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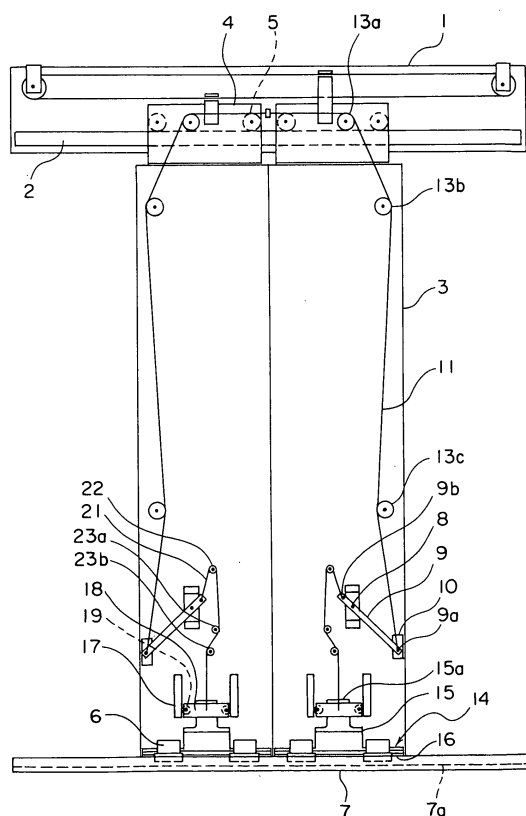
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**(54) DOOR DEVICE OF ELEVATOR**

(57) In an elevator door apparatus, a pivoting member pivoting around a pivoting shaft together with opening and closing operations of a door main body is mounted to a door main body. A connecting rope is connected between the pivoting member and a fixed portion fixed relative to a landing entrance. A vertically-movable movable covering body is disposed on a lower end portion of the door main body. The movable covering body is connected to the pivoting member, and covers a gap between the lower end portion of the door main body and a floor portion of the entrance by coming into contact with the floor portion. In a door closed state, the movable covering body is placed in contact with the floor portion, and during a door opening operation, the pivoting member is pivoted such that the movable covering body separates from the floor portion.

**FIG. 1**



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## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to an elevator door apparatus having a door main body for opening and closing a landing entrance or a car entrance.

### BACKGROUND ART

**[0002]** In conventional elevators, such as that disclosed in Japanese Patent Laid-Open No. HEI 8-67486 (Gazette), for example, constructions are disclosed in which a gap between a lower end portion of a landing door and a landing doorsill is covered by disposing a lower portion packing for contacting a doorsill groove on the lower end portion of the landing door. However, in constructions of this kind, since the lower portion packing slides during opening and closing of the landing door while still in contact with the doorsill groove, there is a risk that sliding noise may be generated. Since it is necessary to change abraded lower portion packing frequently, costs are increased and complicated maintenance procedures are required.

**[0003]** In conventional elevators such as that disclosed in Japanese Utility Model Registration Abstract No. 3032400, a covering body is disclosed that is displaced obliquely downward during door closing to cover the gap between the lower end portion of the landing door and the doorsill. However, in constructions of this kind, it has been necessary to strictly adjust and maintain the mounted position of the covering body. This is because if the covering body comes into contact with the doorsill before the landing door is completely closed, a situation arises in which the landing door cannot be fully closed, and if, on the other hand, the landing door reaches a fully-closed state before the covering body comes into contact with the doorsill, a gap will remain. Consequently, mounting and maintenance of the covering body require complicated procedures.

### DISCLOSURE OF THE INVENTION

**[0004]** The present invention aims to solve the above problems and an object of the present invention is to provide an elevator door apparatus capable of more reliably covering a gap at a lower end portion of a door main body in a door closed state, while maintaining opening and closing operation performance of the door main body.

**[0005]** In order to achieve the above object, according to one aspect of the present invention, there is provided an elevator door apparatus including: a door main body for opening and closing an entrance; a pivoting member mounted to the door main body, pivoting around a pivoting shaft together with opening and closing operations of the door main body; a connecting rope connected between the pivoting member and a fixed portion that is fixed relative to the entrance; and a movable covering

body disposed so as to be vertically movable on a lower end portion of the door main body, and connected to the pivoting member, for covering a gap between the lower end portion of the door main body and a floor portion of the entrance by coming into contact with the floor portion, the pivoting member being pivoted such that the movable covering body is placed in contact with the floor portion in a door closed state, and the movable covering body separates from the floor portion during a door opening operation.

### BRIEF DESCRIPTION OF THE DRAWINGS

#### [0006]

Figure 1 is a rear elevation showing a door closed state of an elevator landing door apparatus according to Embodiment 1 of the present invention; Figure 2 is a rear elevation showing a door open state of the landing door apparatus in Figure 1; Figure 3 is a rear elevation showing part of the landing door apparatus in Figure 1 enlarged; Figure 4 is a cross section taken along line IV - IV in Figure 3; Figure 5 is a rear elevation showing part of the landing door apparatus in Figure 2 enlarged; Figure 6 is a cross section taken along line VI - VI in Figure 5; Figure 7 is a rear elevation showing a door open state of an elevator landing door apparatus according to Embodiment 2 of the present invention; Figure 8 is a rear elevation showing a door closed state of an elevator landing door apparatus according to Embodiment 3 of the present invention; and Figure 9 is a rear elevation showing a door open state of the landing door apparatus in Figure 8.

### BEST MODE FOR CARRYING OUT THE INVENTION

**[0007]** Preferred embodiments of the present invention will now be explained with reference to the drawings.

#### Embodiment 1

**[0008]** Figure 1 is a rear elevation showing a door closed state of an elevator landing door apparatus according to Embodiment 1 of the present invention (figure viewed from a hoistway side), Figure 2 is a rear elevation showing a door open state of the landing door apparatus in Figure 1, Figure 3 is a rear elevation showing part of the landing door apparatus in Figure 1 enlarged, Figure 4 is a cross section taken along line IV - IV in Figure 3, Figure 5 is a rear elevation showing part of the landing door apparatus in Figure 2 enlarged, and Figure 6 is a cross section taken along line VI - VI in Figure 5.

**[0009]** In the figures, a door apparatus housing 1 functioning as a fixed portion is secured above a landing entrance 20. A door rail 2 extending parallel to a direction

of frontage of the landing entrance 20 is secured to the door apparatus housing 1. The landing entrance 20 is opened and closed by a pair of door main bodies 3. Opening and closing of the door main bodies 3 is guided by the door rail 2.

**[0010]** A door hanger 4 for suspending the door main bodies 3 from the door rail 2 is secured to an upper end portion of each of the door main bodies 3. A plurality of hanger rollers 5 rolling along the door rail 2 are disposed on each of the door hangers 4. The door main bodies 3 are opened and closed together with opening and closing of a car door by a driving force from a door motor mounted to a car.

**[0011]** A plurality of door feet 6 are mounted to lower end portions of each of the door main bodies 3. A landing doorsill 7 is secured to a floor portion of the landing entrance. A doorsill groove 7a into which the door feet 6 are inserted is disposed on the landing doorsill 7. The doorsill groove 7a extends in a direction of frontage of the landing entrance 20, and guides the lower end portions of the door main bodies 3 during opening and closing.

**[0012]** A pivoting lever 9 functioning as a pivoting member that is pivotable around a pivoting shaft 8 is mounted to a back surface of each of the door main bodies 3. The pivoting levers 9 are pivoted together with opening and closing operations of the door main bodies 3. The pivoting levers 9 have first and second connecting portions 9a and 9b. The first and second connecting portions 9a and 9b are disposed on opposite sides of the pivoting shaft 8 from each other. A distance from the pivoting shaft 8 to the first connecting portion 9a is greater than a distance from the pivoting shaft 8 to the second connecting portion 9b.

**[0013]** A connecting rope 11 is connected between the first connecting portion 9a of each of the pivoting levers 9 and a central portion of the door apparatus housing 1 in a direction of frontage. A plurality of rotatable connecting rope guide rollers 13a to 13c for directing the connecting ropes 11 toward the pivoting levers 9 are disposed on the door hangers 4 and the door main bodies 3.

**[0014]** A vertically-movable movable covering body 14 is disposed on a lower end portion of each of the door main bodies 3. The movable covering bodies 14 cover gaps between the lower end portions of the door main bodies 3 and an upper surface of the landing doorsill 7 by coming into contact with the landing doorsill 7 when in a door closed state. The movable covering bodies 14 are placed separably in contact with the landing doorsill 7 on a landing side of the doorsill groove 7a.

**[0015]** In addition, the movable covering bodies 14 have: a covering body base 15; and a covering member 16 secured to a lower end portion of the covering body base 15, and placed separably in contact with the landing doorsill 7. An engaging portion 15a is disposed on an upper end portion of the covering body base 15. The covering member 16 extends over an entire width direction of a door main body 3. The covering member 16 is

constituted by a highly-airtight material for such as rubber, etc., for example.

**[0016]** A pair of hook guides 17 extending in a vertical direction are mounted parallel to each other below the pivoting lever 9 on the back surface of each of the door main bodies 3. Hooks 18 for engaging with the engaging portions 15a are disposed between the hook guides 17. A hook roller 19 rolling along a hook guide 17 is disposed at each of first and second end portions of the hook 18. The hooks 18 are vertically movable so as to be guided by the hook guides 17.

**[0017]** Short ropes 21 are connected between the second connecting portions 9b of the pivoting levers 9 and the hooks 18. A rotatable direction-changing roller 22 onto which the short rope 21 is wound is disposed above the pivoting lever 9 on the back surface of each of the door main bodies 3. The direction-changing roller 22 inverts the direction of the short rope 21. A plurality of rotatable short rope guide rollers 23a and 23b for directing the short ropes 21 from the direction-changing rollers 22 to the hooks 18 are disposed on the back surfaces of the door main bodies 3.

**[0018]** Weights 10 functioning as a forcing means for forcing the pivoting levers 9 in such a direction that the movable covering bodies 14 come into contact with the landing doorsill 7 are mounted to end portions of the pivoting levers 9 near the first connecting portions 9a. The connecting ropes 11 and the connecting rope guide rollers 13a to 13c are disposed such that the door main bodies 3 are forced in a door closing direction by the weights 10.

**[0019]** Next, operation will be explained. In the door closed state, the pivoting levers 9 are held in the state in Figure 1, and tension is applied to the connecting ropes 11 by gravity acting on the weights 10. The covering members 16 are in contact with the upper surface of the landing doorsill 7, and gaps between the lower end portions of the door main bodies 3 and the upper surface of the landing doorsill 7 are covered by the movable covering bodies 14. Thus, smoke generated by fire is prevented from entering the hoistway through the gaps between the lower end portions of the door main bodies 3 and the upper surface of the landing doorsill 7.

**[0020]** When a door opening operation is started, the door main bodies 3 are moved in a door opening direction against the force from the weights 10 on the door main bodies 3. Thus, the pivoting levers 9 are pivoted in such a direction that the first connecting portion 9a and the weights 10 are displaced upward. The movable covering bodies 14 are raised and separated from the landing doorsill 7 by the pivoting of the pivoting levers 9. During a door closing operation, the movable covering bodies 14 gradually descend, and the covering members 16 come into contact with the landing doorsill 7 at the time of completion of the door closing operation. Consequently, the movable covering bodies 14 do not slide on the landing doorsill 7 during the opening and closing operations, preventing abrasion of the covering members 16

and the occurrence of noise.

**[0021]** In a landing door apparatus of this kind, because the movable covering bodies 14 are made to be placed in contact with the landing doorsill 7 in a door closed state, and the movable covering bodies 14 do not come into contact with the landing doorsill 7 during opening and closing operations, gaps at lower end portions of the door main bodies 3 can be covered in the door closed state while maintaining opening and closing operation performance of the door main bodies 3. Thus, smoke insulation and sound insulation can be improved.

**[0022]** Because the connecting ropes 11 are connected between the pivoting levers 9 and the door apparatus housing 1 to pivot the pivoting levers 9 together with the opening and closing of the door main bodies 3, and the movable covering bodies 14 are made to be placed in contact with and separated from the landing doorsill 7 by this pivoting of the pivoting levers 9, the construction can be simplified, and mounting and adjustment can be facilitated.

**[0023]** In addition, because the movable covering bodies 14 are placed separably in contact with the landing doorsill 7 on a landing side of a doorsill groove 7a, smoke can be prevented from penetrating inside a panel of the door main bodies 3, and smoke can also be prevented from passing through the panel, and penetrating into the hoistway. Furthermore, damage to the covering members 16 can be checked easily from the landing side, also enabling workability during maintenance to be improved.

**[0024]** Still furthermore, because the connecting rope guide rollers 13a to 13c for directing the connecting ropes 11 toward the pivoting levers 9 are disposed on the door hangers 4 and the door main bodies 3, the connecting ropes 11 can easily be prevented from interfering with the other machinery.

**[0025]** Furthermore, because the distance from the pivoting shaft 8 to the first connecting portion 9a is greater than the distance from the pivoting shaft 8 to the second connecting portion 9b, the stroke of the movable covering bodies 14 can be made smaller than the opening and closing stroke of the door main bodies 3, enabling space occupied by the movable covering bodies 14 to be reduced.

**[0026]** In addition, because the connecting ropes 11 are disposed such that the door main bodies 3 are forced in a door closing direction by the weights 10, it is no longer necessary for a means for forcing the door main bodies 3 in the door closing direction to be disposed separately, enabling the construction to be simplified.

**[0027]** Still furthermore, because the weights 10 are used for the forcing means, the construction is simple, and a stable force can be generated irrespective of the position of the door main bodies 3.

#### Embodiment 2

**[0028]** Next, Figure 7 is a rear elevation showing a door open state of an elevator landing door apparatus accord-

ing to Embodiment 2 of the present invention.

**[0029]** In the figure, a pivoting lever 31 functioning as a pivoting member that is pivotable around a pivoting shaft 30 is mounted to a back surface of each of door main bodies 3. The pivoting levers 31 are pivoted together with opening and closing operations of the door main bodies 3. The pivoting levers 31 have first and second connecting portions 31a and 31b. The first and second connecting portions 31a and 31b are disposed on the same side of a pivoting shaft 30 as each other. A distance from the pivoting shaft 30 to the first connecting portion 31a is greater than a distance from the pivoting shaft 30 to the second connecting portion 31b.

**[0030]** A connecting rope 11 is connected between the first connecting portion 31a and a central portion of a door apparatus housing 1 in a direction of frontage. Short ropes 21 are connected between the second connecting portions 31b and the hooks 18. A plurality of rotatable short rope guide rollers 32a and 32b for directing the short ropes 21 from the second connecting portions 31b to the hooks 18 are disposed on the back surfaces of the door main bodies 3.

**[0031]** Weights 10 functioning as a forcing means for forcing the pivoting levers 9 in such a direction that the movable covering bodies 14 come into contact with the landing doorsill 7 are mounted to end portions of the pivoting levers 31 near the first connecting portions 31a. The connecting ropes 11 are disposed such that the door main bodies 3 are forced in a door closing direction by the weights 10. The rest of the construction is similar to that of Embodiment 1.

**[0032]** If the first and second connecting portions 31a, 31b are disposed on the same side of the pivoting shaft 30 in this manner, similar effects to those in Embodiment 1 can also be achieved.

**[0033]** Moreover, in Embodiments 1 and 2, weights 10 are used for the forcing means, but the forcing means is not limited to weights, and a torsion spring, etc., can also be used, for example.

**[0034]** A spring for pressing a movable covering body against a doorsill may also be disposed between a door main body and a movable covering body as a forcing means.

**[0035]** In addition, weights may also be mounted to a movable covering body.

**[0036]** Still furthermore, use may also be made of the deadweight of a movable covering body to make the movable covering body function as a weight.

#### Embodiment 3

**[0037]** Next, Figure 8 is a rear elevation showing a door closed state of an elevator landing door apparatus according to Embodiment 3 of the present invention, and Figure 9 is a rear elevation showing a door open state of the landing door apparatus in Figure 8.

**[0038]** In Embodiment 1, connecting ropes 11 were connected to a central portion in a direction of frontage

of the door apparatus housing 1, but in Embodiment 3, connecting ropes 11 are connected to end portions in the direction of frontage of the door apparatus housing 1. For this reason, door main bodies 3 are forced in a door opening direction due to gravity acting on weights 10. However, since the door main bodies 3 are locked in a door closed position in a door closed state, the door main bodies 3 will not perform a door opening operation automatically unless the lock is released.

**[0039]** In Embodiment 1, since directions of operation of the second connecting portions 9b and directions of operation of the movable covering bodies 14 were in opposite directions, direction-changing rollers 22 were used, but In Embodiment 3, since the directions of operation of the second connecting portions 9b and the movable covering bodies 14 are the same, direction-changing rollers are unnecessary. The rest of the construction is similar to that of Embodiment 1.

**[0040]** In a construction of this kind, because the movable covering bodies 14 are placed in contact with the landing doorsill 7 in a door closed state, and the movable covering bodies 14 do not come into contact with the landing doorsill 7 during opening and closing operations, gaps at lower end portions of the door main bodies 3 can also be covered in the door closed state while maintaining opening and closing operation performance of the door main bodies 3. Thus, smoke insulation and sound insulation can be improved.

**[0041]** Because the connecting ropes 11 are connected between the pivoting levers 9 and the door apparatus housing 1 to pivot the pivoting levers 9 together with the opening and closing of the door main bodies 3, and the movable covering bodies 14 are made to be placed in contact with and separated from the landing doorsill 7 by this pivoting of the pivoting levers 9, the construction can be simplified, and mounting and adjustment can be facilitated.

**[0042]** Moreover, in Embodiments 1 to 3, a pivoting lever and a movable covering body were connected by a short rope, but it is also possible to make the connection by a link member, for example.

**[0043]** In Embodiments 1 to 3, landing door apparatuses were explained, but the present invention can also be applied to car door apparatuses, enabling sound insulation and smoke insulation to be improved. In that case, it is preferable for a movable covering body to come into contact with a floor portion on a cab interior portion side of a doorsill groove of the car.

**[0044]** In addition, the present invention can be applied to centrally-opening door apparatuses and to side-opening door apparatuses, and can also be applied to single panel door apparatuses and door apparatus having a plurality of panels.

## Claims

1. An elevator door apparatus comprising:

a door main body for opening and closing an entrance;  
a pivoting member mounted to the door main body, pivoting around a pivoting shaft together with opening and closing operations of the door main body;  
a connecting rope connected between the pivoting member and a fixed portion that is fixed relative to the entrance; and  
a movable covering body disposed so as to be vertically movable on a lower end portion of the door main body, and connected to the pivoting member, for covering a gap between the lower end portion of the door main body and a floor portion of the entrance by coming into contact with the floor portion, wherein the pivoting member is pivoted such that the movable covering body is placed in contact with the floor portion in a door closed state, and the movable covering body separates from the floor portion during a door opening operation.

2. The elevator door apparatus according to Claim 1, wherein:

the entrance is a landing entrance;  
door feet are disposed on a lower end portion of the door main body; and  
the movable covering body is placed separably in contact with a floor portion on a landing side of a doorsill groove into which the door feet are inserted.

3. The elevator door apparatus according to Claim 1, wherein:

the entrance is a car entrance;  
door feet are disposed on a lower end portion of the door main body; and  
the movable covering body is placed separably in contact with a floor portion on a cab interior portion side of a doorsill groove into which the door feet are inserted.

4. The elevator door apparatus according to Claim 1, wherein rotatable connecting rope guide rollers for directing the connecting rope toward the pivoting member are disposed on the door main body.

5. The elevator door apparatus according to Claim 1, wherein the pivoting member has a first connecting portion to which the connecting rope is connected, and a second connecting portion connected to the movable covering body, a distance from the pivoting shaft to the first connecting portion being greater than a distance from the pivoting shaft to the second connecting portion.

6. The elevator door apparatus according to Claim 1, further comprising a forcing means for forcing the pivoting member in such a direction that the movable covering body comes into contact with the floor portion. 5
7. The elevator door apparatus according to Claim 6, wherein the connecting rope is disposed such that the door main body is forced in a door closing direction by the forcing means. 10
8. The elevator door apparatus according to Claim 6, wherein the forcing means is a weight mounted to the pivoting member. 15
9. The elevator door apparatus according to Claim 1, wherein the fixed portion is a door apparatus housing fixed above the entrance, to which a door rail for guiding opening and closing of the door main body is mounted. 20

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FIG. 1

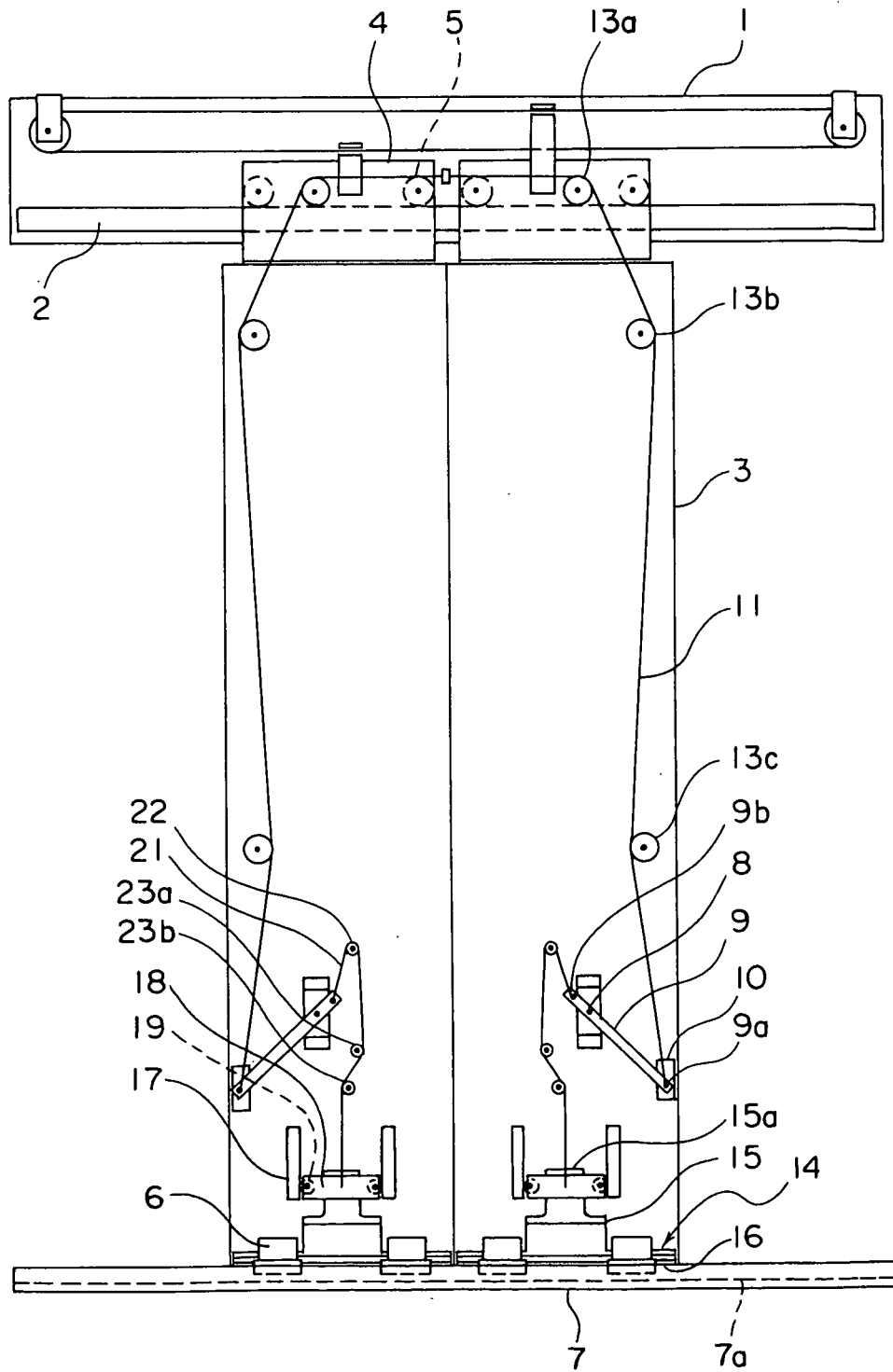


FIG. 2

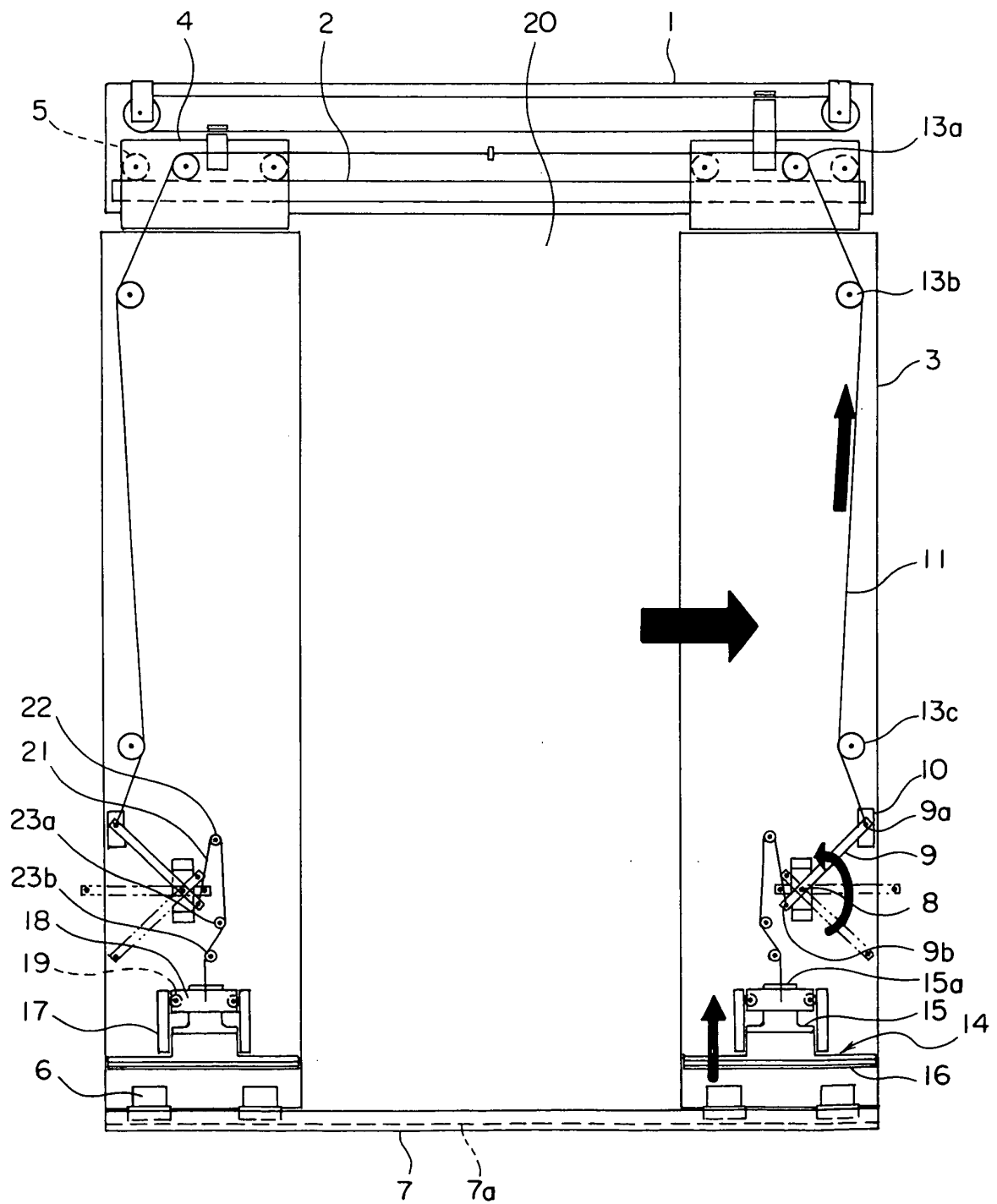




FIG. 3

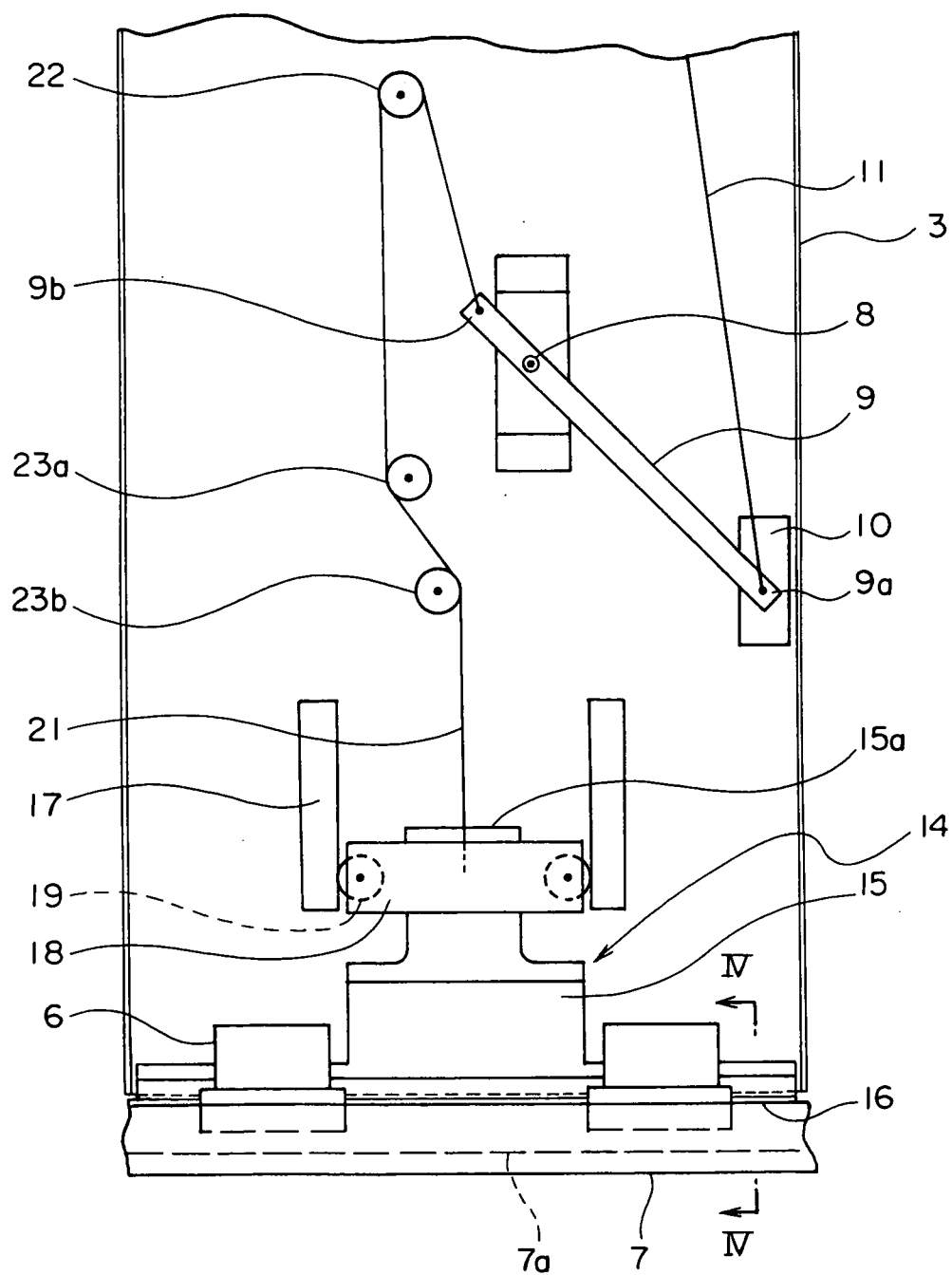


FIG. 4

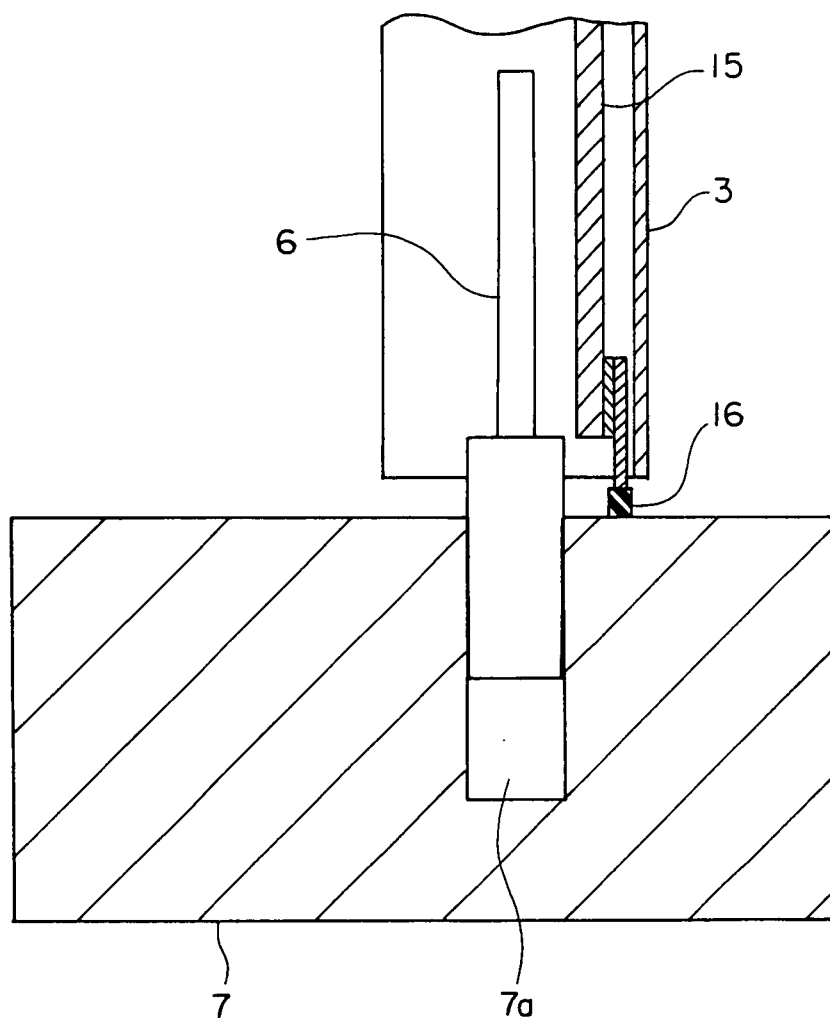


FIG. 5

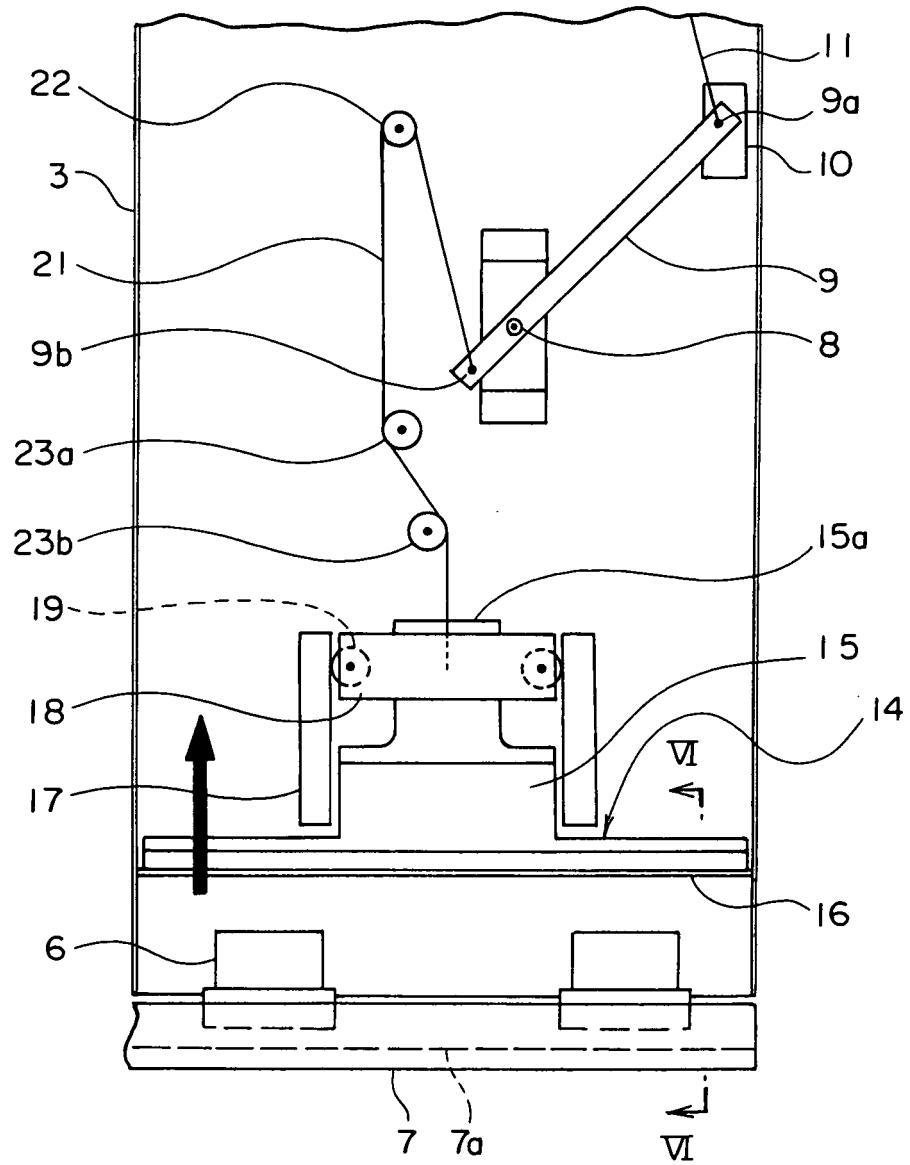


FIG. 6

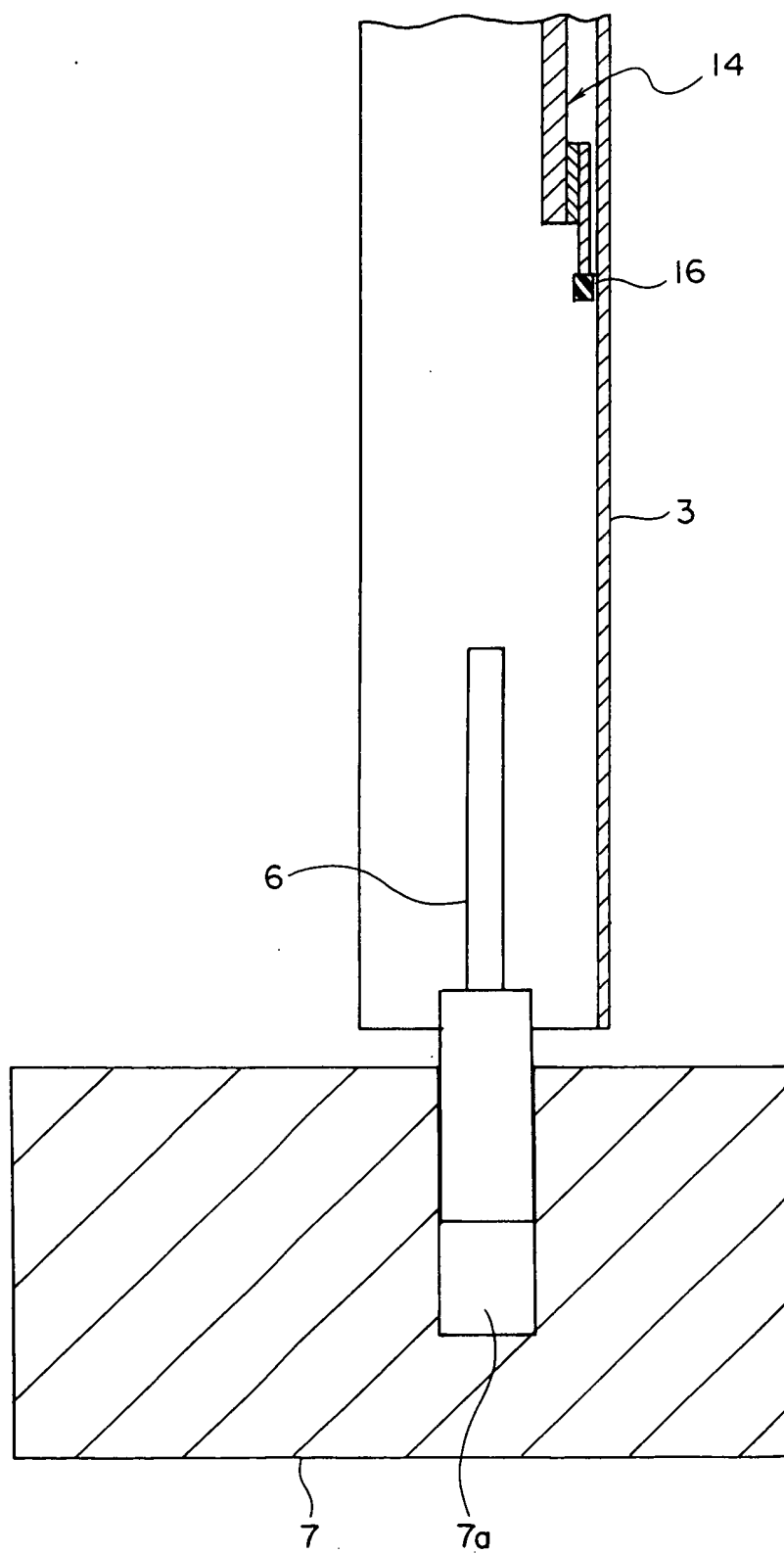


FIG. 7

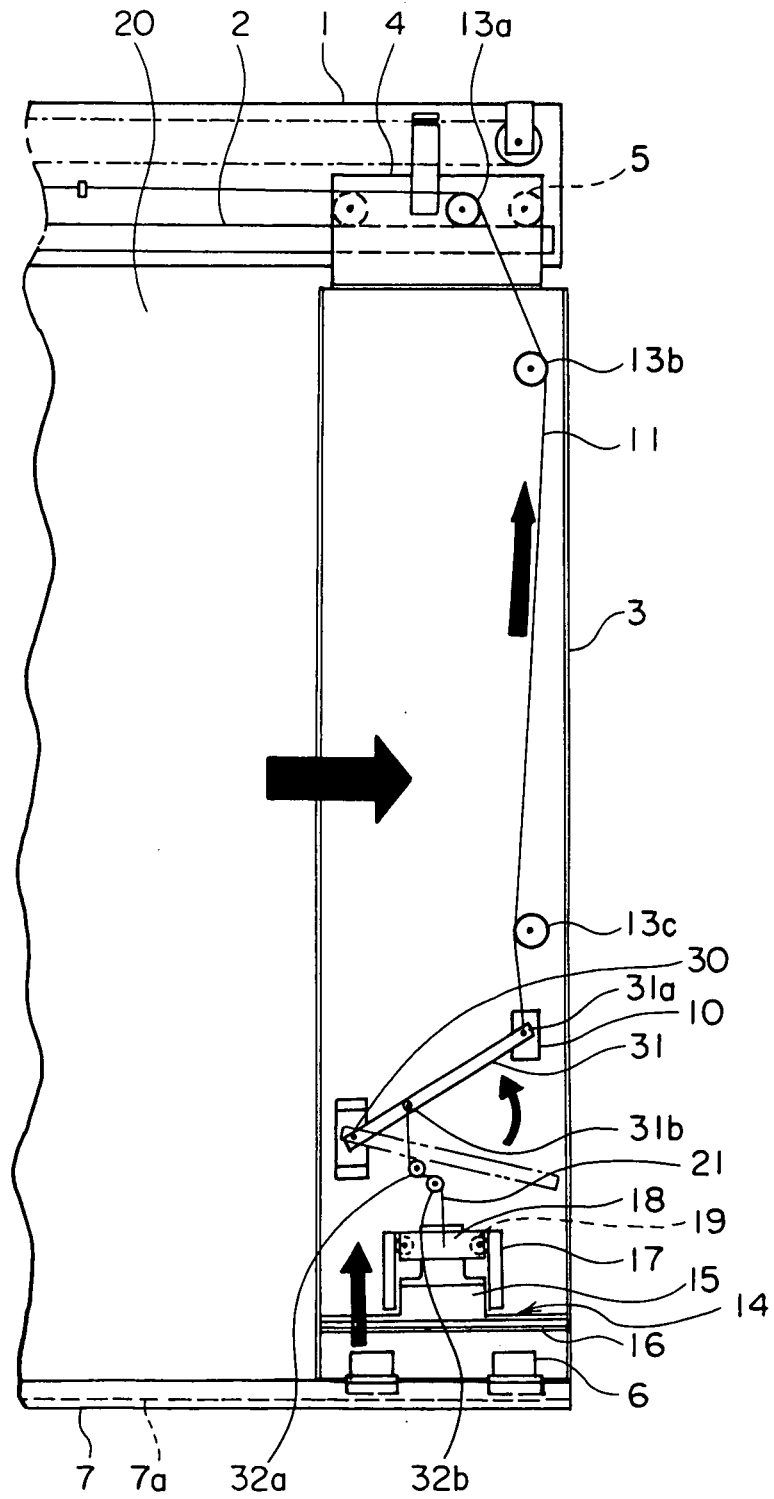


FIG. 8

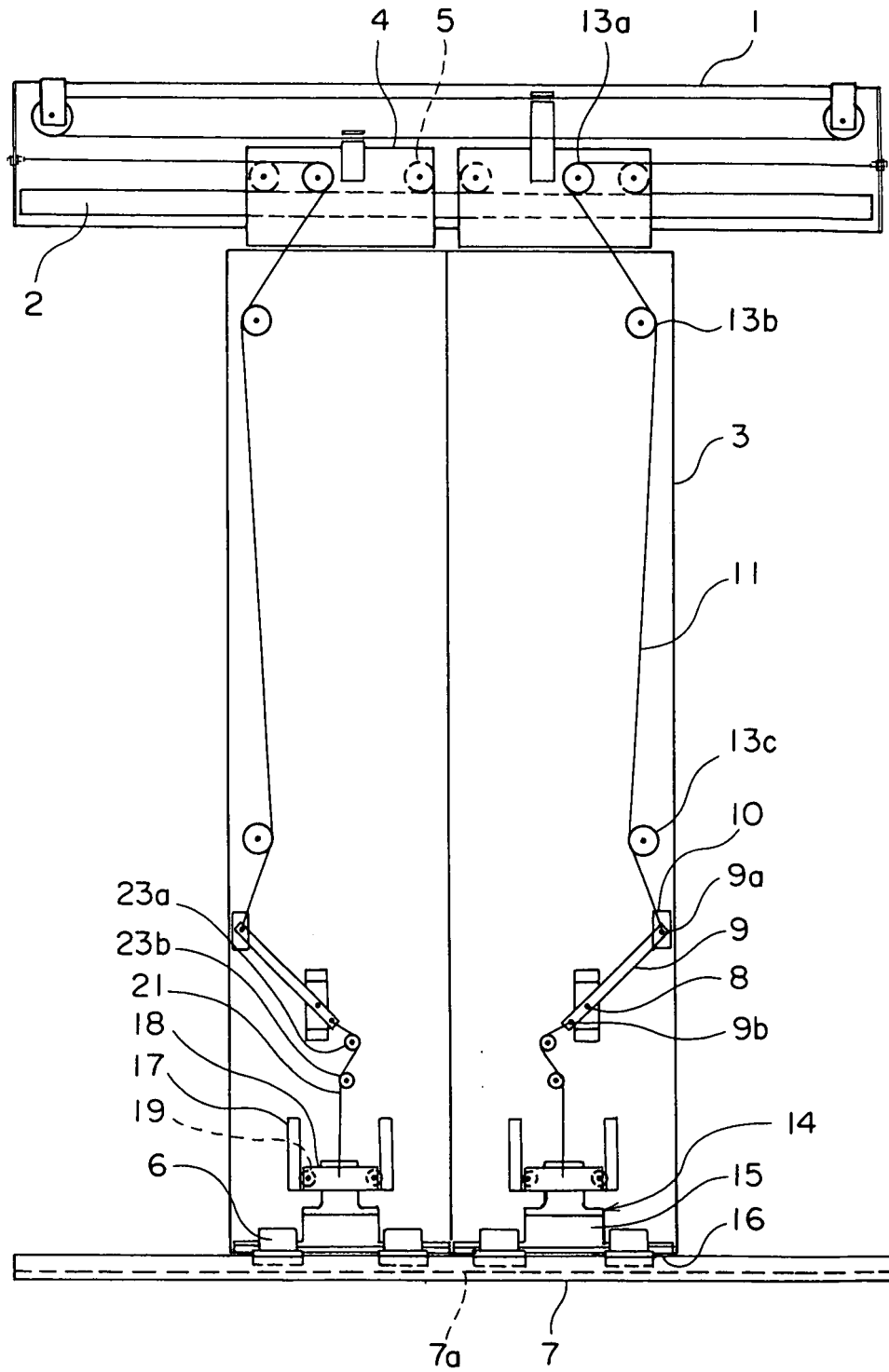
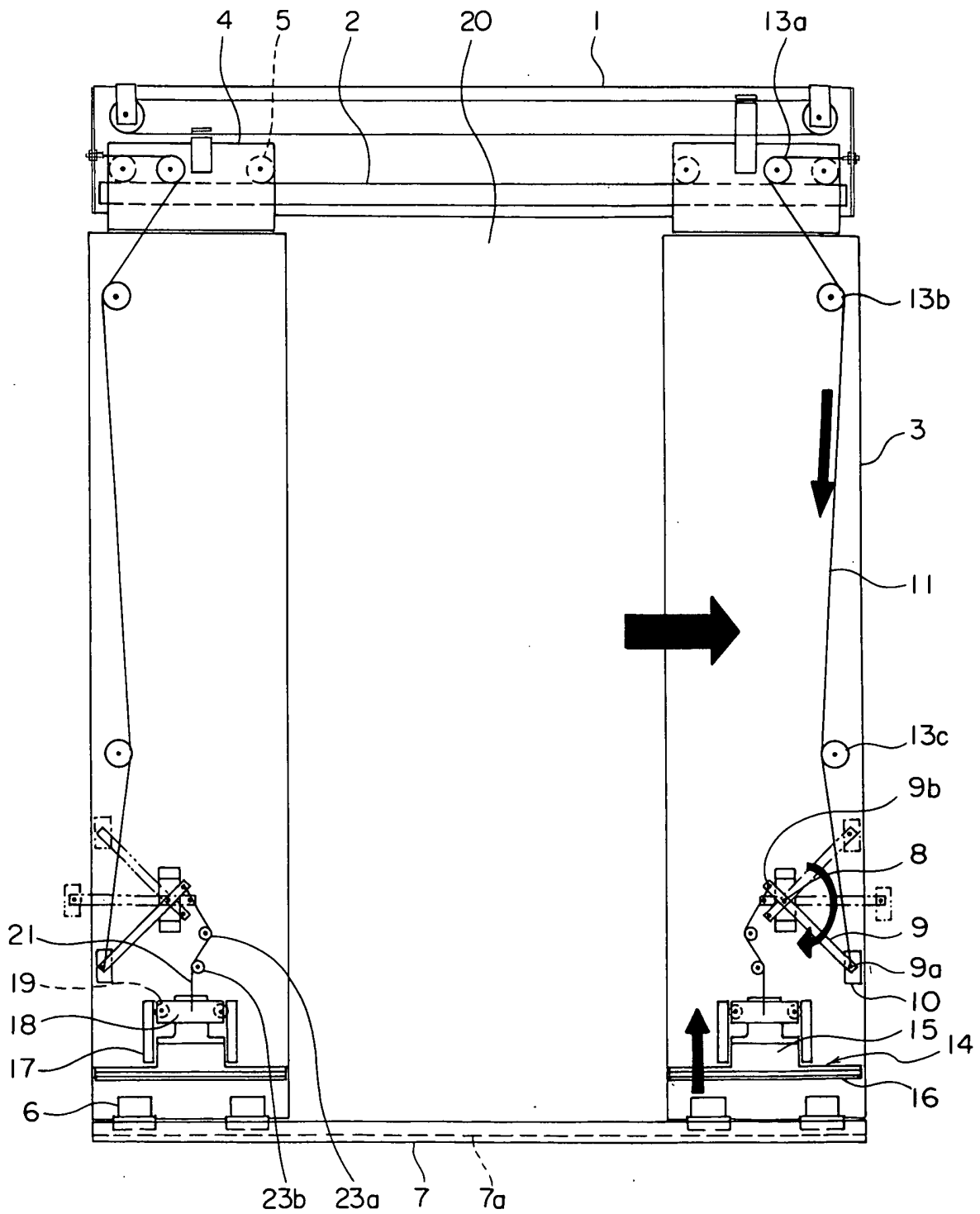


FIG. 9



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/06762

<b>A. CLASSIFICATION OF SUBJECT MATTER</b> Int.Cl. <sup>7</sup> B66B13/30  According to International Patent Classification (IPC) or to both national classification and IPC		
<b>B. FIELDS SEARCHED</b> Minimum documentation searched (classification system followed by classification symbols) Int.Cl. <sup>7</sup> B66B13/30  Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2004 Kokai Jitsuyo Shinan Koho 1971-2004 Toroku Jitsuyo Shinan Koho 1994-2004  Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
<b>C. DOCUMENTS CONSIDERED TO BE RELEVANT</b>		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 3032400 U (Fujitec Co., Ltd.), 17 December, 1996 (17.12.96), Par. Nos. [0010] to [0014]; Figs. 1 to 2 (Family: none)	1-6, 8-9 7
Y A	JP 51-36344 Y1 (Tokyo Kagu Kogyo Kabushiki Kaisha), 07 September, 1976 (07.09.76), Page 1, column 2, line 22 to page 2, column 3, line 2; page 2, column 4, lines 1 to 3; Figs. 1 to 5 & JP 48-91734 U	1-6, 8-9 7
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search 25 February, 2004 (25.02.04)		Date of mailing of the international search report 09 March, 2004 (09.03.04)
Name and mailing address of the ISA/ Japanese Patent Office  Facsimile No.		Authorized officer  Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/06762

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 63-60886 A (Toshiba Corp.), 16 March, 1988 (16.03.88), Page 4, column 11, line 16 to column 13, line 13; Figs. 1 to 2 (Family: none)	6, 8
A	JP 7-106862 B2 (Mitsubishi Electric Corp.), 15 November, 1995 (15.11.95), Pay attention to closer 17 & JP 1-303286 A	7

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