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(54) ON-CAGE HANDRAIL FOR ELEVATOR

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MAIN COURANTE POUR CAGE D'ASCENSEUR

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(56) References cited:
JP-A- 4 292 386
JP-A- 8 310 771
JP-A- 2000 143 125
JP-Y2- 2 042 704
JP-Y2- 6 049 577

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Description

Technical Field

[0001] The present invention relates to a handrail on top of an elevator cage, and more specifically, to a handrail provided on top of an elevator cage during an operation on top of the cage.

Background Art

[0002] A handrail on top of an elevator cage is shown i.e. in JP-A-4292386.

[0003] Figure 21 schematically shows a handrail 610 provided on top of a conventional elevator cage 600, and Figure 21A is a front view, and Figure 21B is a side view seen from the right side of Figure 21A.

[0004] As shown in Figure 21, the elevator cage 600 includes a cage 2 and a handrail 610.

[0005] The handrail 610 includes a left handrail 620, a right handrail 630, and a back handrail 640. The handrails 620, 630, 640 are mounted to a support frame 4. The support frame 4 is fastened to the cage 2 via a fastening column 6. On top of the fastening column 6, a rope passage 8 is provided that passes a rope for hoisting or lowering the elevator cage 600 through a pulley (not shown) placed under the cage 2.

[0006] The left handrail 620 and the back handrail 640 each includes two vertical frames 14 placed perpendicularly to a ceiling surface of the cage 2, and between the two vertical frames 14, includes a lower lateral frame 20 and an upper lateral frame 22 placed perpendicularly to the vertical frames 14. The right handrail 630 includes two vertical frames, each of which is a combination of a lower vertical frame 16 and an upper vertical frame 18, and between the two vertical frames, includes a lower lateral frame 20 and an upper lateral frame 22 placed perpendicularly to the vertical frames 16, 18.

[0007] In order to save a space on top of the elevator cage 600, the handrail 610 can be rotated and folded 90° inward around a mounting screw 34 that penetrates a mounting member 32 and the vertical frame 14 or the lower vertical frame 16, to be accommodated. The vertical frame of the right handrail 630 is adapted so that when the handrail 610 is folded, the upper vertical frame 18 is placed under the lower vertical frame 16.

[0008] The handrail 610 has a safety device that detects accommodation of the handrail. The safety device includes a safety switch 92 provided on the right handrail 630, and a pressing bracket 96 mounted to the left handrail 620 via a string 94. When the handrail 610 is accommodated, the pressing bracket 96 turns on the safety switch 92 to allow the accommodation of the handrail to be detected.

[0009] When the handrail 610 having such a configuration for an elevator is folded, the left handrail 620 can be placed over the upper vertical frame 18 and the upper lateral frame 22 of the right handrail 630, as shown in Figures 21C and 21D. This can prevent the left and right handrails 620, 630 from hitting and interfering with each other when the left and right handrails 620, 630 are folded, even if the left and right handrails 620, 630 are relatively high. Such a configuration reduces a height required for accommodating the handrail 610 to save a space, and allows a relatively high handrail to be placed even in a small space.

[0010] When the elevator is operated, the space on top of the elevator cage 600 containing the handrail 610 and the device on top of a cage 12 is preferably minimized. On the other hand, inspections or other operations performed on top of the cage require a relatively high handrail in terms of safety.

[0011] However, if a high handrail having the above described structure is to be provided on top of a narrow elevator cage, for example, a folding position of the vertical frame, that is, a position of the mounting screw 34 has to be relatively high so as to prevent the handrail from hitting the device on top of a cage 12 when the handrail is folded. Thus, a relatively high space is required even if the handrail is folded and accommodated.

[0012] When safety inspections or other operations are performed on top of the elevator cage, an operator rides on the cage from an elevator hall of a top floor of a building where the elevator is provided. In this case, a handrail requires to be assembled from the hall before the operator rides on the elevator cage for safety during the operation. However, it is difficult to assemble the handrail from the hall. This increases time for installing the handrail, and thus increases overall operation time during the operation, causing the elevator to stop for long hours and imposing inconvenience on users of the elevator.

[0013] Further, when performing the operation, the operator cannot ride on the cage without releasing a safety device. After the operation, in order to operate the elevator, the safety device requires to be operated to detect accommodation of the handrail. A switch of the safety device requires to be turned on from the hall after the accommodation of the handrail, which is difficult depending on the position of the safety switch. Even if an elevator has halls in two directions, a direction of riding on the cage or a direction of stepping off the cage is limited depending on the position of the safety switch. This may increase time for the operation, causing the elevator to stop for long hours.

Disclosure of the Invention

[0014] The invention has objects to solve the above described problems, provide a high handrail that can be accommodated even in a small space, and reduce time for installing and accommodating the handrail and for operating a safety device, and proposes an improved handrail on an elevator cage.

[0015] In the present invention, a handrail on top of an elevator cage comprises a handrail provided on top of

an elevator cage, a support frame that supports the handrail, and a fastening column that fastens the support frame to the cage. The handrail includes side handrails provided on top of the cage in parallel with two opposite sides of the cage, and a back handrail provided on top of the cage perpendicularly to the side handrails, at least the side handrails of the handrails include adjustment means for adjusting a height of said at least side handrails, and the handrail further includes accommodation means for allowing the handrail to be horizontally folded and accommodated on a top surface of the cage.

[0016] Accordingly, a relatively high handrail can be provided on top of the elevator cage, and accommodated even in a small space

Brief Description of the Drawings

[0017]

Figure 1 is a perspective view of a handrail installed on top of an elevator cage according to Embodiment 1 of the invention;

Figures 2A to 2C schematically show a state where the handrail is assembled on top of the elevator cage in Embodiment 1 of the invention;

Figures 3A to 3C show a state where the handrail is accommodated in Embodiment 1 of the invention;

Figures 4A to 4F illustrate, in section, a process of accommodating a left handrail in Embodiment 1 of the invention;

Figures 5A and 5B illustrate a handrail installed on top of an elevator cage according to Embodiment 2 of the invention;

Figures 6A and 6B schematically illustrate a state where the handrail is accommodated in Embodiment 2 of the invention;

Figures 7A to 7F schematically illustrate, partially in perspective, a state of accommodating a left handrail in Embodiment 2 of the invention;

Figures 8A and 8B schematically illustrate a handrail installed on top of an elevator cage according to Embodiment 3 of the invention;

Figure 9 schematically shows, in section, vertical frames of left and right handrails according to Embodiment 3 of the invention;

Figures 10 to 12 schematically illustrate, in section, a process of accommodating a left handrail in Embodiment 3 of the invention;

Figures 13A and 13B schematically show a state where the handrail is accommodated in Embodiment 3 of the invention;

Figures 14A and 14B schematically show a state where a handrail not part of the invention is installed on top of an elevator cage;

Figures 15A and 15B schematically show a state where the handrail not part of the invention is accommodated;

Figures 16A to 16C are front views, partially in perspective, illustrating a state of folding left and right handrails of the handrail not part of the invention;

Figures 17A and 17B schematically show a state where a handrail not part of the invention is installed on top of an elevator cage;

Figures 18A and 18B schematically show a state where the handrail not part of the invention is accommodated;

Figure 19 shows a state where left and right handrails not part of the invention are being accommodated;

Figure 20 schematically shows a state of turning on a switch of a safety device when an accommodation rotation plate enters an accommodation state in the handrail not part of the invention; and

Figures 21A to 21D schematically show a handrail provided on a conventional elevator cage.

Best Mode for Carrying out the Invention

[0018] Now, embodiments of the invention will be described with reference to the drawings. In the drawings, the same reference numerals denote same or corresponding parts, and descriptions thereof will be simplified or omitted.

[0019] First, Embodiment 1 of the invention will be described with reference to Figures 1 to 3.

[0020] Figure 1 is a perspective view of a handrail 110 installed on top of an elevator cage 100 according to Embodiment 1 of the invention.

[0021] As shown in Figure 1, the elevator cage 100 includes a cage 2 and a handrail 110. The handrail 110 includes a left handrail 120, a right handrail 130, and a back handrail 140. The handrails 120, 130, 140 are mounted to a support frame 4. The support frame 4 is fastened to the cage 2 by a fastening column 6. On top of the fastening column 6, a rope passage 8 is provided. The rope passage 8 is used to pass a hoisting and lowering wire rope through a pulley (not shown) under the cage 2 to hoist and lower the elevator cage 100. On top of the cage 2, a device on top of a cage 12 is provided.

[0022] Figure 2 schematically shows a state where the handrail 110 is assembled on top of the elevator cage 100, and Figure 2A is a top view, Figure 2B is a front view, and Figure 2C is a side view seen from the right side of Figure 2A.

[0023] As shown in Figure 2, the handrails 120, 130, 140 each includes two vertical frames, each of which is a combination of a lower vertical frame 16 and an upper vertical frame 18, and between the two vertical frames, includes a lower lateral frame 20 and an upper lateral frame 22 placed perpendicularly to the vertical frames 16, 18.

[0024] The lower vertical frame 16 is a hollow square prism. The lower vertical frame 16 has through holes 24, 26 in lower and upper portions thereof, respectively. The upper vertical frame 18 is a square prism. The upper vertical frame 18 has an installation through hole 28 and an accommodation through hole 30 in lower and upper

portions thereof, respectively.

[0025] A mounting bracket 32 is an L-shaped metal fitting with two surfaces crossing substantially perpendicularly to each other, and one surface thereof is fastened to the support frame 4. A mounting screw 34 penetrates the other surface of the mounting bracket 32 and the through hole 24 provided in the lower vertical frame 16, and thus the lower vertical frame 16 connects to the support frame 4.

[0026] In a state where the handrail 110 is installed, a mounting screw 36 penetrates the through hole 26 of the lower vertical frame 16 and the installation through hole 28 of the upper vertical frame 18, and thus the upper vertical frame 18 is fastened to the lower vertical frame 16.

[0027] The lower lateral frame 20 is fastened perpendicularly to the lower vertical frame 16 between upper ends of the two lower vertical frames 16. The upper lateral frame 22 is fastened perpendicularly to the upper vertical frame 18 between top ends of the two upper vertical frames 18.

[0028] Figure 3 shows a state where the handrail 110 is accommodated, and Figure 3A is a top view, Figure 3B is a front view, and Figure 3C is a side view seen from the right side of Figure 3A.

[0029] As shown in Figure 3, in the state where the handrail 110 is accommodated, the upper vertical frame 18 is accommodated in the lower vertical frame 16. In a state where the upper vertical frame 18 is accommodated, the handrails 120, 130, 140 are folded 90° inward around the mounting screw 34. The back handrail 140 is placed under the left and right handrails 120, 130 to prevent the handrails from interfering with each other during the accommodation of the handrails.

[0030] Next, a state of accommodating the handrail 110 will be described with reference to Figure 4.

[0031] Figure 4 illustrates, in section, a process of accommodating the left handrail 120, and Figures 4A, 4C and 4E show sections parallel to the front, and Figures 4B, 4D and 4F show sections parallel to the side.

[0032] As shown in Figures 4A, 4B, in the state where the handrail 110 is installed, the lower vertical frame 16 is mounted to the support frame 4 by the mounting bracket 32, and fastened perpendicularly to a top surface of the cage 2. The mounting screw 36 is passed through the through hole 26 of the lower vertical frame 16 and the installation through hole 28 of the upper vertical frame, thus the upper vertical frame 18 is fastened to the lower vertical frame 16 such that the left handrail 120 is placed in a highest position.

[0033] When the left handrail 120 is accommodated from this state, the mounting screw 36 that fastens the upper vertical frame 18 to the lower vertical frame 16 is first pulled out. This causes the upper vertical frame 18 to be removed from the lower vertical frame 16. In this state, as shown in Figures 4C and 4D, the upper vertical frame 18 is pulled down and slid into the lower vertical frame 16 to be accommodated. Then, the mounting screw 36 is passed through the accommodation through hole 30 of the upper vertical frame 18 and the through hole 26 of the lower vertical frame to be fastened.

[0034] Then, as shown in Figures 4E and 4F, the lower vertical frame 16 that has accommodated the upper vertical frame 18 is rotated and folded approximately 90° inward around the mounting screw 34. In this state, the left handrail 120 is accommodated.

[0035] The right handrail 130 and the back handrail 140 are similarly accommodated.

[0036] Thus, the handrail 110 is folded in two steps. This prevents interference when the left and right handrails are folded, and allows the handrail to be accommodated in a small space without the device on top of a cage 12 or the like being an obstacle.

[0037] As described above, the left handrail 120, the right handrail 130, and the back handrail 140 are provided on top of the cage 2, but not limited to the three sides, the handrails may be provided on all four sides, or on the left and right sides only.

[0038] In Embodiment 1, the handrails 120, 130, 140 can be folded in the two steps. However, for example, the left and right handrails only may be folded in the two steps, and the back handrail may be folded in a single step. Further, not limited to the two-step folding, three or more step folding may be acceptable in view of a space on the top surface, strength and a height of the handrail, or the like.

[0039] In Embodiment 1, the lower vertical frame 16 is the hollow square prism, and the upper vertical frame 18 can be slid into the lower vertical frame 16 to be accommodated. However, not limited to this, for example, conversely, the upper vertical frame 18 may be a hollow square prism, and the lower vertical frame 16 may be accommodated in the upper vertical frame 18.

[0040] The shapes or the positions of the vertical frames, the lateral frames, and the mounting brackets are not limited to those described in Embodiment 1 within the scope of the invention.

[0041] In Embodiment 1, the lower vertical frame 16 corresponds to a lower handrail of the invention, and the upper vertical frame 18 corresponds to an upper handrail of the invention. Portions including the through hole 26 of the lower vertical frame 16, the installation through hole 28, the accommodation through hole 30, and the mounting screw 36 correspond to adjustment means and mounting means of the invention. Portions including the through hole 24 of the lower vertical frame, the mounting bracket 32, and the mounting screw 34 correspond to accommodation means of the invention.

[0042] Next, Embodiment 2 of the invention will be described with reference to Figures 5 to 7.

[0043] Figure 5 illustrates a handrail 210 installed on top of an elevator cage 200 according to Embodiment 2 of the invention, and Figure 5A is a front view, and Figure 5B is a side view seen from the right side of Figure 5A.

[0044] As shown in Figure 5, in a state where the handrail 210 is installed, the handrail 210 includes a left hand-

rail 220, a right handrail 230, and a back handrail 240, like the handrail 110 in Embodiment 1.

[0045] The left handrail 220 and the right handrail 230 each includes two vertical frames, each of which is a combination of a lower vertical frame 16 and an upper vertical frame 18, and between the two vertical frames, includes a lower lateral frame 20 and upper lateral frame 22 placed perpendicularly to the vertical frames, thus include four frame rods.

[0046] In Embodiment 2, the lower vertical frame 16 has through holes 24, 40 in lower and upper portions thereof, respectively. The upper vertical frame 18 has a through hole 42 in a lower portion thereof. A mounting bracket 44 is placed on a connecting portion between the lower vertical frame 16 and the upper vertical frame 18. The mounting bracket 44 has two through holes in upper and lower portions thereof. Amounting screw 46 penetrates the lower through hole of the mounting bracket 44 and the through hole 40 of the lower vertical frame. A mounting screw 48 penetrates the upper through hole of the mounting bracket 44 and the through hole 42 of the upper vertical frame 18. Thus, the lower vertical frame 16 and the upper vertical frame 18 are connected via the mounting bracket 44. The mounting bracket 44 is rotatable around the mounting screw 46. The upper vertical frame 18 is rotatable around the mounting screw 48.

[0047] On the other hand, the back handrail 240 includes a lower lateral frame 20 and an upper lateral frame 22, but vertical frames are not formed in two steps unlike the left and right handrails 220, 230, and two vertical frames 14 each constituted by one column are placed on both ends of the upper and lower lateral frames 20, 22 perpendicularly thereto.

[0048] Like Embodiment 1, a mounting screw 34 is passed through the through hole 24 provided in a lower portion of the lower vertical frame 16 or the vertical frame 14, and a mounting bracket 32, thus the handrails 220, 230, 240 are rotatably mounted to the support frame 4.

[0049] Figure 6 schematically illustrates a state where the handrail 210 is accommodated, and Figure 6A is a front view, and Figure 6B is a side view seen from the right side of Figure 6A.

[0050] As shown in Figure 6, the upper vertical frame 18 of each of the left handrail 220 and the right handrail 230 is rotated and folded 180° inward at the mounting bracket 44 provided between the lower vertical frame 16 and the upper vertical frame 18. In this state, the lower vertical frame 16 is rotated and folded 90° inward at the mounting bracket 32 that mounts the lower vertical frame 16 and a support frame 4. That is, the left and right handrails 220, 230 are folded in two steps to be accommodated.

[0051] On the other hand, the back handrail 240 is folded 90° inward at the mounting bracket 32 that mounts the support frame 4 and the vertical frame 14. At this time, the back handrail 240 is placed under the left and right handrails 220, 230.

[0052] Figure 7 schematically illustrates, partially in perspective, a state of accommodating the left handrail 220, and Figures 7A, 7C and 7E are front views, and Figures 7B, 7D and 7F are side views seen from the left side of Figures 7A, 7C and 7E. In Figure 7, inside parts of the support frame 4 and the mounting brackets 32, 44 are shown in perspective.

[0053] Now, a process of accommodating the left handrail 220 will be described with reference to Figure 7.

[0054] As shown in Figures 7A and 7B, the left handrail 220 is installed on top of a cage 2.

[0055] In this state, the lower vertical frame 16 is mounted to the support frame 4 via the mounting bracket 32, and fastened perpendicularly to a top surface of the cage 2. The upper vertical frame 18 is connected, via the mounting bracket 44, to the top of the lower vertical frame 16, in a superposed manner in the same direction.

[0056] Figures 7C and 7D show a state where the upper vertical frame 18 is folded 180° inward at a portion between the lower vertical frame 16 and the upper vertical frame 18.

[0057] In this state, the mounting bracket 44 rotates 90° inward around the mounting screw 46 that penetrates the thorough hole of the mounting bracket 44 and the through hole 40 of the lower vertical frame 16. The upper vertical frame 18 rotates 90° around the mounting screw 48 that penetrates the through hole 42 to be folded inward. Thus, as shown in Figures 7C, 7D, the upper vertical frame 18 is folded 180° inward and placed in parallel with the lower vertical frame 16.

[0058] Figures 7E, 7F show a state where the handrail 210 is folded. Here, with the upper vertical frame 18 being folded 180° inward, the lower vertical frame is rotated and folded 90° inward around the mounting screw 34 at a lower portion of the lower vertical frame 16. Thus, both the lower vertical frame 16 and the upper vertical frame 18 are horizontally folded on top the cage 2.

[0059] The accommodation process of the left handrail 220 has been described, but the right handrail 230 is similarly accommodated. For the back handrail 240, the vertical frame 14 is constituted by one column, and, as shown in Figure 6, simply rotated and folded 90° inward around the mounting screw 34 to be accommodated. This allows the handrail 210 to be accommodated in the state shown in Figure 6.

[0060] Here, no front handrail is provided opposite the back handrail 240, thus unlike the left and right handrails 220, 230, there is no possibility that handrails on opposite sides interfere with each other even if the back handrail 240 is not folded in two steps. A device on top of a cage 12 that tends to be an obstacle when the handrail is folded is placed near the front, thus the device on top of a cage 12 does not become an obstacle when the back handrail 240 is folded. Thus, the back handrail 240 is folded in a single step.

[0061] This prevents the left and right handrails 220, 230 from hitting and interfering with each other when the handrail 210 is accommodated, and prevents the device on top of a cage 12 from becoming an obstacle. Thus, a

high handrail can be provided even on top of a narrow elevator while saving a space.

[0062] In Embodiment 2, the mounting bracket 44 through which the mounting screws 46, 48 are passed is used as rotation means to fold the upper vertical frame 18 inward, but not limited to this, anything that can once fold the upper vertical frame 18 may be used.

[0063] The shapes or the positions of the mounting bracket 44 and the mounting screws 46, 48 are not limited to those described in Embodiment 2 within the scope of the invention.

[0064] Other configurations are the same as those in Embodiment 1, and descriptions thereof will be omitted.

[0065] In Embodiment 2, portions including the through holes 40, 42, the mounting bracket 44, and the mounting screws 46, 48 correspond to adjustment means and connection means of the invention.

[0066] Next, Embodiment 3 of the invention will be described with reference to Figures 8 to 13.

[0067] Figure 8 schematically show a state where a handrail 310 is installed on top of an elevator cage 300 according to Embodiment 3 of the invention, and Figure 8A is a front view, and Figure 8B is a side view seen from the right side of Figure 8A.

[0068] As shown in Figure 8, the handrail 310 includes a left handrail 320, aright handrail 330, and a back handrail 340, and the handrails 320, 330, 340 are mounted to a support frame 4 like Embodiment 1.

[0069] The left handrail 320 and the right handrail 330 each includes two vertical frames, each of which is a combination of a lower vertical frame 16 and an upper vertical frame 18, and between the two vertical frames, includes a lower lateral frame 20 and an upper lateral frame 22 placed perpendicularly to the vertical frames. The lower lateral frame 20 is placed near middle portions of the two lower vertical frames 16. The upper lateral frame 22 is placed on upper portions of the two upper vertical frames 18.

[0070] On the other hand, a vertical frame of the back handrail 340 is constituted by one vertical frame 14. The back handrail 340 includes two vertical frames 14, and between the vertical frames 14, includes a lower lateral frame 20, and an upper lateral frame 22 placed perpendicularly to the vertical frames 14.

[0071] Figure 9 schematically shows the vertical frames of the left and right handrails 320, 330, and Figure 9A schematically shows the lower vertical frame 16, and Figure 9B schematically shows the upper vertical frame 18. In Figures 9A and 9B, the left shows a front, and the right shows a side.

[0072] The lower vertical frame 16 is a hollow square prism having an open surface on one side. As shown in Figure 9A, a vertical U-shaped groove 52 is provided in a top of the lower vertical frame 16. The vertical U-shaped groove 52 is formed by vertically hollowing the top of the lower vertical frame 16 into a U-shape. Below the vertical U-shaped groove 52, a lower engagement pole 54 is provided that extends perpendicularly to a vertical direction of the lower vertical frame 16. In the front view on the left side of Figure 9A, the lower engagement pole 54 extends forward and backward perpendicularly to the drawing sheet, and in the side view on the right side, the lower engagement pole 54 extends toward the left and the right perpendicularly to the lower vertical frame 16. Below the lower engagement pole 54, a lateral U-shaped groove 56 is provided. The lateral U-shaped groove 56 is formed by hollowing a side of the lower vertical frame 16 into a U-shape perpendicularly to the vertical direction of the lower vertical frame 16. A side where the lateral U-shaped groove 56 is provided, that is, a left side in the front view on the left side of Figure 9A is an open surface. Like Embodiments 1 and 2, a through hole 24 is provided in a lower portion of the lower vertical frame 18.

[0073] As shown in Figure 9B, an elliptical hole 58 is provided in a lower portion of the upper vertical frame 18. In the front view on the left side of Figure 9B, the elliptical hole 58 is a hole passing through the upper vertical frame 18 in an elliptical shape perpendicularly to the drawing sheet. An upper engagement pole 60 is provided above the elliptical hole 58. The upper engagement pole 60 extends in the same direction as the lower engagement pole 54 of the lower vertical frame 16, specifically, in the front view on the left side of Figure 9B, the upper engagement pole 60 extends forward and backward perpendicularly to the drawing sheet, and in the side view on the right side, the upper engagement pole 60 extends toward the left and the right perpendicularly to the upper vertical frame 14.

[0074] Figures 10 to 12 schematically illustrate, in section, a process of accommodating the left handrail 320, and Figures 10A, 11A and 12A show front views, and Figures 10B, 11B and 12B show side views. Figure 13 schematically shows a state where the handrail 310 is accommodated, and Figure 13A is a front view, and Figure 13B is a side view seen from the right side of Figure '13A.

[0075] As shown in Figure 10, the lower vertical frame 16 is mounted to a support frame 4 by passing a mounting screw 34 through a mounting bracket 32 and a through hole.

[0076] The upper engagement pole 60 of the upper vertical frame 18 is engaged into the vertical U-shaped groove 52 of the lower vertical frame 16, and the lower engagement pole 54 of the lower vertical frame 16 is inserted into an upper portion of the elliptical hole 58 of the upper vertical frame 18. In this manner, the lower vertical frame 16 and the upper vertical frame 18 are connected to form a vertical frame in a line. The lower lateral frame 20 and the upper lateral frame 22 provided between the two vertical frames are substantially parallel to a top surface of a cage 2.

[0077] From this state, pulling up the upper vertical frame 18 as shown in Figure 11 allows the upper vertical frame 18 to rotate. In this state, the upper engagement pole 60 engaged into the vertical U-shaped groove 52 is displaced upward and removed from the vertical U-

shaped groove 52. Pulling up the upper vertical frame causes the lower engagement pole 54 to be displaced downward in the elliptical hole 58.

[0078] In this state, the upper vertical frame 18 can be moved toward the left and the right, and in order to fold the handrail 310, the upper vertical frame 18 is rotated and tilted approximately 180° outward around the lower engagement pole 54 as shown in Figure 12. In this state, part of the upper vertical frame 18 is accommodated in the lower vertical frame 16 from the open surface thereof. However, the upper portion of the upper vertical frame 18 and the upper lateral frame 22 hit the support frame 4, which prevents the upper vertical frame 18 from rotating completely 180°, and causes the upper vertical frame 18 to stop in a state of being accommodated partway in the lower vertical frame 18.

[0079] For the right handrail 330, in an accommodated state similarly to the left handrail 320, the lower vertical frame 16 is folded 90° inward around the mounting screw 34 to be accommodated as shown in Figure 13. At this time, the upper portion of the upper vertical frame 18 and the upper lateral frame 22, which have hit the support frame 4 and have not been completely accommodated, are completely accommodated.

[0080] Other configurations are the same as those in Embodiments 1 and 2, and descriptions thereof will be omitted.

[0081] In this invention, a relationship between lengths of the upper and lower vertical frames is not limited to that described in Embodiment 3. However, the configuration in Embodiment 3 allows the handrail to be longer, thus allowing a high handrail that can be accommodated in a small space to be installed.

[0082] In the invention, the shapes or the positions of the vertical U-shaped groove 52, the lower engagement pole 54, the lateral U-shaped groove 56, the elliptical hole 58, and the upper engagement pole 60 are not limited to those described in Embodiment 3.

[0083] In Embodiment 3, portions including the vertical U-shaped groove 52, the lower engagement pole 54, the lateral U-shaped groove 56, the elliptical hole 58, and the upper engagement pole 60 correspond to adjustment means and connection means of the invention.

[0084] Next, an embodiment not part of the invention will be described with reference to Figures 14 to 16.

[0085] Figure 14 schematically show a state where a handrail 410 is installed on top of an elevator cage 400 according to an embodiment not part of the invention, and Figure 14A is a front view, and Figure 14B is a side view seen from the right side of Figure 14A.

[0086] As shown in Figure 14, the handrail 410 includes a left handrail 420, a right handrail 430, and a back handrail 440.

[0087] The left handrail 420 and the right handrail 430 each includes two vertical frames, each of which is a combination of a lower vertical frame 16 and an upper vertical frame 18 via a mounting bracket 70, and between the two vertical frames, includes a lower lateral frame 20 and an upper lateral frame 22 placed perpendicularly to the vertical frames.

[0088] An accommodation rod 72 is provided on the mounting bracket provided between the lower vertical frame 16 and the upper vertical frame 18 of the left and right handrails 420, 430. The accommodation rod 72 is, as described later, rotatably mounted, at one end thereof, to an upper left portion of the mounting bracket 70 of the left handrail 420 such that a placement angle between the accommodation rod 72 and the mounting bracket 70 can be changed, and at the other end thereof, to a lower left portion of the mounting bracket 70 of the right handrail 430 such that the placement angle between the accommodation rod 72 and the mounting bracket 70 can be changed.

[0089] Figure 15 schematically shows a state where the handrail 410 is accommodated, and Figure 15A is a front view, and Figure 15B is a side view seen from the right side of Figure 15A.

[0090] As shown in Figure 15, the left and right handrails 420, 430 of the handrail 410 are folded 90° inward at the mounting bracket 70 to be accommodated. The back handrail 440 is rotated and folded 90° inward around a mounting screw 34 to be accommodated under the left and right handrails 420, 430.

[0091] When the handrail 410 is folded from an installed state in Figure 14 to an accommodated state in Figure 15, the right handrail 430 is automatically folded by folding the left handrail 420.

[0092] Figures 16A to 16C are front views, partially in perspective, illustrating a state of folding the left and right handrails 420, 430 of the handrail 410. In Figures 16A to 16C, the mounting bracket 70 is shown in perspective.

[0093] As shown in Figure 16A, the mounting bracket 70 is rotatably mounted, at a lower right portion thereof, to the lower vertical frame 16 and the upper vertical frame 18 on the front side of the left handrail 420 by a mounting screw 74. Another mounting bracket 70 is rotatably mounted, at an upper right portion thereof , to the lower vertical frame 16 and the upper vertical frame 18 on the front side of the right handrail 420 by a mounting screw 74.

[0094] The upper vertical frame 18 is adhered to the mounting bracket 70. The accommodation rod 72 is rotatably mounted, at one end thereof, to the upper left portion of the mounting bracket 70 of the left handrail 420 by a mounting screw 76. The accommodation rod 72 is rotatably mounted, at the other end thereof, to the lower left portion of the mounting bracket 70 of the right handrail 430 by a mounting screw 76.

[0095] When the left and right handrails 420, 430 having such configurations are folded 90° inward, the upper vertical frame 18 of the left handrail 420 is first rotated and folded inward around the mounting screw 74 in the arrow ① direction in Figure 16A.

[0096] At this time, as the upper vertical frame 18 of the left handrail 420 moves, the mounting bracket 70 fastened to the upper vertical frame 18 rotates around the

mounting screw 74 in the arrow ② direction in Figure 16B. As the mounting bracket 70 of the left handrail 420 rotates, the mounting screw 76 that mounts the accommodation rod 72 rotates, with the placement angle between the accommodation rod 72 and the mounting bracket 70 being appropriately changed, to push the accommodation rod 72 in the arrow ③ direction. This causes the mounting screw 76 that mounts the accommodation rod 72 to the mounting bracket 70 provided on the right handrail 430 to be pushed in the arrow ④ direction, and rotated around the mounting screw 74. At this time, the mounting bracket 70 of the right handrail 430 rotates in the arrow ④ direction together with the mounting screw 76. During the rotation, the placement angle between the accommodation rod 72 and the mounting bracket 70 is appropriately changed. The upper vertical frame 18 fastened to the mounting bracket 70 of the right handrail 430 rotates together with the mounting bracket 70, and tilted in the arrow ⑤ direction.

[0097] The case where the left handrail 420 is folded to automatically accommodate the right handrail 430 has been described, but, conversely, the right handrail 430 may be folded in the arrow ⑤ direction to automatically fold the left handrail 420. In this case, contrary to the case of first folding the left handrail 420, the right handrail 430 is tilted in the arrow⑤ direction to rotate the mounting bracket 70 in the arrow ④ direction, and the accommodation rod 72 is pulled in the arrow ③ direction. This causes the mounting bracket 70 to rotate in the arrow ② direction to fold the left handrail 420 in the arrow ① direction.

[0098] If a force in the arrow ③ direction is applied to the accommodation rod 72 without folding the left or right handrails 420, 430, a force in the arrow ② direction is applied to the mounting bracket 70 of the left handrail 420, and a force in the arrow ④ direction is applied to the mounting bracket 70 of the right handrail 430. This allows the left and right handrails 420, 430 to be folded in the directions of the arrows ① and ⑤, respectively, to be automatically accommodated.

[0099] The case of accommodating the handrails has been described, but the handrails can be installed by applying a force in the direction opposite the above described direction to the left handrail 420, the right handrail 430, or the accommodation rod 72.

[0100] Other configurations are the same as those in Embodiments 1 to 3, and descriptions thereof will be omitted.

[0101] Configuring as described above allows both the left and right handrails 420, 430 to be accommodated or installed at a time simply by applying a force to one of the handrails or the accommodation rod 72, when the left and right handrails 420, 430 are accommodated or installed. This allows the handrail to be accommodated or installed easily and quickly even on top of a narrow elevator, and reduces time for accommodating the handrail.

[0102] In the embodiment not part of the invention, portions including the mounting bracket 70, the accommodation rod 72, and the mounting screws 72, 74 correspond to automatic accommodation means.

[0103] Next, another embodiment not part of the invention will be described with reference to Figures 17 to 20.

[0104] Figure 17 schematically shows a state where a handrail 510 is installed on top of an elevator cage 500 according to an embodiment not part of the invention, and Figure 17A is a front view, and Figure 17B is a side view seen from the right side of Figure 17A.

[0105] As shown in Figure 17, the handrail 510 provided on top of the elevator cage 500 according said embodiment includes, like the previous embodiment, left and right handrails 520, 530 and a back handrail 540, and has a function of folding the left and right handrails 520, 530 at a time, but the configurations thereof are different. In Embodiment 5, a switch of a safety device can be automatically turned on or off when the left and right handrails 520, 530 are accommodated or installed.

[0106] As shown in Figure 17, the handrails 520, 530, 540 each includes two vertical frames 14, and between the two vertical frames 14, includes a lower lateral frame 20 and an upper lateral frame 22 placed perpendicularly to the vertical frames 14. Each vertical frame 14 is mounted to a support frame 4 so as to be folded inward, by passing a mounting screw 34 through a through hole 24 and a mounting bracket 32 provided in a lower portion. On the vertical frames 14 on the front sides of the left and right handrails 520, 530, accommodation rods 80, 82 are rotatably mounted above the mounting brackets 32 such that placement angles between the accommodation rods 80, 82 and the vertical frames 14 can be changed.

[0107] The other ends of the accommodation rods 80, 82 are rotatably mounted to an accommodation rotation plate 84 such that placement angles between the accommodation rods 80, 82 and the accommodation rotation plate 84 can be changed. The accommodation rotation plate 84 is mounted to an accommodation rotation axis plate 86, and is rotatable around a central axis 88. Inside the accommodation rotation axis plate 86, a switch 90 of a safety device is provided on a position that abuts against the accommodation rotation plate 84 when the accommodation rotation plate 84 rotates.

[0108] Figure 18 schematically shows a state where the handrail 510 is accommodated, and Figure 18A is a front view, and Figure 18B is a side view seen from the right side of Figure 18B.

[0109] As shown in Figure 18, in the state where the handrail 510 is accommodated, the vertical frame 14 is folded 90° inward to be accommodated. Like the previous embodiment, the left and right handrails 520, 530 are folded on the back handrail 540 folded.

[0110] Figure 19 shows a state where the left and right handrails 520, 530 are being accommodated.

[0111] During accommodation, in Figure 19, as shown by the arrow the left handrail 620 is folded inward, then the accommodation rod 80 rotates at mounting screws

at both ends thereof, and moves in the arrow ② direction, with the placement angle with respect to the vertical frame 14 or the accommodation rotation plate 84 being appropriately changed. This causes the accommodation rotation plate 84 to be pushed in the arrow ③ direction, to rotate around the central axis 88, and then, to pull the accommodation rod 82 in the arrow ④ direction. Thus, the vertical frame 14 of the right handrail 530 provided on the other end of the accommodation rod 82 is tilted in the arrow ⑤ direction. In this manner, for the handrail 510, the left handrail 520 is accommodated to accommodate the right handrail 530 at the same time.

[0112] Figure 20 schematically shows a state of turning on the switch 90 of the safety device when the accommodation rotation plate 84 enters an accommodation state, and Figure 20A shows an OFF state of the switch 90 of the safety device, and Figure 20B shows an ON state of the switch 90.

[0113] As shown in Figure 20A, in a state where the handrail 510 is installed, the accommodation rotation plate 84 is placed above the accommodation rotation axis plate 86, and thus the switch 90 of the safety device is OFF. On the other hand, in a state where the handrail 510 is accommodated, as shown in Figure 20B, the accommodation rotation plate 84 is placed on the switch 90 of the safety device. Thus, the switch 90 is always ON in the state where the handrail 510 is accommodated.

[0114] The case where the left handrail 520 is folded to fold the right handrail 530 has been described, but the right handrail 530 may be folded to fold the left handrail 520. In this case, contrary to the case of first folding the left handrail 520 , in Figure 19, a force in the arrow ⑤ direction is applied to the right handrail 530, a force in the arrow ④ direction is applied to the accommodation rod 82, a force in the arrow ③ direction is applied to the accommodation rotation plate 84, a force in the arrow ② direction is applied to the accommodation rod 80, and then the left handrail 520 is folded in the arrow ① direction. Alternatively, the left and right handrails 520, 530 can be accommodated at the same time by applying the force in the arrow ② or ④ direction to the accommodation rod 80 or 82. Rotating the accommodation rotation plate 84 in the arrow ③ direction allows the forces in the directions of the arrows ②, ①, and the arrows ④, ⑤ to be applied, and thus allows the left and right handrails to be accommodated at the same time. The switch 90 of the safety device can be automatically turned on by any of the accommodation methods.

[0115] The case where the left and right handrails 520, 530 are accommodated has been described, but the left and right handrails 520, 530 can be installed at a time by applying a force in the direction opposite the above described direction to any of the left and right handrails 520, 530, the accommodation rods 80, 82, and the accommodation rotation plate 84. In this case, the switch 90 of the safety switch can be automatically turned off to automatically release the safety device by any of the installation methods.

[0116] The shapes or the positions of the accommodation rods 80, 82, the accommodation rotation plate 84, the accommodation rotation axis plate 86, the central axis 88, and the switch 90 of the safety device are not limited to those described in Embodiment 5 within the scope of the invention.

[0117] Other configurations are the same as those in the previous embodiments, and descriptions thereof will be omitted.

[0118] Configuring as described above allows the left and right handrails to be folded at a time with a simple function. Further, the safety device can be automatically operated or released at the same time as the handrail is accommodated or installed. This reduces time for installing the handrail or other operations.

[0119] In the embodiment according to figs. 17-20, portions including the accommodation rods 80, 82, the accommodation rotation plate 84, the accommodation rotation axis plate 86, and the central axis 88 correspond to adjustment means.

Industrial Applicability

[0120] As described above, the aspect of the invention including the adjustment means for adjusting the height of the handrail allows the handrail to be folded and accommodated with the heights of the side handrails being low. Thus, a relatively high handrail can be provided on top of the elevator cage, and accommodated even in a small space, while preventing interference between the side handrails during accommodation, or interference with the device on top of a cage.

[0121] The aspect including the automatic accommodation means makes it possible that one of the side handrails is accommodated or installed to allow the other of the side handrails to be accommodated or installed. This reduces time for installing and accommodating the handrail during inspection or other operations of the elevator, and thus reduces overall operation time.

[0122] The aspect that allows the safety device to be automatically operated or stopped reduces time for operating or stopping the safety device. This also reduces the overall operation time during the inspection or other operations of the elevator.

Claims

1. A handrail (110) on top of an elevator cage (100) comprising:

a handrail (110) provided on top of an elevator cage (100);
a support frame (4) that supports said handrail (110); and
a fastening column (6) that fastens said support frame (4) to said cage (100),
wherein said handrail (110) includes side hand-

rails (120, 130) provided on top of said cage (100) in parallel with two opposite sides of said cage (100), and a back handrail (140) provided on top of said cage (100) perpendicularly to said side handrails (120, 130),
at least the side handrails (120, 130) of said handrails (110) include adjustment means (26, 28, 30, 36) for adjusting a height of said at least side handrails, and
said handrail (110) further includes accommodation means (24, 32, 34) for allowing said handrail (110) to be horizontally folded and accommodated on a top surface of said cage (100).

2. The handrail (110) on top of an elevator cage according to claim 1, wherein said accommodation means (24, 32, 34) rotates and folds said handrail (110) toward the top surface of said cage (100) around a mounting portion (34) of said handrail (110) to said support frame (4).

3. The handrail (110) on top of an elevator cage (100) according to claim 1 or 2, wherein said side handrails /120, 130) each includes a hollow lower handrail (29) mounted to said support frame (4), and an upper handrail (22) connected to said lower handrail (20), said adjustment means (26, 28, 30, 36) has mounting means for mounting or dismounting said lower handrail and said upper handrail, and
said mounting means is removed to accommodate said upper handrail in said lower handrail.

4. The handrail (110) on top of an elevator cage according to claim 1 or 2, wherein said side handrails (120, 130) each includes a lower handrail mounted to said support frame, and an upper handrail connected to said lower handrail,
said adjustment means (40-48) has a connecting portion (44) that rotatably connects said lower handrail and said upper handrail, and said upper handrail is rotated and folded toward said lower handrail around said connecting portion.

5. The handrail (110) on top of an elevator cage (100) according to claim 1 or 2, wherein said side handrails (120, 130) each includes a lower handrail mounted to said support frame, and an upper handrail connected to said lower handrail, and
said adjustment means (40-48) rotates said upper handrail toward said lower handrail around a connecting portion (44) between said upper handrail and said lower handrail to accommodate said upper handrail in said lower handrail.

Patentansprüche

1. Geländer (110) auf einer Aufzugskabine (100) mit:
einem Geländer (110), das auf einer Aufzugskabine (100) vorgesehen ist,
einem Abstützrahmen (4), der das Geländer (110) abstützt, und
einer Befestigungssäule (6), die den Abstützrahmen (4) mit der Kabine (100) befestigt,
wobei das Geländer (110) Seitengeländer (120, 130), die auf der Kabine (100) parallel zu zwei gegenüberliegenden Seiten der Kabine (100) vorgesehen sind, und ein Rückgeländer (140), das auf der Kabine (100) senkrecht zu den Seitengeländern (120, 130) vorgesehen ist, aufweist,
wobei wenigstens die Seitengeländer (120, 130) der Geländer (110) Einstelleinrichtungen (26, 28, 30, 36) zum Einstellen einer Höhe wenigstens der Seitengeländer aufweisen und
das Geländer (110) ferner einer Aufnahmeeinrichtung (24, 32, 34) aufweist, um es dem Geländer (110) zu ermöglichen, horizontal zusammengelegt zu werden und auf einer oberen Oberfläche der Kabine (100) aufgenommen zu werden.

2. Geländer (110) auf einer Aufzugskabine nach Anspruch 1, bei dem die Aufnahmeeinrichtung (24, 32, 34) das Geländer (110) zu der oberen Oberfläche der Kabine (100) hin um einen Anbringabschnitt (34) des Geländers (110) an dem Abstützrahmen (4) herum dreht und zusammenlegt.

3. Geländer (110) auf einer Aufzugskabine (100) nach Anspruch 1 oder 2, bei dem die Seitengeländer (120, 130) jeweils ein hohles unteres Geländer (29), das an dem Abstützrahmen (4) angebracht ist, und ein oberes Geländer (22) aufweisen, welches mit dem unteren Geländer (20) verbunden ist,
wobei die Einstelleinrichtung (26, 28, 30, 36) Anbringeinrichtungen zum Anbringen oder Entfernen des unteren Geländers und des oberen Geländers aufweist und
die Anbringeinrichtung entfernt wird, um das obere Geländer in das untere Geländer aufzunehmen.

4. Geländer (110) auf einer Aufzugskabine (100) nach Anspruch 1 oder 2, bei dem die Seitengeländer (120, 130) jeweils ein unteres Geländer, das an dem Abstützrahmen angebracht ist, und ein oberes Geländer (22) aufweisen, das mit dem unteren Geländer (20) verbunden ist,
wobei die Einstelleinrichtung (40-48) einen Verbindungsabschnitt (44) aufweist, der das untere Geländer und das obere Geländer drehbar verbindet, und das obere Geländer zu dem unteren Geländer hin um den Verbindungsabschnitt gedreht und zusammengelegt wird.

5. Geländer (110) auf einer Aufzugskabine (100) nach

Anspruch 1 oder 2, bei dem die Seitengeländer (120, 130) jeweils ein unteres Geländer (29), das an dem Abstützrahmen angebracht ist, und ein oberes Geländer (22) aufweisen, das mit dem unteren Geländer verbunden ist, und
die Einstelleinrichtung (40-48) das obere Geländer zu dem unteren Geländer hin um einen Verbindungsabschnitt (44) zwischen dem oberen Geländer und dem unteren Geländer dreht, um das obere Geländer in das untere Geländer aufzunehmen.

Revendications

1. Garde-fou (110) disposé sur le dessus d'une cage d'ascenseur (100), comprenant :

un garde-fou (110) prévu sur le dessus d'une cage d'ascenseur (100) ;
un cadre support (4) qui supporte ledit garde-fou (110) ; et
une colonne de fixation (6) qui fixe ledit cadre support (4) sur ladite cage (100) ;
où ledit garde-fou (110) comprend des garde-fous latéraux (120, 130) prévus sur le dessus de ladite cage (100) et disposés parallèlement à deux côtés opposés de ladite cage (100), et un garde-fou arrière (140) prévu sur le dessus de ladite cage (100) perpendiculairement auxdits garde-fous latéraux (120, 130),
au moins les garde-fous latéraux (120, 130) dudit garde-fou (110) comprennent des moyens de réglage (26, 28, 30, 36), pour régler une hauteur au moins desdits garde-fous latéraux, et
ledit garde-fou (110) comprend en outre des moyens de logement (24, 32, 34), pour permettre audit garde-fou (110) d'être plié horizontalement et logé sur une surface de dessus de ladite cage (100).

2. Garde-fou (110) disposé sur le dessus d'une cage d'ascenseur selon la revendication 1, dans lequel lesdits moyens de logement (24, 32, 34) font tourner et plient ledit garde-fou (110) vers la surface de dessus de ladite cage (100), autour d'une partie de montage (34) dudit garde-fou (110), jusqu'audit cadre support (4).

3. Garde-fou (110) disposé sur le dessus d'une cage d'ascenseur (100) selon la revendication 1 ou 2, dans lequel lesdits garde-fous latéraux (120, 130) comprennent chacun un garde-fou inférieur creux (29) monté sur ledit cadre support (4), et un garde-fou supérieur (22) relié audit garde-fou inférieur (20), lesdits moyens de réglage (26, 28, 30, 36) comportent des moyens de montage, pour monter ou démonter ledit garde-fou inférieur et ledit garde-fou supérieur, et lesdits moyens de montage sont enlevés, pour loger ledit garde-fou supérieur dans ledit garde-fou inférieur.

4. Garde-fou (110) disposé sur le dessus d'une cage d'ascenseur (100) selon la revendication 1 ou 2, dans lequel lesdits garde-fous latéraux (120, 130) comprennent chacun un garde-fou inférieur monté sur ledit cadre support, et un garde-fou supérieur relié audit garde-fou inférieur,
lesdits moyens de réglage (40 - 48) comportent une partie d'assemblage (44) qui relie, par rotation, ledit garde-fou inférieur et ledit garde-fou supérieur, et ledit garde-fou supérieur est tourné et plié vers ledit garde-fou inférieur, autour de ladite partie d'assemblage.

5. Garde-fou (110) disposé sur le dessus d'une cage d'ascenseur (100) selon la revendication 1 ou 2, dans lequel lesdits garde-fous latéraux (120, 130) comprennent chacun un garde-fou inférieur monté sur ledit cadre support, et un garde-fou supérieur relié audit garde-fou inférieur, et
lesdits moyens de réglage (40 - 48) font tourner ledit garde-fou supérieur vers ledit garde-fou inférieur autour d'une partie d'assemblage (44) placée entre ledit garde-fou supérieur et ledit garde-fou inférieur, pour loger ledit garde-fou supérieur dans ledit garde-fou inférieur.

Fig.1

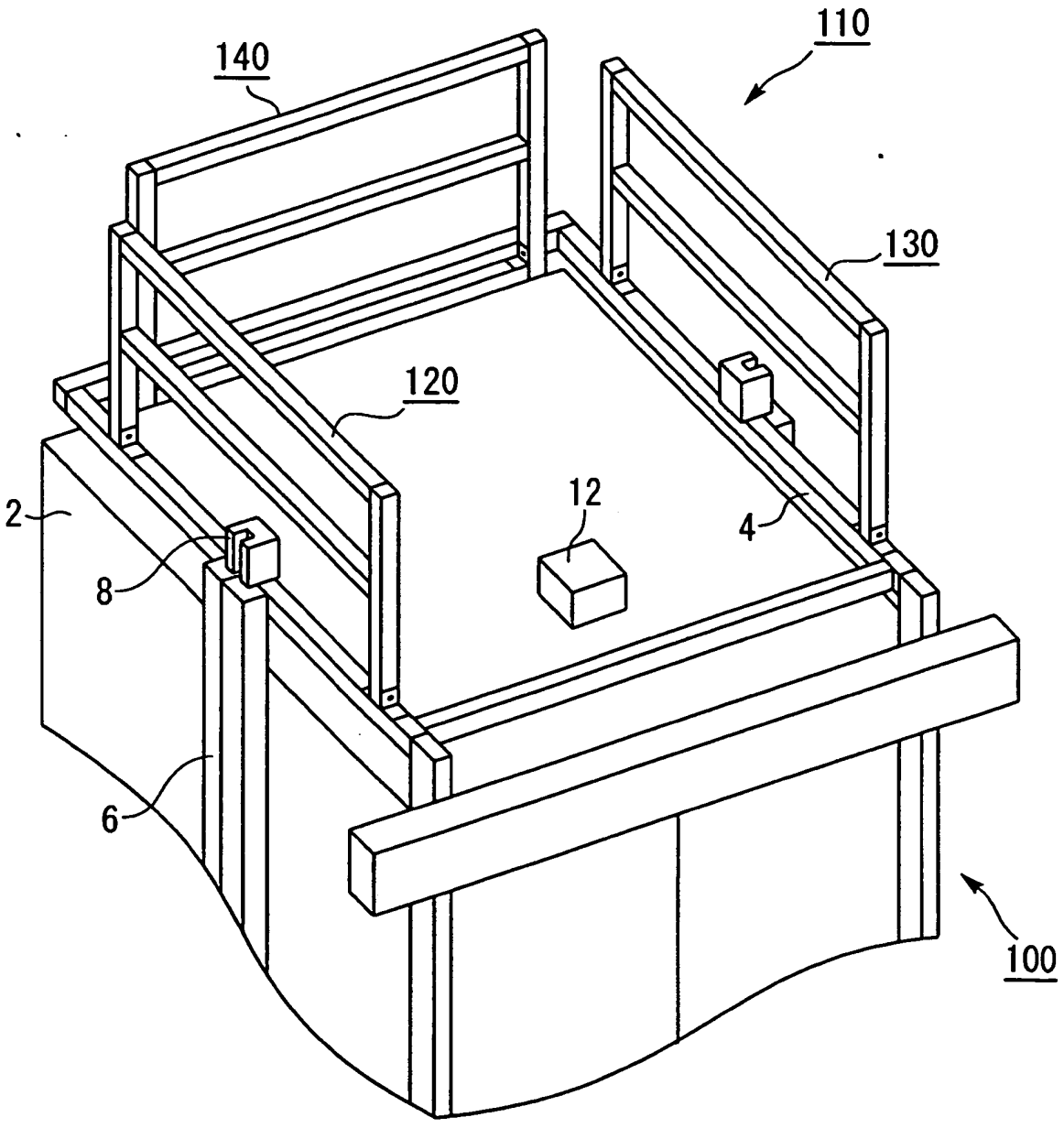


Fig.2

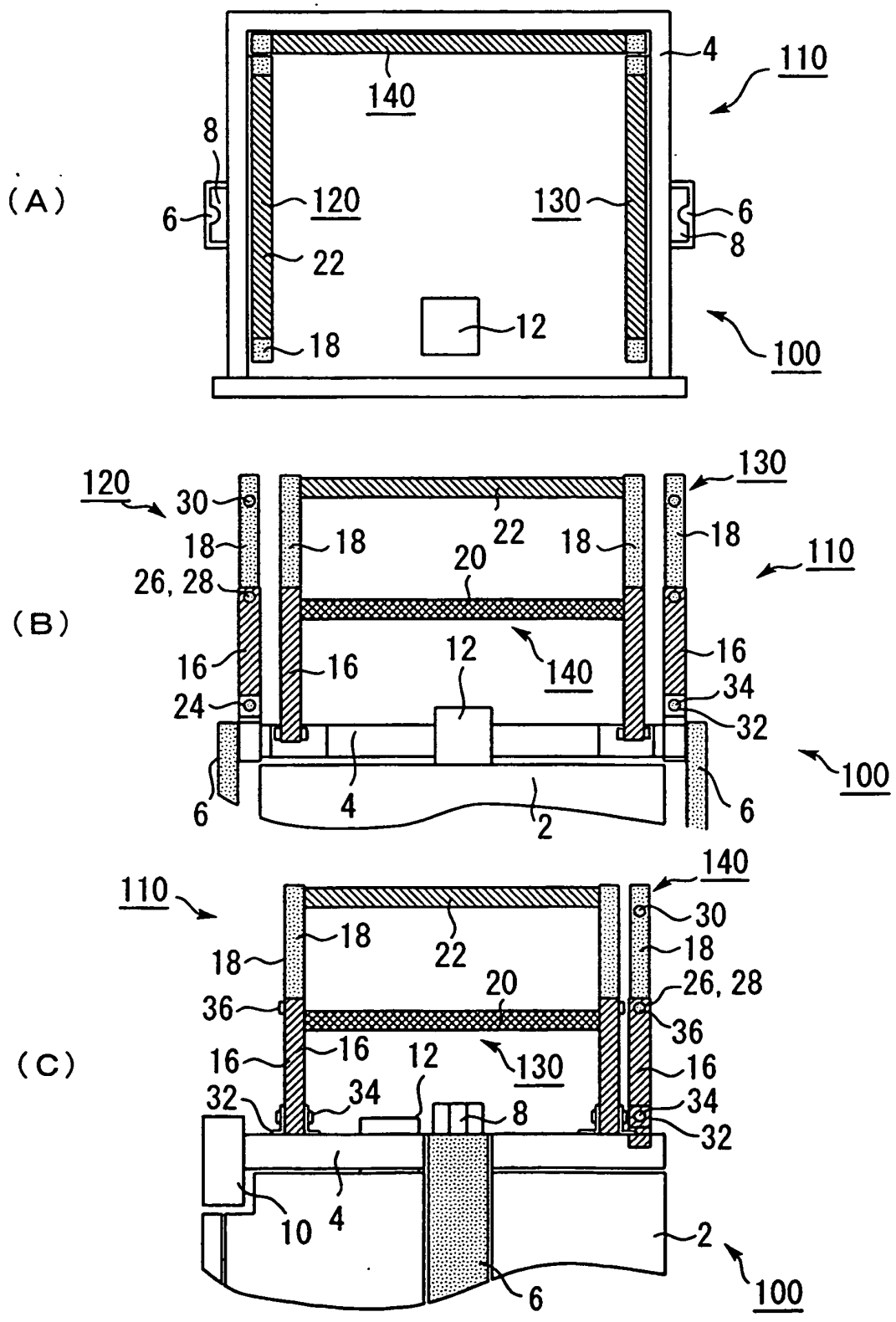
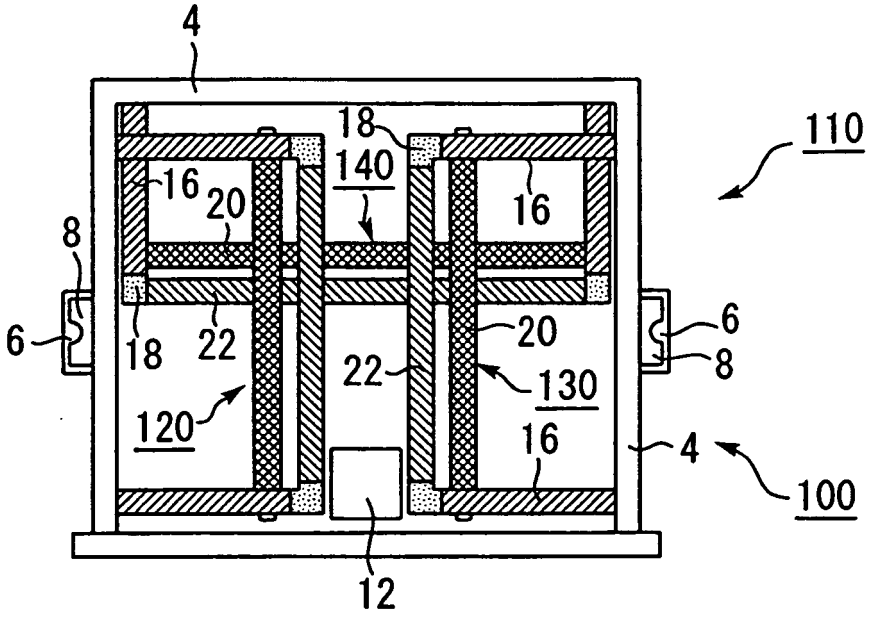
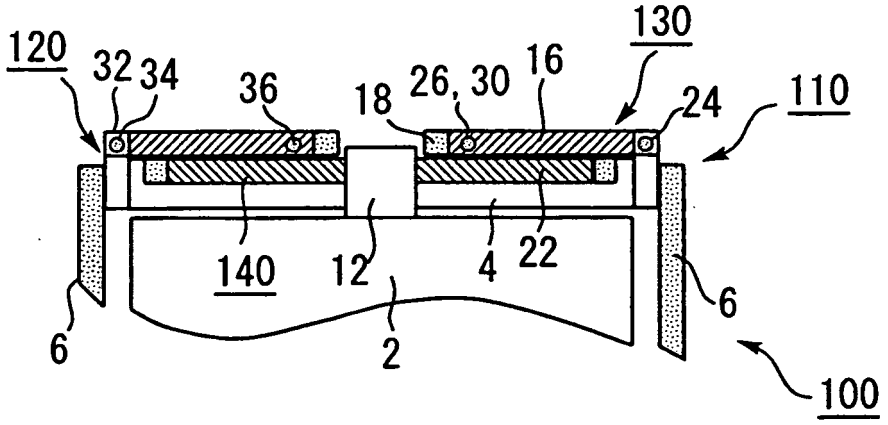

(A)
140
4
110
8
6
120
130
6
8
22
12
18
100
(B)
120
30
18
26, 28
18
22
18
130
18
110
20
16
16
12
140
16
24
34
32
100
6
4
2
6
(C)
110
140
18
22
30
18
18
20
26, 28
36
36
16
16
12
130
16
32
34
34
8
32
10
4
2
6
100

Fig.3

(A)


4
18
140
110
16
20
16
8
6
18
22
22
20
130
6
8
120
16
4
100
12

(B)


120
32
34
36
18
26, 30
16
130
24
110
140
12
4
22
6
6
2
100

(C)

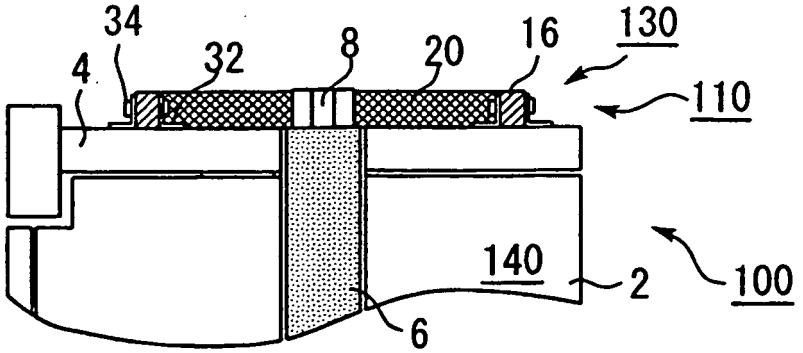

34
4
32
8
20
16
130
110
140
2
100
6

Fig. 4

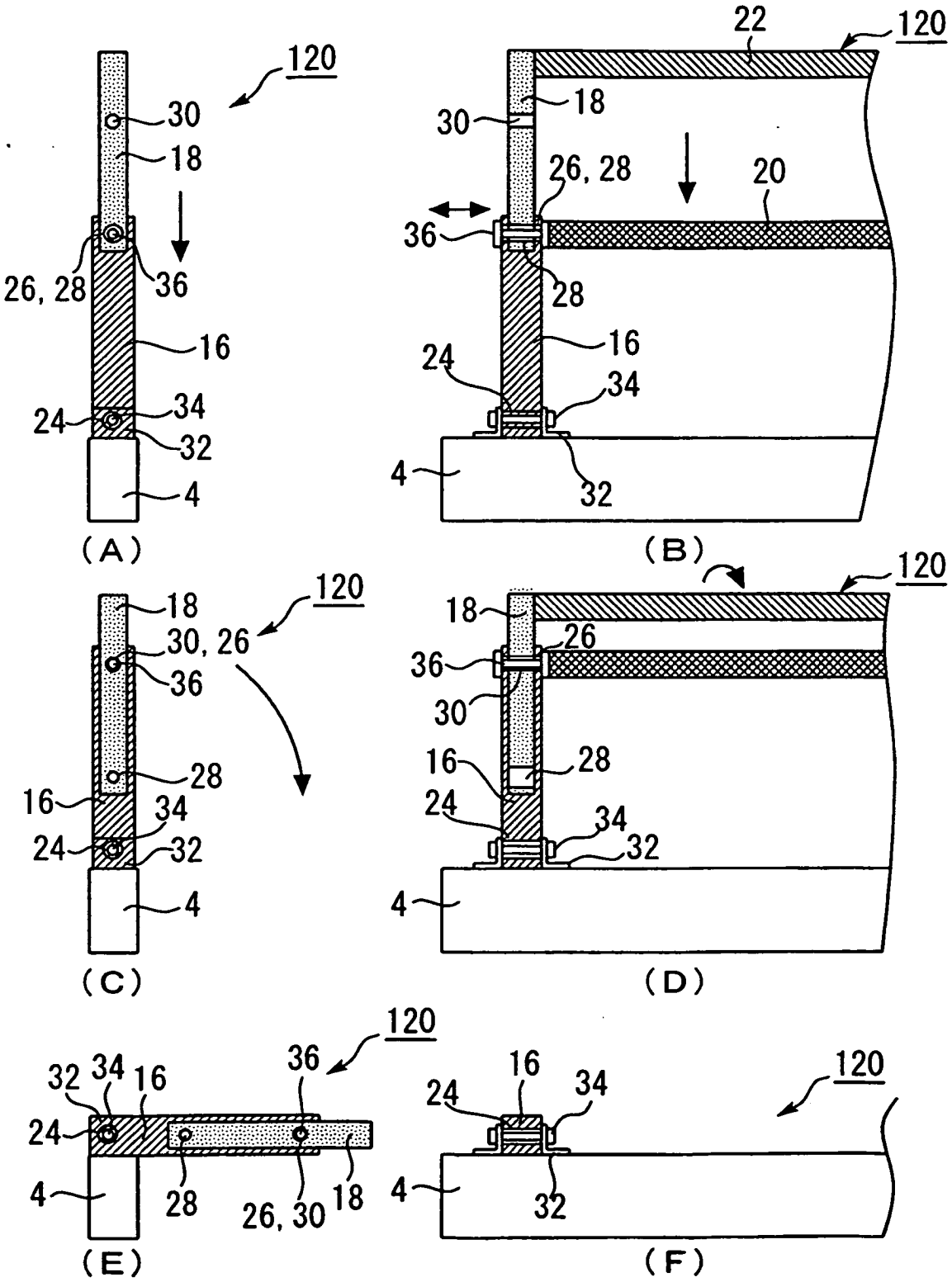

120
30
18
26, 28
36
16
24
34
32
4
(A)
22
120
30
18
26, 28
20
36
28
16
24
34
4
32
(B)
120
18
30, 26
36
28
16
34
24
32
4
(C)
120
18
26
36
30
16
28
24
34
32
4
(D)
120
36
32
34
16
24
4
28
26, 30
18
(E)
120
16
34
24
4
32
(F)

Fig.5

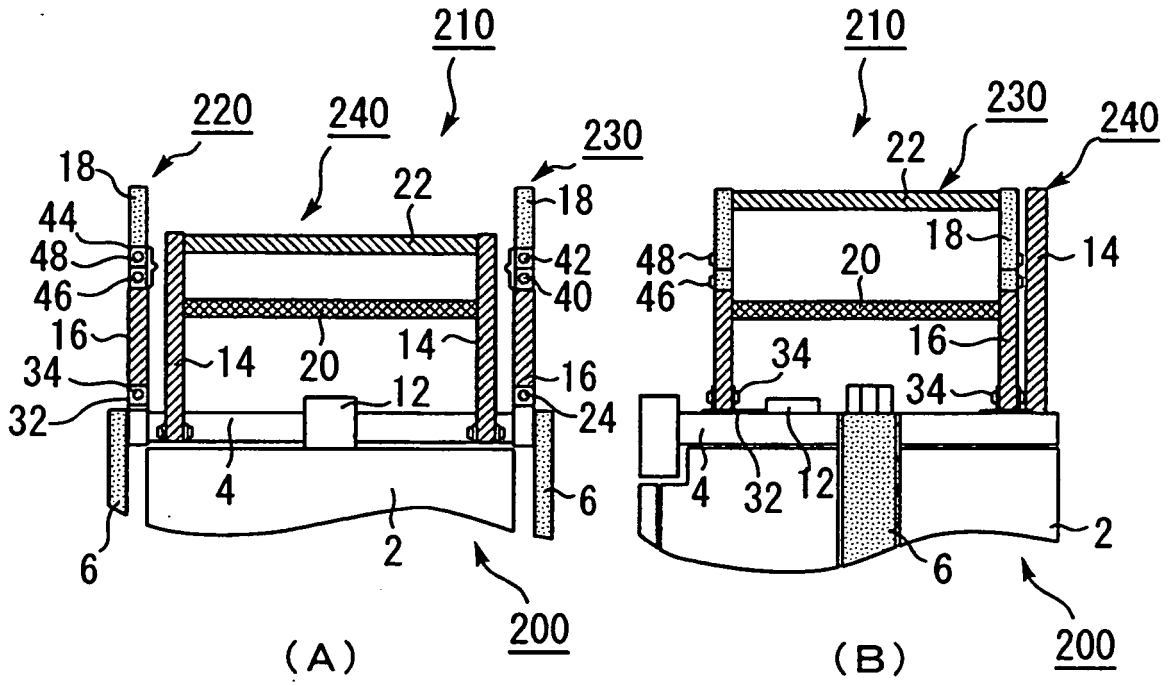

210
220
240
230
18
44
48
46
16
34
32
22
42
40
14
20
12
24
4
6
2
200
(A)
210
230
240
22
18
14
48
46
20
16
34
32
12
(B)

Fig. 6

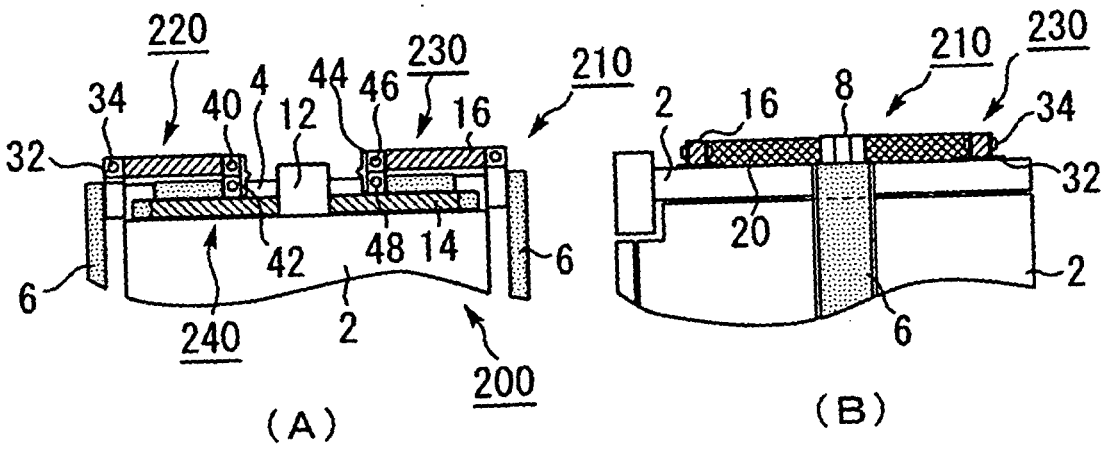

220
230
210
34
40
4
44
46
16
12
32
42
48
14
6
6
240
2
200
(A)
210
230
2
16
8
34
32
20
2
6
(B)

Fig. 7

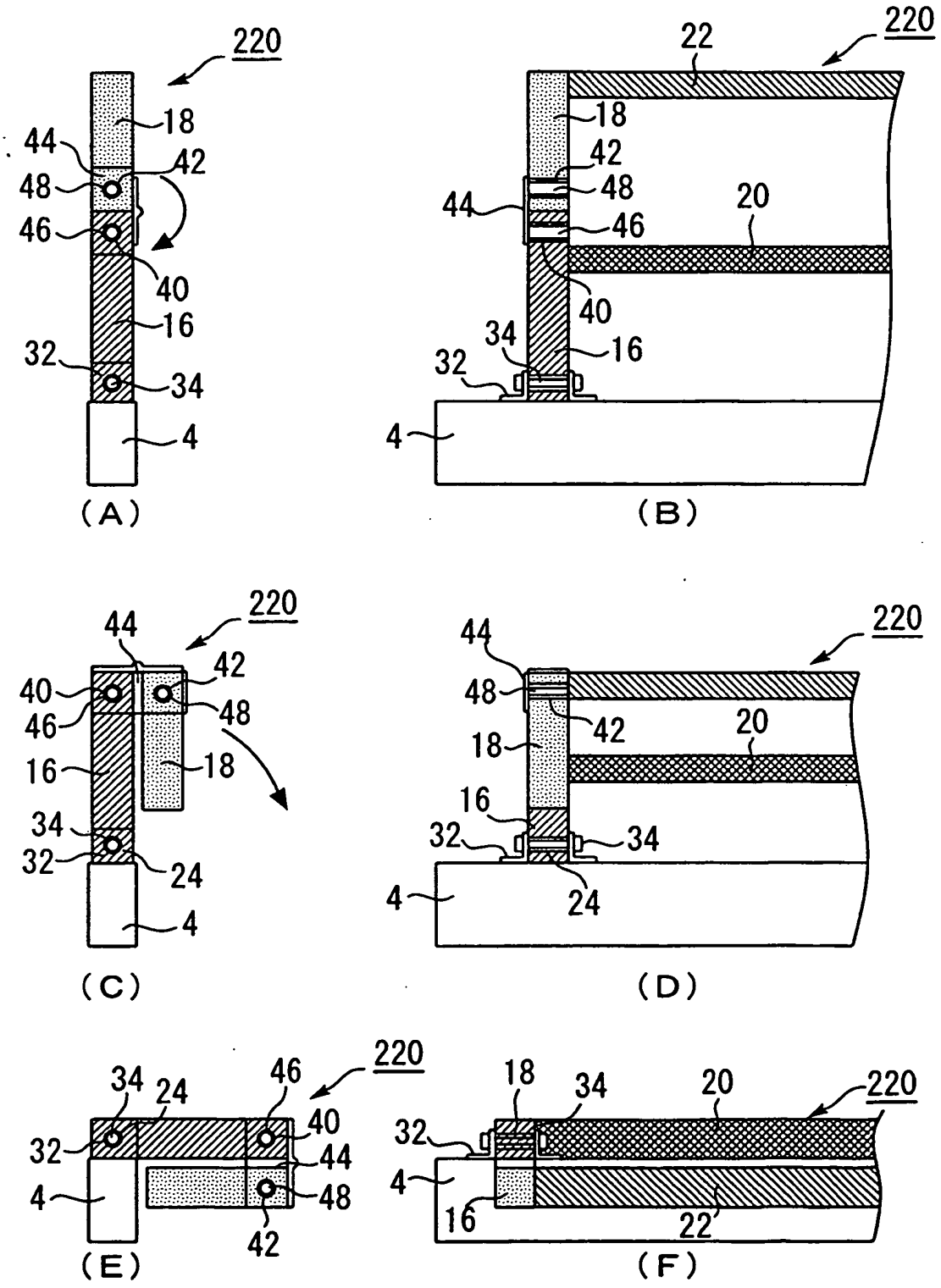

220
18
44
42
48
46
40
16
32
34
4
(A)
22
220
18
42
48
44
46
20
40
34
16
32
4
(B)
44
220
40
42
46
48
16
18
34
32
24
4
(C)
44
220
48
42
20
18
16
32
34
4
24
(D)
34
24
46
220
32
40
44
4
48
42
(E)
18
34
20
220
32
4
16
22
(F)

Fig.8

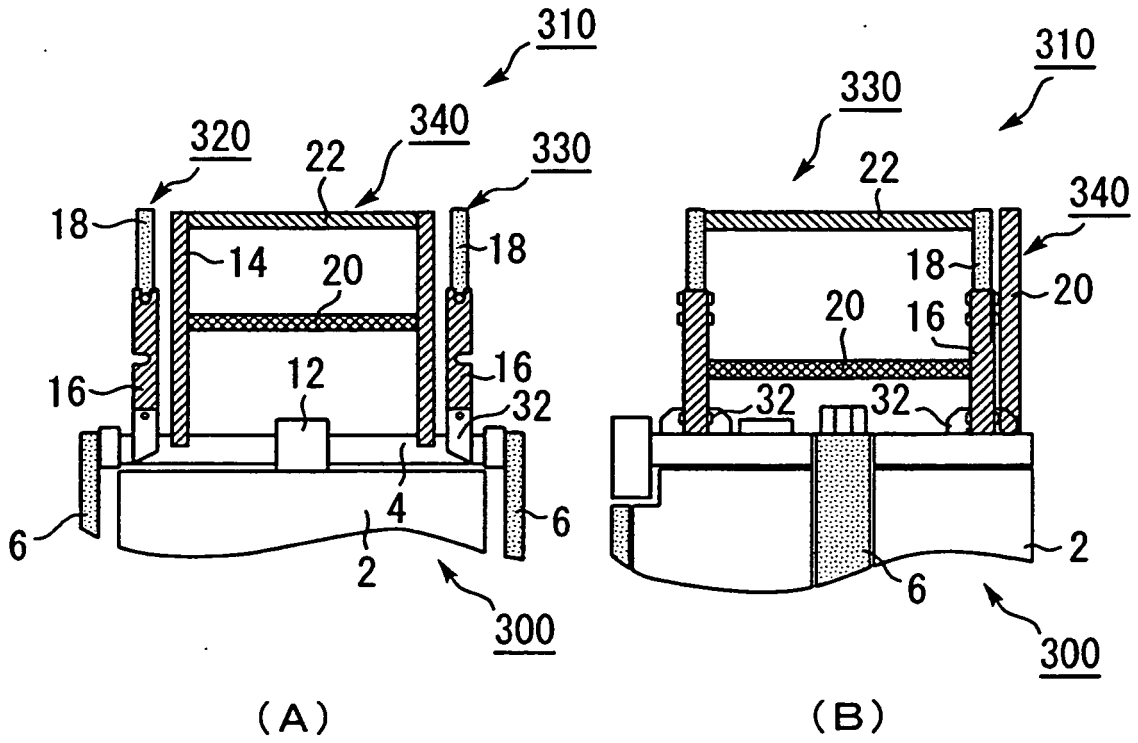

310
320
340
330
22
18
14
20
18
16
12
16
32
4
6
6
2
300
(A)
310
330
22
340
18
20
20
16
32
32
2
6
300
(B)

Fig. 9

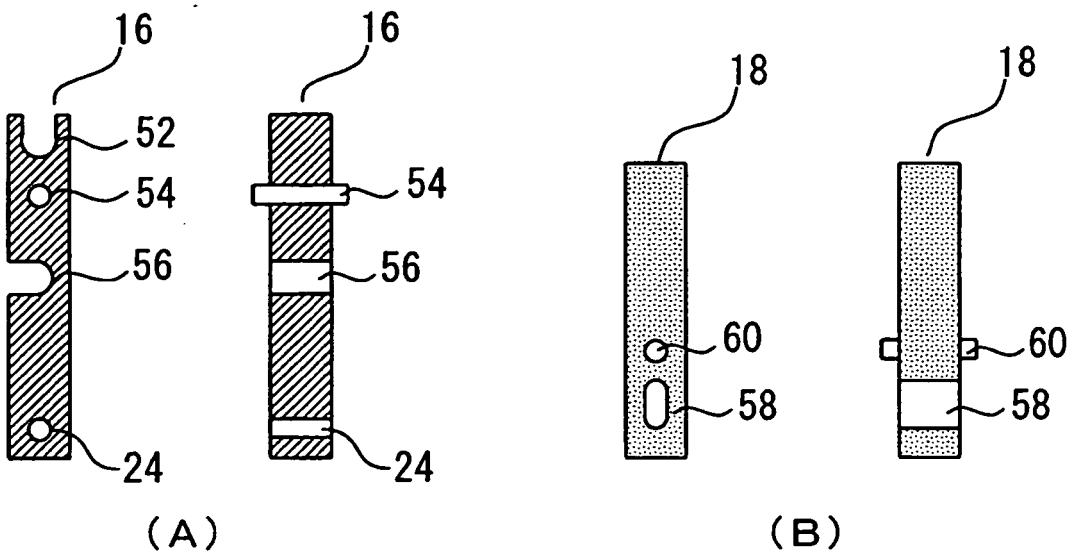


Fig.10

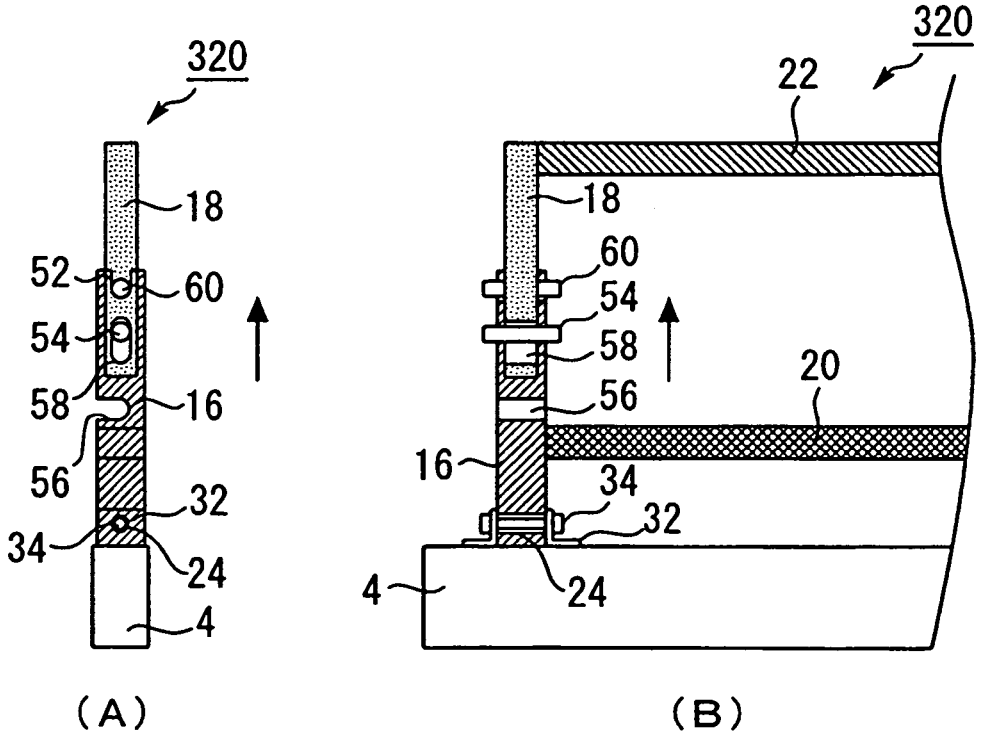

320
18
52
60
54
58
16
56
32
34
24
4
(A)
320
22
18
60
54
58
20
56
16
34
32
4
24
(B)

Fig.11

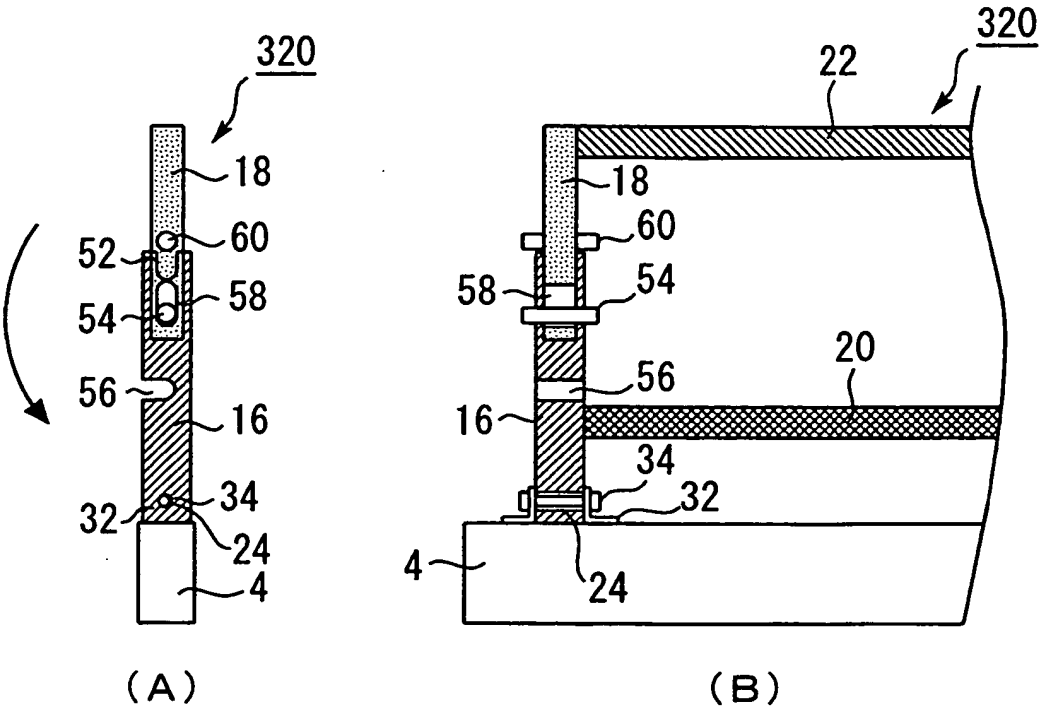

320
18
52
60
58
54
56
16
32
34
24
4
(A)
320
22
18
60
58
54
20
56
16
34
32
4
24
(B)

Fig.12

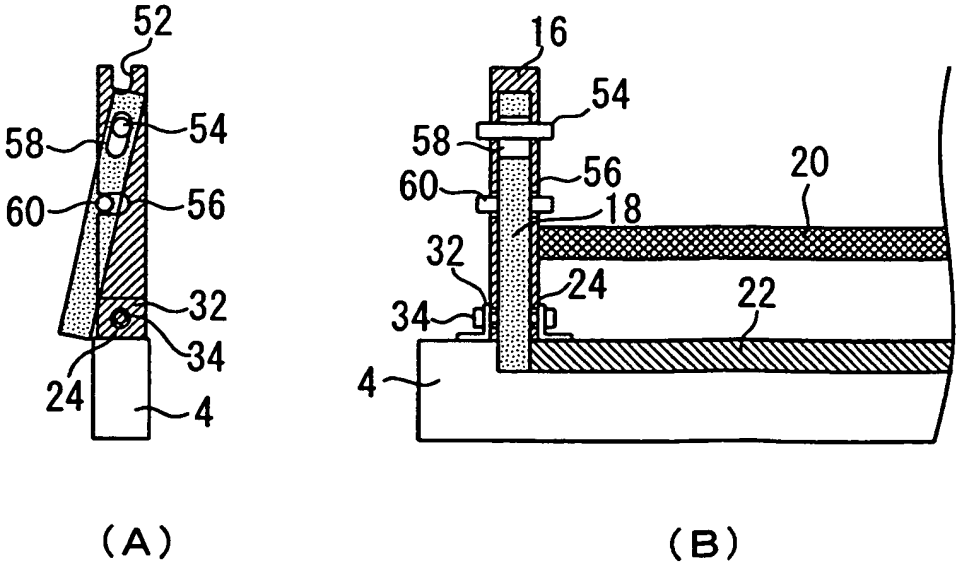

52
58
54
60
56
32
34
24
4
(A)
16
54
58
56
20
60
18
32
24
22
34
4
(B)

Fig.13

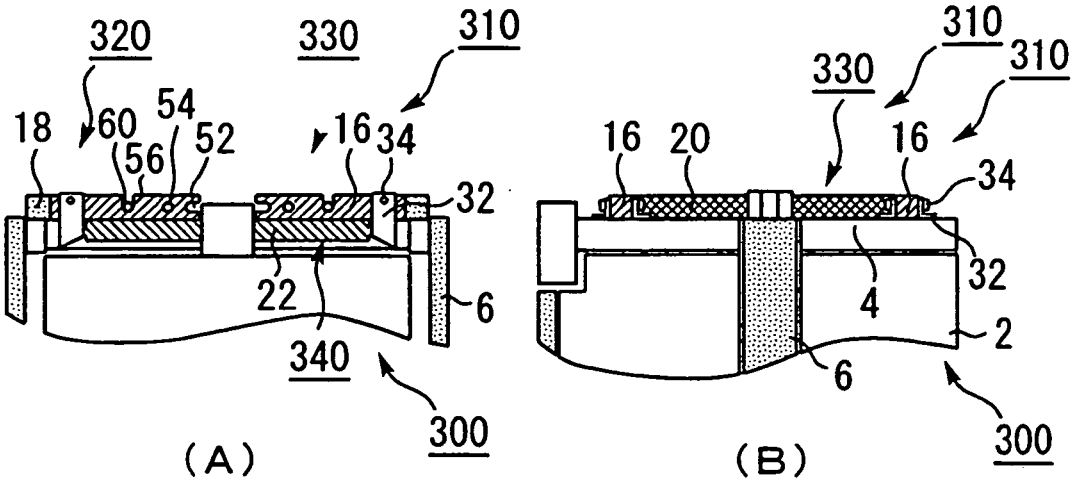

320
330
310
18
60
54
56
52
16
34
32
22
6
340
300
(A)
310
330
310
16
20
16
34
32
4
2
6
300
(B)

Fig.14

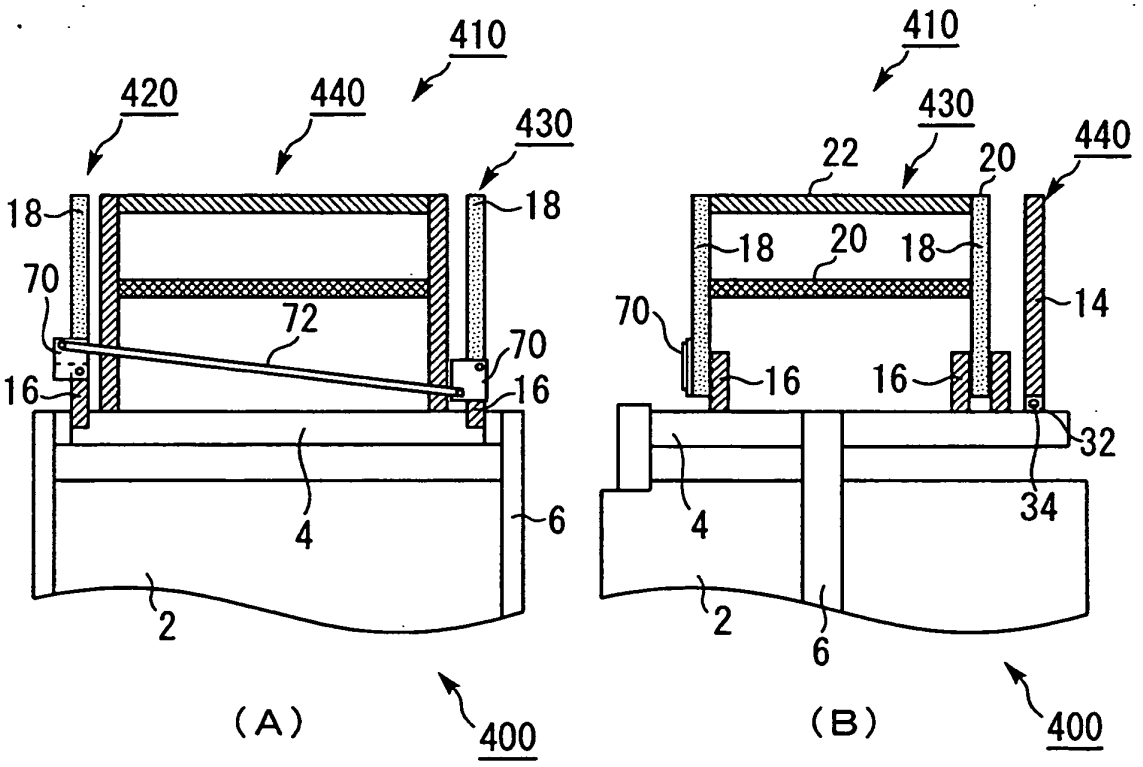

410
420
440
430
18
18
70
72
70
16
16
4
6
2
(A)
400
410
430
440
22
20
18
20
18
70
14
16
16
32
34
4
2
6
(B)
400

Fig.15

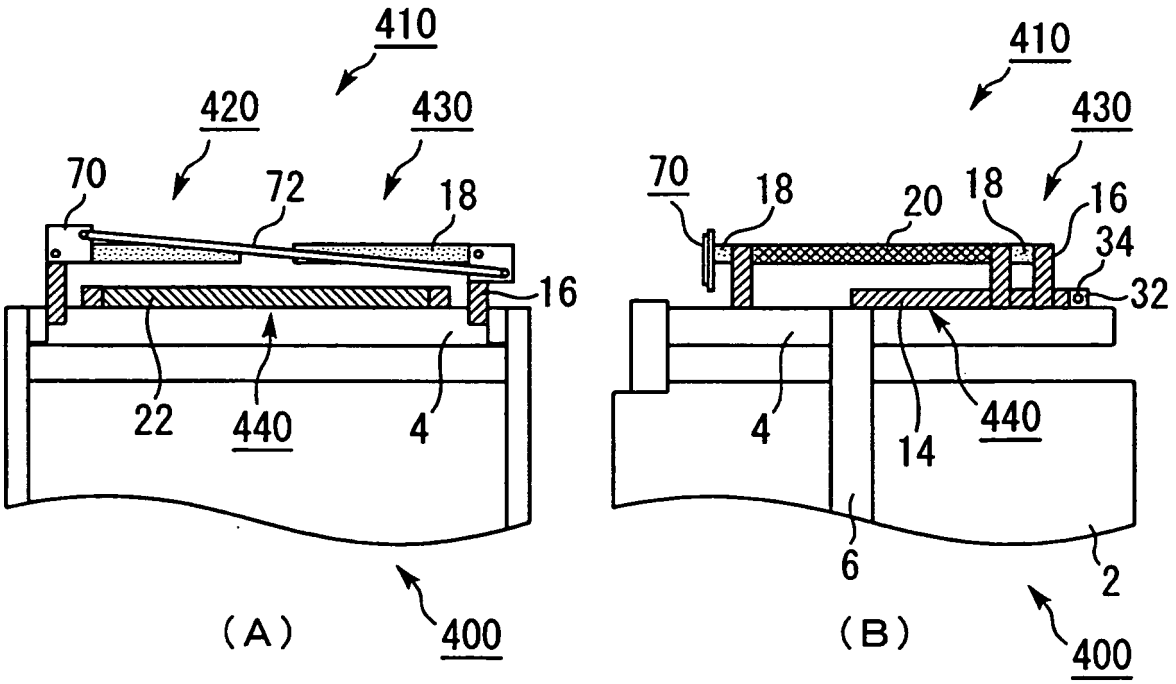

410
420
430
70
72
18
16
22
440
4
400
(A)
410
430
70
18
20
18
16
34
32
4
14
440
6
2
400
(B)

Fig.16

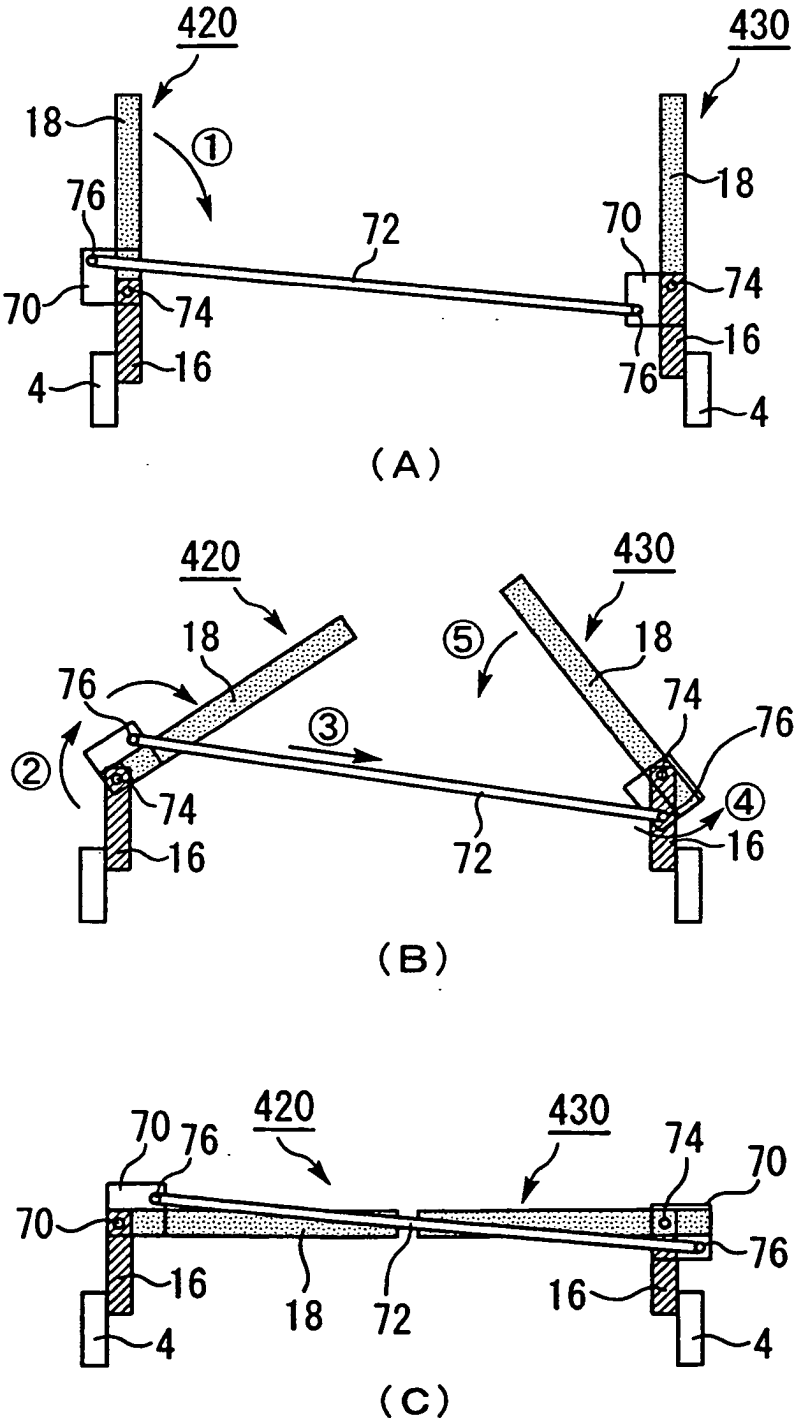


Fig.17

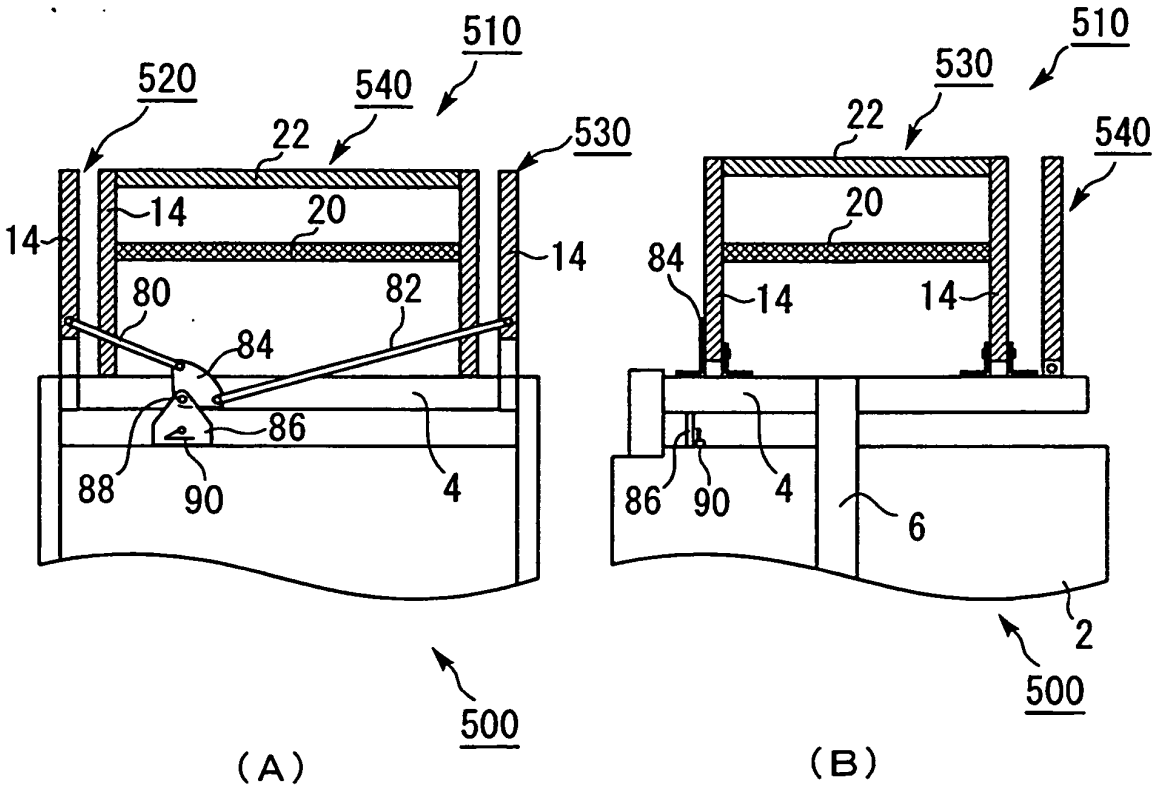

510
520
540
530
22
14
20
14
14
80
82
84
86
88
90
4
500
(A)
510
530
540
22
20
84
14
14
86
90
4
6
2
500
(B)

Fig.18

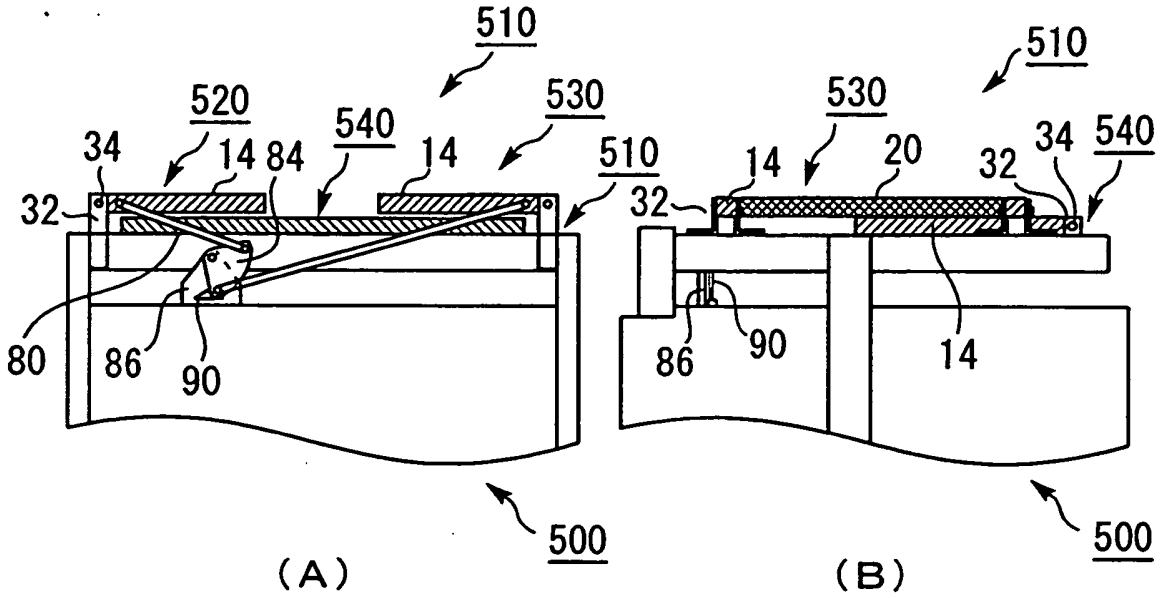

510
520
530
540
34
14
84
14
510
32
80
86
90
(A)
510
530
14
20
32
34
540
32
86
90
14
(B)
500
500

Fig.19

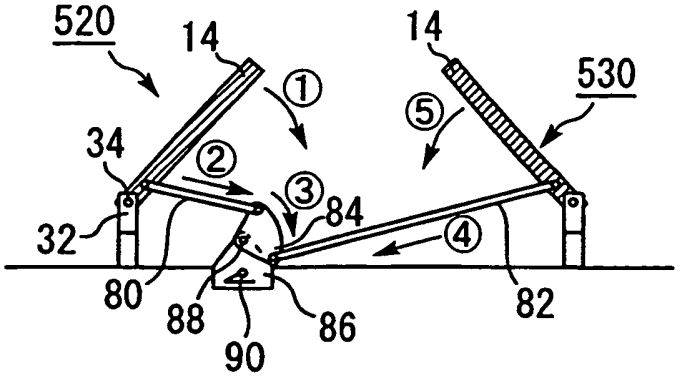

520
14
①
14
530
⑤
34
②
③
84
④
32
80
88
86
82
90

Fig.20

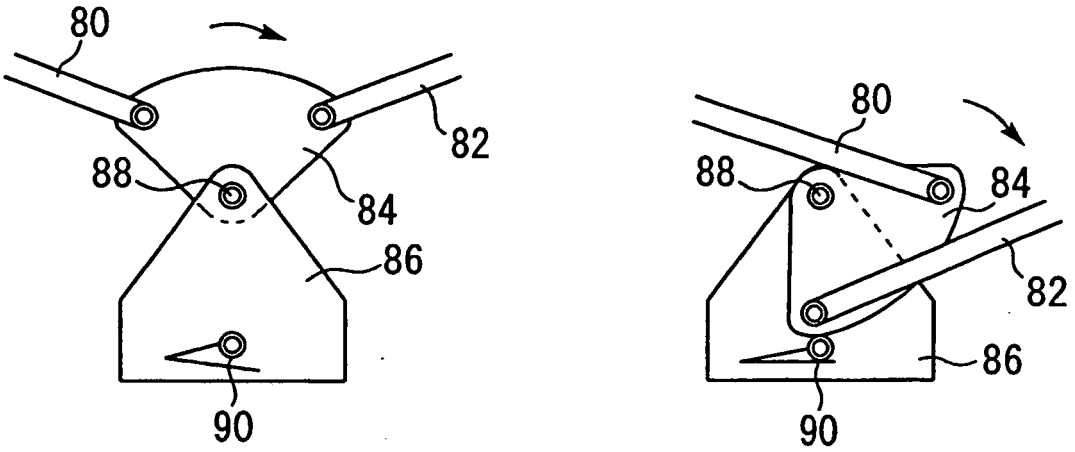
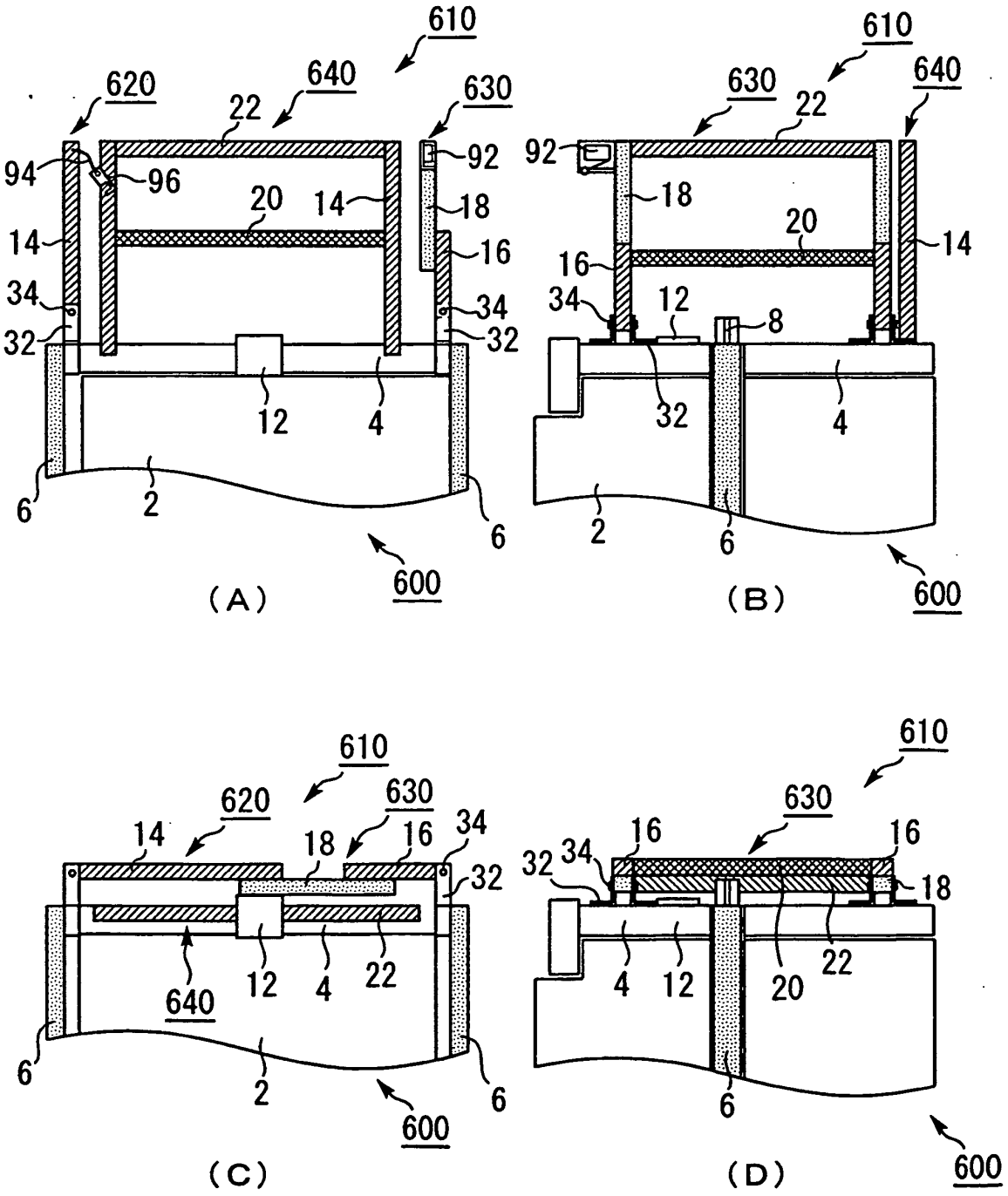


Fig.21


610
620
640
630
22
94
96
92
20
14
18
16
34
32
12
4
6
2
600
(A)
610
630
640
22
92
18
20
14
16
34
12
8
32
4
2
6
600
(B)
610
620
630
14
18
16
34
32
640
12
4
22
6
2
600
(C)
610
630
16
16
32
34
18
4
12
20
22
6
600
(D)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4292386 A **[0002]**