(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 431 228 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
23.06.2004 Bulletin 2004/26

(51) Int Cl.[7]: **B66B 5/00**

(21) Application number: **04006916.3**

(22) Date of filing: **09.02.2000**

(84) Designated Contracting States:
DE FR GB NL

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
00902881.2 / 1 167 268

(71) Applicant: **MITSUBISHI DENKI KABUSHIKI KAISHA**
Tokyo 100-8310 (JP)

(72) Inventor: **The designation of the inventor has not yet been filed**

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

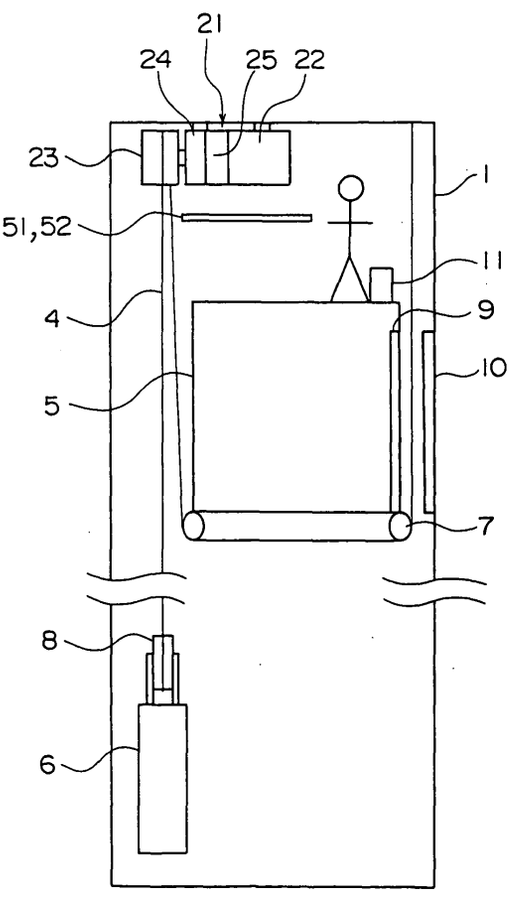
Remarks:
This application was filed on 23 - 03 - 2004 as a divisional application to the application mentioned under INID code 62.

(54) Safety device for working on top of an elevator car

(57) A safety device for working on top of an elevator car, employed in an elevator in which a driving machine (21) for raising and lowering a car (5) is disposed at an upper portion of a hoistway (1) and a portion of the driving machine (21) is disposed in an area where the car (5) is projected in its raising and lowering direction, comprises:

a light projecting device (51) provided on a side wall of the hoistway (1) for horizontally projecting a plurality of light beams (53) below the driving machine (21);
a light receiving device (52) provided on a side wall of the hoistway (1) opposite to said light projecting device (51) for receiving the light beams (53) projected from said light projecting device (51); and
a stop circuit (40) for stopping the raising of the car (5) when at least one of the light beams (53) is intercepted.

FIG. 8



EP 1 431 228 A2

Description

TECHNICAL FIELD

[0001] This invention relates to a safety device for working on top of an elevator car, which is employed in an elevator in which a driving machine is disposed at an upper portion of a hoistway, and which prevents a worker from colliding against the driving machine while working on top of the car.

BACKGROUND ART

[0002] Fig. 13 is a side view showing a conventional elevator such as disclosed, for example, in EP0926093A, and Fig. 14 is a plan view showing the elevator in Fig. 13. In the figures, a driving machine 2 having a sheave 3 is fixed to an upper portion of a hoistway 1. A middle portion of a main rope 4 is wound around the sheave 3.

[0003] A car 5 and a counterweight 6 are suspended by the main rope 4. A pair of car suspending sheaves 7 around which the main rope 4 is wound are provided at a bottom portion of the car 5. A counterweight suspending sheave 8 around which the main rope 4 is wound is provided at a top portion of the counterweight 6. The car 5 is provided with car doors 9. Landing doors 10 opposing the car doors 9 are provided on a hall side.

[0004] A door machine 11 for opening/closing the car doors 9 and the landing doors 10 is mounted on a top portion of the car 5. Also, a fence 12 for restricting the area of movement for a worker while working on top of the car 5 is erected on the top portion of the car 5.

[0005] In such an elevator, as shown in Fig. 14, a portion of the driving machine 2 is disposed in an area where the car 5 is projected in its raising and lowering direction. In other words, a portion of the driving machine 2 overlaps the car 5 when looked at from above. Accordingly, a fear exists that a worker may run into the driving machine 2 while working on top of the car 5. To prevent this, the worker is kept from entering an area S1 directly below the driving machine 2 by providing the fence 12.

[0006] Further, since a space S3 is secured above an area S2 on the car 5 where the worker can move, the worker can safely carry out his work while standing even if the car 5 moves to an uppermost position.

[0007] However, since various devices other than the door machine 11 are disposed on top of the car 5, and because it is difficult to actually provide the fence 12, the fear exists that the work space will become very small if the fence 12 is provided.

[0008] Next, Fig. 15 is a side view showing a conventional elevator such as disclosed, for example, in Japanese Utility Model Publication No. 48-3961, and Fig. 16 is a plan view showing the elevator in Fig. 15. In the figures, a ceiling detection plate 14 is suspended from a ceiling portion of the hoistway 1 through a plurality of hangers 13.

[0009] In such an elevator, when the worker works on top of the car 5, if the car 5 is raised and the worker contacts the ceiling detection plate 14, it is detected by a sensor (not shown), to thereby stop the raising of the car 5. Accordingly, the worker is prevented from colliding against the driving machine 2.

[0010] However, since the ceiling detection plate 14 spreads above the whole car 5, the area S3 can not be used for maintenance space, and there is problem that maintenance work on the driving machine 2 can not be performed from the top of the car 5. Further, it is necessary to heighten the ceiling of the hoistway 1 to permit the worker to stand on the car 5 when the car 5 moves to the uppermost floor, thereby inhibiting effective utilization of space in the building.

[0011] Next, Fig. 17 is a side view showing a conventional elevator such as disclosed, for example, in Japanese Patent No. 2862713, and Fig. 18 is a plan view showing the elevator in Fig. 17. In the figures, a plurality of chains 15 are suspended from the driving machine 2.

[0012] In such an elevator, the worker contacts or sees the chains 15 before colliding against the driving machine 2, to thereby prevent collision with the driving machine 2.

[0013] However, since there is a possibility that the worker will not contact or recognize the chains 15 because of their position and the position of the worker on the car 5, safety can not be sufficiently secured.

DISCLOSURE OF THE INVENTION

[0014] The present invention is made to solve the problems mentioned above, and an object of the present invention is to provide a safety device for working on top of an elevator car, wherein a working space on a car can be secured, maintenance on a driving machine can be performed from the top of the car, and workers can be more safely kept from running into the driving machine.

[0015] To this end, according to one aspect, there is provided a safety device for working on top of an elevator car, employed in an elevator in which a driving machine for raising and lowering a car is disposed at an upper portion in a hoistway and a portion of the driving machine is disposed in an area where the car is projected in its raising and lowering direction, comprising: a detection plate suspended in the hoistway and disposed between the driving machine and the car to allow maintenance operations from a top of the car, the detection plate being capable of moving upwardly by being pushed from a lower position; a buffer attached to a bottom surface of the detection plate; a plurality of detecting switches for detecting the upward movement of the detection plate; and a stop circuit for stopping the raising of the car when at least one of the detecting switches is operated by the upward movement of the detection plate.

[0016] According to the present invention, there is

provided a safety device for working on top of an elevator car, employed in an elevator in which a driving machine for raising and lowering a car is disposed at an upper portion of a hoistway and a portion of the driving machine is disposed in an area where the car is projected in its raising and lowering direction, comprising: a light projecting device provided on a side wall of the hoistway for horizontally projecting a plurality of light beams below the driving machine; a light receiving device provided on a side wall of the hoistway opposite to the light projecting device for receiving the light beams projected from the light projecting device; and a stop circuit for stopping the raising of the car when at least one of the light beams is intercepted.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a side view showing an elevator according to a first embodiment;
Fig. 2 is a plan view showing the elevator in Fig. 1;
Fig. 3 is a cross-sectional view showing an essential portion of the safety device in Fig. 1;
Fig. 4 is a cross-sectional view showing a state where the air bag in Fig. 3 is pushed from the lower position;
Fig. 5 is a circuit diagram showing a control circuit of the safety device in Fig. 1;
Fig. 6 is a plan view showing a safety device for working on top of an elevator car according to a second embodiment;
Fig. 7 is a side view showing the safety device in Fig. 6;
Fig. 8 is a side view showing an elevator according to an embodiment of the present invention;
Fig. 9 is a plan view showing the elevator in Fig. 8;
Fig. 10 is a circuit diagram showing the control circuit of the safety device in Fig. 8;
Fig. 11 is an explanatory view showing a state where the worker goes into the region between the light emitting device and the light receiving device in Fig. 8;
Fig. 12 is a plan view showing the safety device in Fig. 11;
Fig. 13 is a side view showing an example of a conventional elevator;
Fig. 14 is a plan view showing the elevator in Fig. 13;
Fig. 15 is a side view showing another example of a conventional elevator;
Fig. 16 is a plan view showing the elevator in Fig. 15;
Fig. 17 is a side view showing another example of a conventional elevator; and
Fig. 18 is a plan view showing the elevator in Fig. 17.

BEST MODE FOR CARRYING OUT THE INVENTION

[0018] A preferred embodiment of the present invention will be described below with reference to the accompanying drawings.

[0019] Fig. 1 is a side view showing an elevator according to a first embodiment, and Fig. 2 is a plan view showing the elevator in Fig. 1. In the figures, a driving machine 21 is fixed to an upper portion of a hoistway 1. The driving machine 21 has a motor 22, a sheave 23 rotated by the motor 22, reduction gears 24 for transmitting the driving force of the motor 22 to the sheave 23, and a braking portion 25 for braking the rotation of the sheave 23.

[0020] A middle portion of a main rope 4 is wound around the sheave 23. A car 5 and a counterweight 6 are suspended by the main rope 4. A pair of car suspending sheaves 7 around which the main rope 4 is wound are provided at a lower portion of the car 5. A counterweight suspending sheave 8 around which the main rope 4 is wound is provided at a top portion of the counterweight 6.

[0021] The car 5 is provided with car doors 9. Landing doors 10 opposing the car doors 9 are provided on a hall side. A door machine 11 for opening/closing the car doors 9 and the landing doors 10 is mounted on a top portion of the car 5.

[0022] A safety device 31 for working on top of the car 5 for preventing workers on the car 5 from running into the driving machine 21 is suspended from a ceiling portion of the hoistway 1. The safety device 31 is disposed at a position between the car 5 and the driving machine 21 where it does not interfere with the car 5.

[0023] Further, the safety device 31 has a plurality of (four in the figure) hangers 32, a detection plate 33 suspended by the hangers 32, a plurality of detecting switches 34 disposed between the hangers 32 and the detection plate 33, and an air bag 35 attached as a buffer to a bottom portion of the detection plate 33.

[0024] Fig. 3 is a cross-sectional view showing an essential portion of the safety device 31 in Fig. 1. The detection plate 33 is provided with a plurality of penetrating holes 33a. Each detecting switch 34 has a first contact seat 36 made of insulating material and connected to a lower end portion of the hanger 32, a second contact seat 37 made of insulating material and fixed to the detection plate 33, a first contact 38 fixed to the first contact seat 36, and a second contact 39 fixed to the second contact seat 37 and contacting with and separating from the first contact 38.

[0025] The second contact seat 37 and the second contact 39 are provided with penetrating holes 37a and 39a continued to the penetrating hole 33a. The first contact seat 36 has a flange portion 36a for supporting the first contact 38, and a rod portion 36b penetrating the penetrating holes 33a, 37a and 39a.

[0026] Fig. 4 is a cross-sectional view showing a state where the air bag 35 in Fig. 3 is pushed from the lower position. In the case where the air bag 35 is pushed from the lower position, the air bag 35 is deformed and the detection plate 33 is pushed upwardly. Accordingly, the

second contact seat 37 and the second contact 39 fixed to the detection plate 33 are moved upwardly to separate the second contact 39 from the first contact 38.

[0027] Fig. 5 is a circuit diagram showing a control circuit of the safety device 31 in Fig. 1. Contacts 34A to 34D of four detecting switches 34 are connected in series with each other. Since the contacts 34A to 34D are normally-closed contacts, when any one of the contacts 34A to 34D is opened, the raising of the car 5 is stopped by a stopping circuit 40.

[0028] In the above described elevator, during work on the car 5, when the car 5 is raised with a worker in the area S1 directly below the driving machine 21, the worker collides with the air bag 35, and the detection plate 33 is pushed upwardly. Consequently, the detecting switches 34 are opened, and the raising of the car 5 is stopped.

[0029] Accordingly, the workers can be more safely prevented from colliding against the driving machine 21. Also, the working area S2 on the car 5 can be sufficiently secured, and maintenance for the driving machine 21 can be performed from the top of the car 5. Further, since the air bag 35 is used, the impact of collision against the safety device 21 can be sufficiently decreased, thereby further improving safety. Also, since a plurality of detecting switches 34 are provided and the raising of the car 5 is stopped when any one of the detecting switches 34 is operated, reliability can be improved.

[0030] It should be noted that, while the air bag 35 is shown as the buffer in the first embodiment, the buffer is not limited to this, and it is also possible to use, for example, sponge, foamed plastic or the like.

Second Embodiment

[0031] Next, Fig. 6 is a plan view showing a safety device for working on top of an elevator car according to a second embodiment, and Fig. 7 is a side view showing the safety device in Fig. 6. In this embodiment, an oil receiving portion 41a shaped like a tray is provided at a top surface of the detection plate 41. The other constructions are the same as in the first embodiment.

[0032] In such a safety device, any lubricating oil leaking from the reduction gears 24, bearings (not shown) or the like of the driving machine 21 is received by the oil receiving portion 41a. Accordingly, the lubricating oil is prevented from dropping onto the car 5.

Third Embodiment

[0033] Next, Fig. 8 is a side view showing an elevator according to the present invention, and Fig. 9 is a plan view showing the elevator in Fig. 8. In this embodiment, a photoelectric proximity detecting device having a light projecting device 51 and a light receiving device 52 is used as a safety device. The light projecting device 51 and the light receiving device 52 are provided on the side walls of the hoistway 1 to oppose each other. A plurality of light beams 53 projected from the light projecting device 51 travel horizontally below the driving machine 21 and are received by the light receiving device 52. In other words, the light projecting device 51 and the light receiving device 52 are disposed at positions lower than the driving machine 21. The construction of the rest of the elevator is the same as in the first embodiment.

[0034] Fig. 10 is a circuit diagram showing the control circuit of the safety device in Fig. 8. An output contact 54 of the photoelectric proximity detecting device is connected to the stopping circuit 40 for stopping the raising of the car 5.

[0035] In such an elevator, during work on the car 5, when the car 5 is raised with a worker in the area S1 directly below the driving machine 21, the worker becomes positioned between the light projecting device 51 and the light receiving device 52, as shown in Fig. 11, before colliding against the driving machine 21. At this time, as shown in Fig. 12, one portion of the plurality of light beams 53 is intercepted by the worker. When the light beams 53 are intercepted, this is detected by the light receiving device 52, and the output contact 54 is opened, to thereby stop the raising of the car 5.

[0036] Accordingly, the workers can be more safely prevented from colliding against the driving machine 21. Also, the working area S2 on the car 5 can be sufficiently secured, and maintenance for the driving machine 21 can be performed from the top of the car 5. Further, since the worker only intercepts the light beams 53, the worker receives no impact from a collision. In addition, since the plurality of detecting light beams 53 is projected and the raising of the car 5 is stopped when any portion of the light beams 53 is intercepted, reliability can be improved.

Claims

1. A safety device for working on top of an elevator car, employed in an elevator in which a driving machine (21) for raising and lowering a car (5) is disposed at an upper portion of a hoistway (1) and a portion of the driving machine (21) is disposed in an area where the car (5) is projected in its raising and lowering direction,

characterized by comprising:

a light projecting device (51) provided on a side wall of the hoistway (1) for horizontally projecting a plurality of light beams (53) below the driving machine (21);

a light receiving device (52) provided on a side wall of the hoistway (1) opposite to said light projecting device (51) for receiving the light beams (53) projected from said light projecting device (51); and

a stop circuit (40) for stopping the raising of the car (5) when at least one of the light beams (53)

is intercepted.

FIG. 1

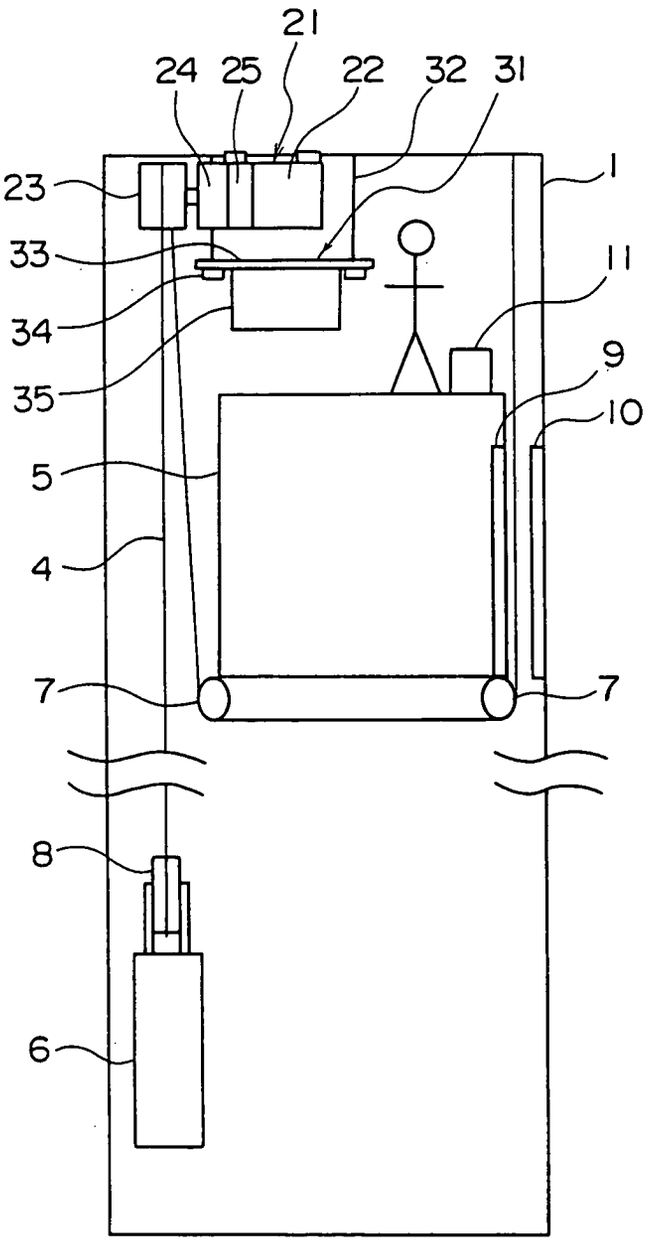


FIG. 2

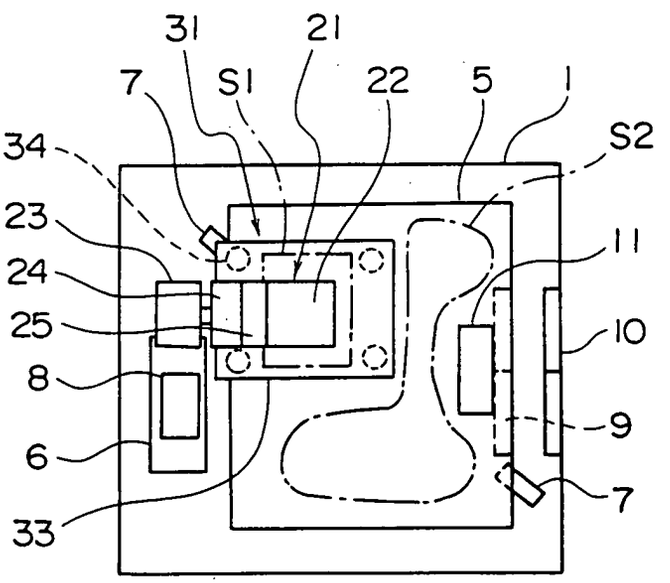


FIG. 3

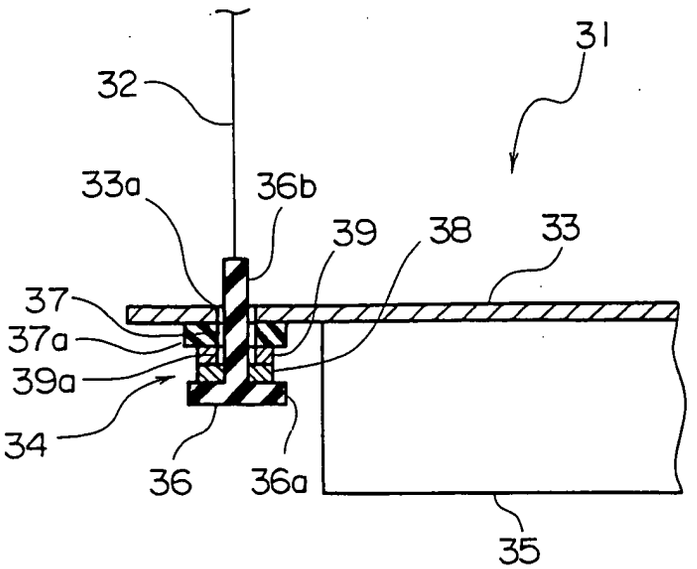


FIG. 4

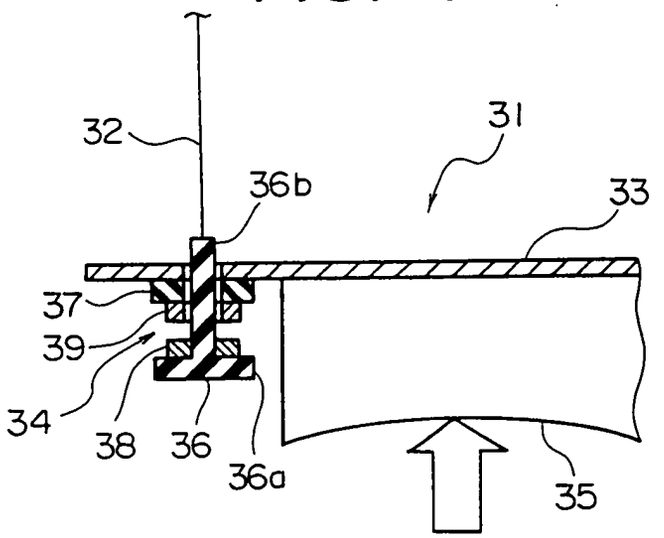


FIG. 5

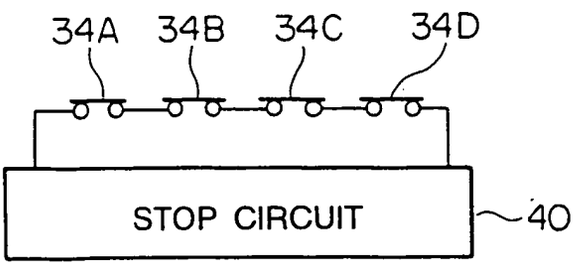


FIG. 6

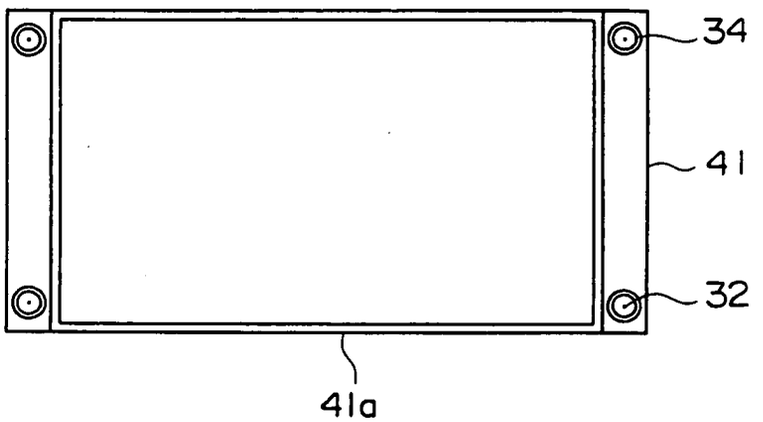


FIG. 7

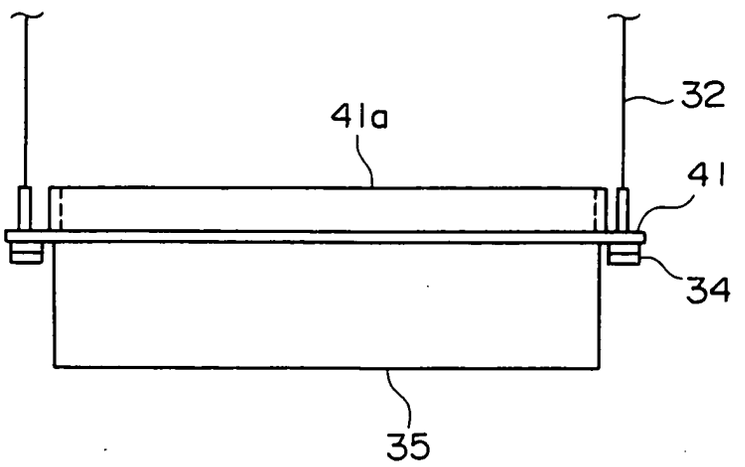


FIG. 8

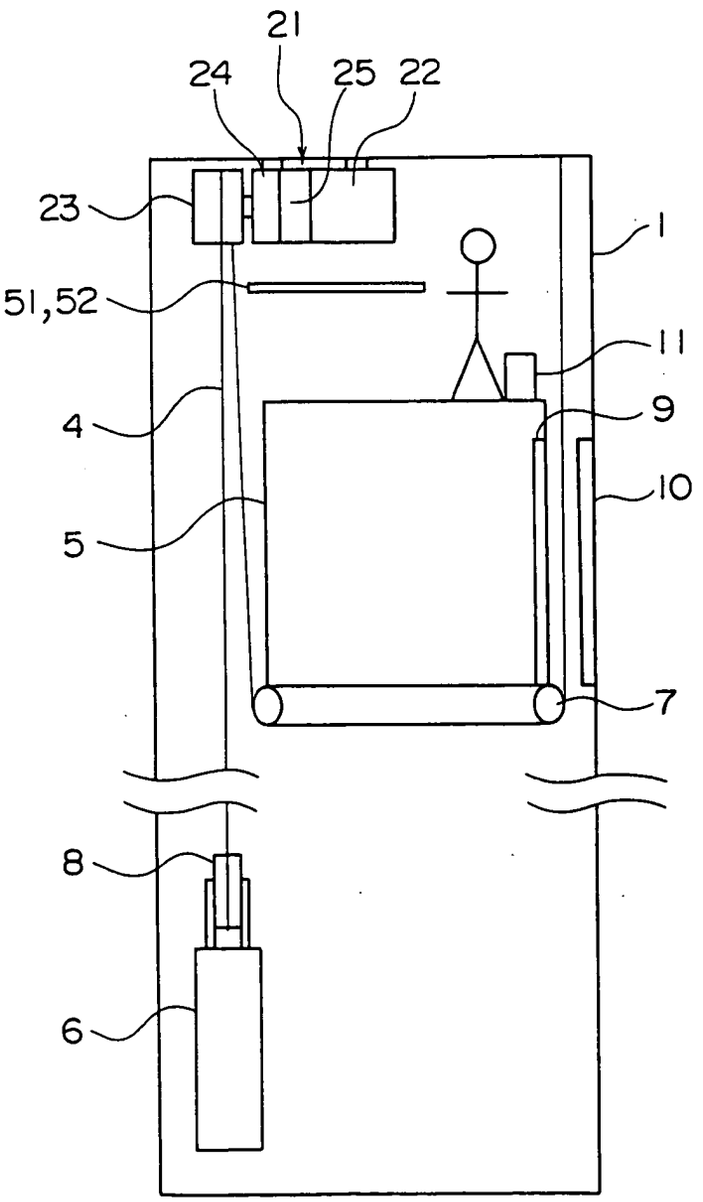


FIG. 9

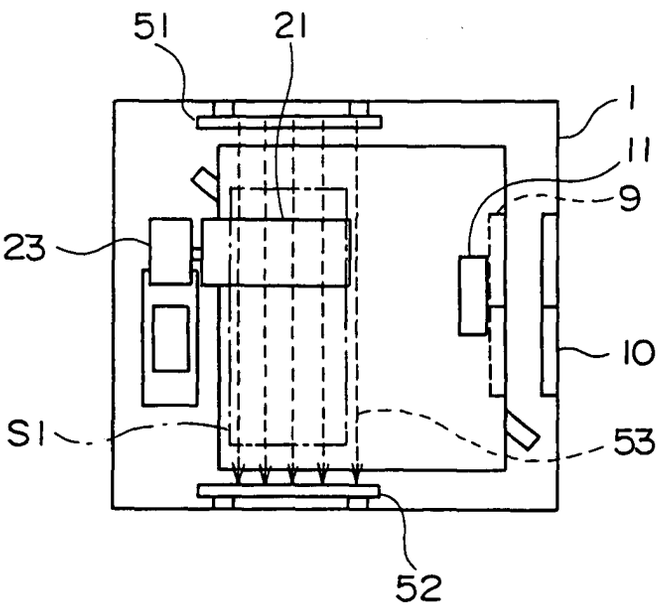


FIG. 10

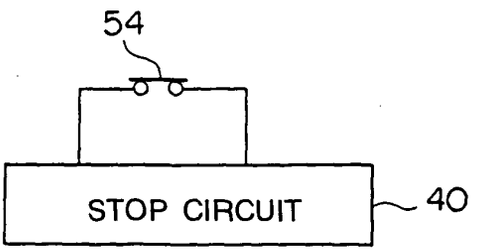


FIG. 11

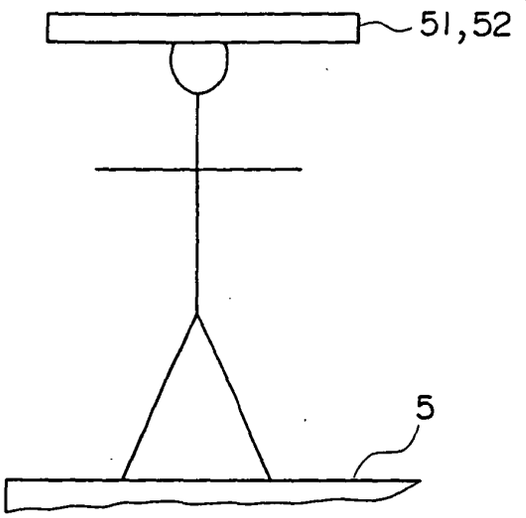


FIG. 12

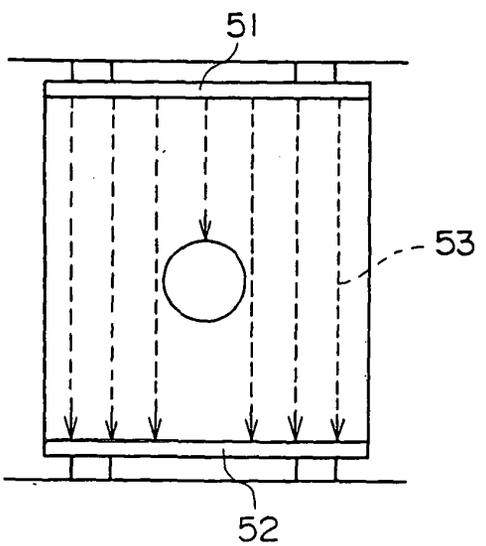


FIG. 13

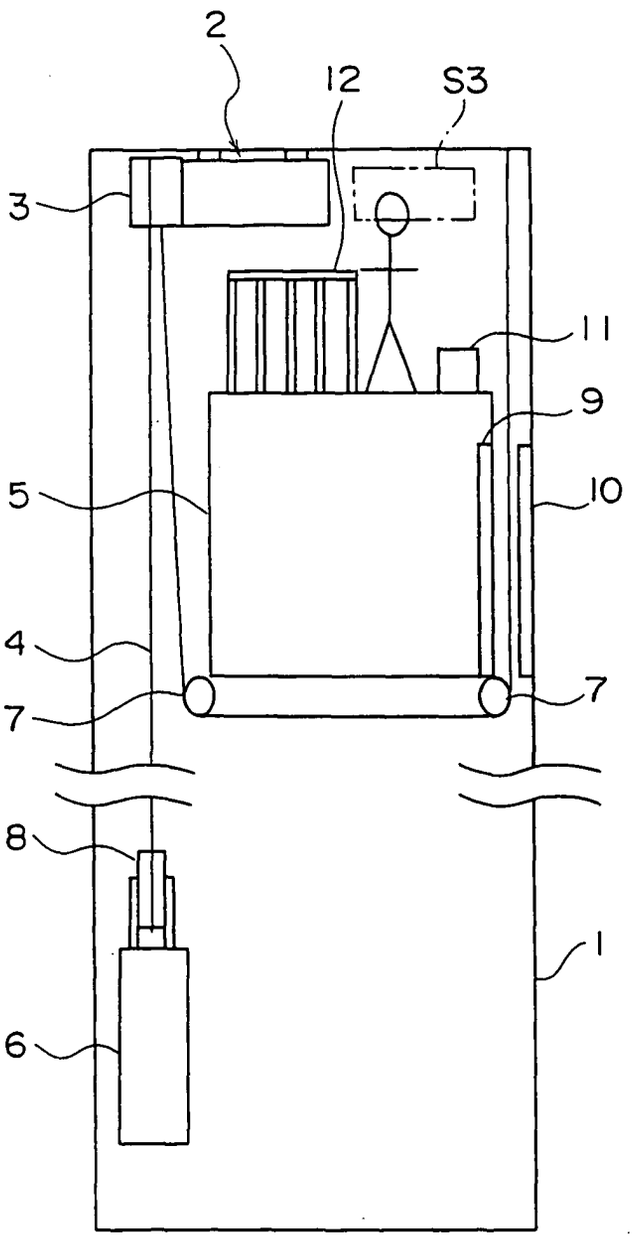


FIG. 14

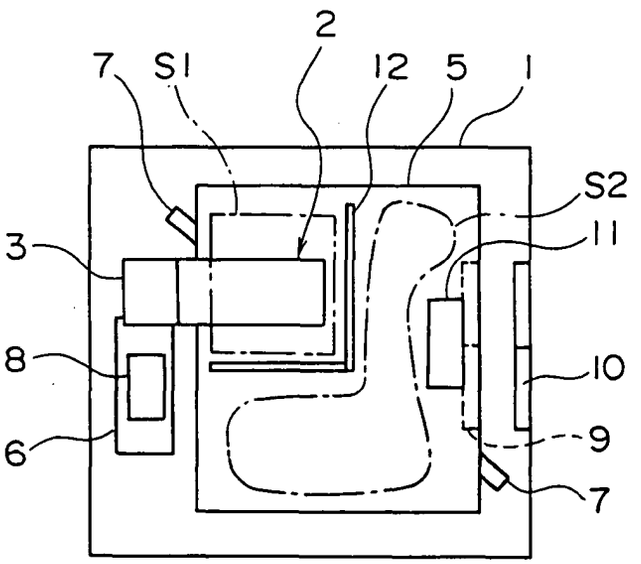


FIG. 15

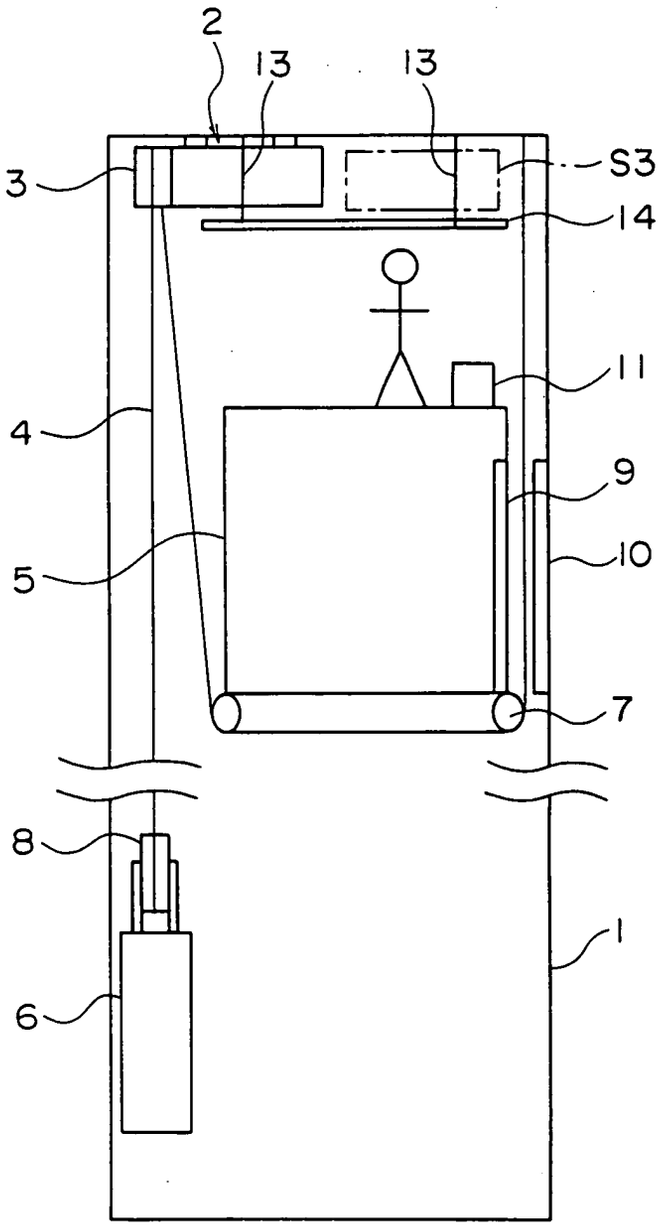


FIG. 16

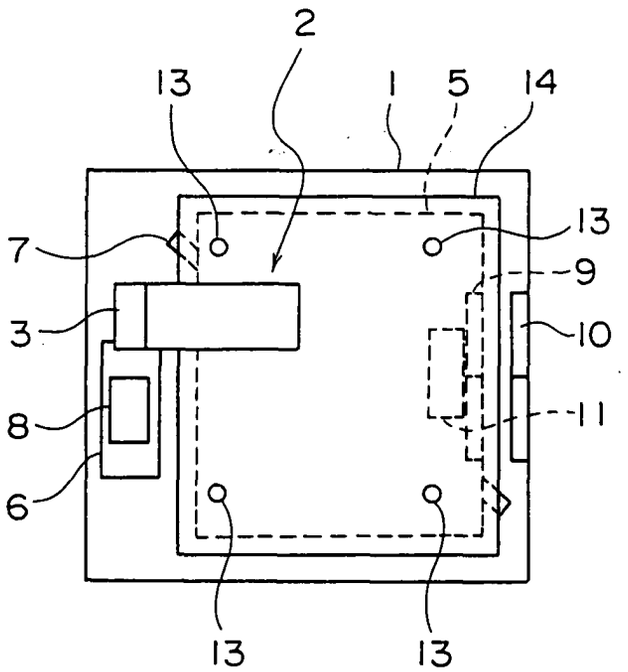


FIG. 17

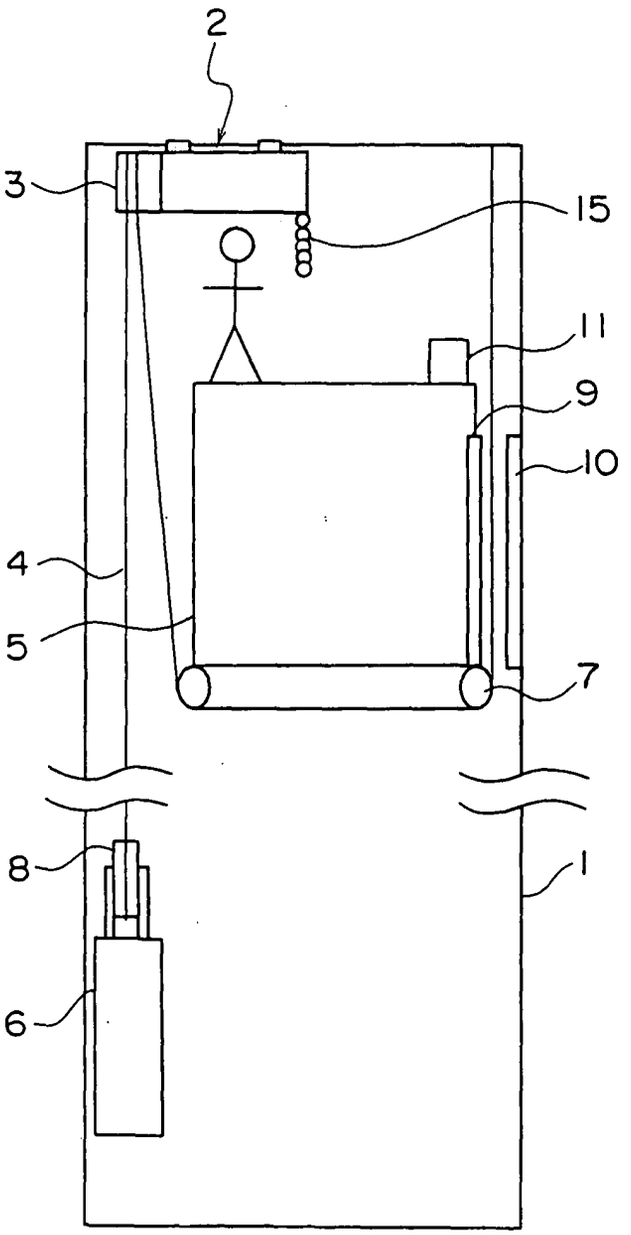


FIG. 18