



(11) **EP 2 055 662 A1**

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

(43) Date of publication:  
**06.05.2009 Bulletin 2009/19**

(51) Int Cl.:  
**B66B 7/02 (2006.01)**

(21) Application number: **06782900.2**

(86) International application number:  
**PCT/JP2006/316396**

(22) Date of filing: **22.08.2006**

(87) International publication number:  
**WO 2008/023407 (28.02.2008 Gazette 2008/09)**

(84) Designated Contracting States:  
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR**  
Designated Extension States:  
**AL BA HR MK RS**

(72) Inventor: **HONDA, Takenobu**  
**Tokyo 100-8310 (JP)**

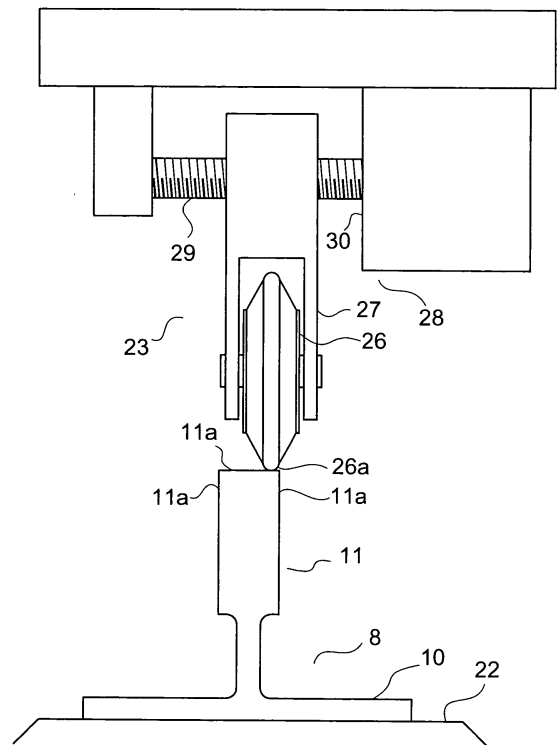
(74) Representative: **HOFFMANN EITL**  
**Patent- und Rechtsanwälte**  
**Arabellastrasse 4**  
**81925 München (DE)**

(71) Applicant: **Mitsubishi Electric Corporation**  
**Chiyoda-ku**  
**Tokyo 100-8310 (JP)**

(54) **GUIDE RAIL FOR ELEVATOR, AND RAIL SURFACE PROCESSING DEVICE FOR ELEVATOR**

(57) A contact member facing in opposition to guide rails is provided on a vertical moving member which is driven to move up and down in a hoistway. The guide rails each have a rail support member, and a guide portion that is fixedly secured to the rail support member for guiding the vertical moving member while being in contact with the contact member. A minute concave portion and a minute convex portion are formed on a contact surface of the guide portion facing the contact member. The convex portion is provided with a pressed surface which is made smooth by placing a pressing member into pressed abutment with the contact surface thereby to plastically deform a material of the guide portion. As a result, it is possible to prevent trouble such as for example wear of the contact member, etc.

**FIG. 3**



**EP 2 055 662 A1**

**Description**

[TECHNICAL FIELD]

**[0001]** The present invention relates to a guide rail for an elevator that guides a vertical moving member of the elevator, and to a rail surface processing apparatus for an elevator that processes a surface of the guide rail.

[BACKGROUND ART]

**[0002]** In a conventional elevator, rust preventive oil is sometimes coated on surfaces of guide rails installed in a hoistway. In the past, there has been proposed a rust preventive oil removal apparatus that causes a rust preventive oil removal member, which is lower in hardness than guide rails, to move along each guide rail while making the rust preventive oil removal member into sliding contact therewith so as to remove the rust preventive oil from the surfaces of the guide rails. The surfaces of the guide rails are formed by cutting processing such as, for example, planing, milling, or the like (see a first patent document).

**[0003]**

[First Patent Document] Japanese Patent No. 3243104

[DISCLOSURE OF THE INVENTION]

[PROBLEMS TO BE SOLVED BY THE INVENTION]

**[0004]** The surface processing of the guide rails is carried out by cutting processing such as, for example, planing, milling, or the like, so in the case of planing processing, a tool receives a load only in a specific direction, whereby a plurality of minute and sharp convex portions like the scales of a fish are formed on the surfaces of the guide rails, whereas in the case of milling processing, too, cutting is carried out by a rotating tool, whereby a plurality of minute and sharp convex portions due to processing marks of the tool are formed on the surfaces of the guide rails.

**[0005]** Accordingly, when slide members attached to a car are caused to move while being placed in sliding contact with guide rails, for example, the slide members become liable to be worn, or the sliding resistance and sliding sound between the slide members and the guide rails are increased, by sharp convex portions formed on the surfaces of the guide rails. In addition, the vibration of the car is also increased by the sliding resistance between the slide members and the guide rails.

**[0006]** In addition, although it is possible to polish the surfaces of the guide rails to provide mirror finished surfaces, not only the production cost is increased by the time and effort required for the polishing processing, but also a squeaking sound might be generated between the guide rails and the slide members due to the mirror finishing

of the surfaces of the guide rails.

**[0007]** The present invention is intended to obviate the problem as referred to above, and has for its object to obtain a guide rail for an elevator and a rail surface processing apparatus for an elevator in which the occurrence of trouble due to the surface configuration of the guide rail can be prevented, and in which the guide rail can be produced with ease.

10 [MEANS FOR SOLVING THE PROBLEMS]

**[0008]** A guide rail for an elevator according to the present invention includes a guide portion that guides a vertical moving member while being in contact with a contact member mounted on the vertical moving member, wherein a minute concave portion and a minute convex portion are formed on a contact surface of the guide portion facing the contact member, and the convex portion is provided with a pressed surface which is made smooth by placing a pressing member into pressed abutment with the contact surface thereby to plastically deform a material of the guide portion.

**[0009]** A rail surface processing apparatus for an elevator according to the present invention serves to process a surface of a guide rail having a guide portion which guides a vertical moving member while being in contact with a contact member provided on the vertical moving member, and the apparatus includes a surface finishing member that includes a pressing member having a smooth abutment surface formed thereon, and a pressing device for placing the abutment surface into pressed contact with a contact surface of the guide portion facing the contact member, wherein a part of a material of a sharp pointed portion formed on the contact surface is plastically deformed into a shape conforming to the abutment surface by pressing the abutment surface against the contact surface by means of the pressing device, whereby the pointed portion is formed into a minute convex portion with a smooth pressed surface formed thereon.

[BRIEF DESCRIPTION OF THE DRAWINGS]

**[0010]**

Fig. 1 is a construction view showing an elevator according to a first embodiment of the present invention.

Fig. 2 is a side elevational view showing a rail surface processing apparatus when surface finishing processing of a car guide rail of Fig. 1 is performed. Fig. 3 is a cross sectional view along line III - III in Fig. 2.

Fig. 4 is an enlarged view showing the configuration of a contact surface after a finishing roller of Fig. 3 is pressed or pushed against it.

Fig. 5 is an essential part cross sectional view showing a rail surface processing apparatus for an elevator.

tor according to a second embodiment of the present invention.

Fig. 6 is an essential part cross sectional view showing a rail surface processing apparatus for an elevator according to a third embodiment of the present invention.

Fig. 7 is a side elevational view showing a rail surface processing apparatus for an elevator according to a fourth embodiment of the present invention.

Fig. 8 is a cross sectional view along line VIII - VIII in Fig. 7.

#### [BEST MODE FOR CARRYING OUT THE INVENTION]

**[0011]** Hereinafter, preferred embodiments of the present invention will be described while referring to the accompanying drawings.

#### Embodiment 1.

**[0012]** Fig. 1 is a construction view that shows an elevator according to a first embodiment of the present invention. In this figure, a car (vertical moving member) 2 and a counterweight (vertical moving member) 3 are arranged in a hoistway 1 so as to be movable up and down. In addition, a winch (drive unit) 5 having a drive sheave 4, and a deflection wheel 6 are arranged at an upper portion of the hoistway 1. The drive sheave 4 is driven to rotate by the driving force of the winch 5.

**[0013]** A main rope 7, which serves to hang the car 2 and the counterweight 3, is wrapped around the drive sheave 4 and the deflection wheel 6. The car 2 and the counterweight 3 are driven to move up and down in the hoistway 1 by the rotation of the drive sheave 4.

**[0014]** In the hoistway 1, there are arranged a pair of car guide rails 8 for guiding the car 2, and a pair of counterweight guide rails 9 for guiding the counterweight 3. The car 2 is disposed between the individual car guide rails 8, and the counterweight 3 is disposed between the individual counterweight guide rails 9. In addition, slide members (contact members), being in contact with the individual car guide rails 8, are attached to the car 2, and slide members (contact members), being in contact with the individual counterweight guide rails 9, are attached to the counterweight 3 (neither of the slide members is shown in the drawings).

**[0015]** Each of the car guide rails 8 has a plate-shaped rail support member 10 that is disposed along the vertical direction, and a guide portion 11 that is fixedly secured to the rail support member 10 for guiding the car 2 while being in contact with a slide member of the car 2. Also, each of the counterweight guide rails 9 has a plate-shaped rail support member 12 that is disposed along the vertical direction, and a guide portion 13 that is fixedly secured to the rail support member 12 for guiding the counterweight 3 while being in contact with a slide member of the counterweight 3.

**[0016]** Each of the guide portions 11 protrudes in a

direction from each of the rail support members 10 toward the car 2. Also, each of the guide portions 13 protrudes in a direction from each of the rail support members 12 toward the counterweight 3. The cross sectional shapes in the horizontal direction of the individual car guide rails 8 and the individual counterweight guide rails 9 are T-shaped configurations comprising rail support portions 10, 12 and the guide portions 11, 13, respectively.

**[0017]** The individual car guide rails 8 and the individual counterweight guide rails 9 are formed by means of cutting processing such as planing, milling, etc. Also, the contact surfaces of the individual guide portions 11, 13 for the slide members are finished surfaces which are formed by surface finishing processing by means of a rail surface processing apparatus.

**[0018]** Fig. 2 is a side elevational view that shows the rail surface processing apparatus when surface finishing processing of a car guide rail of Fig. 1 is performed. Fig. 3 is a cross sectional view along line III - III in Fig. 2. In these figures, a rail surface processing apparatus 21 includes a table 22 on which a work piece is put on, a surface finishing member 23 that is arranged at a location above the table 22 for processing a surface of the work piece, and a shifting device 24 that moves the surface finishing member 23 along the table 22. The table 22 is provided with a plurality of fixation hooks or claws for fixing the work piece to the table 22. Hereinafter, reference will be made to the case where a car guide rail 8 is taken as a work piece.

**[0019]** The car guide rail 8 is fixedly mounted on the table 22 along the direction of movement of the surface finishing member 23. The car guide rail 8 is arranged with its guide portion 11 being directed toward the surface finishing member 23 (upwardly).

**[0020]** The surface finishing member 23 includes a finishing roller (pressing member) 26 made of steel, a pressing device 27 that serves to press or push the guide portion 11 of the car guide rail 8 against the finishing roller 26, and a position adjustment device 28 that has the pressing device 27 mounted thereon, and serves to adjust the position of the finishing roller 26 in a direction perpendicular to the movement of the surface finishing member 23 and in a direction parallel to the table 22 (in a processing width direction). The surface finishing member 23 performs the surface finishing processing of the contact surface 11a by pressing or pushing the finishing roller 26 against the contact surface 11a of the guide portion 11.

**[0021]** The finishing roller 26 is formed on its outer periphery with a smooth abutment surface 26a that is adapted to be pressed or held against the contact surface 11a of the guide portion 11. The abutment surface 26a is arranged along a circumferential direction of the finishing roller 26. The width of the abutment surface 26a is made to be smaller than the width of the guide portion 11. In addition, in this example, the cross sectional shape of the abutment surface 26a in a plane perpendicular to the circumferential direction of the finishing roller 26 is made

to be semicircular. The finishing roller 26 is caused to roll along the guide portion 11 in accordance with the movement of the surface finishing member 23 due to the shifting device 24 while being pressed to the contact surface 11a of the guide portion 11. As the material of the finishing roller 26, there may be used any material that is not easily deformed due to the surface configuration of the guide rail 8. Steel and, in addition thereto, ceramics for instance may be used.

**[0022]** A adjustment spring (not shown) for adjusting the pressing force of the finishing roller 26 to the guide portion 11 is built into the pressing device 27.

**[0023]** The position adjustment device 28 includes a feed screw 29 that is disposed along the processing width direction, and a motor 30 that serves to turn the feed screw 29. The finishing roller 26 is caused to displace in the processing width direction with respect to the table 22 by the feed screw 29 being driven to turn by the motor 30.

**[0024]** Fig. 4 is an enlarged cross sectional view that shows the cross sectional configuration of the contact surface 11a after the finishing roller 26 of Fig. 3 is pressed against it. Here, in Fig. 4, the cross sectional shape of the contact surface 11a before the finishing roller 26 is pressed against it is shown by a broken line. In this figure, on the contact surface 11a before the finishing roller 26 is pressed against it, there are formed a plurality of sharp pointed portions 31 by means of cutting processing.

**[0025]** In contrast to this, on the contact surface 11a or the finished surface against which the finishing roller 26 is pressed, there are formed a plurality of convex portions 32 with a part (top) of each their pointed portion 31 being pressed or crushed into a shape conforming to the abutment surface 26a, and a plurality of concave portions 33 arranged in between adjacent ones of the individual convex portions 32. That is, on the individual convex portions 32, there are formed rolled or pressed faces 34, respectively, which are smoothed due to the plastic deformation of the material of the sharp portions (parts) of the pointed portions 31 by bringing the abutment surface 26a of the finishing roller 26 into pressed abutment with the contact surface 11a.

**[0026]** The pressing force of the finishing roller 26 to the guide portion 11 is adjusted by the adjustment of the adjustment spring of the pressing device 27 to such a force that can plastically deform only a part of each pointed portion 31. As a result, the individual pointed portions 31 are plastically deformed to form individual convex portions 32, and spaces between adjacent ones of the individual convex portions 32 can be left as concave portions.

**[0027]** The slide members are in contact with the rolled or pressed surfaces 34 of the individual convex portions 32 during the operation of the elevator. In addition, lubricating oil for enabling the slide members to move smoothly with respect to the guide portion 11 is held in the individual concave portions 33.

**[0028]** In this example, the material of the car guide rail 8 is made to be SS400 (steel having a tensile strength

of 400 N/mm<sup>2</sup>). Also, in this example, the surface roughness of the car guide rail 8 before surface finishing processing is performed by the rail surface processing apparatus 21 is made to be 20 - 30  $\mu$  m by means of planing processing. Further, in this example, it is set such that the outside diameter of the finishing roller 26 is 25 mm, the radius of the cross section of the abutment surface 26a is 4 mm, the pressing force of the pressing device 27 is about 50 kg, and the moving speed of the surface finishing member 23 is 100 m/min. As a result of the surface finishing processing of the guide portion 11 having been actually performed by the rail surface processing apparatus 21 under such a condition, it was verified that the surface roughness of the guide portion 11 can be reduced by half, and the ratio of the surface areas of the convex portion 32 and the concave portion 33 can be made substantially equal to each other.

**[0029]** With respect to the guide portion 13 of each counterweight guide rail 9, the surface finishing processing thereof is performed by the rail surface processing apparatus 21, as in the guide portion 11 of each car guide rail 8.

**[0030]** Now, reference will be made to a procedure when the surface finishing processing of each car guide rail 8 is performed. First of all, a car guide rail 8 formed by cutting processing such as planing, etc., is fixed mounted on the table 22, and the abutment surface 26a of the finishing roller 26 is pressed to the guide portion 11. After this, the surface finishing member 23 is driven to move by means of the shifting device 24, whereby the finishing roller 26 is caused to roll along the guide portion 11 up to an end of the car guide rail 8 while the finishing roller 26 being pressed against the guide portion 11. At this time, a part of the material of each pointed portion 31 formed on the contact surface 11a is plastically deformed to serve as a smooth rolled or pressed surface 34. As a result, each pointed portion 31 is formed into a convex portion 32.

**[0031]** After this, by turning the feed screw 29, the position of the finishing roller 26 is moved in the processing width direction, and the surface finishing member 23 is again driven to move, whereby the finishing roller 26 is caused to roll while being pressed against the guide portion 11.

**[0032]** The above-mentioned procedure is repeatedly carried out so that the finishing roller 26 is caused to roll over the entire contact surface 11a of the guide portion 11 while being pressed against it. As a result, a part of every pointed portion 31 formed on the contact surface 11a is plastically deformed to form a convex portion 32 that is provided with a rolled or pressed surface 34. In this manner, the surface finishing processing of the guide portion 11 is carried out. Here, note that with respect to each counterweight guide rail 9, the surface finishing processing thereof is carried out, as in each car guide rail 8.

**[0033]** In such a car guide rail 8, the minute concave portions 33 and the minute convex portions 32 are formed

on the contact surface 11a of the guide portion 11, and the pressed surfaces 34, which are smoothed due to the plastic deformation of the material of the guide portion 11 by pressing the finishing roller 26 against it, are formed on the convex portions 32. Accordingly, it is possible to suppress the wear of the slide members due to the convex portions 32. In addition, it is also possible to prevent increases in the sliding resistance and sliding sound between the slide members and the guide portion 11 as well as an increase in the vibration of the car 2. Further, it is possible to make smaller the contact areas between the slide members and the guide portion 11 as compared with the case where the contact surface 26a is a mirror finished surface, so it is also possible to prevent the generation of a squeaking sound between the slide members and the guide portion 11. That is, the occurrence of trouble resulting from the surface configuration of the guide portion 11 can be prevented. Furthermore, the lubricating oil can be held in the concave portions 33, so the slide members can be caused to slide smoothly with respect to the guide portion 11. Moreover, surface finishing processing on the guide portion 11 can be performed only by pressing the finishing roller 26 against the guide portion 11. Thus, the production of the car guide rails 8 can be facilitated. Here, note that similar advantageous effects can be achieved for the counterweight guide rails 9.

**[0034]** In addition, in such a rail surface processing apparatus 21 for an elevator, the surface of each guide portion 11 is processed by the surface finishing member 23 which includes the finishing roller 26 having the smooth abutment surface 26a formed thereon and the pressing device 27 for pressing the abutment surface 26a of the finishing roller 26 to the contact surface 11a of the guide portion 11. Accordingly, the smooth rolled or pressed surfaces 34 can be formed on the contact surface 11a only by pressing the finishing roller 26 against the guide portion 11, and hence surface finishing processing on the guide portion 11 can be carried out with ease. Here, note that the surface finishing processing on the guide portion 13 of each counterweight guide rail 9 can also be carried out with ease.

**[0035]** In addition, since the finishing roller 26 is pressed to the guide portions 11, 13, surface finishing processing can be performed while moving the finishing roller 26 in a rolling manner, so the surface finishing processing of the guide portions 11, 13 can be carried out in an efficient manner.

**[0036]** Each of the concave portions 33 may also be a groove that is disposed along the direction of movement of the slide members. In this case, the individual grooves are formed on the surfaces of the guide portions 11, 13, respectively, for example, by means of planing processing, etc., before the surface finishing processing thereon is performed. With this, the lubricating oil can be supplied to between the slide members and the guide portions 11, 13 in a reliable manner, so smooth movements of the slide members with respect to the guide portions 11, 13

can be achieved in a more reliable manner.

Embodiment 2.

**[0037]** Although in the above example, the width of the abutment surface 26a is made smaller than the width of each of the guide portions 11, 13, the individual widths of the abutment surface 26a and the guide portions 11, 13 may be made equal to one another.

**[0038]** Specifically, Fig. 5 is an essential part cross sectional view that shows a rail surface processing apparatus for an elevator according to a second embodiment of the present invention. In this figure, the width of an abutment surface 26a of a finishing roller 26 is made equal to the width of each of a guide portion 11. The abutment surface 26a is a flat surface that is arranged along a circumferential direction of the finishing roller 26. In this regard, note that the width of the abutment surface 26a of the finishing roller 26 is also made equal to the width of a guide portion 13 of a counterweight guide rail 9. The construction of this embodiment other than the above is similar to that of the first embodiment.

**[0039]** Thus, since the width of the abutment surface 26a of the finishing roller 26 is made equal to the width of each of the guide portions 11, 13, there becomes no need to cause the finishing roller 26 to roll over the guide portions 11, 13 in a repeated manner while displacing the finishing roller 26 in a processing width direction, and hence the surface finishing processing of the guide portions 11, 13 can be carried out with further ease.

Embodiment 3.

**[0040]** Fig. 6 is an essential part cross sectional view that shows a rail surface processing apparatus for an elevator according to a third embodiment of the present invention. In this figure, on an abutment surface 26a of a finishing roller 26, there are formed a plurality of protruding portions 41 that extend along a circumferential direction of the finishing roller 26. The individual protruding portions 41 are arranged at intervals in a thickness direction of the finishing roller 26. In addition, the individual protruding portions 41 protrude from an outer peripheral portion of the finishing roller 26 to a diametrically outer side of the finishing roller 26. The respective surfaces of the individual protruding portions 41 and the abutment surface 26a are made smooth. In this example, the cross-sectional shape of each of the protruding portions 41 in a plane perpendicular to the circumferential direction of the finishing roller 26 is made semicircular.

**[0041]** The pressing force of the finishing roller 26 to a guide portion 11 is adjusted by the adjustment of an adjustment spring of a pressing device 27 to such a force that can plastically deform the material of the guide portion 11 along the shape of the abutment surface 26a. Surface finishing processing is performed on a contact surface 11a of the guide portion 11 by pressing the abutment surface 26a against the contact surface 11a.

**[0042]** On the contact surface 11a of the guide portion 11 after the surface finishing processing is performed, there are formed a plurality of minute grooves (concave portions) 42 and convex portions 43, respectively, by pressing the finishing roller 26 against the guide portion 11 thereby to plastically deform the material of the guide portion 11. Accordingly, the individual grooves 42 are made to take their inner surface shapes conforming to the individual protruding portions 41, respectively, and the individual convex portions 43 are made to take surface shapes conforming to the portions of the abutment surface 26a between adjacent ones of the individual protruding portions 41. In addition, the inner surfaces of the individual grooves 42 and the surfaces of the individual convex portions 43 are made smooth. Here, note that the guide portion 13 of a counterweight guide rail 9 is subjected to the same surface finishing processing as that performed on the guide portion 11. The construction of this embodiment other than the above is similar to that of the second embodiment.

**[0043]** In such a car guide rail 8, the minute grooves 42 and convex portions 43 formed by pressing the finishing roller 26 against the guide portion 11 thereby to plastically deform the material of the guide portion 11 are provided on the contact surface 11a of the guide portion 11. As a result, the surfaces of the convex portions 43 are made smooth, and for example, the wear of the slide members and the like can be suppressed, thereby making it possible to prevent the occurrence of trouble resulting from the surface configuration of the guide portion 11. In addition, lubricating oil can be held in the grooves 42, so the slide members can be caused to slide smoothly with respect to the guide portion 11. Thus, the production of the car guide rail 8 can be facilitated. Here, note that similar advantageous effects can be achieved for the counterweight guide rail 9.

**[0044]** In addition, since the grooves 42 disposed along the direction of movement of the slide members are formed on the contact surface 11a of the guide portion 11, the lubricating oil can be supplied to between the slide members and the guide portion 11 in a further reliable manner, so smooth movements of the slide members with respect to the guide portion 11 can be achieved more reliably.

**[0045]** Moreover, in such a rail surface processing apparatus for an elevator, the surface of each guide portion 11 is processed by the surface finishing member 23 which includes the finishing roller 26 having the abutment surface 26a with the protruding portions 41 formed thereon, and the pressing device 27 for pressing the abutment surface 26a to the contact surface 11a of the guide portion 11. Accordingly, even in case where there is no groove formed on the contact surface 11 a before the surface finishing processing thereof, the material of the guide portion 11 can be plastically deformed by the protruding portions 41, so the grooves 42 and the convex portions 43 can be formed in a more reliable manner. In addition, the grooves 42 and the convex portions 43 can

be formed on the contact surface 11a only by pressing the finishing roller 26 against the guide portion 11, so the surface finishing processing on the guide portion 11 can be carried out with ease. Here, note that similar advantageous effects can be achieved for the surface finishing processing on the guide portion 13 of each counterweight guide rail 9.

Embodiment 4.

**[0046]** Fig. 7 is a side elevational view that shows a rail surface processing apparatus for an elevator according to a fourth embodiment of the present invention. In this figure, a rail surface processing apparatus 51 has a processing unit 52 installed on a car 2. The processing unit 52 is mounted on the car 2 in such a manner that it is arranged in opposition to car guide rails 8. In addition, the processing unit 52 is caused to move together with the car 2 while performing surface finishing processing on the car guide rails 8. The rail surface processing apparatus 51 performs surface finishing processing on the car guide rails 8 that have already been installed in a hoistway 1.

**[0047]** The car 2 has a car room 53 and a car frame 54 that encloses and supports the car room 53. The slide members 55 facing in opposition to the individual car guide rails 8, respectively, are arranged at an upper portion and at a lower portion, respectively, of the car frame 54. The processing unit 52 is mounted on the upper portion of the car frame 54.

**[0048]** Fig. 8 is a cross sectional view along line VIII - VIII in Fig. 7. In this figure, the processing unit 52 has a support frame 56 that is fixedly secured to the car frame 54, and a plurality of (three in this example) surface finishing members 57 that are mounted on the support frame 56 for performing the surface finishing processing on a guide portion 11 of each of the car guide rails 8.

**[0049]** The guide portion 11 is formed at its opposite sides and at its top with contact surfaces 11a, respectively, with which the slide members 55 are in contact. The support frame 56 surrounds the guide portion 11 in such a manner as to face in opposition to the individual contact surfaces 11a, respectively.

**[0050]** The individual surface finishing members 57 are arranged between the support frame 56 and the guide portion 11. With such an arrangement, the individual surface finishing members 57 are disposed in a manner as to surround the guide portion 11 in a horizontal direction. In addition, each of the surface finishing members 57 has a finishing roller (pressing member) 26 made of steel, a pressing device 27 for pressing the finishing roller 26 to the guide portion 11 of a car guide rail 8, and a position adjustment device 28 for adjusting the horizontal position of the finishing roller 26 with respect to the guide portion 11. The construction of each of the surface finishing members 57 is similar to the construction of the surface finishing member 23 of the first embodiment.

**[0051]** Feed screws 29 of the individual position ad-

justment devices 28 are disposed horizontally along the individual contact surfaces 11a, respectively. The individual finishing rollers 26 are caused to displace along the feed screws 29, respectively, by the feed screws 29 being driven to turn by the motors 30, respectively. As a result, the positions of the individual finishing rollers 26 with respect to the guide portion 11 can be adjusted.

**[0052]** The finishing rollers 26 of the individual surface finishing members 57 are individually pressed against the individual contact surfaces 11a, respectively, that are arranged at the respective opposite sides and the top of the guide portion 11. In addition, the individual finishing rollers 26 are caused to roll in the direction of movement of the car 2 while being pressed against (being in contact with) the individual contact surfaces 11a, respectively, in accordance with the movement of the car 2. That is, the individual surface finishing members 57 perform surface finishing processing on the individual contact surfaces 11a of the guide portion 11, respectively. The construction of this embodiment other than the above is similar to that of the first embodiment.

**[0053]** Now, reference will be made to a procedure when the surface finishing processing of each car guide rail 8 is performed. First of all, the processing unit 52 is mounted on the car 2. At this time, the individual finishing rollers 26 are pressed to the individual contact surfaces 11a of the guide portion 11. After this, the car 2 is driven to move from one of an upper end portion and a lower end portion of the hoistway 1 to the other thereof while causing the individual finishing rollers 26 to roll on the guide portion 11.

**[0054]** Thereafter, by turning the feed screws 29, the positions of the individual finishing rollers 26 are displaced in the horizontal direction, after which the car 2 is again driven to move from one of the upper end portion and the lower end portion of the hoistway 1 to the other thereof.

**[0055]** The above-mentioned procedure is repeatedly carried out so that the individual finishing rollers 26 are caused to roll over the entire contact surfaces 11a of the guide portion 11 while being pressed against them. In this manner, the surface finishing processing of the guide portion 11 is carried out.

**[0056]** Here, note that in case where the surface finishing processing of a guide portion 13 of a counterweight guide rail 9 is performed, the processing unit 52 is mounted on a counterweight 3, and the surface finishing processing of the guide portion 13 is carried out by moving the counterweight 3.

**[0057]** In such a rail surface processing apparatus 51 for an elevator, the individual surface finishing members 57 are mounted on the car 2, and the finishing rollers 26 of the individual surface finishing members 57 are caused to roll while being in contact with the contact surfaces 11a of each guide portion 11 in accordance with the movement of the car 2. Accordingly, even when the car guide rails 8 have already been installed in the hoistway 1, the surface finishing processing of the guide portions 11 can

be carried out with ease only by moving the car 2.

**[0058]** For example, when the mirror finishing of the contact surfaces 11a of the guide portions 11 occurs due to the polishing action of the slide members 55 and lubricating oil to generate a squeaking sound between the slide members 55 and the guide portions 11, the surface finishing processing of the guide portions 11 can be performed with the car guide rails 8 remaining installed in the hoistway 1, and the trouble of generating a squeaking sound can be easily eliminated without exchanging the car guide rails 8. Here, note that similar advantageous effects as with the guide rails 8 can be achieved for the counterweight guide rail 9.

**[0059]** In addition, the plurality of surface finishing members 57 are arranged in such a manner as to surround each guide portion 11, and the finishing rollers 26 of the individual surface finishing members 57 are pressed against the contact surfaces 11a of each guide portion 11, respectively. Accordingly, surface finishing processing can be performed at the same time with respect to the plurality of contact surfaces 11a formed on each guide portion 11. As a result, it is possible to shorten the time of surface finishing processing.

## Claims

1. A guide rail for an elevator **characterized by** comprising a guide portion that guides a vertical moving member while being in contact with a contact member mounted on the vertical moving member, wherein a minute concave portion and a minute convex portion are formed on a contact surface of the guide portion facing the contact member, and the convex portion is provided with a pressed surface which is made smooth by placing a pressing member into pressed abutment with the contact surface thereby to plastically deform a material of the guide portion.
2. A guide rail for an elevator **characterized by** comprising a guide portion that guides a vertical moving member while being in contact with a contact member mounted on the vertical moving member, wherein a contact surface of the guide portion facing the contact member is provided with a minute concave portion and a minute convex portion which are formed by placing a pressing member into pressed abutment with the contact surface thereby to plastically deform a material of the guide portion.
3. The guide rail for an elevator as set forth in claim 1 or claim 2, **characterized in that** the concave portion is a groove that is disposed along the direction of movement of the vertical moving member.
4. A rail surface processing apparatus for an elevator

which serves to process a surface of a guide rail having a guide portion which guides a vertical moving member while being in contact with a contact member provided on the vertical moving member, the apparatus **characterized by** comprising a surface finishing member that includes a pressing member having a smooth abutment surface formed thereon, and a pressing device for placing the abutment surface into pressed contact with a contact surface of the guide portion facing the contact member, wherein a part of a material of a sharp pointed portion formed on the contact surface is plastically deformed into a shape conforming to the abutment surface by pressing the abutment surface against the contact surface by means of the pressing device, whereby the pointed portion is formed into a minute convex portion with a smooth pressed surface formed thereon.

5. A rail surface processing apparatus for an elevator which serves to process a surface of a guide rail having a guide portion which guides a vertical moving member while being in contact with a contact member provided on the vertical moving member, the apparatus **characterized by** comprising a surface finishing member that includes a pressing member having an abutment surface with a protruding portion formed thereon, and a pressing device for placing the abutment surface into pressed contact with a contact surface of the guide portion facing the contact member, wherein a material of the guide portion is plastically deformed into a shape conforming to the abutment surface by pressing the abutment surface against the contact surface by means of the pressing device, whereby a minute concave portion and a minute convex portion are formed on the contact surface.
6. The rail surface processing apparatus for an elevator as set forth in claim 4 or claim 5, **characterized in that** the pressing member is a roller which is caused to roll while being in contact with the contact surface.
7. The rail surface processing apparatus for an elevator as set forth in claim 6, **characterized in that** the surface finishing member is provided on the vertical moving member; and z the roller is caused to roll in accordance with the movement of the vertical moving member.

55

FIG. 1

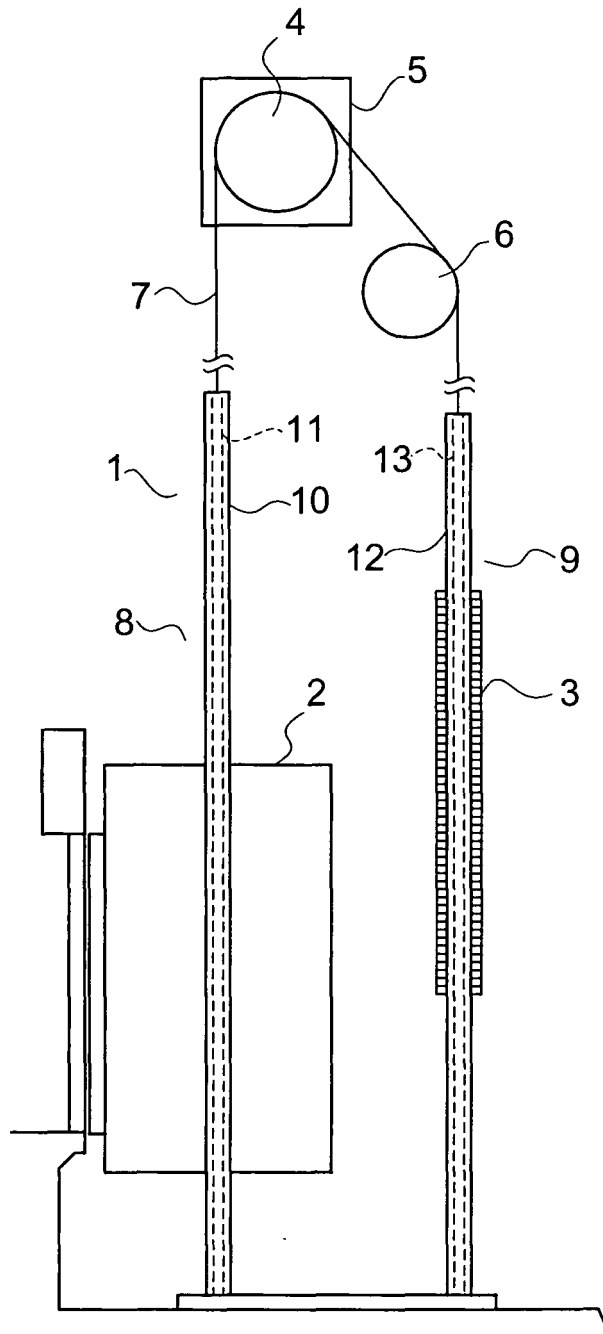


FIG. 2

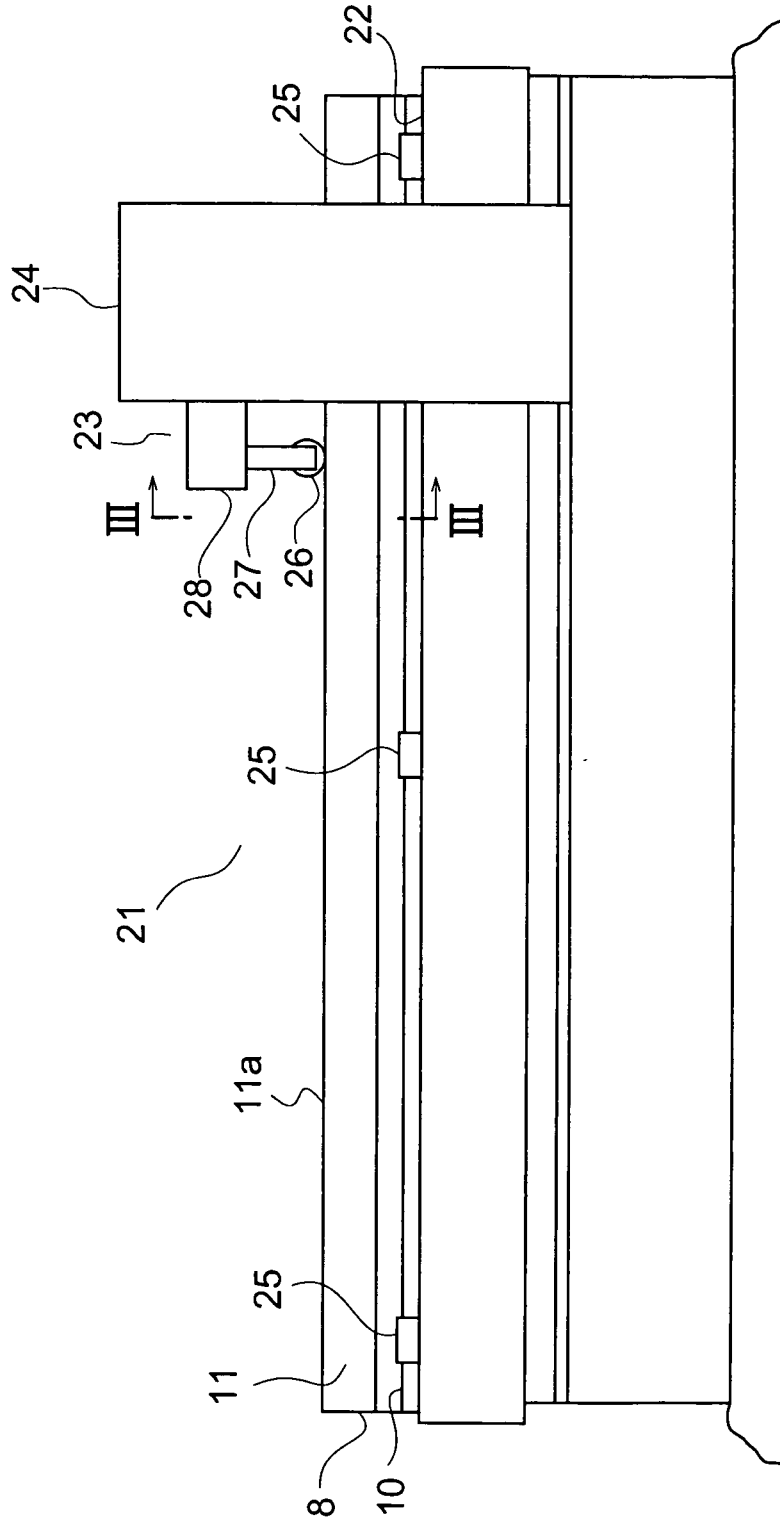


FIG. 3

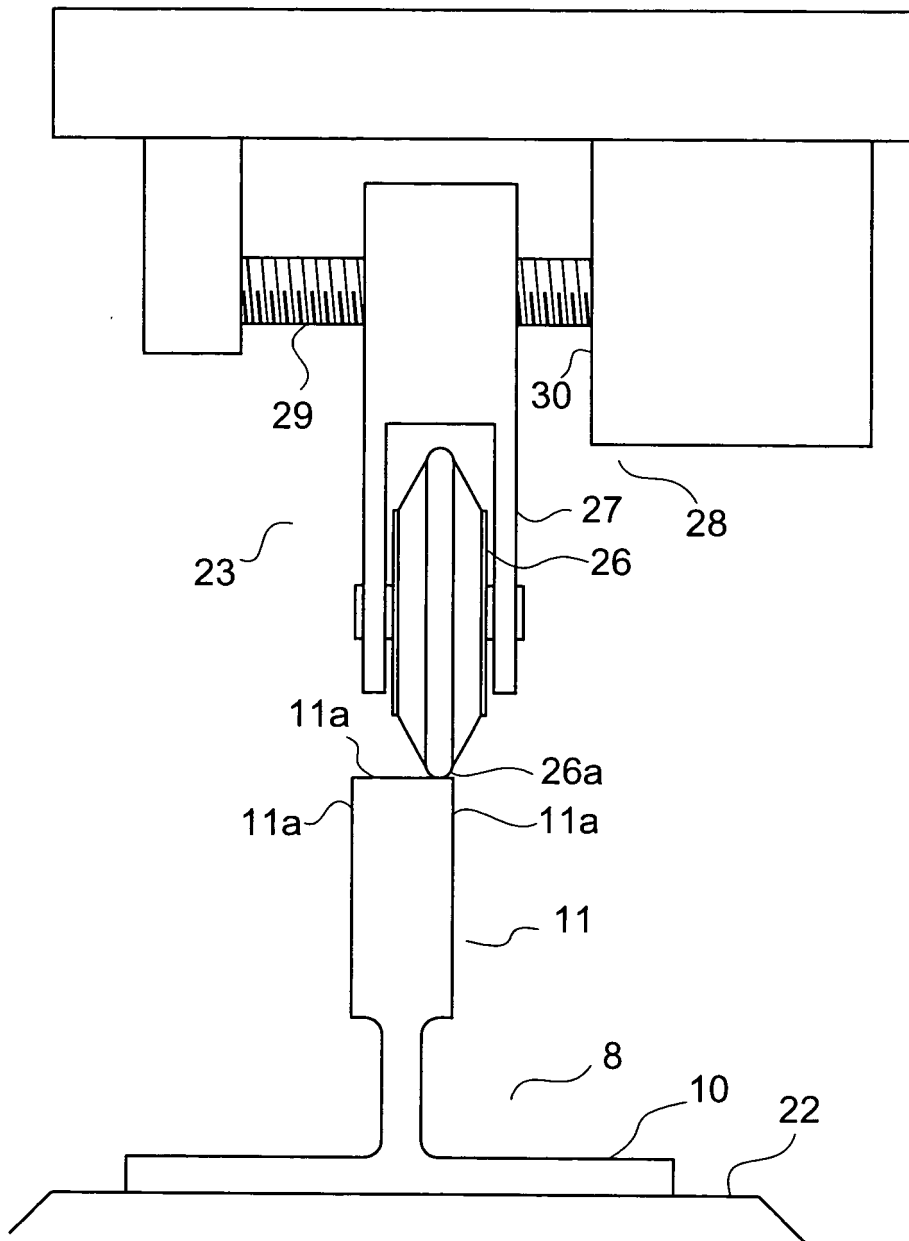


FIG. 4

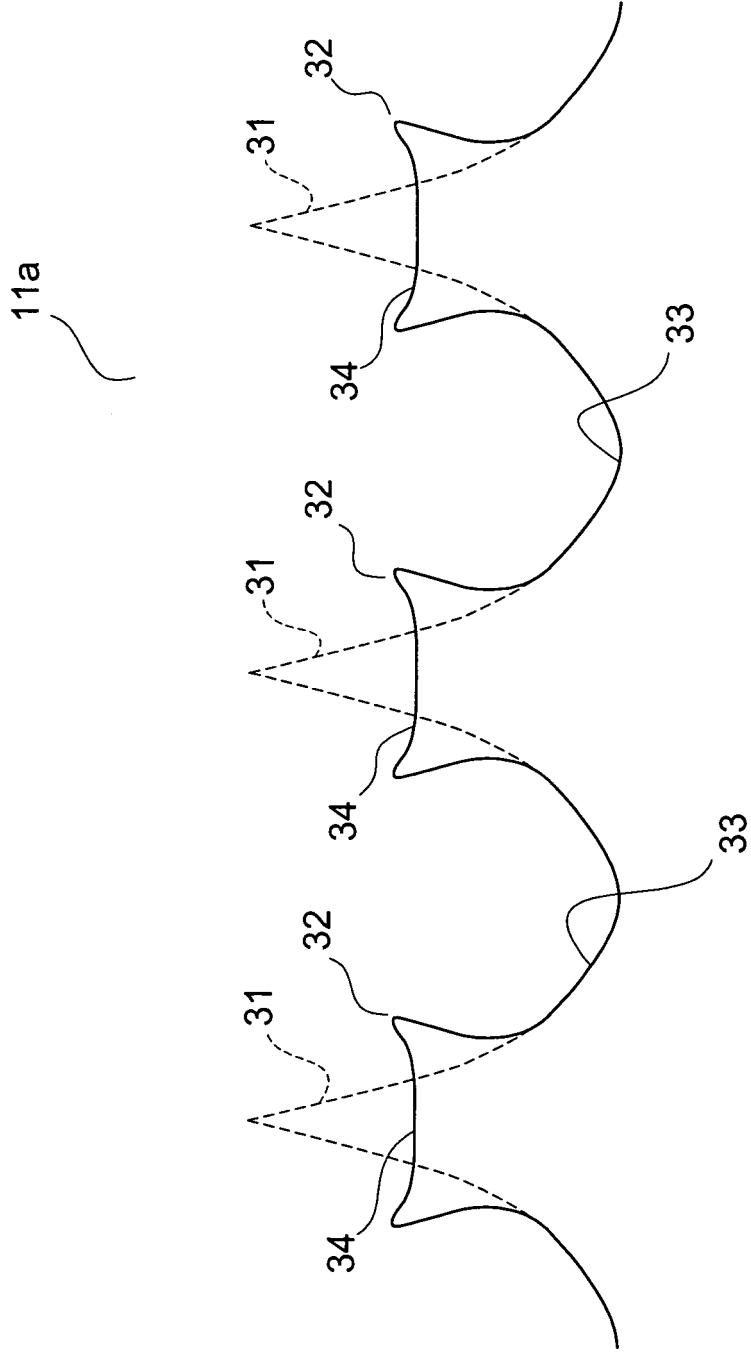


FIG. 5

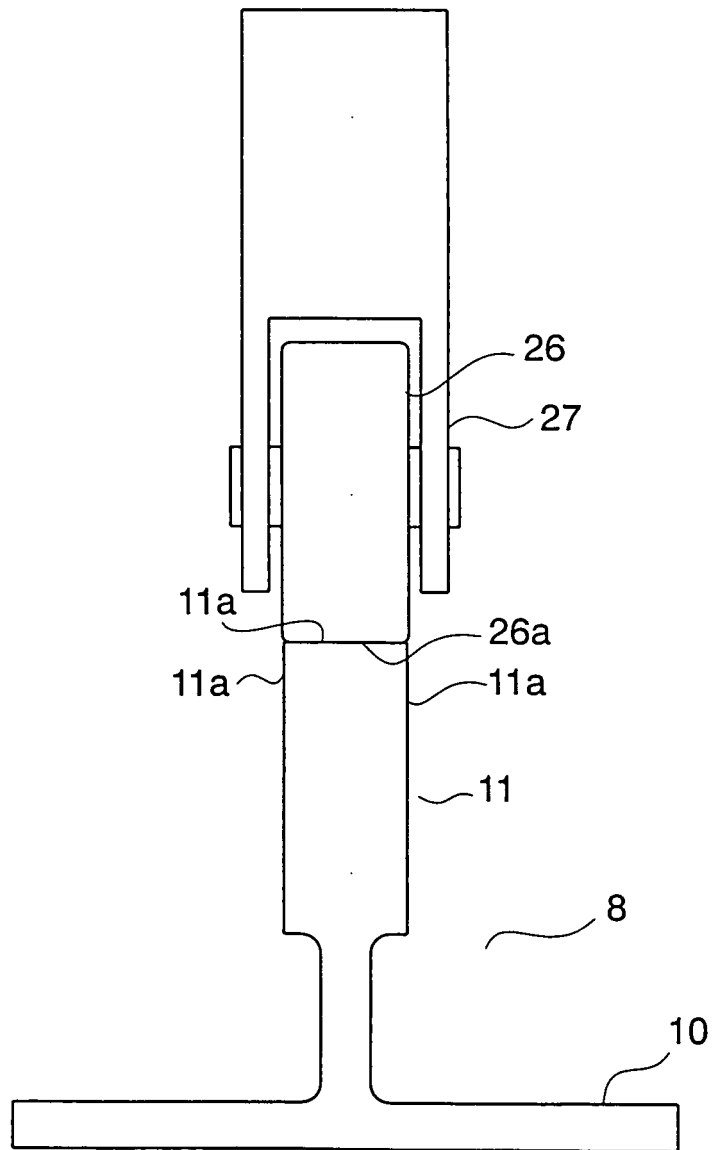


FIG. 6

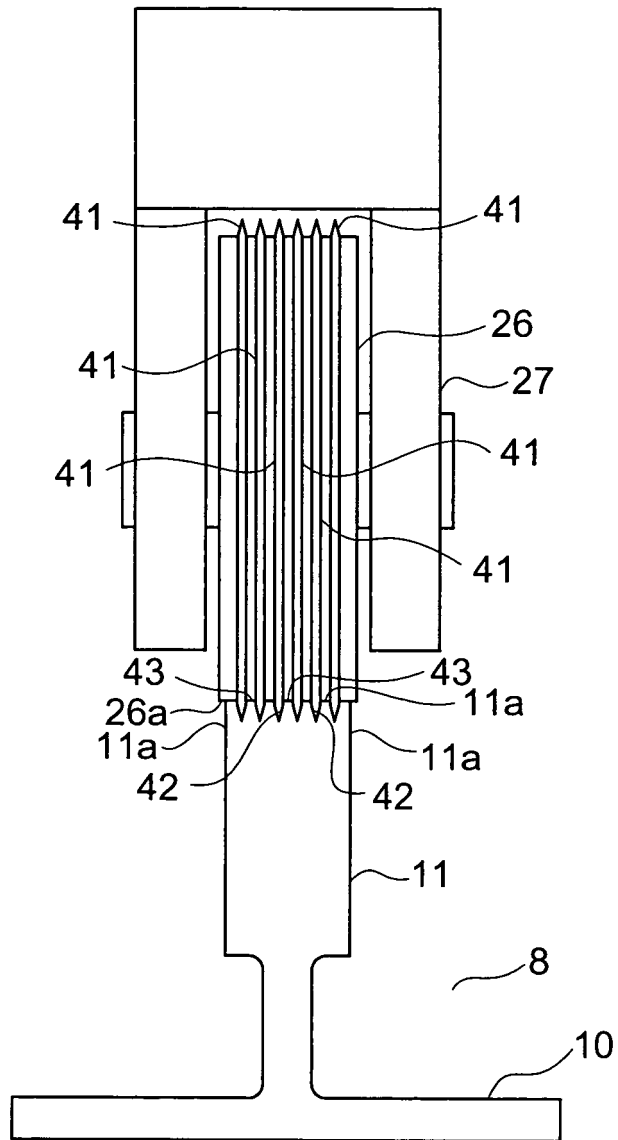


FIG. 7

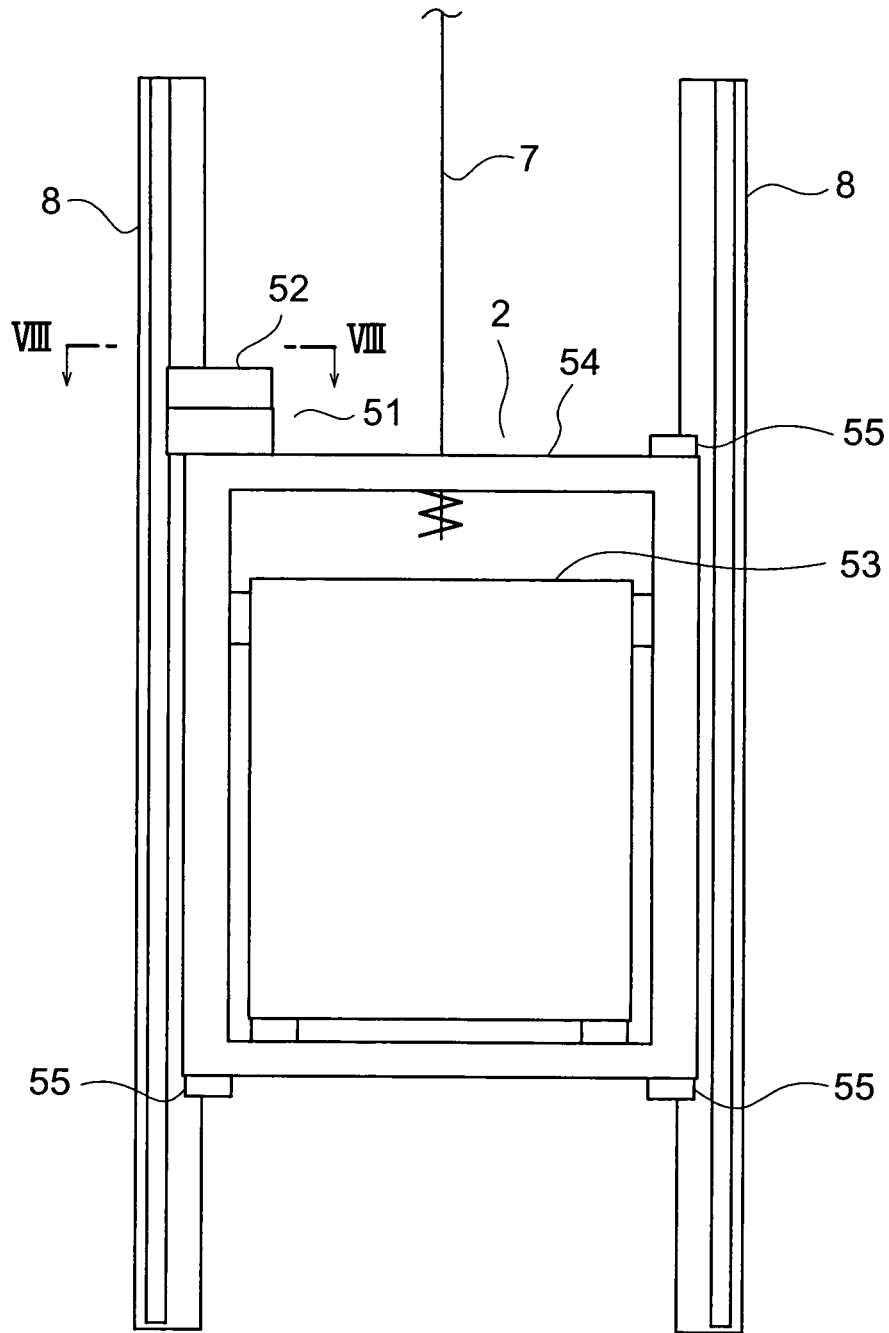
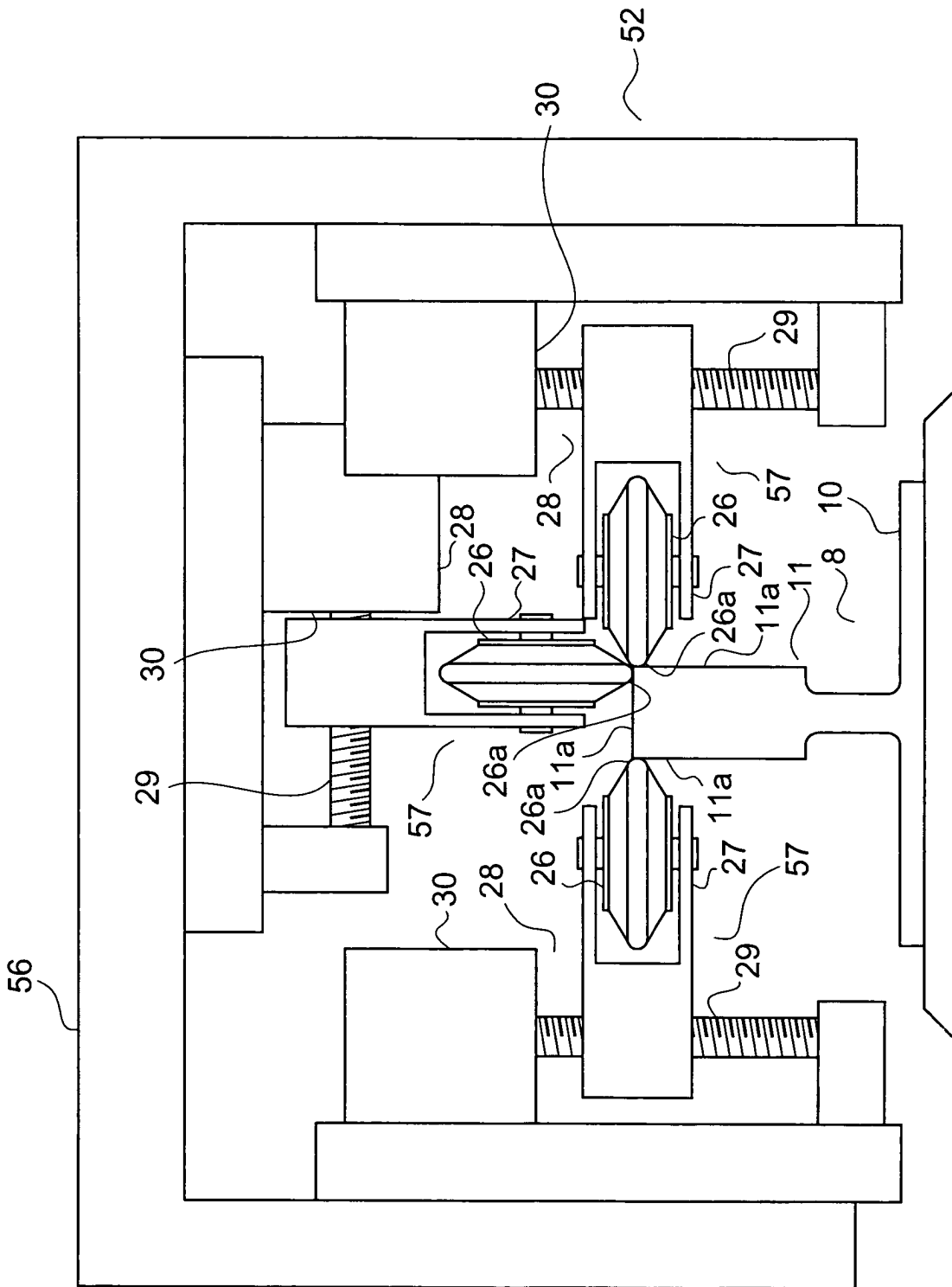


FIG. 8



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/316396

| A. CLASSIFICATION OF SUBJECT MATTER<br>B66B7/02 (2006.01) i   |  |                       |
|---|--|-----------------------|
| According to International Patent Classification (IPC) or to both national classification and IPC   |  |                       |
| B. FIELDS SEARCHED  |  |                       |
| Minimum documentation searched (classification system followed by classification symbols)<br>B66B7/02   |  |                       |
| Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched<br>Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2007<br>Kokai Jitsuyo Shinan Koho 1971-2007 Toroku Jitsuyo Shinan Koho 1994-2007 |  |                       |
| Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  |  |                       |
| C. DOCUMENTS CONSIDERED TO BE RELEVANT  |  |                       |
| Category*   | Citation of document, with indication, where appropriate, of the relevant passages   | Relevant to claim No. |
| Y   | JP 8-118136 A (Kabushiki Kaisha Fuji Seisakusho),<br>14 May, 1996 (14.05.96),<br>Full text; Figs. 1 to 5<br>(Family: none)   | 1-7                   |
| Y   | JP 61-45097 Y2 (Showa Products Kabushiki Kaisha),<br>18 December, 1986 (18.12.86),<br>Full text; Figs. 1 to 4<br>(Family: none)  | 1-7                   |
| Y   | JP 57-142722 A (Hitachi, Ltd.),<br>03 September, 1982 (03.09.82),<br>Page 4, upper left column, line 16 to page 5,<br>upper left column, line 11; Figs. 9 to 11<br>(Family: none)  | 1-7                   |
| <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  | "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  |                       |
| "E" earlier application or patent but published on or after the international filing date   | "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   |                       |
| "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)   | "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 |                       |
| "O" document referring to an oral disclosure, use, exhibition or other means  | "&" document member of the same patent family  |                       |
| "P" document published prior to the international filing date but later than the priority date claimed  |  |                       |
| Date of the actual completion of the international search<br>13 April, 2007 (13.04.07)  | Date of mailing of the international search report<br>24 April, 2007 (24.04.07)  |                       |
| Name and mailing address of the ISA/<br>Japanese Patent Office  | Authorized officer   |                       |
| Facsimile No.   | Telephone No.  |                       |

Form PCT/ISA/210 (second sheet) (April 2005)

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2006/316396

| 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 3243104 B2 (Toshiba Corp.),<br>19 October, 2001 (19.10.01),<br>Par. No. [0041]; Fig. 10<br>(Family: none)   | 7                     |
| A   | JP 4-153183 A (Hitachi, Ltd.),<br>26 May, 1992 (26.05.92),<br>Full text; Figs. 1 to 10<br>(Family: none)   | 1-7                   |
| A   | JP 2003-285216 A (Mitsubishi Electric Corp.),<br>07 October, 2003 (07.10.03),<br>Full text; Figs. 1 to 18<br>(Family: none)                                    | 1-7                   |
| A   | JP 7-206316 A (Mitsubishi Electric Building<br>Techno-Service Co., Ltd.),<br>08 August, 1995 (08.08.95),<br>Claim 3; Par. No. [0035]; Fig. 2<br>(Family: none) | 3                     |

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

**REFERENCES CITED IN THE DESCRIPTION**

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

**Patent documents cited in the description**

- JP 3243104 B [0003]