fastening the upper reinforcing member to the adjusting plate can be fastened and unfastened through the joint portion from an outside of the panels.

[0013] Still further, according to the present invention, a structure for attaching panels to the wall surface of the building body of a construction is characterized in that the above described panel is a panel with holding frame comprising a panel main body made of a laminated composite material, a support portion connected and fixed to the back surface of the panel main body, and a rim portion for surrounding and catching the peripheral edge of the panel main body, and further comprising a plurality of holding frames, respectively, attached to peripheral edges of the panel main body to support the panel main body.

[0014] In this case, as the "panel main body" of the panel with holding frame may be employed a composite plate formed by laminating metallic sheets on both the surfaces of a base made of a non-metallic material, or a composite plate formed by laminating metallic sheets on both the surfaces of a honeycomb structure formed or a metallic material, a fiber material, etc. Further, it is desirable to form a holding frame and reinforcing members for protecting the peripheral edge part of the panel main body with an extruded metallic material, preferably with an aluminum material.

[0015] In accordance with the structure for attaching panels to the wall surface of the building body of a construction of the present invention, a plurality of attaching brackets in pieces are fixed to the wall surface of the building body of the construction by means of anchor bolts or the like and the reinforcing members provided in the upper part and the lower part of the back surfaces of the panels are connected to the attaching brackets so as to be detachable, which is different from the structure of the prior art in which attaching steel members such as the angle materials are installed on the wall surface of the building body of the construction and the leg portions standing up perpendicularly from the support portions of the holding frames are fixed to the angle materials.

[0016] At that time, when a plurality of panels are arranged vertically on the wall surface of the building body of the construction, the respective attaching brackets are attached transversely at prescribed intervals to the wall surface of the building body corresponding to joint portions between the panels. Further, each attaching bracket connects the lower end of the upper panel and the upper end of the lower panel of the two vertically adjacent panels to each other with the attaching brackets and supports them.

[0017] A method for connecting and supporting the upper and lower ends of the two vertically adjacent panels to one attaching bracket will be specifically described below. The attaching bracket is provided with horizontal flanges respectively in its upper and lower parts, and the receiving plate and the adjusting plate are, respectively, attached to the surfaces of the horizontal flanges so as to be movable. Then, the lower end of the upper panel is restricted in movement by inserting the lower ends of pins suspended from the lower reinforcing member into the holes formed in the receiving plate. The upper end of the lower adjusting panel is fixed to the adjusting plate by detachably fastening the

upper reinforcing member to the adjusting plate by means of bolts.

Brief Description of the Drawings

[0018]

Fig. 1 is a schematic perspective view showing a structure for attaching panels with holding frame to the wall surface of the building body of a construction according to one embodiment of the present invention.

Fig. 2 is a sectional view showing panels with holding frame attached by a structure for attaching panels with holding frame to the wall surface of the building body of the construction shown in Fig. 1.

Fig. 3 is a rear view showing the back surface of the panel with holding frame attached by the structure for attaching panels with holding frame to the wall surface of the building body of the construction illustrated in Fig. 1.

Fig. 4 as well as Figs. 4 to 6 is an explanatory view of attaching processes showing a procedure for attaching the panels with holding frame to the wall surface of the building body of the construction by using the structure for attaching panels to the wall surface, that is to say, the attaching structure.

Fig. 5 is an explanatory view of attaching processes showing a procedure for attaching the panels with holding frame to the wall surface of the building body of the construction by using the attaching structure.

Fig. 6 is an explanatory view of attaching processes showing a procedure for attaching the panels with holding frame to the wall surface of the building body of the construction by using the attaching structure.

Fig. 7 is a process explanatory view illustrating an attaching process for removing and replacing the panel with holding frame attached by the attaching structure of the present invention to a suitable position on the wall surface of the building body of the construction by a new panel with holding frame.

Fig. 8 is a process explanatory view illustrating an attaching process for removing and replacing the panel with holding frame attached by the attaching structure of the present invention to a suitable position on the wall surface of the building body of the construction by a new panel with holding frame.

Fig. 9 is a schematic perspective view showing a structure for attaching panels with holding frame to the wall surface of the building body of a construction according to another embodiment of the present invention.

Fig. 10 is a schematic perspective view showing a structure for attaching panels with holding frame to the wall surface of the building body of a construction according to still another embodiment of the present invention.

Fig. 11 is a sectional view showing the structure for attaching panels with holding frame to the wall surface of the building body of the construction shown in Fig. 10.

Fig. 12 is a schematic perspective view showing a structure for attaching panels with holding frame to the wall surface of the building body of a construction according to still another embodiment of the present invention.

Fig. 13 is a partly sectional view taken along the line 13-13 in Fig. 12 which clearly shows a state that a cap is threadedly attached to an attaching bolt employed in the structure for attaching panels with holding frame to the wall surface of the building body of the construction.

Fig. 14 is a schematic perspective view showing a structure for attaching panels with holding frame to the wall surface of the building body of a construction according to still another embodiment of the present invention.

Fig. 15 is a perspective view showing an adjusting plate with bent parts employed in the structure for attaching panels with holding frame shown in Fig. 14.

Fig. 16 is a partly enlarged sectional view showing a conventional structure for attaching panels with holding frame to a wall surface.

Best Mode for Carrying Out the Invention

[0019] Now, a structure for attaching panels to the wall surface of the building body of a construction according to the present invention will be described in more detail by way of embodiments illustrated in the drawings. Fig. 1 is a sectional view showing a structure 20 for attaching panels with holding frame (hereinafter, referred to as "panel") to the wall surface of the building body of a construction (hereinafter, simply referred to as "an attaching structure") according to one embodiment of the present invention. Fig. 2 is a sectional view showing panels attached to the wall surface of the building body of the construction by the attaching structure of this embodiment.

[0020] Further, Fig. 3 is a rear view showing the back surfaces of the panels attached by the attaching structure of panels to the wall surface of the building body of the construction according to the present embodiment. Figs. 4 to 6 are process explanatory views showing the procedure for attaching the panels to the wall surface of the building body of the construction by using the attaching structure. Figs. 7 and 8 are process explanatory views showing attaching processes for removing and replacing the panels attached at a suitable position to the wall surface of the building body of the construction by the attaching structure of the present invention by new panels.

[0021] This attaching structure 20 includes many

panels with holding frame 40. The panel 40 comprises, as shown in Fig. 2, a panel main body 43 formed into a square flat plate shape by laminating metallic sheets 42 on both the surfaces of a base 41 made of a non-metallic material, and a holding frame 44 attached to the peripheral edge of the panel main body 43 to protect the peripheral edge of the panel main body 43 and cover an end surface thereof.

[0022] The holding frame 44 is formed of an aluminum material and comprises a support portion 44a connected and fixed to the back surface of the panel main body 43 and a rim portion 44b for surrounding and catching the peripheral edge of the panel main body 43 which is formed integrally with the support portion 44a. The holding frame 44 is further provided with a joint groove forming wall portion 44c protruding beyond the support portion 44a in the direction substantially opposite to the rim portion 44b. The joint groove forming wall portion 44c defines and forms a joint groove portion in cooperation with an opposed joint forming wall part in the holding frame 44 of a panel 40 disposed adjacently to the above panel.

[0023] The holding frame 44 is fixed to the panel main body 43 by means of an adhesive agent and blind rivets (not shown) while the peripheral edge of the panel main body 43 is sandwiched between the support portion 44a and the peripheral edge of the rim portion 44b. As described above, the holding frame 44 is not provided with a relatively long leg portion standing up substantially perpendicularly from the support portion 44a as in the case of prior art. Therefore, since the holding frame made of an expensive material can be manufactured in a relatively small size, the cost can be lowered.

[0024] Further, as illustrated in Fig. 3, upper, lower, right and left reinforcing members 45 are fixed by means of blind rivets (not shown) to the back surface of the panel 40 along the edge parts of the periphery thereof. Other three reinforcing members 45 are fixed in parallel to the back surface of the panel 40 between the right and left reinforcing members 45 in a similar manner to the above.

[0025] As apparent from Fig. 3, these reinforcing members 45 entirely constitute a ladder shape viewed in plan. The reinforcing members 45 are fixed together in their connecting parts by using screws 46 or the like. The reinforcing members 45 formed into such a ladder shape are provided in order to enhance the surface strength of the panel 40. In particular, the reinforcing members 45 located in the upper part and the lower part when the panel 40 is installed on the wall surface of the building body of the construction serve as important elements employed also when the panel is attached to the wall surface of the building body of the construction.

[0026] These reinforcing members 45 are made of an aluminum material. As clearly shown in Figs. 1 and 2, each reinforcing member 45 is formed into a U-shape in section and comprises side walls 45b and 45c erected substantially perpendicularly from both the side ends of a fixing wall 45a tightly fixed to the back surface of the panel 40. Two reinforcing ribs 47 are formed in the longitudinal direction at prescribed intervals on the inner surfaces of the side walls 45b and 45c. The free ends of the side walls 45b and 45c (side edge parts opposite to the fixing wall) in the reinforcing member 45 are provided with flanges 45d which slightly protrude inward substantially perpendicularly therefrom.

[0027] In the above described reinforcing member 45, small groove parts 48 to which screws are threaded or threadedly attached are formed in the longitudinal direction inside the intersecting parts of the respective side walls 45b and 45c and the fixing wall 45a and inside the intersecting parts of the respective side walls 45b and 45c and the respective flanges 45d. Accordingly, when the reinforcing members 45 are assembled into a ladder shape and fixed together as shown in Fig. 3, the ends of the machine screws 46 are inserted, screwed and fixed into the groove parts 48.

[0028] On the other hand, when many panels 40 are vertically and horizontally aligned and attached to the wall surface of the building body of the construction, as illustrated in Fig. 1, a plurality of attaching brackets 21 are attached by means of anchor bolts 22 transversely at prescribed intervals to positions substantially corresponding to the joint portions between the upper and lower panel 40.

[0029] The attaching bracket 21 is formed of a piece of U-shaped steel having flanges 21b and 21c respectively protruding horizontally from the upper edge and the lower edge of a square base 21a in close contact with the wall surface of the building body of the construction. On the base 21a of the attaching bracket 21 are formed longitudinally long slots 23 in the central portions thereof. The attaching bracket 21 abuts on the wall surface of the building body so as to insert the anchor bolts 22 relatively into the slots 23, washers or the like are fitted to the anchor bolts 22 as required and then nuts 24 are threadedly attached to the anchor bolts to fix the anchor bolts to the slots.

[0030] The slots 23 are formed on the base 21a of the attaching bracket 21 because of reasons mentioned below. Specifically, in order to attain the attachment and detachment of the panels 40, the center of each of the attaching brackets 21 needs to correspond to the center of the joint portion (joint portion in the transverse direction) between the vertically aligned upper and lower panels 40 as much as possible. Therefore, it is necessary to precisely drive the anchor bolts 22 at the prescribed positions described above.

[0031] However, when the anchor bolts 22 are driven to the wall surface of the building body of the construction, reinforcing bars in the building body may possibly interfere with the anchor bolts 22 so that the anchor bolts 22 cannot be driven at the prescribed positions. At such a time, the anchor bolts are driven at slightly shifting positions upward and downward. Even in this case, since the vertical position of each attaching

bracket 21 can be adjusted within a range of the length of the slots 23, the attaching bracket 21 can be attached to the wall surface of the building body of the construction so that the center of the attaching bracket 21 may substantially correspond to the center of the transverse joint portion.

[0032] The upper flange 21b of the attaching bracket 21 has two transversely long slots 25 formed there. A flat plate shaped receiving plate 26 having substantially the same dimension of width as that of the upper flange 21b is provided on the upper surface thereof. The length of the receiving plate 26 is larger than that of the upper flange 21b. Therefore, when one end part of the receiving plate is aligned with one end part of the upper flange 21b, the other end part of the receiving plate protrudes from the other end part of the upper flange 21b.

[0033] On the receiving plate 26 are formed slots 26a at positions corresponding to those of the slots 25 of the upper flange 21b in the direction intersecting the slots 25, which are widthwise long as seen in Fig.1, when the receiving plate 26 is provided on the upper flange 21b while the respective end portions are aligned with each other. Further, on the part of the receiving plate 26 which protrudes from the upper flange 21b, a lengthwise or transversely long slot 26b is formed.

[0034] Then, after the receiving plate 26 is disposed on the upper flange 21b, bolts 27 are inserted into both the slots 25 and 26a intersecting each other, nuts are threadedly attached thereto from the underside and they are fastened and fixed thereto. Further, the lower flange 21c of the attaching bracket 21 also has two transversely long slots 28 formed therein. On the surface of the lower flange 21c, an adjusting plate 29 having substantially the same dimension of width as that of the lower flange 21c is mounted and attached.

[0035] The length of the adjusting plate 29 is larger than that of the lower flange 21c. Therefore, the adjusting plate 29 is attached to the lower flange 21c in such a manner that both the end portions of the adjusting plate are projected from the lower flange 21c. In the adjusting plate 29 are formed slots 30 at positions corresponding to those of the slots 28 in the lower flange 21c in the direction intersecting the slots 28, which are widthwise long as seen in Fig. 1, when the adjusting plate 29 is attached to the lower surface of the lower flange 21c while both the ends of the adjusting plate are projected from the lower flange. A bolt thread hole 31 is formed in one of the end portions of the adjusting plate projected from the lower flange 21c, and a bolt through hole 32 is formed in the other end portion thereof.

[0036] The bolt thread hole 31 provided in one protruding part which protrudes from one end part of the lower flange 21c when the adjusting plate 29 is attached to the lower flange 21c is formed by welding a nut thereto so as to align it with a hole opened in the adjusting plate 29. Then, after the adjusting plate 29 is provided on the upper surface of the lower flange 21c, bolts 33a are inserted into both the slots 28 and 30 intersecting each other from the underside, nuts 33b are screwed thereto from the upside and they are fastened and fixed thereto.

[0037] In such a way, the receiving plate 26 and the adjusting plate 29 attached to the surfaces of the upper flange 21b and the lower flange 21c of each attaching bracket 21 can move in all directions within horizontal planes on the surfaces of the respective flanges due to the existence of slots 25 and 28 formed in the respective flanges and the slots 26a and 30 formed in the receiving plate 26 and the adjusting plate 29. Consequently, a fine positional adjustment can be carried out upon accurate positioning.

[0038] Now, an explanation will be given to a procedure for attaching the above described panels 40 to a wall surface of the building body of a construction by the attaching structure 20 according to the present embodiment. When many panels 40 are aligned with and attached to the wall surface of the building body of the construction, the attaching positions thereof are previously specifically designed. On the basis of the design drawing, the anchor bolts 22 are driven at positions corresponding to the central parts of the space parts, that is to say, transverse joint portions between the vertically adjacent panels 40 at prescribed transverse intervals.

[0039] Then, the U-shaped attaching brackets 21 are fixed to the wall surface of the building body of the construction by using the respective anchor bolts 22. At the same time, the receiving plate 26 and the adjusting plate 29 are, respectively, fixed to the upper and lower flanges 21b and 21c of each bracket 21 in such a manner as mentioned above. On the other hand, on the reinforcing members 45 of the panel 40 attached to the back surface of the panel main body 43 in the shape of a ladder, as shown in Fig. 2, particularly, on the reinforcing members 45 located in the upper part and the lower part when the panels 40 are installed on the wall surface of the building body of the construction, bolts 34 and 35, the number of which each corresponds to each attaching bracket 21, are attached.

[0040] The attaching bolt 34 is attached to the upper reinforcing member 45 so as to pass through the side walls 45b and 45c erected substantially perpendicularly from both the side ends of the fixing wall 45a of the reinforcing member 45. At that time, a bolt through hole opened in the lower side wall 45c is located in the groove part between the two parallel reinforcing ribs 47 formed on the inner surface thereof.

[0041] In addition, on the inner surface of the lower side wall 45c, a rotation stopper tightly fitted between the reinforcing ribs 47 is arranged at a position in which the bolt through hole formed in the groove part is aligned with the rotation stopper of the lower side wall 45c. Then, the attaching bolt 34 is threadedly attached to the bolt through hole and the tapped hole of the rotation stopper from the underside of the side wall 45c, threadedly attached to a nut in the reinforcing member

45, and then passes upward through a bolt through hole formed in the upper side wall 45b. The attaching bolt 34 is firmly fixed to the lower side wall 45c by fastening the nut threadedly attached to the attaching bolt 34.

[0042] On the other hand, the attaching bolt 35 to be attached to the lower reinforcing member 45 is fixed to the lower reinforcing member in a completely equal manner to the above described attaching bolt 34 except for in the direction opposite to that of the attaching bolt 34. Specifically, the attaching bolt 35 passes through a bolt through hole opened in the upper side wall 45b and the tapped hole of the rotation stopper tightly fitted between the two parallel reinforcing ribs 47 formed on the inner surface thereof, is threadedly attached to a nut in the reinforcing member 45, and then passes downward through a bolt through hole formed in the lower side wall 45c. The attaching bolt 35 is firmly fixed to the upper side wall 45b by fastening the nut threadedly attached to the attaching bolt 35.

[0043] The panels 40 which have the attaching bolts 34 and 35 fixed at the positions corresponding to the attaching brackets 21 to the upper and lower reinforcing members 45 as mentioned above are lifted by suitable means, made slant as shown in Fig. 4 and the end of the attaching bolt 35 is inserted into the slot 26b of the receiving plate 26 as illustrated in Figs. 1 and 5.

[0044] Then, while the lower end part of the panel 40 is lowered downward until it abuts against the upper end of the lower panel 40 adjacent thereto, the panel 40 is erected substantially perpendicularly. Thus, the upper end of the attaching bolt 34 fixed to the upper reinforcing member 45 comes just below a bolt through hole 32 in the adjusting plate 29 fixed to the lower flange 21c of another attaching bracket 21 located above the panel 40.

[0045] After that, the panel 40 is entirely raised straight upward, the upper end of the attaching bolt 34 attached to the upper reinforcing member 45 is inserted into the bolt through hole 32 of the adjusting plate 29 fixed to the lower flange 21c of the attaching bracket 21 and two nuts 36 are threadedly attached thereto. When the nuts 36 are rotated in the direction to fasten them, the panel 40 is raised upward through the attaching bolt 34. Thus, a precise space, namely, a transverse joint portion is formed between the panel 40 and the lower panel with holding frame 40 adjacent thereto.

[0046] In such a way, when many panels 40 are attached to the wall surface of the building body of the construction, the alignment accuracy of many panels 40 has priority to other things. Therefore, the attaching bolts 34 and 35 attached to the upper and lower reinforcing members 45 of the individual panels 40 may not possibly correspond to the slot 26b or the bolt through hole 32 relevant to the receiving plate 26 and the adjusting plate 29 respectively fixed to the upper flange 21b and the lower flange 21c of each attaching bracket 21.

[0047] In this instance, since the receiving plate 26 and the adjusting plate 29 can move in all directions on the surfaces of the respective flanges, as mentioned above, these positions are finely adjusted depending on the positions of the respective panels 40. When each panel 40 is arranged at its prescribed positions in this manner, there is no restriction in the movement of the upward direction in the panel 40 under this state, so that a tap bolt 37 is screwed to the bolt thread hole 31 provided on the adjusting plate 29 and its lower end abuts against the upper side wall 45b of the upper reinforcing member 45.

[0048] As a consequence, as illustrated in Fig. 6, the panels 40 are fixed to the wall surface of the building body of the construction under a state in which the upper sides thereof are suspended by a plurality of attaching brackets 21. When the prescribed number of panels 40 are transversely attached to the wall surface in accordance with the attaching processes described above, then, the panels 40 are sequentially attached to the upper parts thereof in such processes as described above.

[0049] In this connection, in the lower side of each panel 40, as apparent from the above described constitution, the lower end of the attaching bolt 35 fixed to the lower reinforcing member 45 is only inserted into the slot 26b of the receiving plate 26 fixed to the upper flange 21b of the attaching bracket 21.

[0050] However, since the slot 26b is transversely long, the lengthwise moving action of the attaching bolt 35 is regulated and the attaching bolt 35 can slightly transversely move. The transverse movement of the attaching bolt 35 can be achieved, because excessive stress is prevented from being concentrated to the attaching structure of the panels 40 to break the attaching structure when the construction is shaken due to an earthquake or the like.

[0051] If only one of many panels 40 which are regularly arranged on the wall surface of the building body of the construction as described above is broken due to any cause, a procedure for replacing it by new panel with holding frame will be briefly described below. Initially, two upper and lower attaching brackets 21 for fixing the panel 40 to be replaced by a new frame are removed from the wall surface of the building body of the construction.

[0052] The attaching brackets 21 are removed, as illustrated in Fig. 7, by inserting a box spanner S from the joint portion between the panels 40 and detaching the nuts 24 threadedly attached to the anchor bolts 22 therefrom. Then, when the panel 40 to be replaced by a new panel and the panel 40 located below it are removed slightly from the wall surface of the building body of the construction, the two upper and lower brackets 21 are detached from washers 38.

[0053] The two upper and lower attaching brackets 21 unfastened from the anchor bolts 22 in such a way as mentioned above can be lowered by margins for the slots 23 into which the anchor bolts 22 are inserted, so that the two panels 40 are respectively lowered by the

space of the joint portion at the lower end. Consequently, between the panel 40 to be replaced by a new panel and the panel with holding frame 40 above the former, is formed a relatively large space (space corresponding to the space of two joint portions).

[0054] Then, as shown in Fig. 8, the two upper and lower panels 40 are separated from the wall surface of the building body of the construction in such a manner that a part in which the attaching bolt 35 is inserted into the slot 26b of the receiving plate 26 in the lower end of the lower panel 40 is used substantially as a supporting point, particularly, the upper part of the panels is greatly brought down forward and tilted, and both the attaching brackets 21 are detached from the anchor bolts 22.

[0055] Thus, when the panel 40 to be replaced by a new panel is raised slantingly upward, the attaching bolt 35 at the lower end is removed from the slot 26b of the receiving plate 26 attached to the lower attaching bracket 21 so as to be pulled out therefrom. At this time, the panel 40 to be replaced by a new panel may be removed from the building body with the attaching bracket 21 connected to the upper part thereof, or the attaching bracket may be detached from the panel 40 at this stage.

[0056] The new panel 40 which is replaced with the removed panel 40 is attached to the wall surface of the building body in accordance with processes reverse to the above described removing processes for a panel replacement. As described above, only arbitrary panels 40 which are regularly aligned and arranged on the wall surface of the building body of the construction can be readily replaced by new panels 40.

[0057] In this connection, when the panels 40 are attached to the wall surface of the building body of the construction, the space portion between the panels 40 serves as the joint groove (portion) by the joint groove forming wall portions 44c of the holding frames 44 attached to the peripheral edges of the adjacent panel main bodies 43. Into the joint groove, a weather resistant sealing material is pressed in order to stop water and improve appearance, or the back-up material is disposed and the water-proof sealing material is provided thereon as in the prior art. Sometimes, a gasket for a joint is further arranged on the water-proof sealing material.

[0058] In the attaching structure 20 according to the present embodiment, the lower end of the panel 40 has the attaching bolt 35 that is attached to the lower reinforcing member 45 so as to be inserted into the slot 26b of the receiving plate 26 attached to the upper flange 21b of the attaching bracket 21. The above described structure may be formed in another structure shown in Fig. 9.

[0059] More specifically, a cut-out part 121 cut out from the side of a receiving plate 120 fixed to the upper flange 21b of the attaching bracket 21 may be provided in place of the slot 26b. Further, instead of the attaching bolt 35 attached to the lower reinforcing member 45, a special engaging pin 122 may be used. As apparent from Fig. 9, the engaging pin 122 has a lower end serving as a large diameter shaft portion 122a with a diameter substantially the same as the width of the cut-out part 121. A part above the large diameter shaft part is a small diameter shaft portion 122b thinner than the above shaft part.

[0060] With the provision of the cut-out part 121 cut out from the side on the receiving plate 120, when the lower end of the panel 40 is positioned in place, the engaging pin 122 can be fitted to the cut-out part with ease in accordance with a slightly sideward transverse movement without inserting the attaching bolt 35 or the engaging pin 122 into the slot from its upper part.

[0061] Further, in case the panel 40 is located at a normally attached position, when the engaging pin 122 having a thick end is employed, the widthwise moving action of the lower end of the panel 40 is regulated, because the large diameter shaft portion 122a is located in the slot 26b or the cut-out part 121. However, when the panel 40 is wholly lowered downward in order to remove it from the wall surface, the small diameter shaft portion 122b is located in the slot 26b or the cut-out part 121, hence the inclination of the panel 40 can be increased when it is inclined as shown in Fig. 8.

[0062] Further, Fig. 10 shows an attaching structure 200 (hereinafter, simply referred to as a panel attaching structure) for attaching panels to the wall surface of the building body of the construction according to still another embodiment of the present invention. In the panel attaching structure 200 according to this embodiment, attaching brackets 21 are fixed by means of anchor bolts 22 to the wall surface of the building body of the construction substantially corresponding to the joint portions between the panels 40 similarly to the embodiment illustrated in Fig. 1.

[0063] However, this embodiment is different from the embodiment shown in Fig. 1 in that as shown in Fig. 11, although a position on the wall surface of the building body to which the attaching bracket 21 is attached substantially corresponds to the location of the joint portion between the panels 40, the lower horizontal flange 21c is attached substantially at the central part of the joint portion or at a position slightly lower than the central position.

[0064] Besides, on the upper surface of the upper horizontal flange 21b of the attaching bracket 21, a receiving plate 201 is fixed so as to be adjustable in position by means of bolts 202a and nuts 202b through slots 25 and 201a in respectively different directions. On the side of the receiving plate 201 protruding sideward from the upper horizontal flange 21b of the attaching bracket 21, is formed a cut-out part 202c.

[0065] The attaching bolt 35 attached to the lower reinforcing member 45 has its lower end serving as an engaging bolt (pin) inserted into the cut-out part 202c so that a widthwise (direction opposed to the wall surface of the building body of the construction) moving action

in the lower end of the panel 40 is restricted.

[0066] On the other hand, on the lower surface of the lower horizontal flange 21c of the attaching bracket 21, an adjusting plate 203 is fixed so as to be adjustable in position by means of bolts 204a and double nuts 204b through slots 28 and 203a in respectively different directions. On the side of the adjusting plate 203 sideward protruding from the lower horizontal flange 21c of the attaching bracket 21, is formed a cut-out part 203b.

[0067] The upper end of an attaching bolt 205a attached to the upper reinforcing member 45 is inserted into the cut-out part 203b. Double nuts 205b are threadedly attached to the screw shaft part of the attaching bolt 205a protruding upward from the cut-out part 203b, so that the adjusting plate 203 is fixed to the lower flange. As a result, The upper end of the panel 40 is firmly fixed to the lower horizontal flange 21c, that is to say, the attaching bracket 21 through the adjusting plate 203 fixed to the lower horizontal flange by means of the attaching bolt 205a and the double nuts 205b.

[0068] According to the panel attaching structure 200 according to this embodiment with such a structure, since the lower horizontal flange 21c of the attaching bracket 21 is attached to the wall surface so as to be located substantially at the central part of the joint portion, or at the position slightly lower than the central position, the double nuts 205b for fastening the upper end of the panel 40 to the attaching bracket 21 and the double nuts 203a for fixing the adjusting plate 203 to the lower horizontal flange 21c are located in the joint portion between the panels 40.

[0069] Therefore, when an arbitrary panel 40 is replaced by a new panel, a spanner is inserted from the joint portion to unfasten these double nuts 205b and 203a and the adjusting plate 203 is slid in the direction shown by an arrow 206 shown in Fig. 10. Thus, the attaching bolt 205a relatively comes out of the cut-out part 203b of the adjusting plate 203.

[0070] Then, the panel 40 is raised by the space of the joint portion or transversely shifted so that the engaging bolt 35 which regulates in movement the lower end of the panel is pulled out from the cut-out part 202c of the receiving plate 201. Thus, the panel 40 is wholly pulled forward and separated from the wall surface, so that it can be readily detached from the wall surface. A new panel 40 may be attached to the wall surface in accordance with a procedure reverse to the above-mentioned panel detaching procedure.

[0071] Incidentally, in order to fix the attaching bolt 205a to the adjusting plate 203, a nut 205c is threadedly attached to the attaching bolt 205a also on the underside of the adjusting plate 203. Accordingly, the adjusting plate 203 is fixed to the lower horizontal flange under a state it is sandwiched between the nut 205c and the double nuts 205b.

[0072] When the panel 40 is attached to the wall surface, the nut 205c is rotated by means of fingers inserted into the joint portion until the nut 205c comes into contact with the lower surface of the adjusting plate 203, after the correct position of the panel 40 is determined, and then, the spanner is inserted into the space to fasten the double nuts 205, so that the panel can be firmly readily and fixed to the attaching bracket. In the panel attaching structure 200 according to the present embodiment, other structures are basically equal to that of the embodiment illustrated in Fig. 1, and therefore, the explanation of other structures will be omitted.

[0073] Still further, Fig. 12 shows an attaching structure (simply referred to as a panel attaching structure, hereinafter) 300 for attaching panels to the wall surface of the building body of the construction according to still another embodiment of the present invention. In the panel attaching structure 300 according to this embodiment, a cylindrical cap 301 with a bottom is threadedly attached to the lower end of the attaching bolt 35 which the lower end thereof is inserted into the cut-out part 202c formed in the side of the receiving plate 201 and served as an engaging bolt (pin).

[0074] The cap 301 is provided with a flange 301a on its upper end, as illustrated in Fig. 13. The outer peripheral surface of the cap 301 is tapered so that the outside diameter is gradually decreased from an upper part (flange 301a side) to a lower part. The taper formed on the outer peripheral surface of the cap 301 is designed in such a manner that the outside diameter of the intermediate part in the longitudinal direction of the cap is substantially equal to the width of the cut-out part 202c formed on the receiving plate 201. Therefore, as shown in Fig. 12, when the cap 301 threadedly attached to the lower end of the attaching bolt 35 is inserted into the cut-out part 202c, the cap 301 is closely engaged with the cut-out part 202c substantially at the intermediate part of its height.

[0075] The cap 301 is provided with a tapped hole 301b having an opening at its upper part in an axial direction. The lower end of the attaching bolt 35 is relatively threadedly engaged with the tapped hole 301b so that the cap 301 is attached to the attaching bolt 35. Such a cap 301 is made of a rubber or a synthetic resin material.

[0076] By using the above-described cap 301, the attaching bolt 35 is closely engaged with the cut-out part 202c of the receiving plate 201, a widthwise (direction opposed to the wall surface of the building body of the construction) moving action in the lower end of the panel 40 can be completely restricted without generating a backlash.

[0077] The above-described cap 301 has advantages mentioned below. Even when various kinds of attaching bolts 35 having different diameters are used, several kinds of caps which can be respectively threadedly engaged therewith and have the same dimension of outside diameter may be manufactured. Therefore, the width of the cut-out part 202c formed on the receiving plate 201 does not need to be changed. Consequently, the dimensional standard of the receiving plate

201 can be unified. In the panel attaching structure 300 according to the present embodiment, other structures of components are basically equal to those of the embodiment shown in Fig. 10, and therefore, the explanation thereof will be omitted with the same reference numerals affixed to them.

[0078] In addition, the panel attaching structure for attaching panels to the wall surface of the building body of the construction according to the above-described embodiment is preferably applied to a case in which the longitudinal length of each of the panels is comparatively shorter than its horizontal length and these panels are attached to the wall surface. A reason for the above fact is that, if longitudinally elongated panels cannot be attached at their side parts to the building body because of the structural problem of the building body of the construction, the longitudinally elongated panels must be attached only at their upper and lower ends. However, in the case of the longitudinally elongated panels, when the rolling movement of the building body of the construction due to an earthquake or the like occurs, working force is exerted on each of the longitudinally elongated panels so as to rotate it substantially on its intermediate part in the longitudinal direction. Therefore, the upper and lower ends of each longitudinally elongated panel roll rightward and leftward. As a result, there may possibly occur such a fear as the damage of the attaching structure for attaching the upper and lower parts of the longitudinally elongated panels to the wall surface of the building body.

[0079] With the above-described problems taken into consideration, when the longitudinally elongated panels are attached to the wall surface of the building body, an attaching structure 400 as shown in Fig.14 is adopted. Specifically, in the attaching structure 400, an adjusting plate 401 is fixed to the lower surface of the lower horizontal flange 21c of the attaching bracket 21 so as to be adjustable in position by means of bolts 204a and double nuts 204b through slots 28 and 203a in respectively different directions.

[0080] This adjusting plate 401 is shown in Fig. 15. As apparent from Fig. 15, on the protruding ends of the adjusting plate 401 which protrude to both sides from the lower horizontal flange 21c of the attaching bracket 21, are respectively formed cut-out parts 402a and 402b.

[0081] The upper end of an attaching bolt 205a attached to the upper reinforcing member 45 in one of the longitudinally elongated panels 40 is inserted into one cut-out part 402a. To the screw shaft part of the attaching bolt 205a protruding upward from the cut-out part 402a, is threadedly attached double nuts 205b. Thus, the attaching bolt is fixed to the adjusting plate 401. As a consequence, the upper end of the panel 40 is firmly fixed to the lower horizontal flange 21c, in other words, the attaching bracket 21, through the adjusting plate 401 fixed to the lower horizontal flange through the attaching bolt 205a and the double nuts 205b.

[0082] The lower end of the attaching bolt 35 attached to the lower reinforcing member 45 in the other longitudinally elongated panel 40 which is attached to the upper part adjacent to the above-described longitudinally elongated panel 40 is inserted into the other cut-out part 402b of the adjusting plate 401. Double nuts 403 are threadedly engaged with the screw shaft part of the attaching bolt 35 which protrudes downward from the cut-out part 402b. Thus, the attaching bolt is fixed to the adjusting plate 401. As a result, the lower end of the longitudinally elongated panel 40 is firmly fixed to the lower horizontal flange 21c, that is to say, the attaching bracket 21, through the adjusting plate 401 fixed to the lower horizontal flange through the attaching bolt 35 and the double nuts 403.

[0083] As described above, the attaching bolts 205a and 35 for respectively fixing the upper and lower ends of the longitudinally elongated panels 40 which are vertically adjacent to each other to the attaching bracket 21 are fixed to the adjusting plate. As apparent from Fig. 14, on both the ends of the adjusting plate 401 protruding from the attaching bracket 21, are formed bent parts 404a and 404b which are longitudinally bent. Even when the building body of the construction rolls due to an earthquake or the like and the lower ends of the longitudinally elongated plates 40 violently roll rightward and leftward, the bent parts 404 expand and contract to absorb the rolling movement and the damage of the attaching structure 400 can be prevented due to the existence of the bent parts 404a and 404b.

[0084] Since the lower end of the longitudinally elongated panel 40 located in the upper part and the upper end of the longitudinally elongated panel 40 located hereinbelow are fixed to the same adjusting plate 401, as mentioned above, the vertical alignment accuracy, which has been hardly achieved in the case of the longitudinally elongated panels, can be advantageously readily achieved. Further, a work for detaching or attaching a part of many longitudinally elongated panels attached to the wall surface of the building body of the construction therefrom/thereto can be exceptionally easily carried out. Needless to say, the above-described attaching structure 400 may be applied to horizontally elongated panels as in the case of the embodiment shown in Fig. 1 without generating problems. The above attaching structure 400 is rather more preferable, as described above, because the work for detaching and attaching panels can be extremely readily performed when many panels are partly replaced by new panels or the like.

[0085] Although, according to the above description, the "panel with holding frame" comprises the composite plate formed by laminating the metallic sheets on both the surfaces of the base made of a non-metallic material and the aluminum holding frame attached thereto, it should be noted that the attaching structure of the present invention is not limited to the panels with holding frame having such a structure, and a composite

plate formed by laminating the metallic sheets on both the surfaces of the honeycomb structure made of a metal material, a fiber material, etc. Further, as the holding frame and the reinforcing member for protecting the peripheral edge of the panel main body may be formed with any material other than aluminum material, and may be usually preferably formed with an extruded metallic material.

[0086] Still further, needless to say, the attaching structure of the present invention is not limited to the "panels with holding frame", various kinds of panels other than them may be employed when they are attached near to the wall surface of the building body of the construction.

[0087] As stated above, according to the panel attaching structure for attaching panels to the wall surface of the construction of the present invention, a preparation work for attaching a plurality of panels which form, for example, an outer wall or an inner wall, to the wall surface of the building body can be carried out easily. Besides, the panels at any positions after they are installed can be partly removed from the wall surface and can be replaced by new panels with ease.

Industrial Applicability

[0088] The panel attaching structure for attaching panels to the wall surface of the building body of the construction according to the present invention is effectively employed when a plurality of panels, which form, for instance, an outer wall, are attached to the building body of the construction. Further, the present invention is also effectively applied to a case in which a plurality of panels which form an inner wall to the wall surface of the building body of the construction. Furthermore, when the panel attaching structure for attaching panels to the wall surface of the building body of the construction is used, any panels at any positions after the installation of the panels can be partly removed and replaced new panels with ease.

Claims

1. A structure for attaching panels that are attached to the building body of a construction to form a wall surface to the wall surface of the building body of the construction comprises:

two reinforcing members provided at least the upper part and the lower part of a back surface opposed to the wall surface of the building body when the panels are attached to the wall surface of the building body of the construction;

a plurality of attaching brackets transversely attached at intervals to the wall surfaces of the building body corresponding to joint portions between the panels when a plurality of the panels are vertically arranged and disposed on the wall surface of the building body of the construction;

a receiving plate supported by said attaching brackets and regulating in movement the lower end of the upper panel of two vertically adjacent panels; and

an adjusting plate, supported by said attaching brackets, for supporting the upper end of the lower panel,

characterized in that the lower end of the upper panel is restricted in movement by inserting the lower ends of pins suspended from said lower reinforcing member into holes formed in said receiving plate, and the upper end of the lower panel is fixed to said adjusting plate by detachably fastening said upper reinforcing member to said adjusting plate.

2. A structure for attaching panels to the wall surface of the building body of a construction as claimed in claim 1, characterized in that said adjusting plate supported by said attaching brackets is attached so as to be movable along the wall surface of the building body of the construction.

3. A structure for attaching panels to the wall surface of the building body of a construction as claimed in claim 2, characterized in that said receiving plate is supported by said attaching brackets is attached so as to be movable relative to said attaching brackets.

4. A structure for attaching panels to the wall surface of the building body of a construction as claimed in claim 3, characterized in that support portions of said attaching brackets for supporting said adjusting plate are located in the joint portion between the panels, and fastening means for detachably fastening said upper reinforcing member to said adjusting plate can be fastened and unfastened through the joint portion from an outside of the panels.

5. A structure for attaching panels to the wall surface of the building body of a construction as claimed in claim 4, characterized in that the panel being comprised of a panel main body made of a laminated composite material, and a plurality of holding frames, respectively, attached to peripheral edges of the panel main body to support the panel main body, said holding frame being comprised of a support portion connected and fixed to the back surface of said panel main body, and a rim portion for surrounding and catching the peripheral edge of said panel main body.

FIG 1

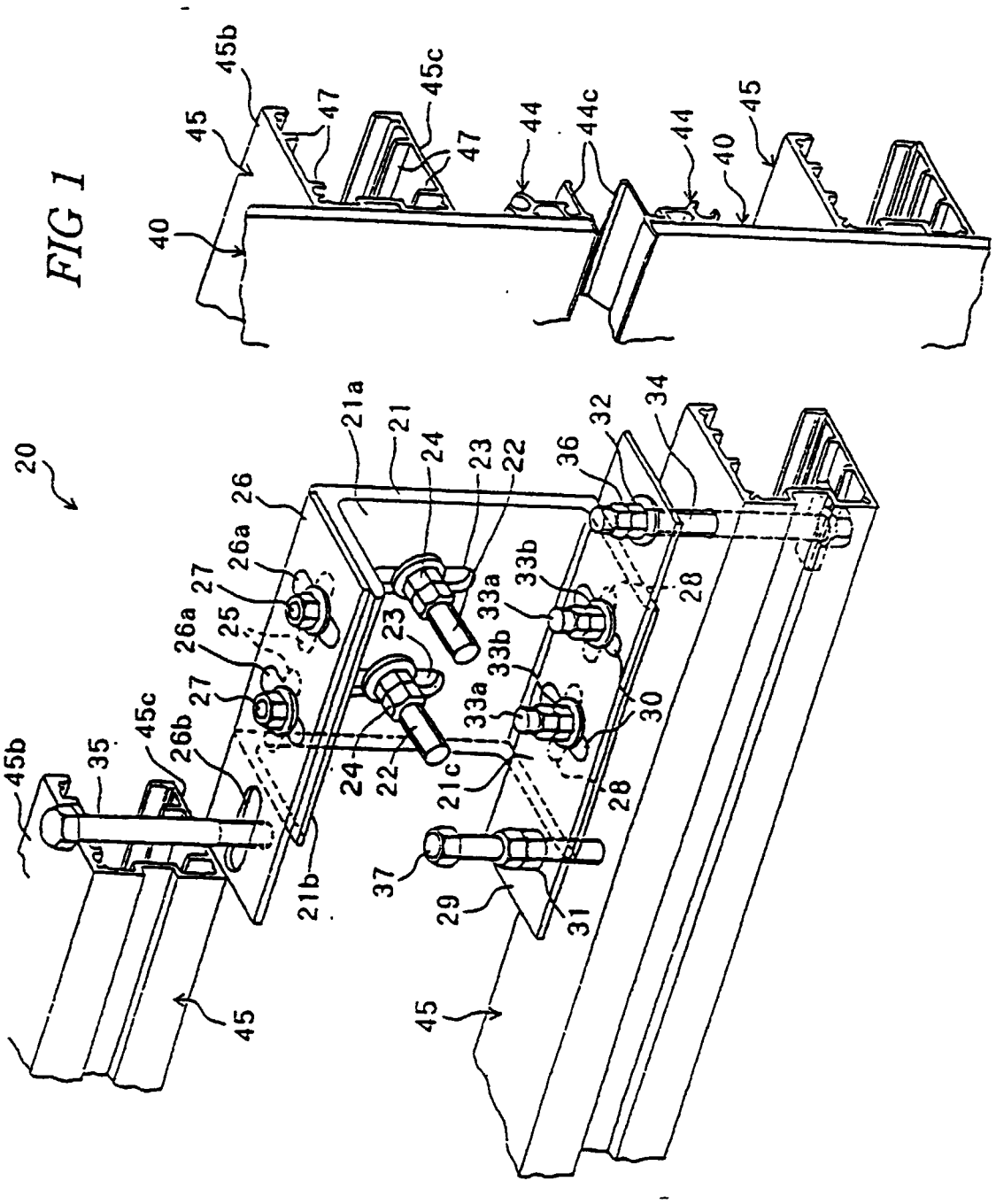
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FIG 2

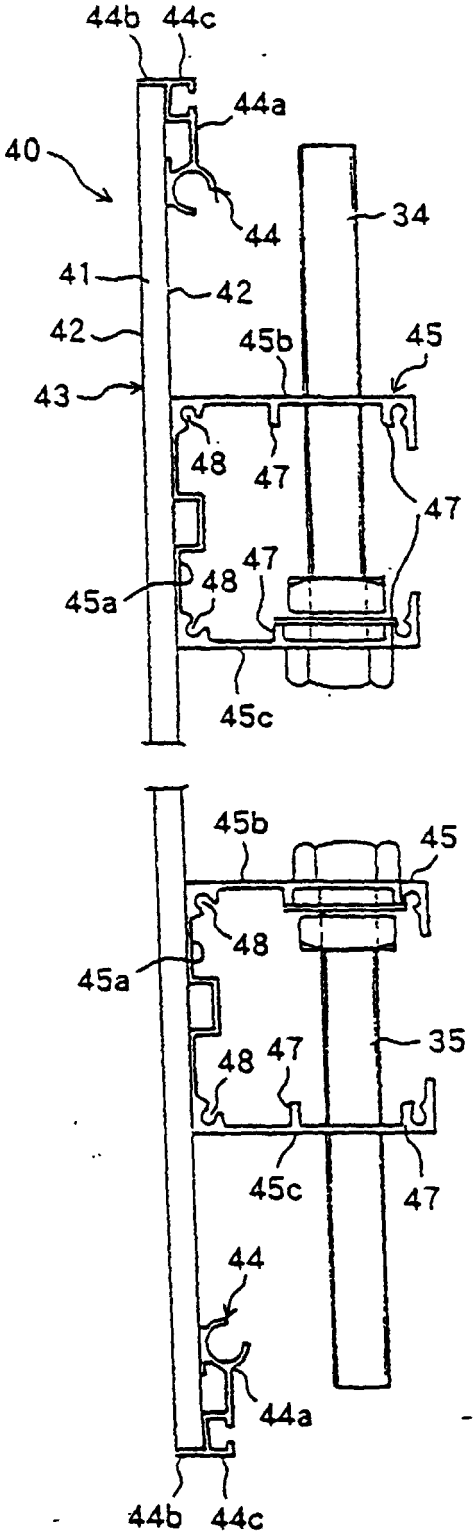
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FIG 3

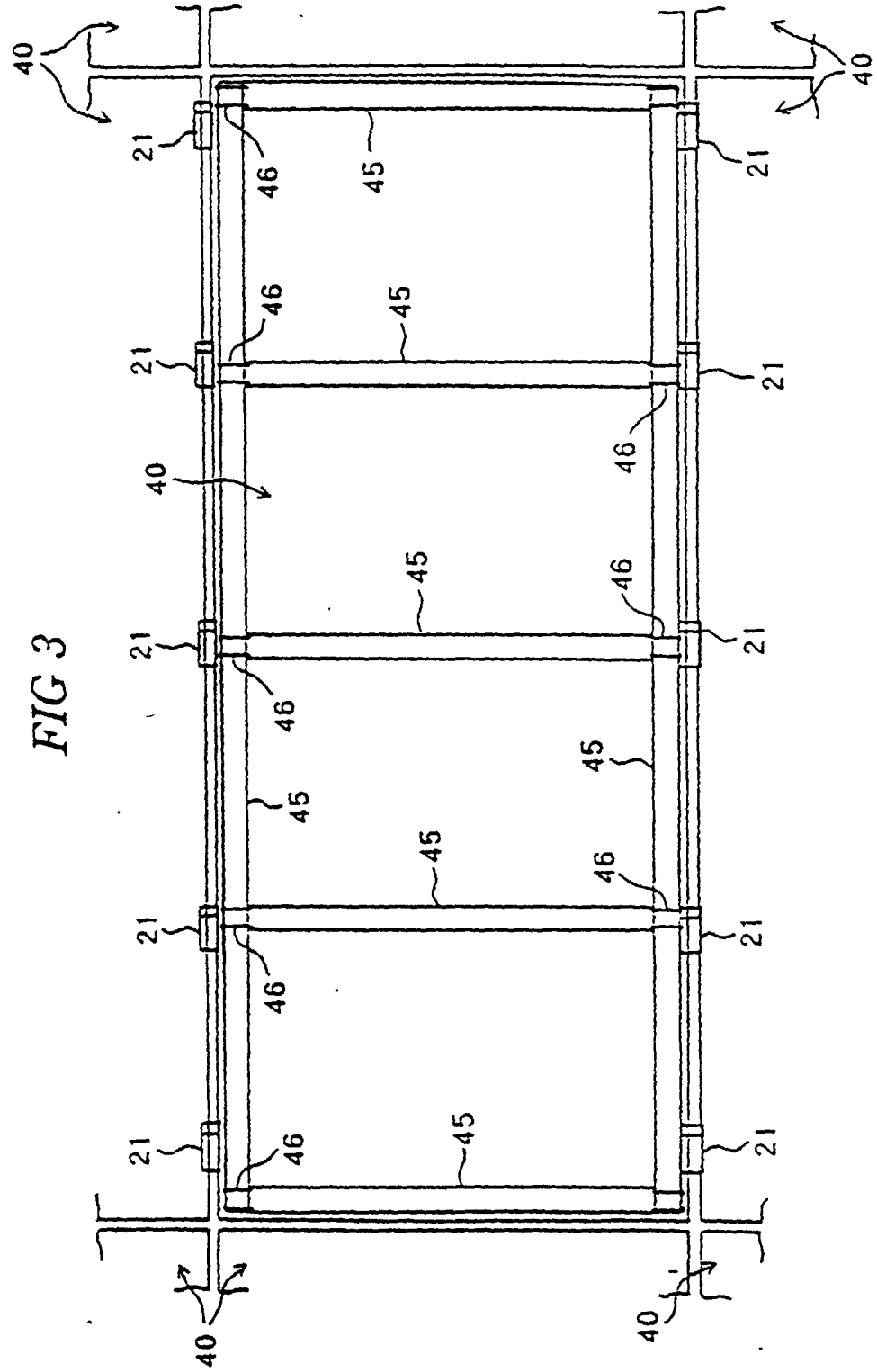

FIG 4

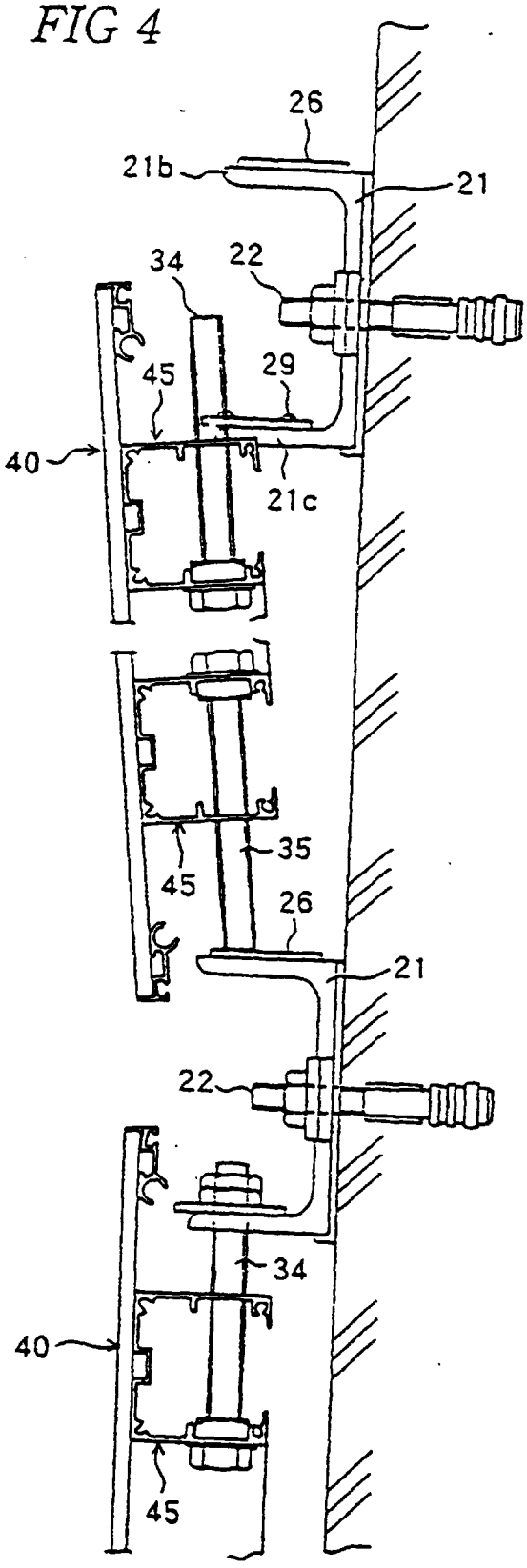

FIG 5

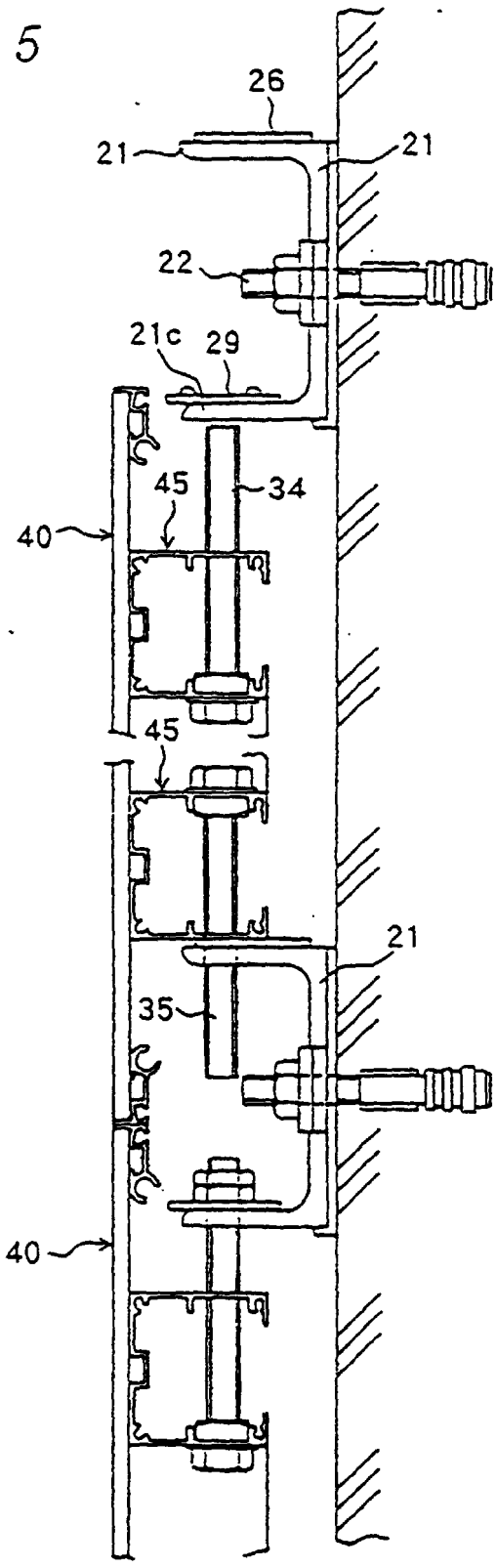

FIG 6

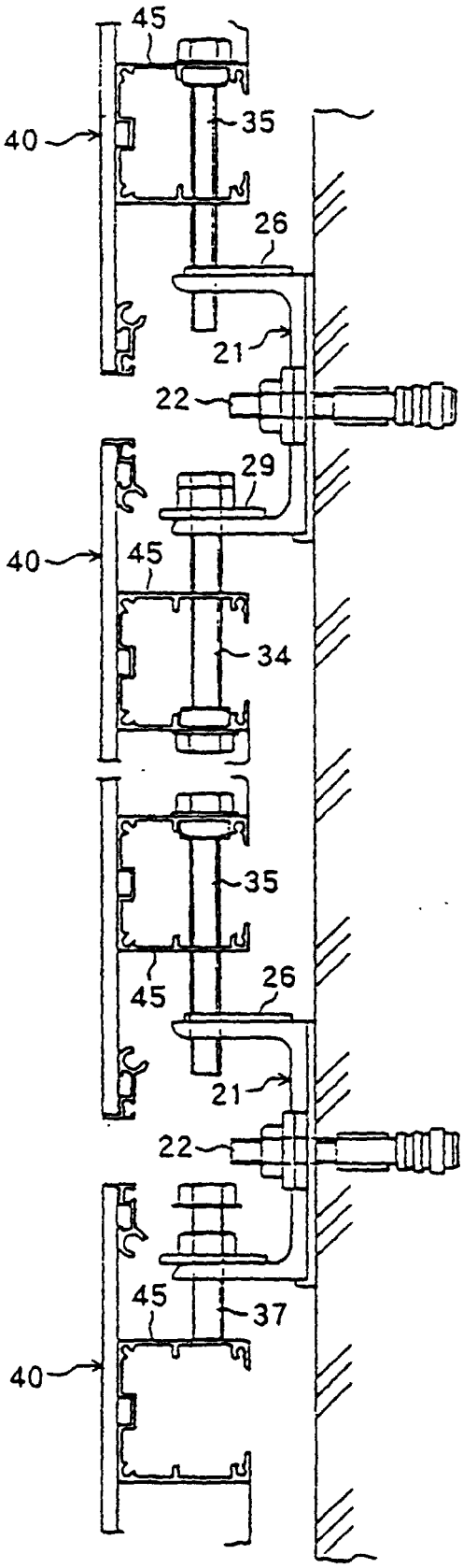

FIG 7

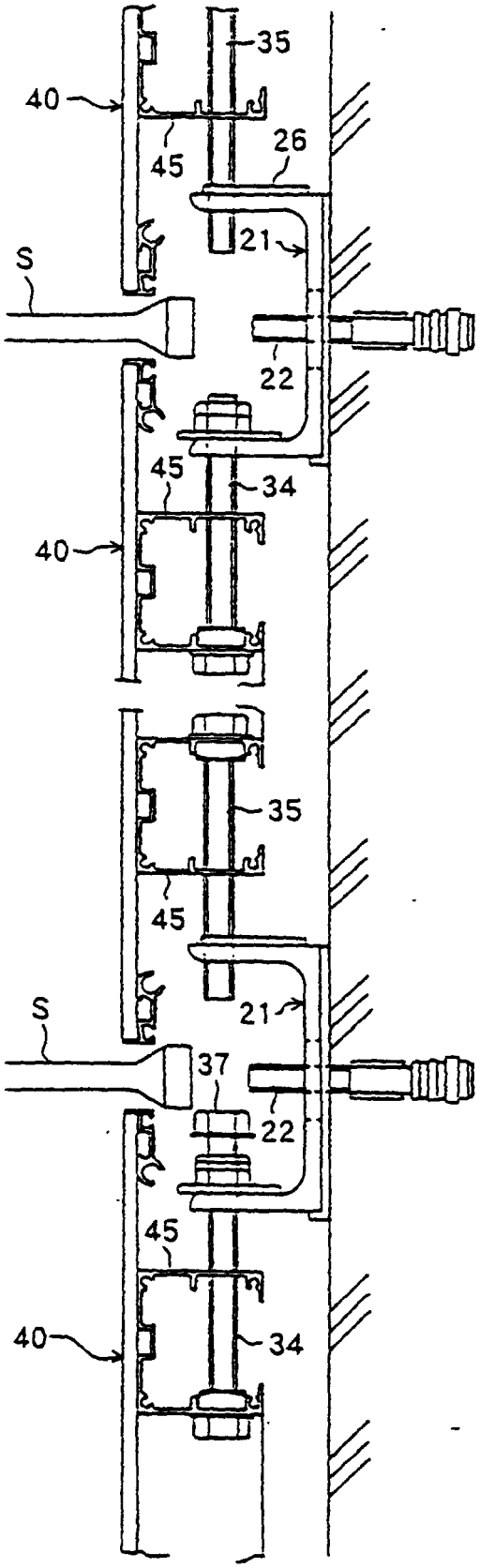

FIG 8

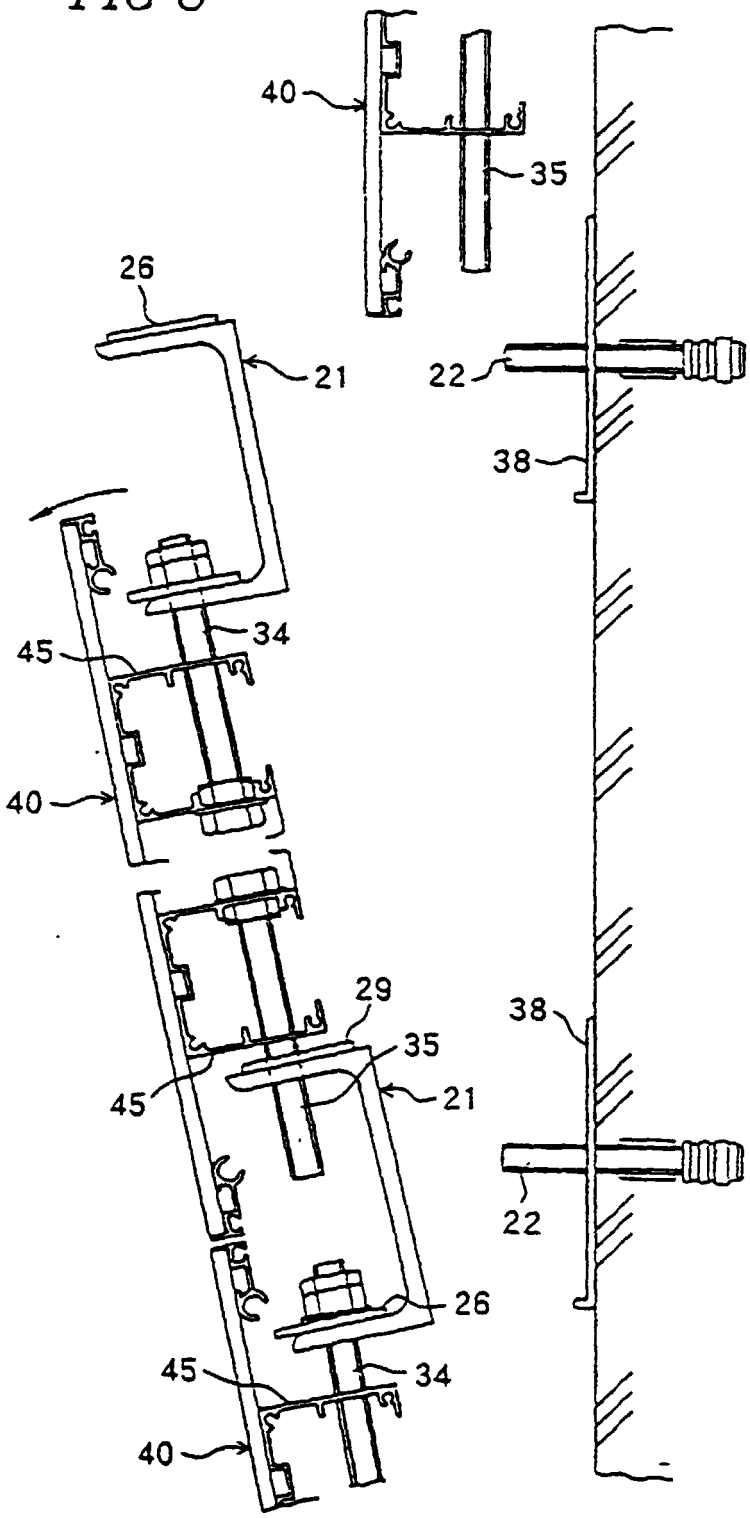

FIG 9

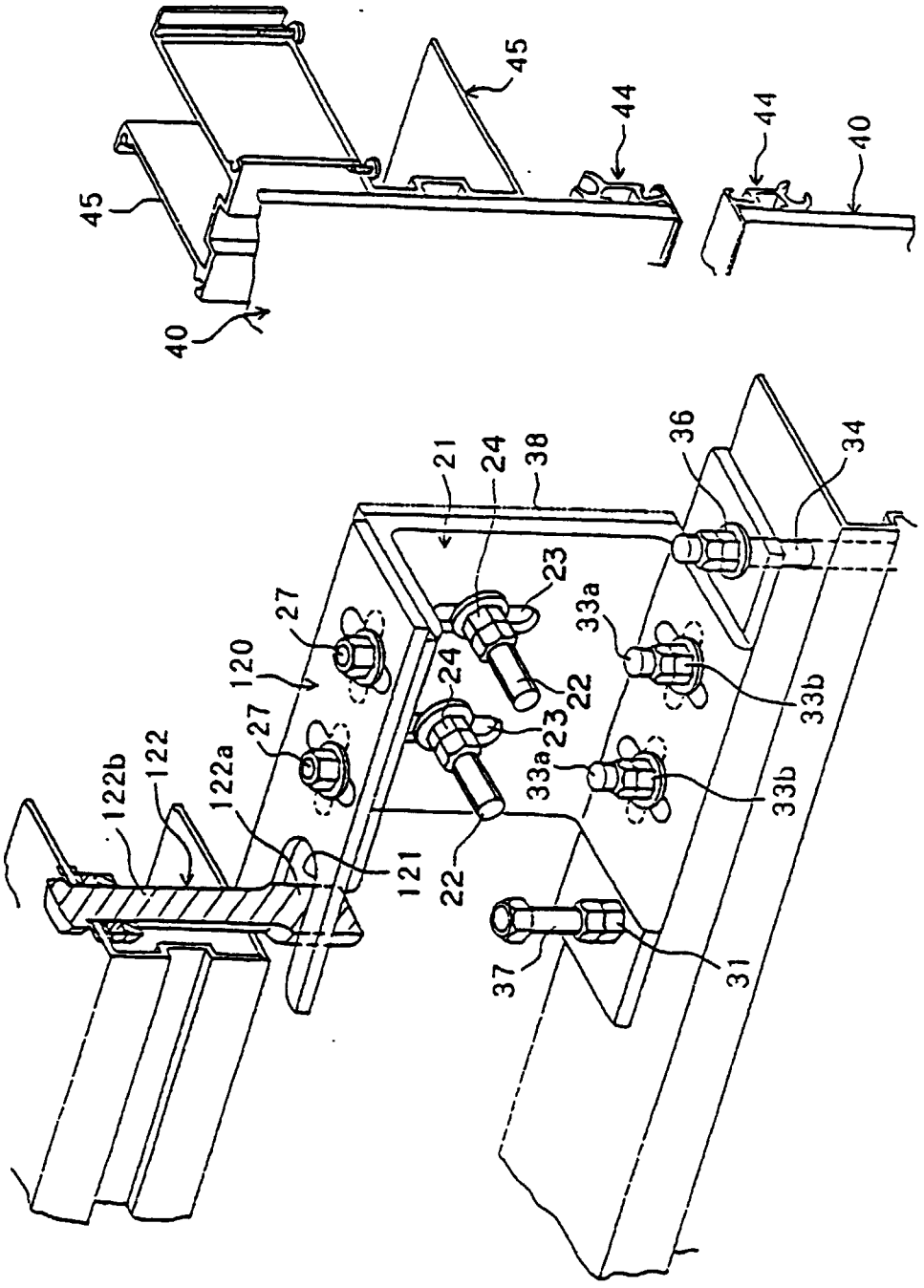
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FIG 10

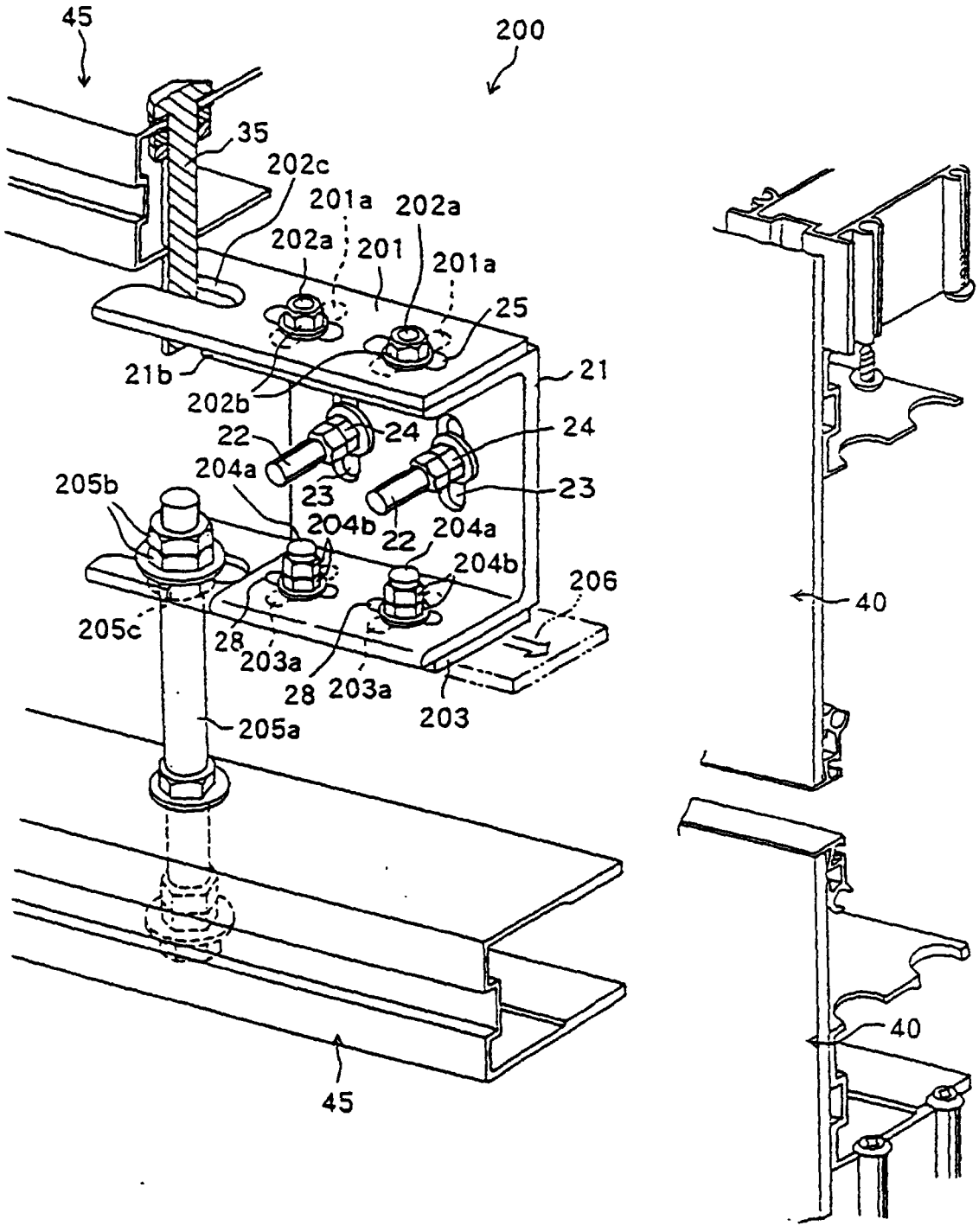
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FIG 11

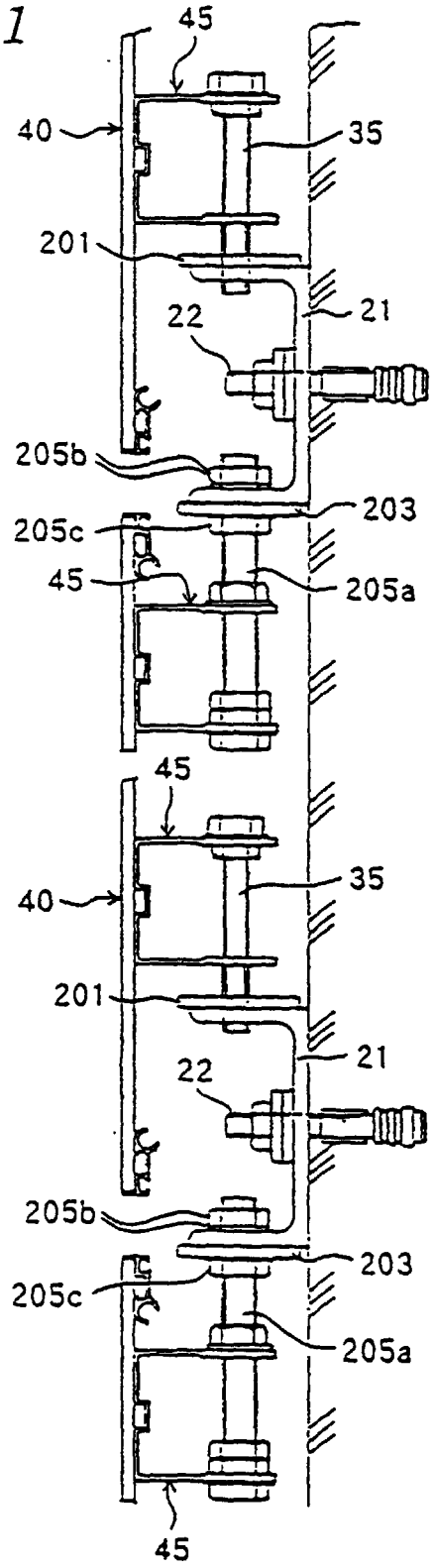
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FIG 12

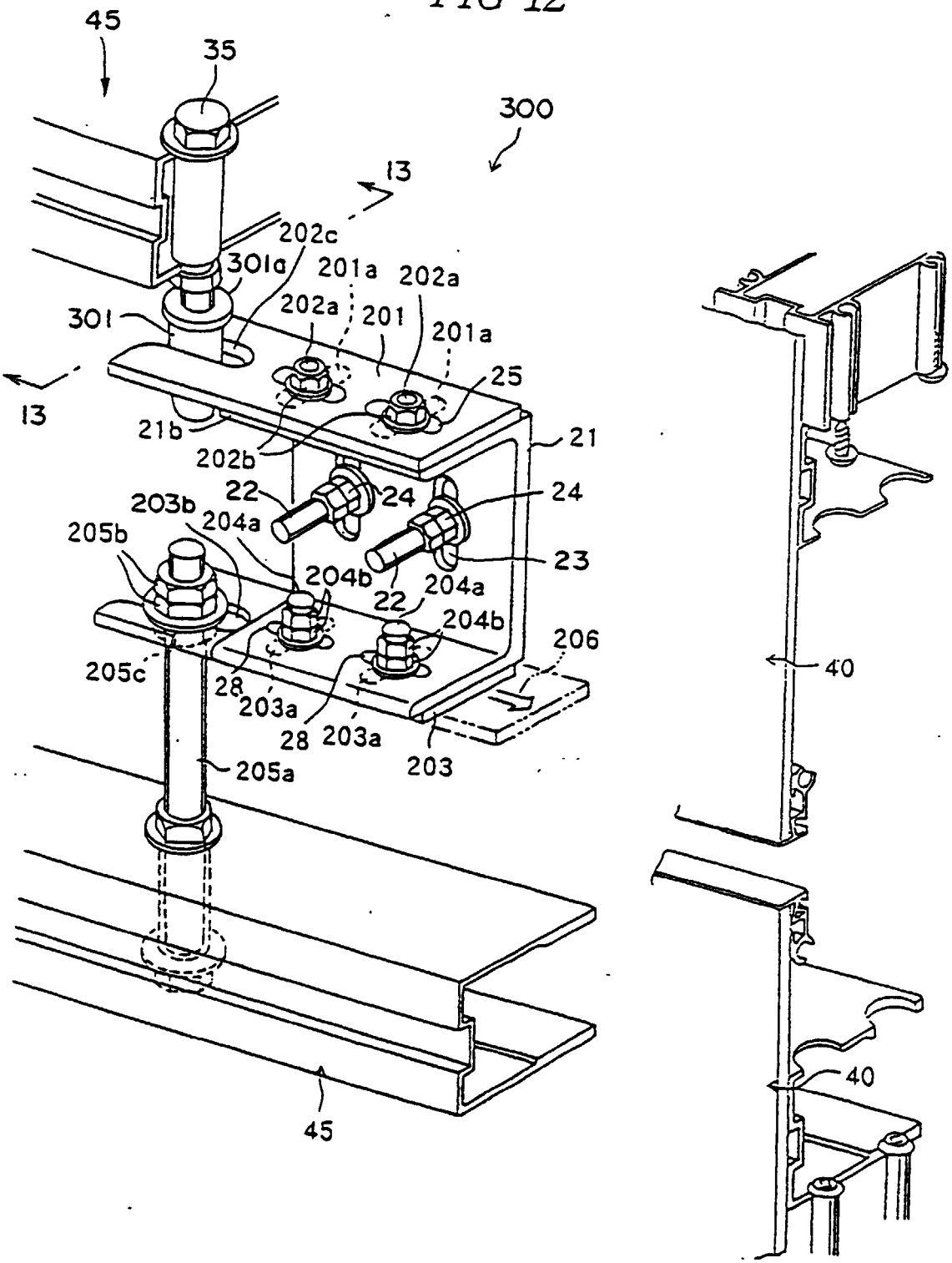
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FIG 13

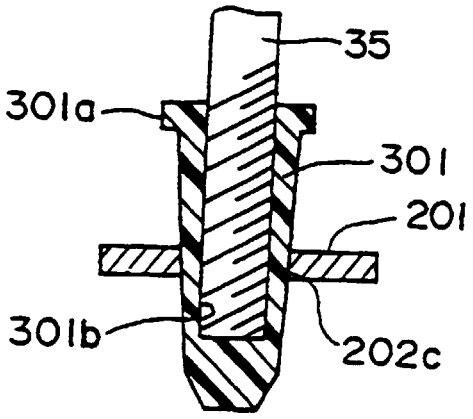
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FIG 14

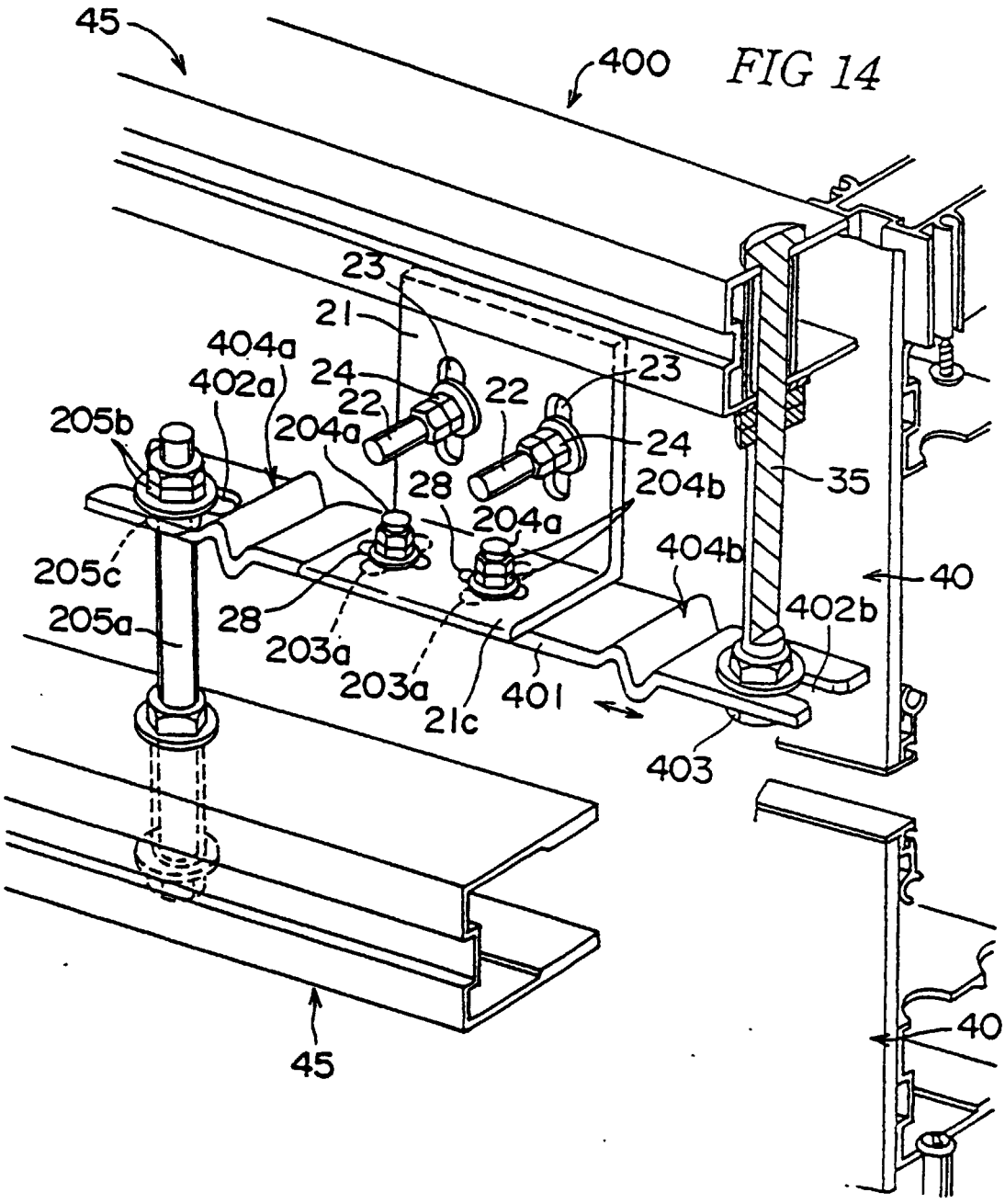
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FIG 15

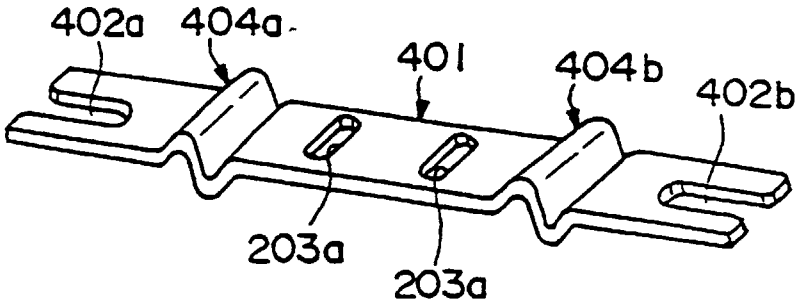
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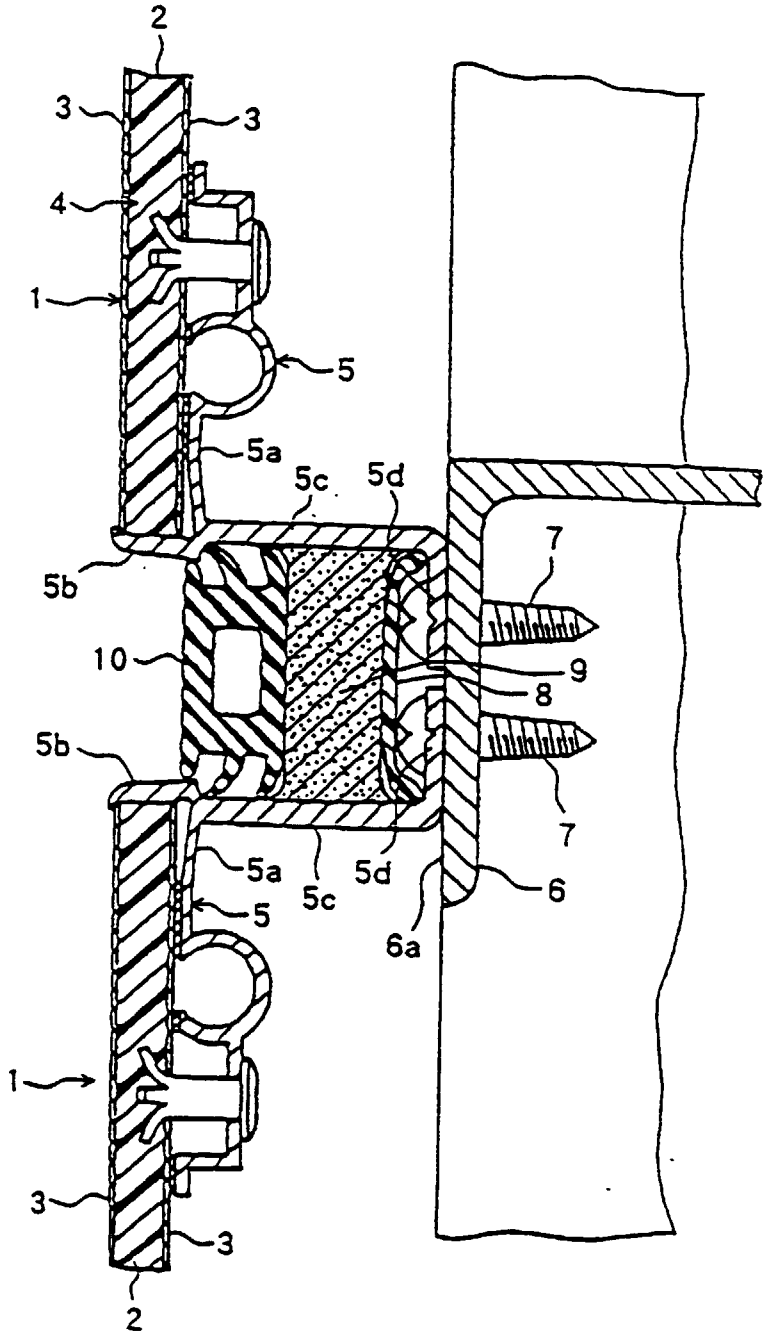
FIG 16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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP99/01456

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[6] E04B2/90

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[6] E04B2/90

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-1999
Jitsuyo Shinan Kokai Koho 1971-1999 Jitsuyo Shinan Toroku Koho 1996-1999

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, 6-63292, B2 (Kajima Corp.), 22 August, 1994 (22. 08. 94)	1-5
A	JP, 2-217560, A (Kubota, Ltd.), 30 August, 1990 (30. 08. 90)	1-5
A	JP, 8-5211, Y2 (Ishikawa PC Kougyou K.K.), 14 February, 1996 (14. 02. 96)	1-5

☐ 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
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Date of the actual completion of the international search	Date of mailing of the international search report
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