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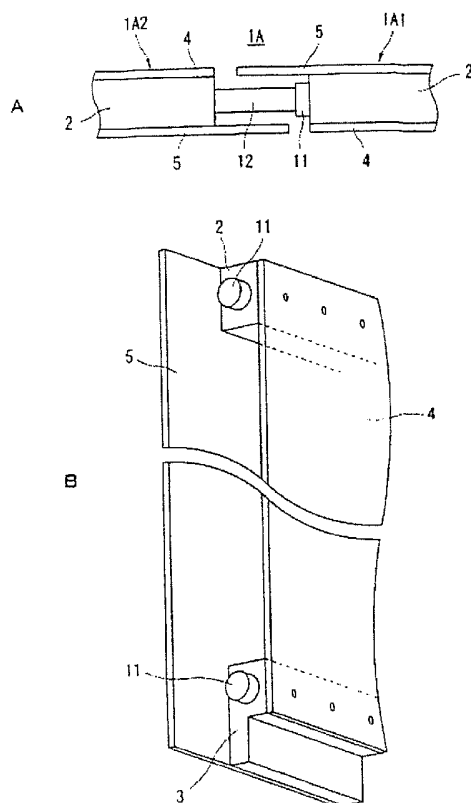
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[Continued on next page]

(54) Title: ELEVATOR DOOR DEVICE



(57) Abstract: An elevator door device including a door panel having a first plate and a second plate that are arranged adjacent to each other, the first plate and the second plate are each coupled to a cross rail. The first plate and the second plate are formed of a transparent material, the first plate has an opening edge and an edge of the second plate extends beyond the cross rail and the opening edge of the first plate.



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ELEVATOR DOOR DEVICE

TECHNICAL FIELD

[0001] This invention relates to an elevator door device in which a transparent door made of glass, acrylic or the like can be installed.

BACKGROUND OF THE INVENTION

[0002] In an elevator hall, as shown in Figure 12, the hall entrance/exit is formed by jamb 101 and hall door 102 opens and closes the hall entrance/exit. A hanger 103 that has rollers 104 is affixed at the upper end of hall door 102, a rail 106 is also affixed to the upper part of aforementioned jamb 101 with a header 105 intervening, and rollers 104 of hanger 103 roll on rail 106. A shoe 107 is also attached at the lower end of hall door 102 and this shoe 107 engages in sill 108 that is formed in the hall. Hall door 102 will thus open and close the hall entrance/exit with the lower end of hall door 102 guided by sill 108 via shoe 107 and the upper end of hall door 102 guided by rail 106 via hanger 103 and rollers 104.

[0003] Also, as shown in Figure 13, car door 112 opens and closes the entrance/exit of elevator car 111. A hanger 113 that has rollers 114 is affixed against the top upper end of car door 112 in the same manner as for hall door 102. The rail 116 on which hanger 113 moves is affixed to the upper end of the car entrance/exit and rollers 114 of hanger 113 roll on the top of rail 116. The structure of the lower end of the door is the same as for the hall door.

[0004] Car door 112 is opened and closed with a door drive mechanism (door operator) constituted by a motor 121, pulleys 122 and 123, and a belt 124 that moves the hanger of car door 112 installed on the car side. For opening and closing hall door 102, hall door 102 is also opened and closed interlocked with the opening and closing of car door 112 with a door interlock device (omitted from the figure) for interlocking hanger 113 of car door 112 and hanger 103 of hall door 102. Note that the door drive mechanism is not limited to that shown and there are also link types, linear motor types, and the like.

[0005] As illustrated in JP 10-059664, there also exists an elevator door that has a portion of the door as a glass window. There is a first glass and a second glass with a space in between the two glass portions.

[0006] For conventional door safety devices, such as safety shoe/photoelectric safety devices, the equipment is installed in the door.

SUMMARY OF THE INVENTION

[0007] Conventional elevator doors are made of steel sheet, and while resistant to impact, are not transparent. In some cases a portion of the door is used as a glass window as described above, but there is no technology for making the door unit of glass. When an elevator door is made of a transparent material such as glass or acrylic, there is a problem that the door or equipment in the hoistway is visible through it because it is transparent, which lowers the design features. There is also a problem that glass and acrylic are less resistant to impact than steel sheet and break easily.

[0008] The present invention was devised to solve the aforementioned problems. Its objective is to provide an elevator door device in which the entire door panel is made of a transparent material, such as glass, acrylic or the like.

[0009] Exemplary embodiments of the invention include an elevator door device including a door panel having a first plate and a second plate that are arranged adjacent to each other, the first plate and the second plate are each coupled to a cross rail. The first plate and the second plate are formed of a transparent material, the first plate has an opening edge and an edge of the second plate extends beyond the cross rail and the opening edge of the first plate.

[0010] Exemplary embodiments of the invention also include an elevator door having transparent door panels with a halved joint structure using two plates of transparent material, and a door bumper is installed at a part that is not visible at the upper part or lower part in the halved joint structure. It is understood that the elevator door may include one or more door panels. When one door panel is used an additional sheet of glass is mounted on the closing wall of the elevator door so that the halved joint structure is formed when the door panel is in the closed position.

[0011] Further embodiments include an elevator door that is made of transparent material and a door stop is installed on the door drive device. With this invention, a door bumper is installed on the door drive device, and impact onto the transparent material of the door when the door closes can be prevented while maintaining the design features.

[0012] Further embodiments include a reinforcing plate installed at the lower end of the aforementioned door made of transparent material. With this invention, the lower end of the glass door is reinforced by the reinforcing plate, the door will not flex, and displacement caused by flexing of the door made of transparent material can be prevented.

[0013] Further embodiments include a protective thin plate installed on the edge surface of the lower part of the glass door. With this invention, the edge surface of the glass door is

protected by the thin plate, so damage to the edge surface caused by impact of the glass door can be prevented.

[0014] Exemplary embodiments of the invention include a door safety device installed in the door drive device to detect a torque increase in the drive motor and to reverse opening and closing of the door. With this invention, door safety devices installed on conventional doors will be eliminated and the design features of glass doors improved.

[0015] Further embodiments include a photoelectric safety device installed between the two plates that constitute the transparent door and a light beam from the photoelectric safety device is produced between the aforementioned two plates. With this invention, door safety devices installed on conventional doors will be eliminated and the design features of glass doors improved.

[0016] The elevator door includes panels that are glass panels with a halved joint structure and a door bumper is installed vertically in the halved joint structure. So impact to the glass doors can be prevented and falling of items into the door bumper space between the glass doors can be prevented. The door bumper is also not visible, so design features are improved.

[0017] A door bumper for a one-way opening glass door is also installed on the door drive device. So, impact to the glass door when the door opens can also be prevented while maintaining design features.

BRIEF DESCRIPTION OF THE FIGURES

[0018] Figure 1A is a lateral cross section that shows the schematic constitution of halved joint glass doors, and (B) is an oblique view that shows one of these doors.

[0019] Figure 2(A) is a lateral cross section that shows the schematic constitution of doors of one sheet of glass, and (B) is a side view of the same doors.

[0020] Figure 3(A) is a lateral cross section that shows the schematic cross section of doors of one sheet of glass pertaining to another example, and (B) is a side view of the same door.

[0021] Figure 4 is a door stop position explanatory diagram.

[0022] Figure 5(A) is an oblique view that shows the edge surface reinforcing construction at the lower part of a glass door and (B) is a side view of the same door.

[0023] Figure 6(A) is a side cross section that shows the reinforcing construction at the lower end of a glass door and (B) is an oblique view of the same door. (C) is a front view of the same door.

[0024] Figure 7 is a block explanatory diagram for a glass door safety device.

[0025] Figure 8(A) is an oblique view that shows a door hanger fall prevention device, (B) is a side view of a door device in which this device is installed, and (C) is a front view of the same door device.

[0026] Figure 9(A) is an oblique view that shows a door interlock device with a door opening prevention device (function), and (B) is an enlarged view of the same door interlock device.

[0027] Figure 10 is an operation explanation diagram for a door interlock device with a door opening prevention device (function) when the door opens. (A) shows the door fully closed, (B) the door slightly open, and (C) the door fully open.

[0028] Figure 11(A) is an operation explanation diagram for a door interlock device with a door opening prevention device (function) when the car door is locked, and (B) is an enlarged view of part (A) when said car door is locked.

[0029] Figure 12(A) is a side cross section that shows the constitution of a conventional hall door device and (B) is a front view of same.

[0030] Figure 13 is an oblique view that shows the constitution of a conventional car door device.

[0031] Figure 14(A) is a cross section that shows a hoistway provided with a conventional elevator fascia plate, and (B) is a front view of same.

DETAILED DESCRIPTION

[0032] An exemplary embodiment of an elevator door device is illustrated in the referenced figures. For the glass door structure, an example of double-opening doors using two plates of glass for the elevator car is shown in Figures 1A and 1B. The elevator door device includes a double-opening glass door 1A includes a left glass door 1A1 and a right glass door 1A2. Each glass door 1A1 and 1A2 includes an upper cross rail 2 and a lower cross rail 3, along with a transparent plate 4, the width of which is approximately the same as the length of upper and lower cross rails 2 and 3, and a glass plate 5 which has a width that is wider than glass plate 4. The upper and lower ends of glass plates 4 and 5 are attached to the two sides of upper and lower cross rails 2 and 3. The rails can be attached in any known manner, including a fastener such as screws (omitted from the figure).

[0033] In particular, glass sheets 4 are attached to a first side of door 1A1 and to a second side or other side of door 1A2. Wide glass plates 5 are attached to a second side of door 1A1 and a first side of door 1A2 so that end parts 5a on the door closing side of glass plates 5 will

project past the cross rails 2 and 3 on opposing sides of doors 1A1 and 1A2 so that the facing ends of glass doors 1A1 and 1A2 form a halved joint structure.

[0034] The device also includes a door bumper 11 and a rod member 12, which can bump against the door bumper 11, are installed at the top and bottom end on the door closing side of upper and lower cross rails 2 and 3 of left and right glass doors 1A1 and 1A2. Rod member 12 bumps against door bumper 11 when left and right glass doors 1A1 and 1A2 close so that a prescribed space is formed between end part 4a of glass plate 4 of one door and glass plate 5 of the other door.

[0035] With glass door 1A, when left and right glass doors 1A1 and 1A2 close, a prescribed space between the doors is maintained by door bumper 11 and rod member 12, so the glass plates of left and right glass doors 1A1 and 1A2 will not touch. Door bumper 11 and rod member 12 are installed at the top and bottom of the halved joint structure in positions that are not visible by persons inside or outside the elevator car. Note that glass doors 1A1 and 1A2 can also each be two glass doors produced with two glass plates 4 that are the same size with no halved joint. In this case, rod member 12 will be unnecessary. A door produced with two sheets of glass 4 of the same size can also be used as a one-way opening glass door.

[0036] Another exemplary embodiment of the elevator door device is a two-way opening door of one sheet of glass as shown in Figures 2A and 2B. The elevator door device includes a two-way opening glass door 1B, which includes left and right glass doors 1B1 and 1B2. Each glass door 1B1 and 1B2 include a glass plate 4 that is the size of the door and a narrow glass plate 6 for reinforcement. The narrow glass plate 6 is less than the width of the size of the door. The device also includes upper and lower cross rails 2 and 3 of approximately the same length as the width of glass plate 4. The upper and lower ends of glass plate 4 are attached to one side of upper and lower cross rails 2 and 3 with screws. The glass plate 6 is attached to the other side of upper and lower cross rails 2 and 3 of glass doors 1B1 and 1B2. The glass plate 6 of door 1B1 includes a side end 6a that extends past cross rails 2 and 3 so as to overlap a space between doors 1B1 and 1B2 when the doors are in the closed position. The second glass plate 6 of the other door 1B2 is attached to upper and lower cross rails 2 and 3 so that a prescribed space will be formed between the plate 6 and the side end 6a of the other glass plate 6 for the door 1B1. A door bumper 11 is installed at the end on the door closing side of upper and lower cross rails 2 and 3 of the door 1B1.

[0037] When glass door 1B is closed, the door bumper 11 causes a space between the doors 1B1 and 1B2 to be formed and thus, glass plates 4 will not touch. The space portion

between the glass doors 1B1 and 1B2 is covered by the glass plate 6 of the one door 1B1. Note that the end of glass plate 6 of glass door 1B can be used as a one-way opening glass door when made even with the end of glass plate 4.

[0038] Another exemplary embodiment of the elevator door device is a two-way opening door of one sheet of glass as shown in Figures 3A and 3B. The elevator door device includes a two way opening glass door 1C, which includes two doors 1C1 and 1C2 and each door includes a glass plate 4 that is the size of the door. The device also includes an upper cross rail 2 and a lower cross rail 3. The width of the glass plates is approximately the same as the length of the cross rails 2 and 3. Each of the glass plates 4 includes a vertically oriented plate 7 that oppose each other on the closing ends of glass plates 4. The length of the plate 7 is approximately the same as the vertical length width of the glass plates 4. The upper and lower ends of glass plate 4 are attached to one side of upper and lower cross rails 2 and 3 with screws, and plate 7 is attached to the end surface of upper and lower cross rails 2 and 3. Door bumpers 13 made of an acrylic caulking block material are attached to plate 7 on the facing door closing sides of doors 1C1 and 1C2 and are constituted so that a space of the thickness of door bumpers 13 will be formed when doors 1C1 and 1C2 are closed.

[0039] With this example, a space is produced by door bumpers 13 when doors 1C1 and 1C2 are closed and glass plates 4 do not contact each other. The vertically oriented plate 7 on the facing surfaces of doors 1C1 and 1C2 protect the edge of the glass. This glass door can also be used as a one-way opening door.

[0040] Car doors were explained with the aforementioned, but glass hall doors may also be constituted in the same way as the aforementioned car doors. With glass doors 1B and 1C in Figures 2 and 3 above, in the case of car doors, the surfaces of glass plates 4 will be toward the inside of the car, and in the case of hall doors, the surfaces of glass doors 4 will be toward the hall. Upper cross rail 2 of aforementioned glass doors 1A, 1B and 1C is connected to the door hanger in the same way as with a conventional door, and a shoe is attached to lower cross rail 3. Glass door 1C in Figure 3 can also be used as a one-way opening door.

[0041] Referring to Figure 4, a door stop 36 for a one-way opening glass door is illustrated. Door stop 36 is attached by an L shaped attaching member 37 to the inside surface at the end of header case 31 of a door operator 30 so that the end of a door hanger 34 will touch it when glass door 1 is opened.

[0042] Previously, a prior art door stop 132 for a car door would be installed on the door bumper part 131 as indicated by the dotted line. In the door stop 132 was located in the same place on a glass door, then the door stop would be visible to the passengers inside the car.

Thus, by installing the door stop 36 on header case 31, the door stop 36 is not visible to the passengers.

[0043] Figures 5A, 5B, 6A, and 6B illustrate the structure of the lower part of the glass door. At the lower part of glass door 1A, 1B, 1C, a lower edge 3b of lower cross rail 3 is formed so that its thickness front to back is approximately half that of an upper end 3a. The lower end of glass plate 4 is positioned near the lower end of lower cross rail 3. A thin plate 16 with an L shaped cross section is installed to cover the edge surface composed of the lower end surface and back surface of the lower edge 3b of lower cross rail 3 and a caulking 17 is applied between the lower end of glass plate 4 and thin plate 16 to protect the edge surface of the lower part of glass door 1A, 1B, 1C with thin plate 16. Also, as shown in Figure 6, a reinforcing steel plate 15 is attached to a center part of back surface 3c on the lower edge 3b, whose lower surface edge is protected by thin plate 16 (omitted from Figure 6) of glass door 1A, 1B, 1C. The lower end of the steel plate 15 will project into a sill slot 21a and be reinforced by the sill 21. Door shoes 14 are attached at both ends of back surface 3c of lower edge 3b of the lower cross rail.

[0044] Figure 7 illustrates a safety device for elevator door device. Because the glass door is shown as both an elevator car door and a hall door, the elevator glass door is represented by reference numeral 22 and the glass hall door is presented by reference numeral 27. It is understood that door 22 and door 27 encompass all of the embodiments discussed hereinabove. The safety device includes a car door load detection device 23 that is installed inside the door operator (omitted from the figure) at the top of car door 22 and is constituted to detect a torque increase in the drive motor when the door is closing and to reverse operation of the drive motor. The torque of the drive motor increases when a person or object is caught in car door 22 when the door is closing. Car door load detection device 23 detects a torque increase from the drive motor current, controls the drive motor to run backward, and reopens glass car door 22. The figure also illustrates the car door sill 22 and a hall door sill 27.

[0045] The safety device also includes a light-emitting part 24 and a light-receiving part 25 of a multi-axis optical door sensor for detecting whether a person or object is caught in glass car door 22. The light-emitting part 24 and the light-receiving part 25 are installed in the door pocket (omitted from the figure) for car 20. The glass hall door 27 also includes a light-emitting part 28 and a light-receiving part 29 of a photoelectric door sensor for detecting whether a person or object is caught in the glass hall door 27. The light-emitting part 28 and the light-receiving part 28 are installed in the left and right door pockets (omitted from the

figure) in the hall to pass between the two glass plates of glass door 27 in the hall. The outputs of light-receiving parts 25 and 29 of the door sensors are connected to the control part of the door operator. When light from light-emitting parts 24 and 28 is blocked by the person or object and the output of the light-receiving parts 25 and 29 of the door sensors changes, the door operator controls the motor to run backward and reopen glass doors 22 and 27.

[0046] As described above, car door load detection device 23 is installed in the door operator and the light-emitting parts 24 and 28 and the light-receiving parts 25 and 29 are installed in the door pockets. Thus, all of the components for the safety device are not visible through glass doors 22 and 27.

[0047] Figures 8A, 8B, and 8C illustrate a hanger fall prevention device 38 for the elevator door device. The hanger fall prevention device 38 includes a long, narrow fall prevention part 38a, a support part 38b that supports its center part, and a catch part 38c that is part of 38b and is bent into an L shape. Fall prevention part 38a is positioned at the front surface of door hangers 34 of the two-way opening glass doors when glass car doors 1 are closed and support part 38b that supports the center part of fall prevention part 38a has catch part 38c attached to the inner surface of header case 31 of the door operator to be positioned between door hangers 34.

[0048] Each door hanger 34 is provided with rollers 33 and 35, and it is installed to be able to move along rail 32 installed on header case 31 via rollers 33 and 35. If door hanger 34 falls off rail 32 because of vibration or the like, falling is prevented by fall prevention part 38a of fall prevention device 38 if door hanger 34 is about to fall off, and damage to glass doors 1 is prevented.

[0049] Figures 9-11 illustrate an interlock device for both a glass car door and a glass hall door. A door interlock device 40 is constituted by a keeper 41 that is installed on the header case 31 of door operator 30 with a keeper attaching member 42, a car cam 43 that is attached vertically to the front surface of door hanger 34 that is movably installed on header case 31, a follower vane 44, which can move in the vertical direction and is installed on car cam 43 by a pair of links 45, a door opening blocking vane 46 attached to car cam 43 with a pair of links 47, and interlock rollers 48 and 49 attached to the door hanger (omitted from the figure) of the hall doors.

[0050] Roller 44a is installed at the top of follower vane 44 and guide roller 46a is installed at the top of door blocking vane 46. Keeper 41 is provided with cam surface 41a that roller 44a touches vertical cam surface 41b that guides roller 46a vertically. Keeper 41 also has a locking hook 41c into which locking projection 46b, which is installed at the top of

door opening blocking vane 46, engages. Interlock rollers 48 and 49 are attached to the door hanger of the hall door to be positioned outside keeper 41 and follower vane 46 when the car is not on a floor. Follower vane 44 is coupled with links 45 to car cam 43, which is installed on door hanger 34.

[0051] Figure 10A illustrates the car on a floor and the door fully closed. In this position, roller 44a is positioned on the shelf part at the top of cam surface 41a of keeper 41. The links 45 are at a diagonal and the gap between car cam 43 and follower vane 44 is narrow. The roller 46a of door opening blocking vane 46 is touching vertical cam surface 41b of keeper 41 and the gap between car cam 43 and door opening blocking vane 46 is wide. Door opening blocking vane 46 is at its high position, locking projection 46b of door opening blocking vane 46 is separated from locking hook 41c of keeper 41, and the door can be opened.

[0052] Figure 10B shows the car door slightly opened. Car cam 43 is moved toward interlock roller 48 and is just touching interlock roller 48. When the door opens further from this stage, the hall door is interlocked and opens. With the door fully open as shown in Figure 10C, vanes 44 and 46 are separated from keeper 41.

[0053] Concerning Figure 11, when the car is not at a floor (aligned with the hall), door hanger 34 is in the position shown. Interlock rollers 48 and 49 in the hall doors are separated from door interlock device 40 and are not in the location shown. So with the state as in Figure 9 above, door opening blocking vane 46, which has been lifted by links 47, which are diagonally supported by small diameter part 48 of interlock roller 48, drops in the direction of the arrow in Figure 10, locking projection 46b of door opening blocking vane 46 engages in hook 41c of keeper 41, and the car door is locked. When the car reaches the floor, the door will be fully closed as shown in Figure 9A, and the car door is unlocked by interlock roller 48.

[0054] The door interlock device 40 is provided with a car door opening prevention device (function) that automatically locks the car door when the car is not on a floor, so there is no risk of a person exiting into the hoistway when the car is not on a floor. As a safety measure when a person opens the door and exits into the hoistway when the car is not on a floor, in the past, as shown in Figure 14, a metal fascia plate 142 would be used in hoistway 141. When the door is a glass door, it would be visible from outside the hoistway, but the metal fascia plate can be omitted by using door interlock device 10 provided with a door opening prevention device (function). Thus, it is not necessary to replace the metal fascia plate with a transparent fascia plate.

[0055] This application claims priority to Japanese application 2004-307835, which was filed on October 22, 2004, and is herein incorporated by reference in its entirety.

[0056] While the invention has been described with reference to an exemplary embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment disclosed as the best mode contemplated for carrying out this invention, but that the invention will include all embodiments falling within the scope of the appended claims.

CLAIMS

1. An elevator door device comprising:
a door panel having a first plate and a second plate that are arranged adjacent to each other, the first plate and the second plate are each coupled to a cross rail,
wherein the first plate and the second plate are formed of a transparent material, the first plate has an opening edge and an edge of the second plate extends beyond the cross rail and the opening edge of the first plate.
2. The elevator door device according to claim 1, further comprising a second door panel, and the first door panel and the second door panel formed a halved joint structure at an opening between the first door panel and the second door panel.
3. The elevator door device according to claim 1, further comprising a second door panel, and the second door panel includes a transparent third plate and a transparent fourth plate arranged adjacent to each other, wherein the first plate, the second plate, the third plate, and the fourth plate form a halved joint structure at an opening between the first door panel and the second door panel.
4. The elevator door device according to claim 1, further comprising a second door panel, and the second door panel includes a transparent third plate that has an opposing opening edge that generally aligns with the opening edge of the first plate, wherein a gap is located between the opening edge and the opposing opening edge, and the second plate has a width that is greater than or equal to the gap.
5. The elevator door device according to claim 1, further comprising a door bumper that is mounted at an end of the cross-rail adjacent to the opening edge of the first plate, the door bumper extends a distance that is less than the second plate.
6. The elevator door device according to claim 1, further comprising a second cross rail coupled to an opposing end of the first plate and the second plate.
7. The elevator door device according to claim 1, wherein the first plate and the second plate are formed of glass.

8. The elevator door device according to claim 1, wherein a width of the first plate is approximately the same width as the cross-rail and a width of the second plate is greater than a width of the cross-rail.

9. The elevator door device according to claim 1, wherein a width of the first plate is approximately the same width as the cross-rail and a width of the second plate is less than a width of the cross-rail.

10. An elevator door device comprising:

a transparent door panel having a door operator;

a car door load detection device having a drive motor that operates in a first direction to close the door panel, the detection device is mounted at the door operator and is adapted to detect a torque increase in the drive motor and turn the drive motor in an opposing direction to open the door panel.

11. An elevator door device comprising:

a transparent door panel;

a multi-axis optical door sensor having a light-emitting part and a light-receiving part, the light-emitting part and the light-receiving part are mounted in opposing door pockets so that a light from the light-emitting part passes through at least a portion of the transparent door panel.

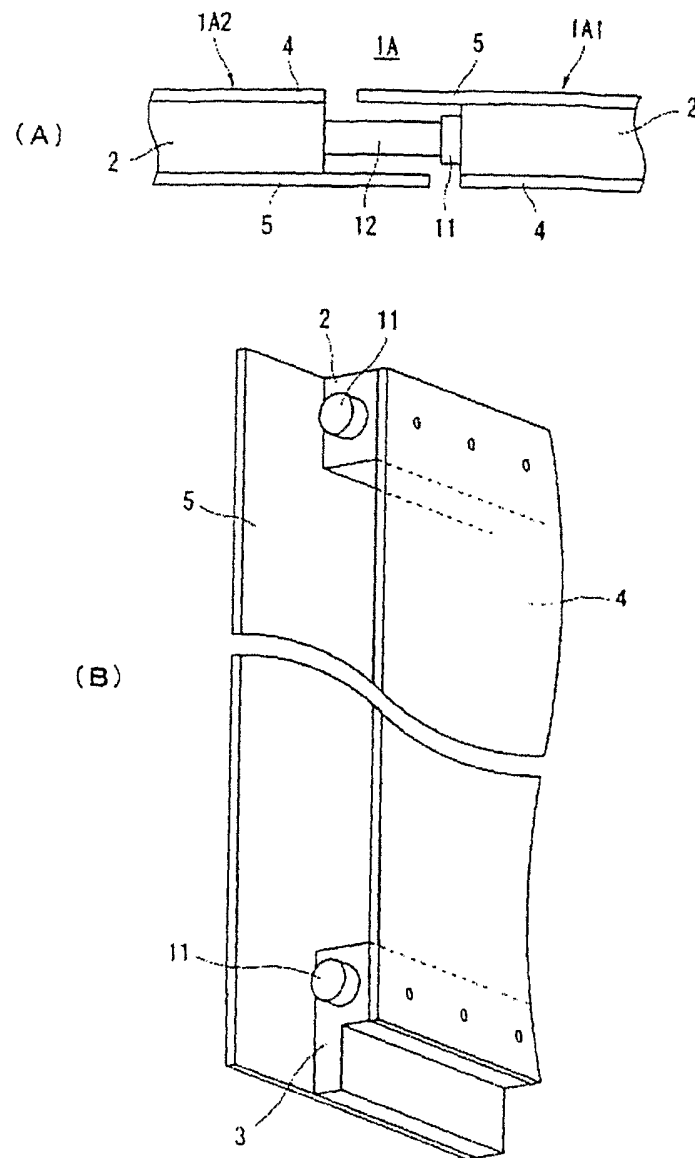


Figure 1

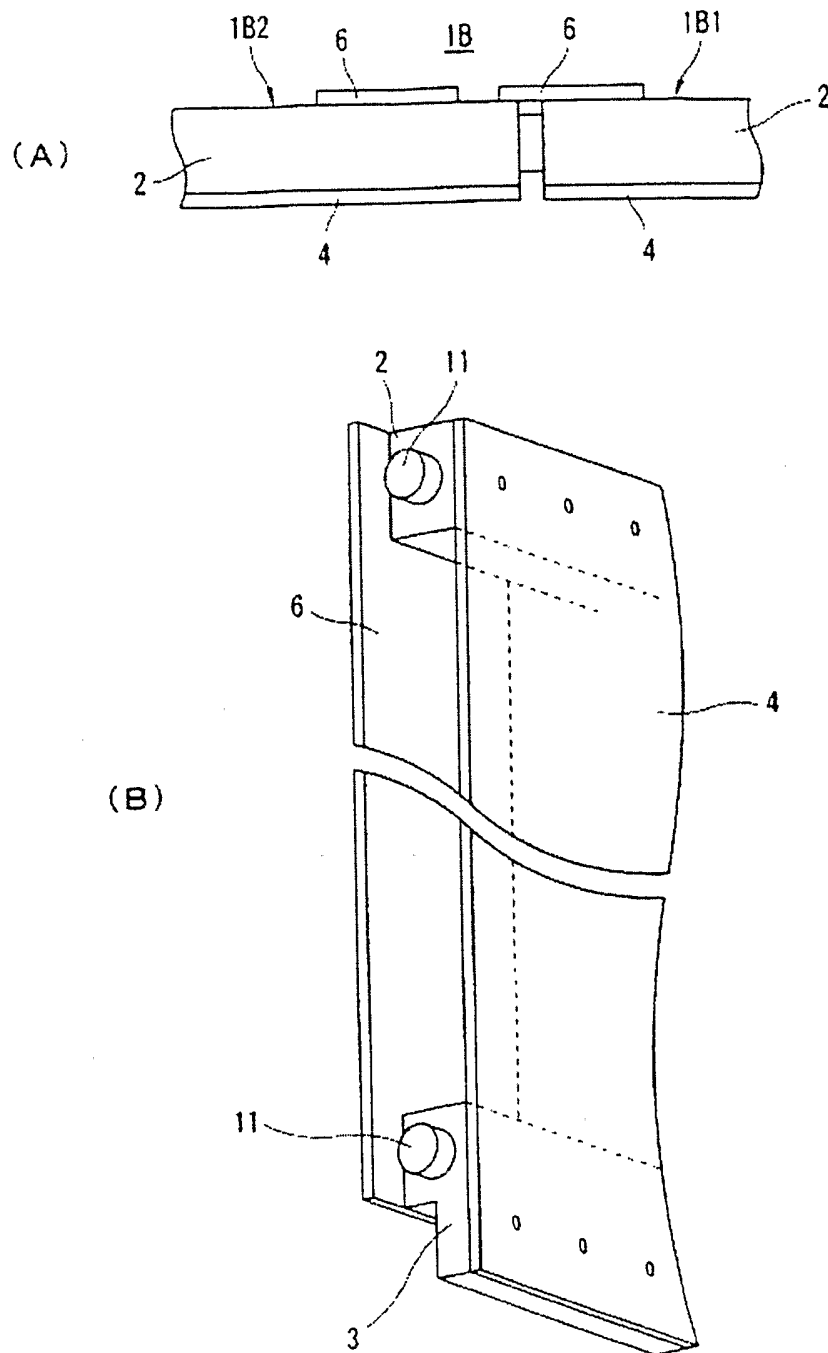


Figure 2

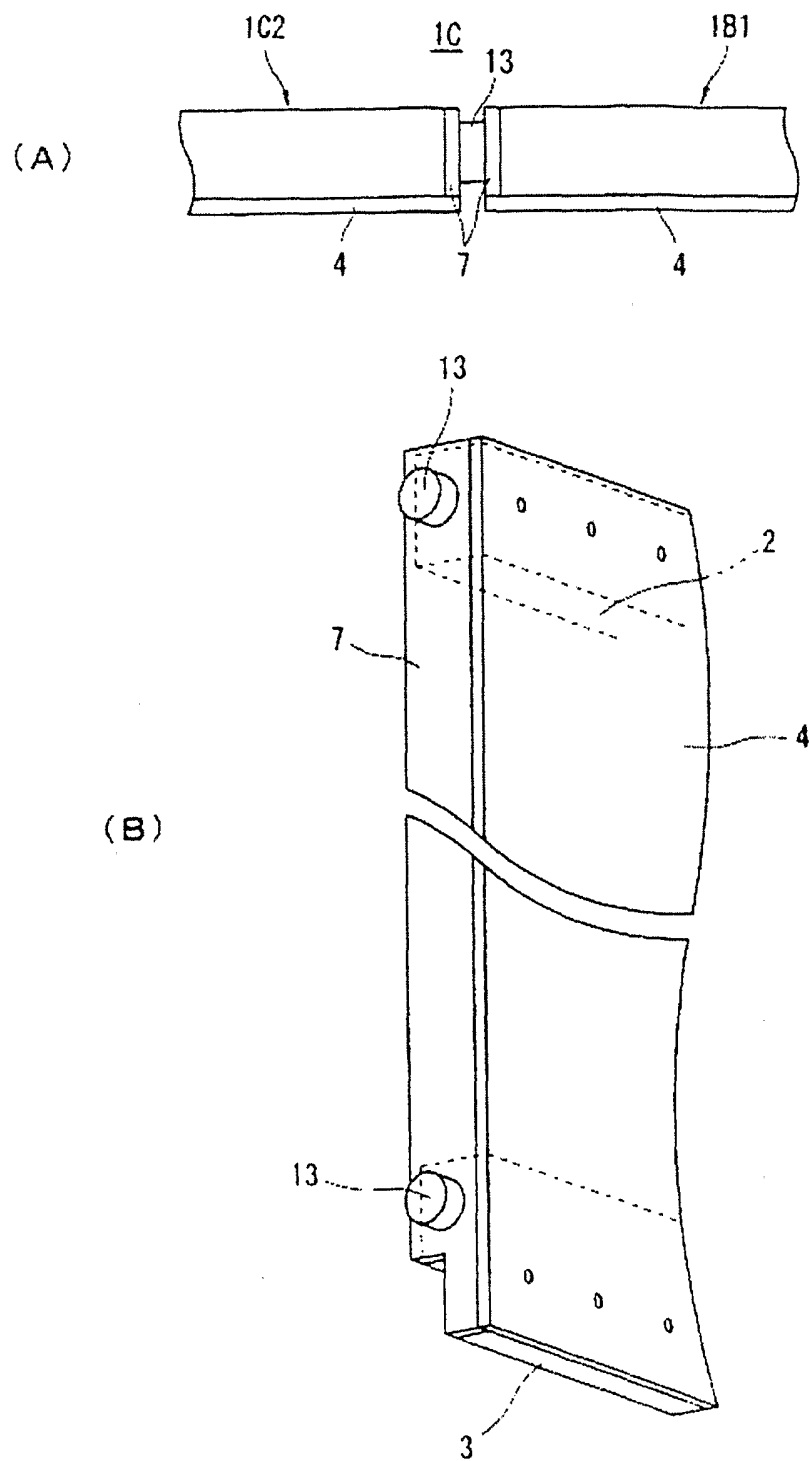


Figure 3

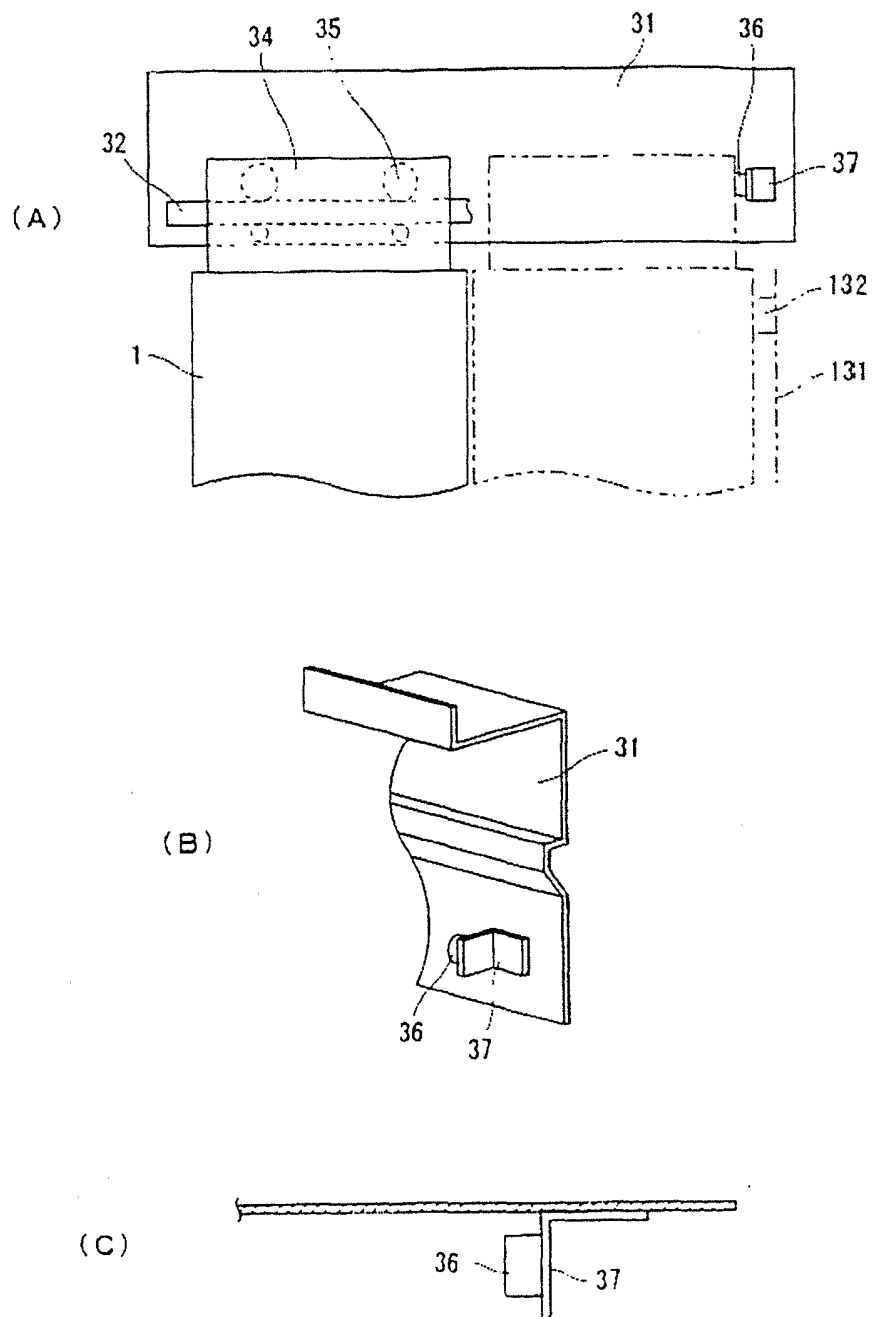
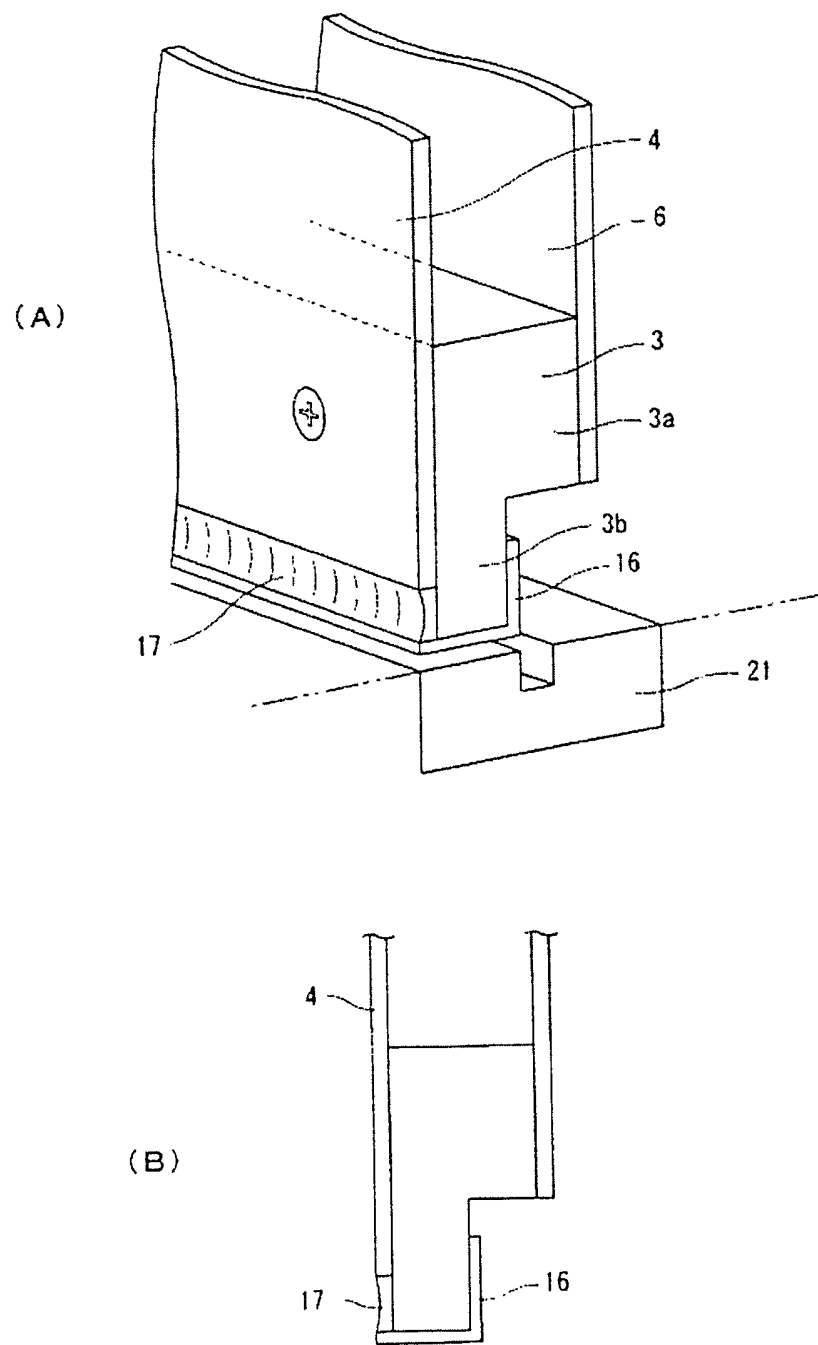


Figure 4



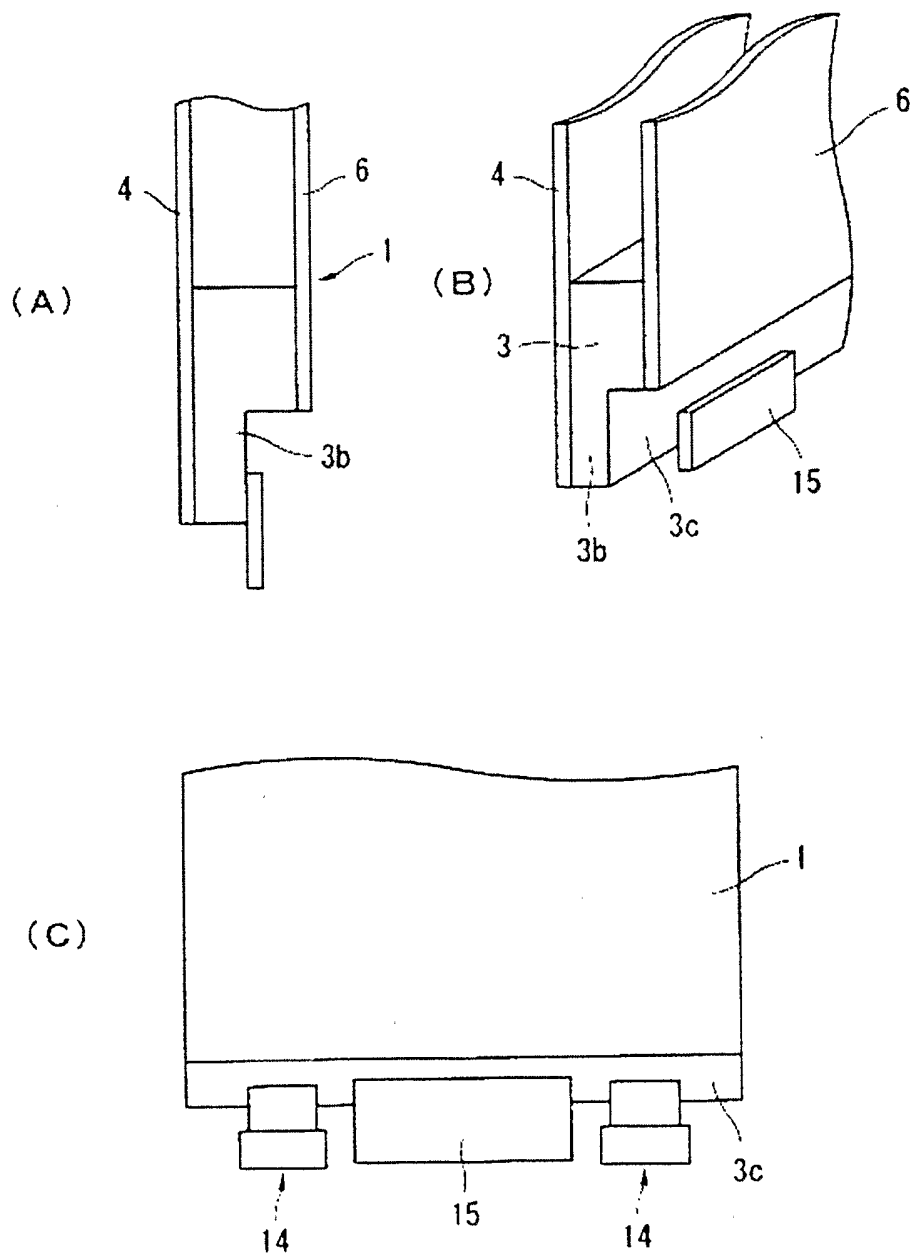


Figure 6

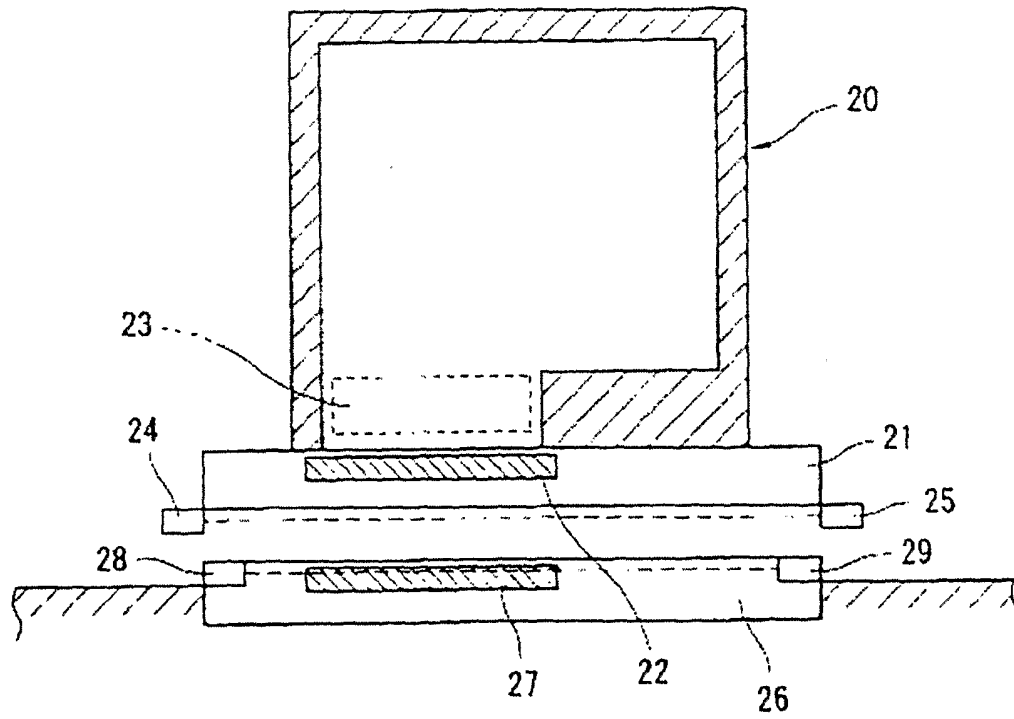


Figure 7

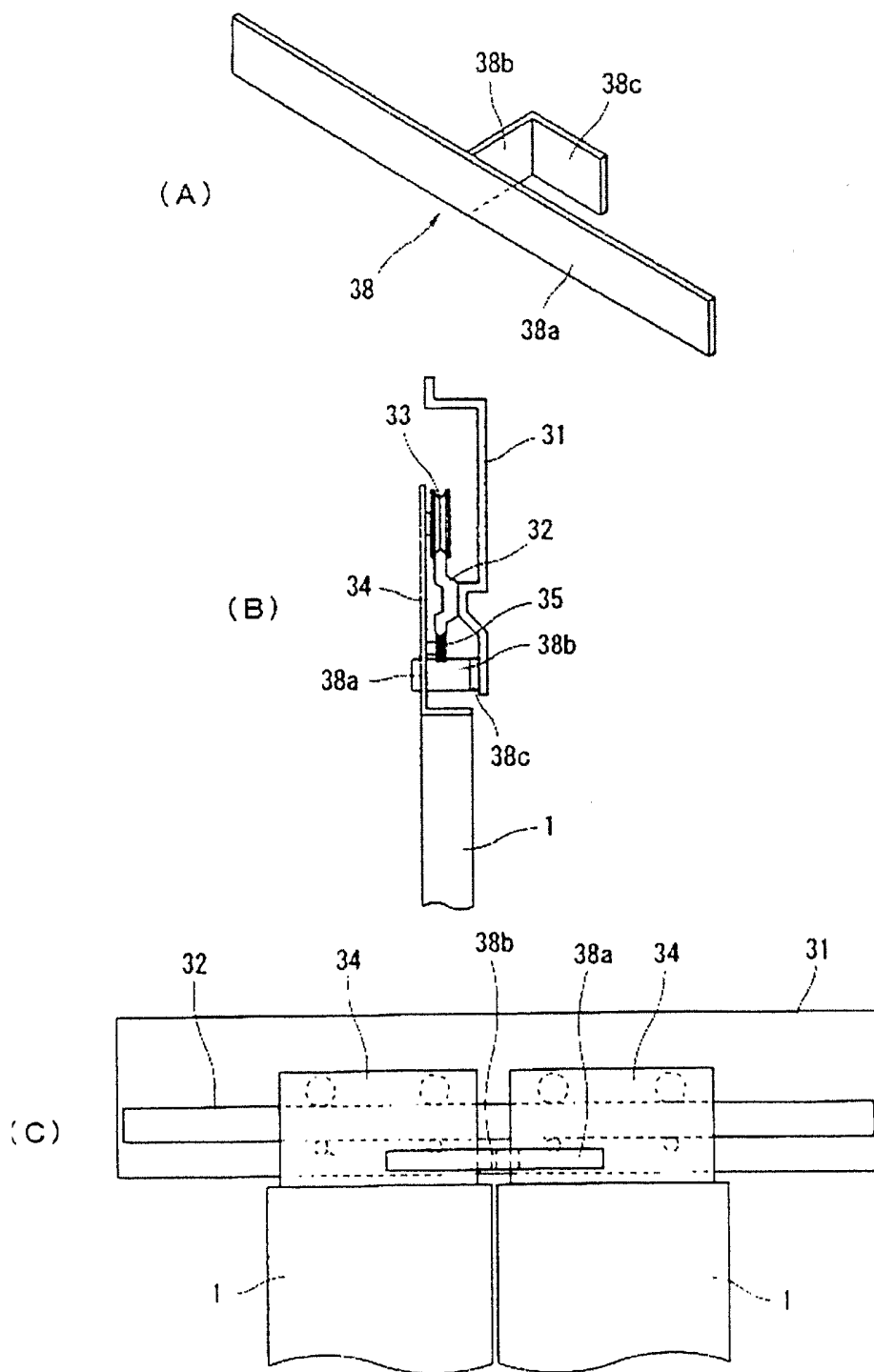


Figure 8

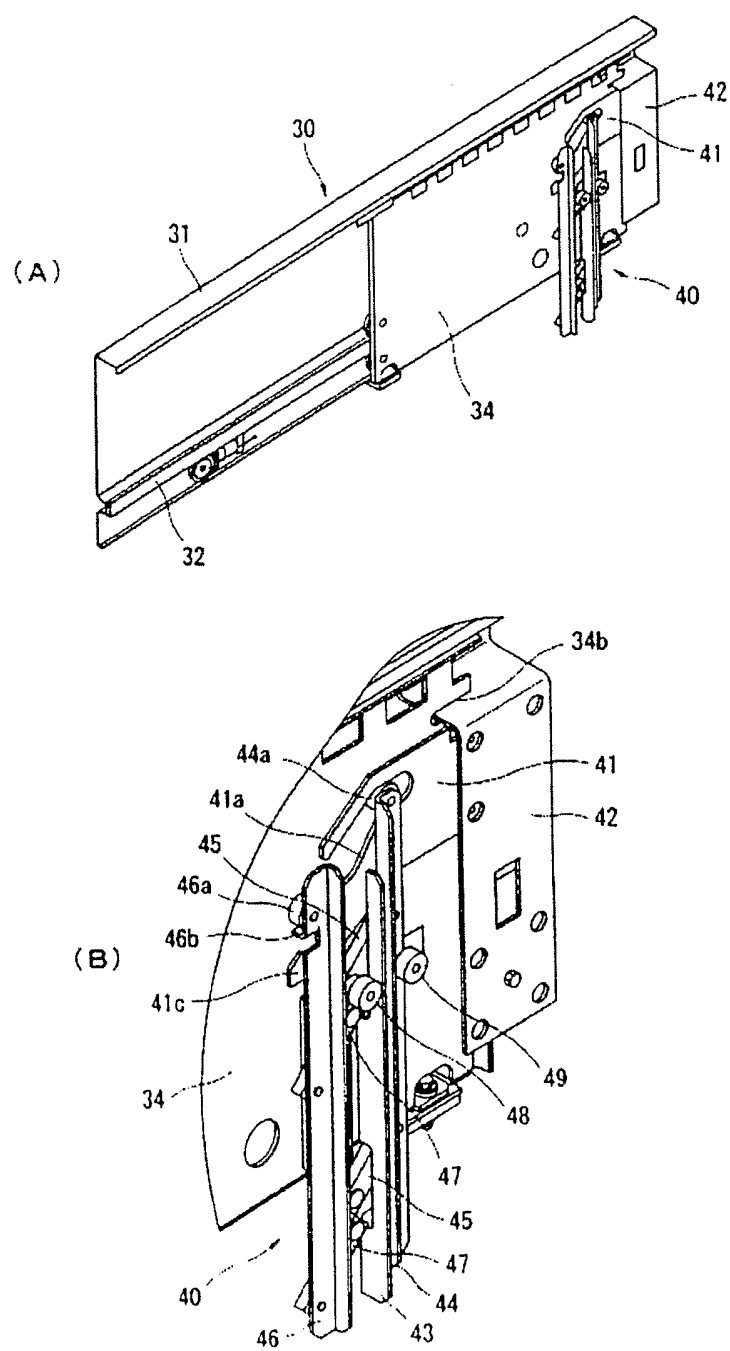


Figure 9

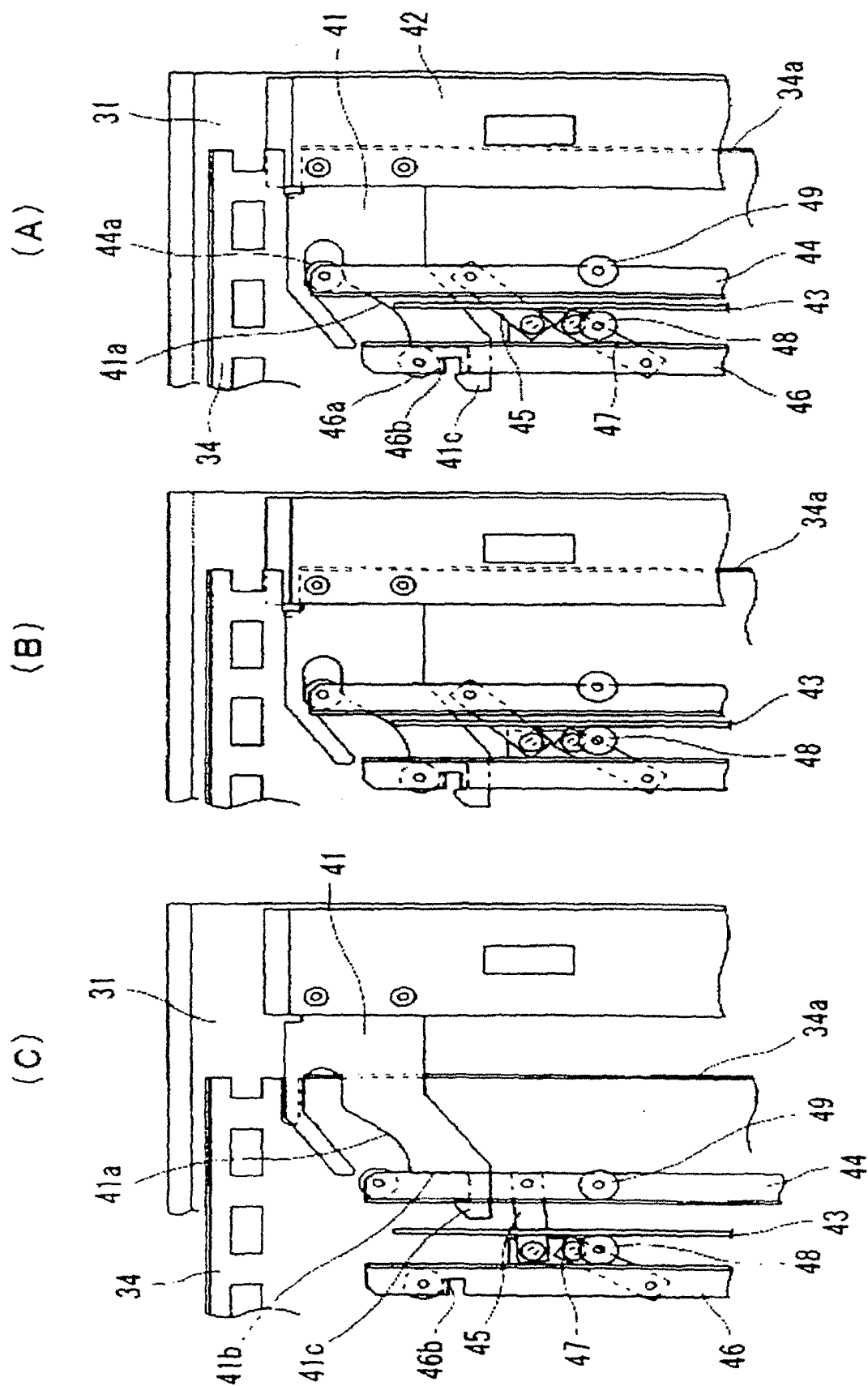


Figure 10

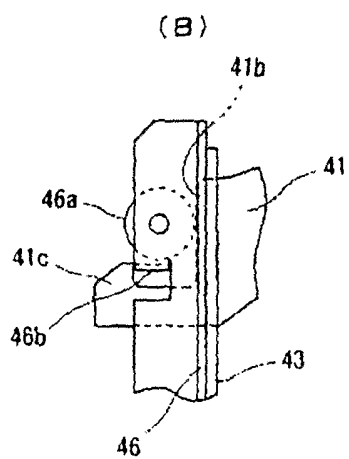
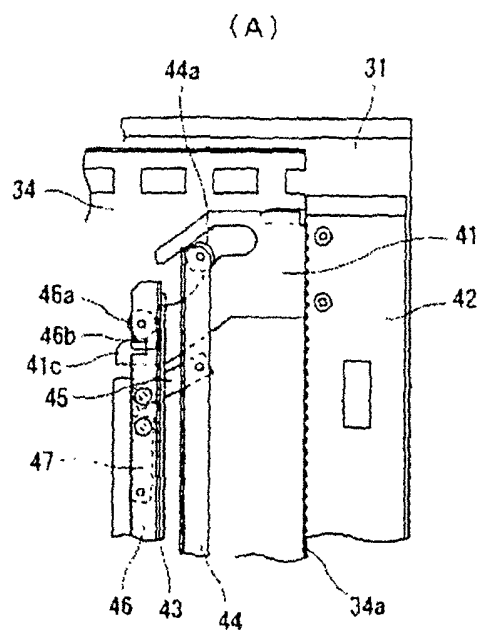


Figure 11

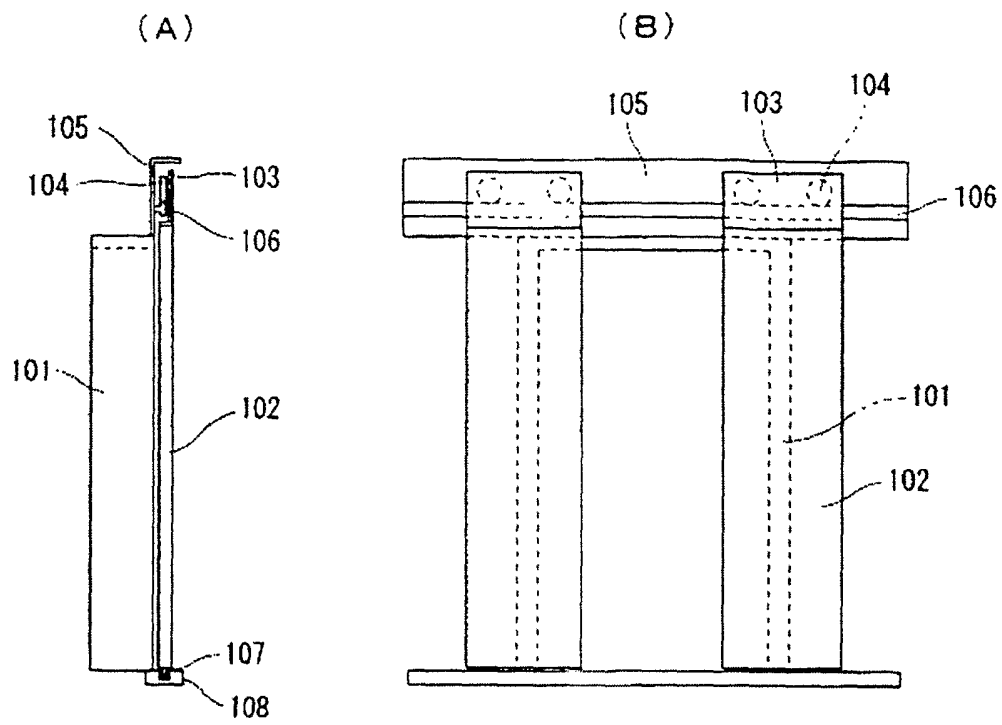


Figure 12

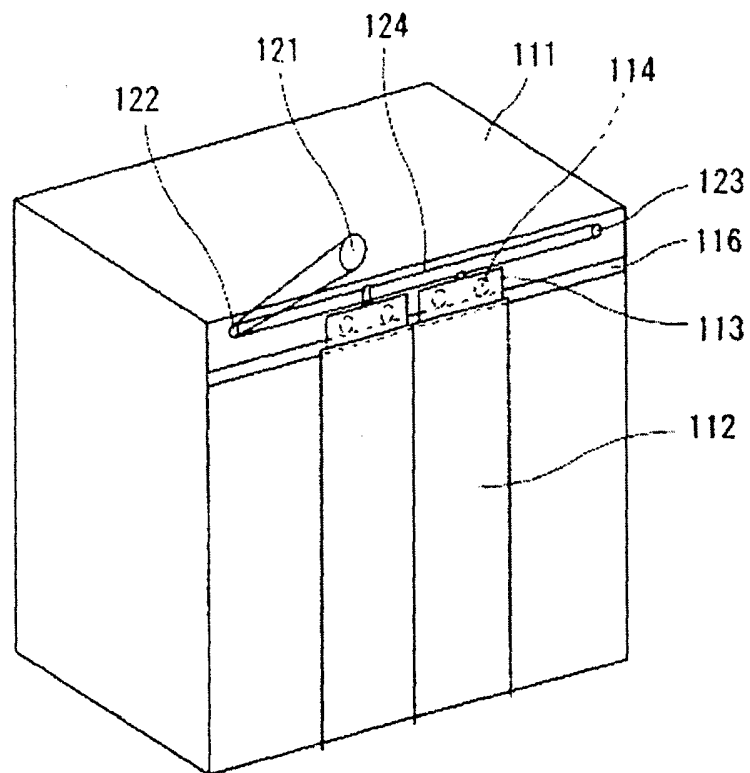


Figure 13