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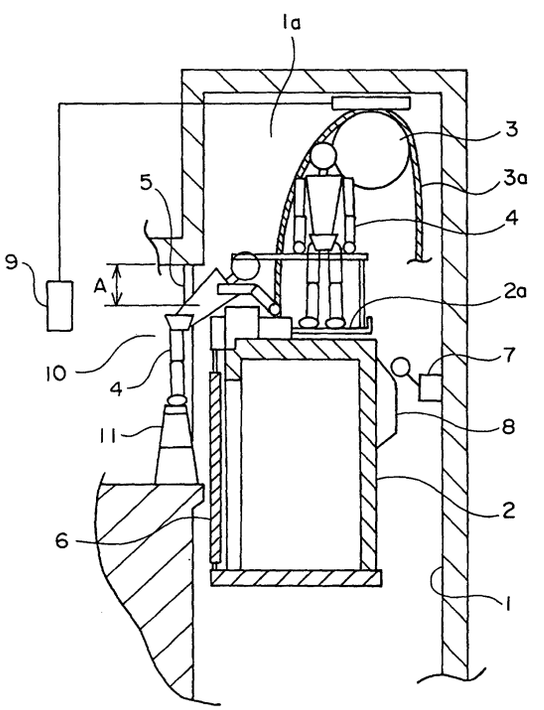
(54) ELEVATOR SYSTEM AND METHOD OF INSPECTING THE ELEVATOR SYSTEM

(57) The elevator system of the present invention provides an elevator system comprising a hoist 3 at an upper portion of a hoistway 1, and in which a car 2 provided in the hoistway 1 is raised and lowered by means of the hoist 3 via a rope 3a, wherein, stopping means 7, 8 which is operated during maintenance inspection of the hoist 3 is provided for stopping the car 2 at a predetermined location, and the predetermined location is a location where a roof top of the car is a predetermined amount lower than an upper frame of a landing 10 entrance of a highest floor.

FIG. 1



EP 1 319 626 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to maintenance inspection of a so-called machine room-less elevator in which a hoist is disposed in an upper portion of an elevator hoistway and an elevator control apparatus is housed in the hoistway thus making a machine room unnecessary, and in particular, to an elevator system in which an inspector may simply and safely perform hoist maintenance inspection.

BACKGROUND TECHNIQUES

[0002] In recent years, in order to efficiently utilize building roofs, so-called machine room-less elevator systems, such as that described in Japanese Patent Application Laid-open No. Hei 8-201152, have become mainstream, in which a machine room conventionally provided on a roof and housing an elevator system control apparatus, hoist and the like is not provided and the control apparatus is provided in a hoistway and the hoist is provided in an uppermost or lowermost portion of the hoistway.

[0003] A construction of a machine room-less elevator in which a hoist is disposed in an upper portion of the hoistway will be explained with reference to FIG. 7. Here, FIG. 7 is a cross sectional drawing of a conventional machine room-less elevator system.

[0004] In FIG. 7, a hoist 3 is disposed at a beam of an upper hoistway portion 1a of a hoistway 1 in which a car 2 of the elevator system is raised and lowered. The hoist 3, a control apparatus disposed inside the hoistway 1 and a control panel provided inside the car 2 are electrically connected, and the control apparatus outputs speed adjustment commands, stop commands and the like to safely and comfortably move the car 2 and perform driving control.

[0005] Next, a maintenance inspection method of the hoist 3 of a conventional elevator system will be explained. First, in order to perform maintenance inspection of the hoist 3, an inspector 4 opens a landing-side door 5 of an elevator landing 10 of a highest floor and a car-side door 6 and enters the car 2. Then, he operates a maintenance inspection switch and the like of the control panel disposed in the car 2 to perform inspection operation and the car 2 ascends/descends to a predetermined location.

[0006] The inspector 4 opens a closed door of an entrance 21 provided in a ceiling of the car 2 using a step-ladder 11, and, from the entrance 21, he can then stand on a maintenance inspection scaffold 2a provided on a roof top of the car 2. Here, in a case where there is another inspector 4, the other inspector 4 raises/lowers the car 2 to a predetermined location from inside the car to facilitate maintenance inspection of the hoist 3 and maintenance inspection of the hoist 3 is performed. In this case, once one wishes for some reason to go outside the hoistway 1, one goes out from the entrance 21 in the ceiling of the car 2, raises/lowers the car 2 and exits to the landing 10 outside the hoistway 1 from the door 6 of the car 2.

[0007] Nevertheless, in the above elevator system, in a case where one stands on the ceiling of the car 2 to perform maintenance inspection of the hoist 3, this inspector 4 moves between the ceiling of the car 2 and the outside of the hoistway 1 through the entrance 21 provided in the ceiling of the car 2 and the car 2 must be raised/lowered in accordance with the extent of this movement. Thus, a cost is incurred because the entrance 21 must be provided in the ceiling of the car 2, and moving between the ceiling of the car 2 and the outside of the hoistway 1during a maintenance inspection operation takes time.

DISCLOSURE OF THE INVENTION

[0008] The present invention aims to overcome these related problems and an object of the present invention is to provide, in a machine room-less elevator, an elevator system where there is no need to raise and lower a car when an inspector moves between a roof of a car and outside of a hoistway during maintenance inspection.

[0009] Also, another object of the present invention is to provide an elevator system in which it is unnecessary to provide an entrance for access when doing maintenance inspection on the roof of the car.

[0010] According to one aspect of the present invention there is provided an elevator system comprising a hoist at an upper portion of a hoistway, and in which a car provided in the hoistway is raised and lowered by means of the hoist via a rope, wherein, stopping means which is operated during maintenance inspection of the hoist is provided for stopping the car at a predetermined location, and the predetermined location is a location where a roof top of the car is a predetermined amount lower than an upper frame of a landing entrance of a highest floor.

[0011] According to another aspect of the present invention there is provided an elevator system wherein, a step portion is provided at a freely opening and closing car-side door provided at an entrance of the car.

[0012] According to yet another aspect of the present invention there is provided an elevator system wherein, the step portion is housed in the car-side door during normal operation of the elevator system and forms a convex portion during maintenance inspection of the elevator system.

[0013] According to still another aspect of the present invention there is provided an elevator system wherein, an entrance height of a landing of a highest floor is set to be a predetermined amount higher than an entrance height of the car.

[0014] According to still yet another aspect of the

present invention there is provided an elevator system wherein, a shielding plate is provided at an upper portion of the landing entrance and between the hoistway and a landing-side door provided at the landing entrance.

[0015] According to a still further aspect of the present invention there is provided a method of inspecting an elevator system wherein, in an elevator system comprising a hoist at an upper portion of a hoistway, and in which a car provided in the hoistway is raised and lowered by means of the hoist via a rope, a roof top of the car is raised from a position a floor face of a landing entrance of a highest floor, and the roof top of the car is stopped at a predetermined position lower than an upper frame of a landing entrance of the highest floor and maintenance inspection of the hoist is performed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG. 1 is a cross sectional drawing showing an elevator system according to Embodiment 1 of the present invention;

FIG. 2 is a cross sectional drawing showing an elevator system according to Embodiment 2 of the present invention;

FIG. 3 is an explanatory drawing of the elevator system according to Embodiment 2 of the present invention;

FIG. 4 is a cross sectional drawing showing an elevator system according to Embodiment 3 of the present invention;

FIG. 5 is a drawing showing the relationship between a entrance height of a landing of a normal elevator system and an entrance height of a car;

FIG. 6 is a cross sectional drawing showing the elevator system according to Embodiment 3 of the present invention;

FIG. 7 is a cross sectional drawing of a conventional machine room-less elevator system;

BEST MODES FOR CARRYING OUT THE INVENTION

[0017] Next, preferred embodiments of the present invention will be explained below.

Embodiment 1

[0018] An Embodiment 1 of an elevator system of the present invention will be described using FIG. 1. Here, FIG. 1 is a cross sectional drawing showing an elevator system according to Embodiment 1 of the present invention.

[0019] In FIG. 1, a car 2 moves up and down in a hoistway 1 comprising an elevator system, and a scaffold 2a is provided at a roof of the car 2. Also, a rope 3a connected to the roof is hoisted by a hoist 3 to raise/lower the car 2. In normal operation, passengers may go in and out between an elevator landing 10 and the car 2 by opening and closing of a landing-side door 5 disposed at a landing entrance of the elevator so as to open and close freely and a car-side door provided at an entrance of the car 2 so as to open and close freely.

[0020] A switch 7 for stopping the car 2 at a predetermined position is provided in the hoistway 1, a cam 8 for contacting the switch 7 at the predetermined position and turning the switch 7 ON is provided on an external side portion of the car 2, a control panel 9 for maintenance inspection operations and the like is disposed at the elevator landing 10 and a stepladder 11 is used for accessing the elevator landing 10 and a hoistway upper portion 1a.

[0021] Here, the hoist 3 is disposed at a beam of the hoistway upper portion 1a and is electrically connected with a control apparatus disposed in the hoistway and the control panel 9 disposed in the elevator landing. The control apparatus outputs speed adjustment commands, stop commands and the like to safely and comfortably move the car 2 and perform driving control.

[0022] Moreover, the cam 8 provided on a side portion of the car 2 is housed in the car 2 during normal operation of the elevator system so as to not contact the switch 7, and only during a maintenance inspection operation does it form a convex portion on the outside of the car 2 to contact the switch 7. That is, the switch 7 and cam 8 comprise a stopping means during a maintenance inspection operation.

[0023] Furthermore, a stopping position of the car 2 stopped by means of the stopping means of the switch 7 and cam 8 is a position where an inspector 4 riding on the roof of the car 2 may easily perform maintenance inspection of the hoist 3 and is set such that there is a gap A (the A shown in FIG. 1) which allows the inspector 4 access between the roof of the car 2 and outside the hoistway 1. The gap A is a distance between the roof top of the car 2 and an upper portion of a frame (upper frame) comprising an entrance of the elevator landing 10 of a highest floor, and the roof top of the car 2 is stopped at a predetermined position lower than the upper frame of the entrance of the elevator landing 10. Since the car 2 is set so as to not rise above the stopping position during maintenance inspection of the hoist 3 by the stopping means, it is possible to insure the safety of the inspector 4 situated between the hoistway upper portion 1a and the roof top of the car 2 during the maintenance inspection.

[0024] Next, a maintenance inspection operation of the hoist 3 of the elevator system in accordance with the present invention will be explained. The inspector 4 operates a button and the like of the control panel 9 dis-

posed at the elevator landing 10 of the highest floor of the building and operation of the elevator system is switched from normal operation to operation for maintenance inspection. In the present embodiment, there are two (2) types of elevator system operation, normal operation, operation with passengers on board, and operation for maintenance inspection, operation when inspecting the hoist and the like, and it is possible to switch between both types of operation. Moreover, maintenance inspection as performed by a number of inspectors 4 will be explained.

[0025] The cam 8, housed in an external side surface of the car during maintenance operation, protrudes outside the side surface of the car 2 simultaneously with switching to operation for maintenance inspection. At this time, it is required that a positional relationship between the cam 8 of the car 2 and the switch 7 be such that the cam 8 is at a lower position than the switch 7. That is to say, when switching to operation for maintenance inspection, the car 2 is positioned at a floor which is below the highest floor. Then, by operating the control panel 9 to lower the car 2 so that the roof top of the car 2 and a floor face of highest floor landing are lined up, it is possible for an inspector 4 to get on the scaffold 2a provided on the roof top of the car 2. When another inspector 4 operates the control panel 9 to raise the car 2 carrying the inspector 4, the cam 8 contacts the switch 7 and the switch 7 is turned ON and the car 2 stops at the predetermined position. Because this stopping position is set in advance for maintenance inspection of the hoist 3, there is no need for the inspector 4 to make small detailed adjustments.

[0026] The inspector 4 performs a maintenance inspection operation of the hoist 3 in a state where the car 2 is stopped at this predetermined position. In this case, once one wishes for some reason to go outside the hoistway 1 or in a case where the other inspector also participates in the operation, it is possible to have free access from the gap A connecting the elevator landing 10 and the roof of the car 2 using the stepladder 11 without raising/lowering the car 2. When the maintenance inspection operation is finished and the inspector 4 operates a button and the like of the control panel 9 disposed at the elevator landing 10 of the highest floor of the building, the cam 8 is again housed in the car 2.

[0027] Accordingly, even when there is some abnormal condition such as an earthquake during the maintenance inspection operation of the hoist 3, the inspector(s) 4 may quickly evacuate to the elevator landing 10 outside the hoistway 1, and it is possible to easily alternate between the roof of the car 2 and outside the hoistway 1 (the elevator landing 10) during the maintenance inspection operation and the safety of the maintenance inspection operation may be increased.

[0028] Also, because it is not necessary to raise/lower the car 2 when the inspector 4 alternates between the roof of the car 2 and outside the hoistway 1 (the elevator landing 10) during the operation, the efficiency of the maintenance inspection operation is also improved.

[0029] Furthermore, although in the present embodiment the stopping means comprises a mechanical means of the switch 7 and the cam 8, a program for stopping at the predetermined position may also be loaded into the control apparatus of the elevator system in advance.

Embodiment 2

[0030] The construction of this embodiment is basically similar to the previously mentioned Embodiment 1 and explanation centers on differing points. Other points are similar to Embodiment 1.

[0031] The elevator system of Embodiment 2 of the present invention will be explained using FIG. 2. Here, FIG. 2 is a cross sectional drawing showing an elevator system according to Embodiment 2 of the present invention, and except for a step portion 12, all other points are similar to FIG. 1 which was explained in Embodiment 1. Thus, portions which are similar or correspond to those in Embodiment 1 will be assigned similar reference numerals and their explanation will be omitted.

[0032] In FIG. 2, a step portion 12 is provided on an approximately central portion of the car-side door 6. Although the step portion 12 is housed flush with the door 6 during normal operation of the elevator system, it is provided so as to be capable of protruding during a maintenance inspection operation and the inspector 4 uses the step portion 12 for stepping when accessing the elevator landing 10 from the roof top of the car 2. The step portion 12 for the elevator system described in FIG. 2 is shown in FIG. 3 as viewed from the elevator landing 10. As shown in FIG. 3, in a case where the car-side door 6 is biparting, the step portion(s) 12 is provided on both sides of the biparting car-side door 6 and each portion protrudes during the maintenance inspection operation and the inspector 4, using these as footstool, is able to climb to the roof top of the car 2.

[0033] That is, when the inspector 4 is performing a maintenance inspection operation for the hoist 3, by extending the step portion 12 and stepping there, it is possible to have free access when moving from the gap A connecting the elevator landing 10 and the roof of the car 2 without employing the stepladder 11.

[0034] Accordingly, it is possible to more easily alternate between the roof of the car 2 and outside the hoistway 1 (the elevator landing 10) during the maintenance inspection operation, and it is not necessary to carry around a stepladder when performing the maintenance inspection operation.

[0035] In the present embodiment, although, as shown in FIG. 3, the step portion is provided on both sides of the biparting car-side door 6, the step portion 12 is not limited as such and may also be provided on one side of the biparting car-side door 6 to be used footstool to climb to the roof top of the car 2.

Embodiment 3

[0036] The construction of this embodiment is fundamentally similar to the previously mentioned Embodiment 1 and explanation centers on differing points. Other points are similar to Embodiment 1.

[0037] The elevator system of Embodiment 3 of the present invention will be explained using FIG. 4. Here, FIG. 4 is a cross sectional drawing showing an elevator system according to Embodiment 3 of the present invention, and although a height of an entrance of the elevator landing 10 to the car 2 differs, all other points are similar to FIG. 1 which was explained in Embodiment 1. Hence, portions which are similar or correspond to those in Embodiment 1 will be assigned similar reference numerals and their explanation will be omitted.

[0038] In FIG. 4, an entrance height D of the elevator landing 10 of the highest floor of a building and an entrance height C of the car 2 differ, and the entrance height D of the elevator landing 10 is higher than the entrance height C of the car 2. Here, in order for comparison with an ordinary elevator system, explanation of a relationship of an entrance height of an elevator landing and entrance height of a car of an ordinary elevator system will be made using FIG. 5. FIG. 5 is a drawing showing the relationship between an entrance height of a landing of a normal elevator system and an entrance height of a car. As shown in FIG. 5, an entrance height B of the elevator landing 10 and an entrance height C of the car are set so as to be approximately the same. That is to say, structures disposed on the upper portion of the roof of the car 2 are concealed when the landing-side door 5 of the elevator landing 10 is opened, and this improves an external appearance of the elevator system.

[0039] In order to prevent harming an external appearance of the elevator system of the present embodiment shown in FIG. 4, structures on the upper portion of the roof of the car 2 are covered and concealed during normal operation by means of a shielding plate 13 and the external appearance is protected. This shielding plate 13 is removably provided on an upper frame of the landing entrance and between the hoistway 1 and the landing-side door 5.

[0040] Next, a maintenance inspection method of the hoist 3 of the elevator system in accordance with the present embodiment will be explained. The inspector 4 operates the control panel 9 provided at the highest floor of a building and switches operation of the elevator system from normal operation to operation for maintenance inspection and the landing-side door of the highest floor elevator landing 10 is opened. Then, the inspector 4 temporarily removes the shielding plate for inspection. In switching operation, the cam 8, housed in an external side surface of the car 2 during normal operation, extends outside the side surface of the car 2. Next, by operating the control panel 9 to lower the car 2 so that the roof top of the car 2 and a floor face of highest floor landing are lined up, it is possible for an inspector 4 to get on the scaffold 2a provided on the roof top of the car 2. When another inspector 4 operates the control panel 9 to raise the car 2 carrying the inspector 4, the cam 8 contacts the switch 7 and the switch 7 is turned ON and the car 2 stops at the predetermined position.

[0041] Next, access of the inspector 4 to the elevator landing 10 and the roof of the car 2 during maintenance operation of the hoist 3 will be described using FIG. 6. FIG. 6 is a cross sectional drawing showing a gap between the upper frame of the landing entrance and the roof surface of the car 2. When the car 2 is stopped at a predetermined stopping position, a gap A' is formed between the elevator landing entrance 10 and the roof of the car 2. The gap A' is a distance between the roof top of the car 2 and the upper frame of the entrance of the elevator landing 10 of the highest floor, and because a height of the upper frame of the entrance of the elevator landing is set higher than that in Embodiment 1, it is possible for the gap A' to have more clearance.

[0042] Also, by changing the height of the entrance of the elevator landing 10 of the highest floor based on a position of the hoist 3, it is possible to freely adjust the distance between roof top of the car 2 and the upper frame of the entrance of the elevator landing 10 of the highest floor. Accordingly, one can easily alternate between the roof of the car 2 and outside the hoistway 1 (the elevator landing 10) during the maintenance inspection operation, the safety of the maintenance inspection operation may be increased and the efficiency of the maintenance inspection operation may also be improved.

[0043] Moreover, if a further space may be provided in the entrance height D of the elevator landing 10 of the highest floor of the building and the entrance height C of the car 2, one may move to the maintenance inspection operation by only removing the shielding plate 13 with the car 2 stopped at the highest floor similar to the case of normal operation.

INDUSTRIAL APPLICABILITY

[0044] As above, the elevator system of the present invention may be applied to a machine room-less elevator system comprising a hoist at an upper portion of a hoistway, and in which a car provided in the hoistway is raised and lowered by means of the hoist via a rope and wherein, stopping means, which is operated during maintenance inspection of the hoist, is provided for stopping the car at a predetermined location.

Claims

1. An elevator system comprising a hoist (3) at an upper portion of a hoistway (1), and in which a car (2) provided in said hoistway (1) is raised and lowered by means of said hoist (3) via a rope (3a), wherein,

stopping means (7, 8) which is operated during maintenance inspection of said hoist (3) is provided for stopping said car (2) at a predetermined location, and said predetermined location is a location where a roof top of said car is a predetermined amount lower than an upper frame of a landing (10) entrance of a highest floor.

2. An elevator system according to Claim 1 wherein, a step portion (12) is provided at a freely opening and closing car-side door (6) provided at an entrance of said car (2).

3. An elevator system according to Claim 2 wherein, said step portion (12) is housed in said car-side door (6) during normal operation of the elevator system and forms a convex portion during maintenance inspection of said elevator system.

4. An elevator system according to Claim 1 wherein, an entrance height (D) of said landing (10) of a highest floor is set to be a predetermined amount higher than an entrance height (C) of said car.

5. An elevator system according to Claim 4 wherein, a shielding plate (13) is provided at an upper portion of said landing entrance and between said hoistway (1) and a landing-side door (5) provided at said landing entrance.

6. A method of inspecting an elevator system wherein, in an elevator system comprising a hoist (3) at an upper portion of a hoistway (1), and in which a car (2) provided in said hoistway (1) is raised and lowered by means of said hoist (3) via a rope (3a), a roof top of said car (2) is raised from a position a floor face of a landing entrance of a highest floor, and said roof top of said car (2) is stopped at a predetermined position lower than an upper frame of a landing entrance of said highest floor and maintenance inspection of said hoist (3) is performed.

FIG. 1

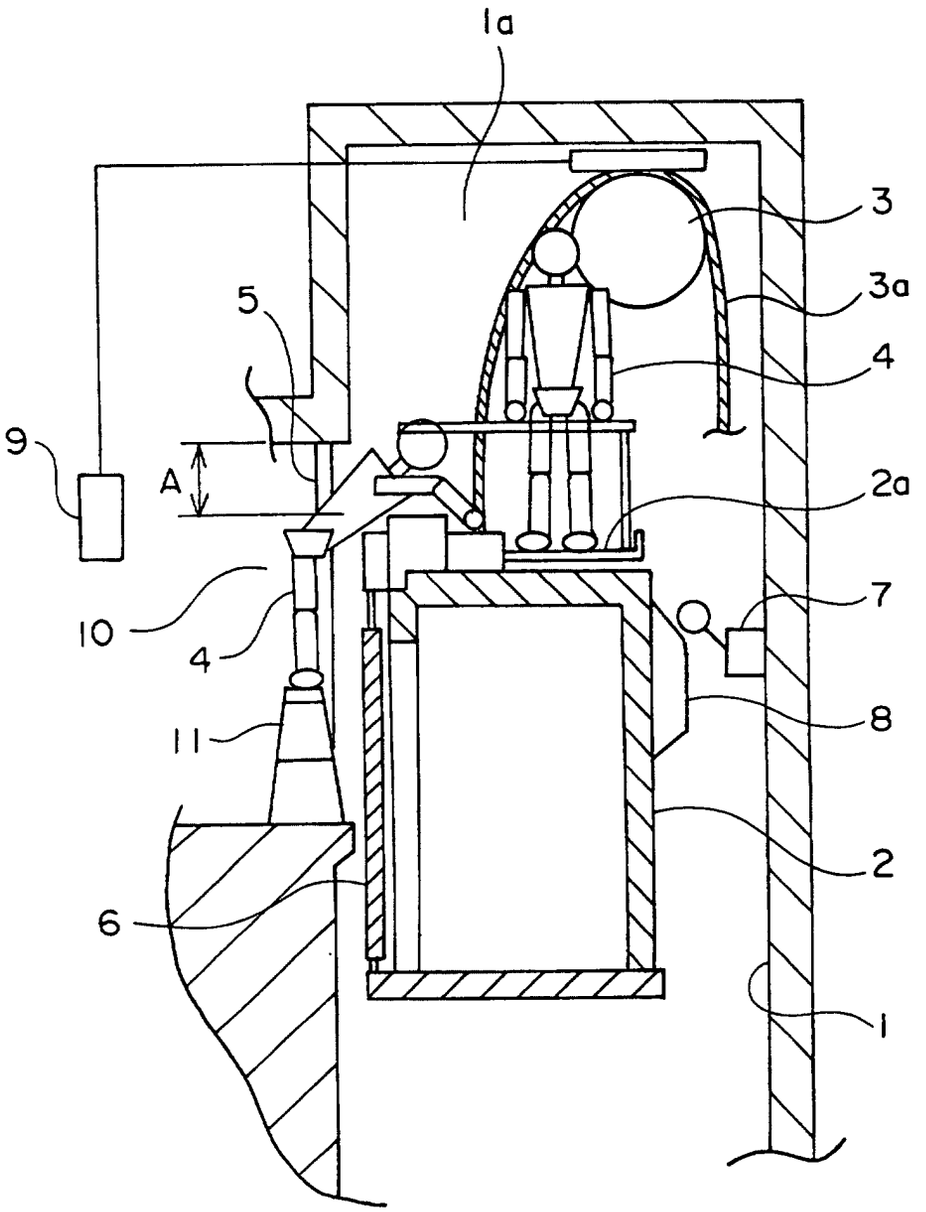


FIG. 2

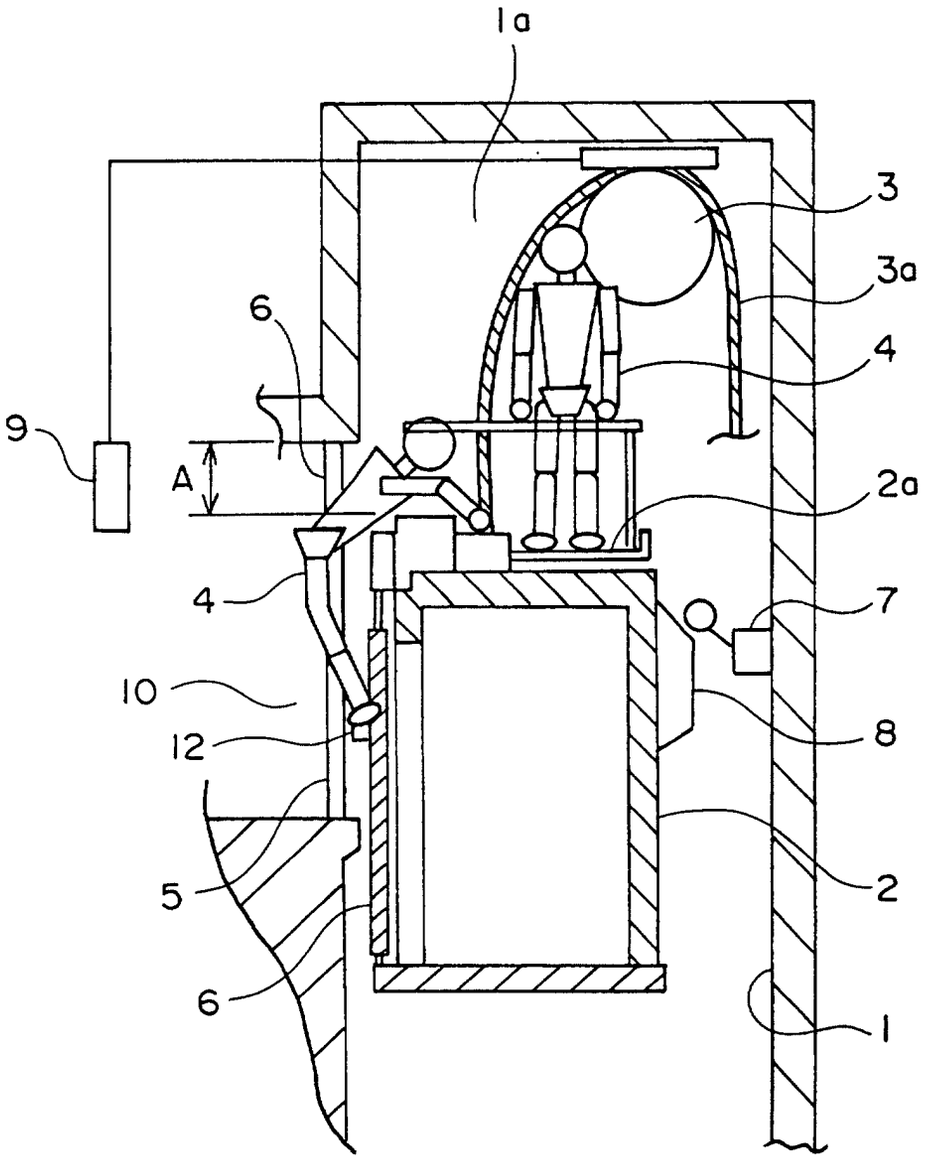


FIG. 3

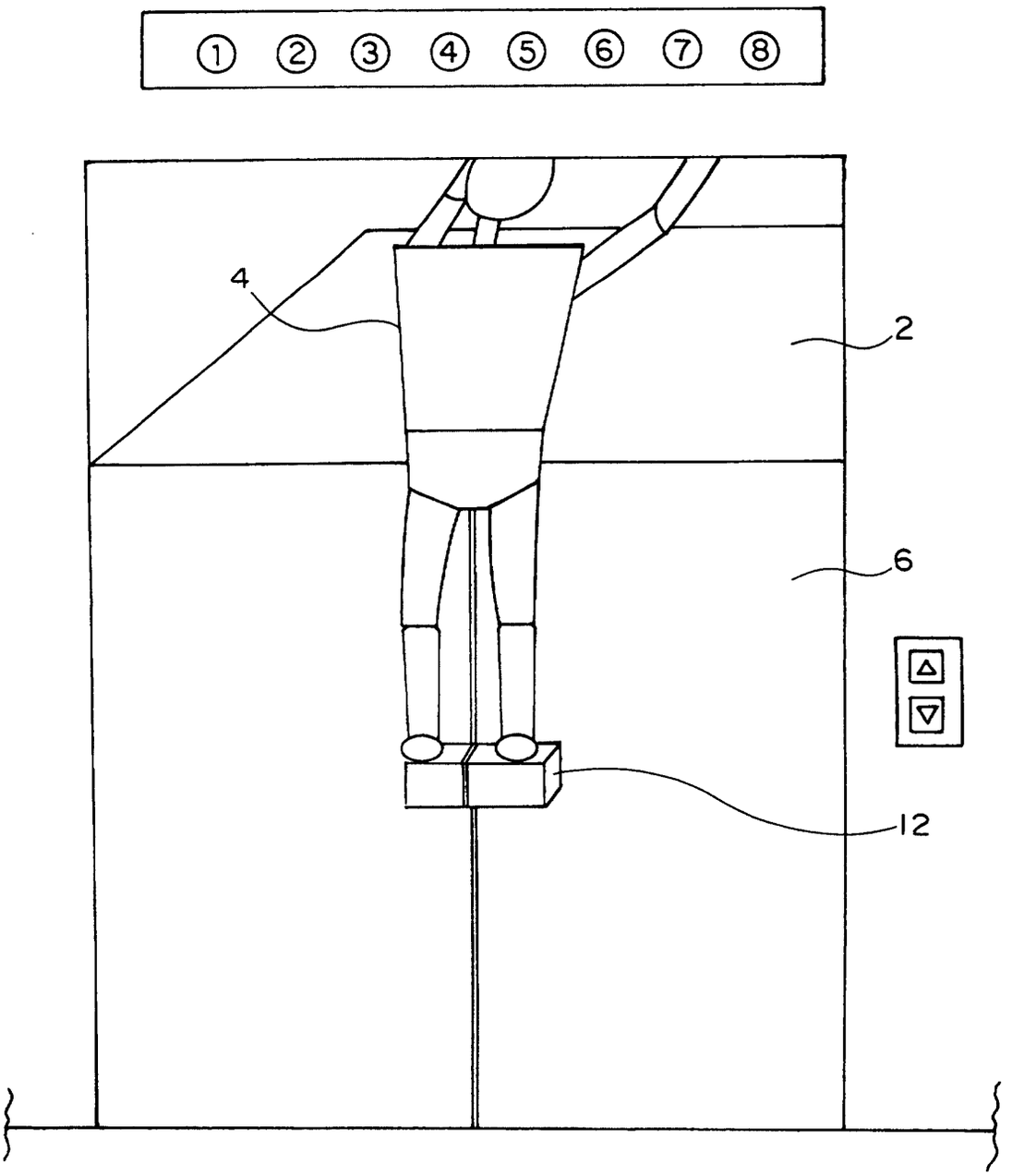


FIG. 4

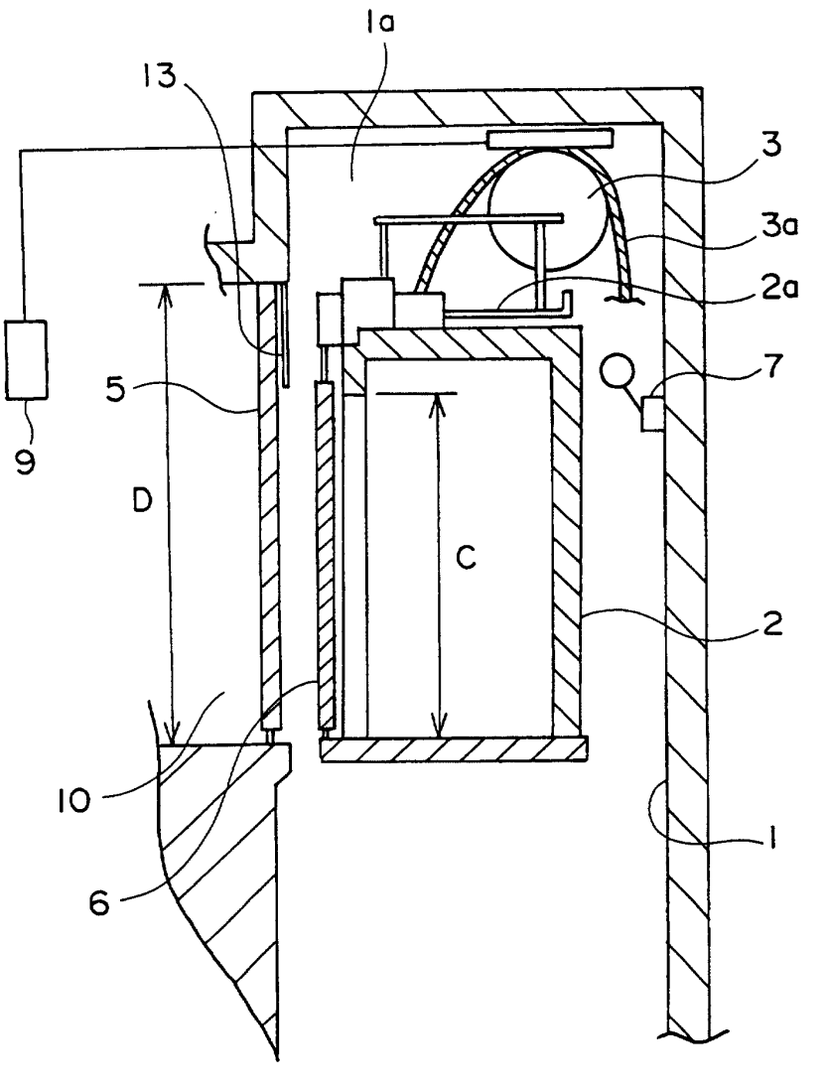


FIG. 5

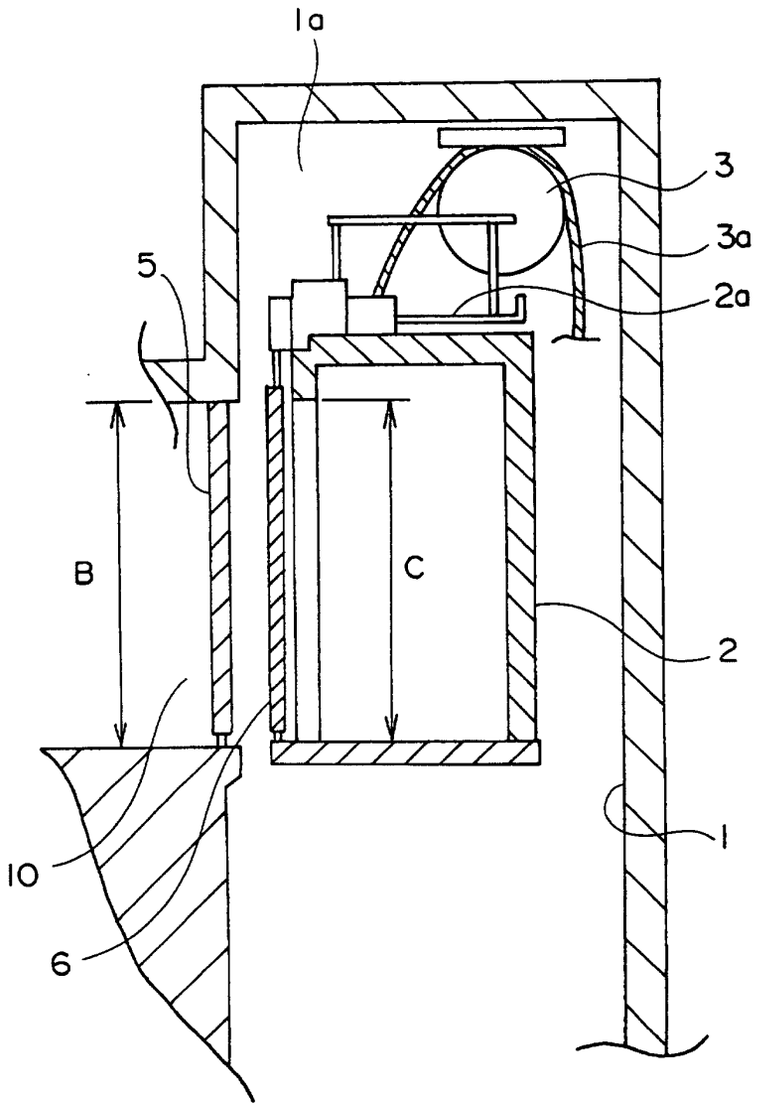


FIG. 6

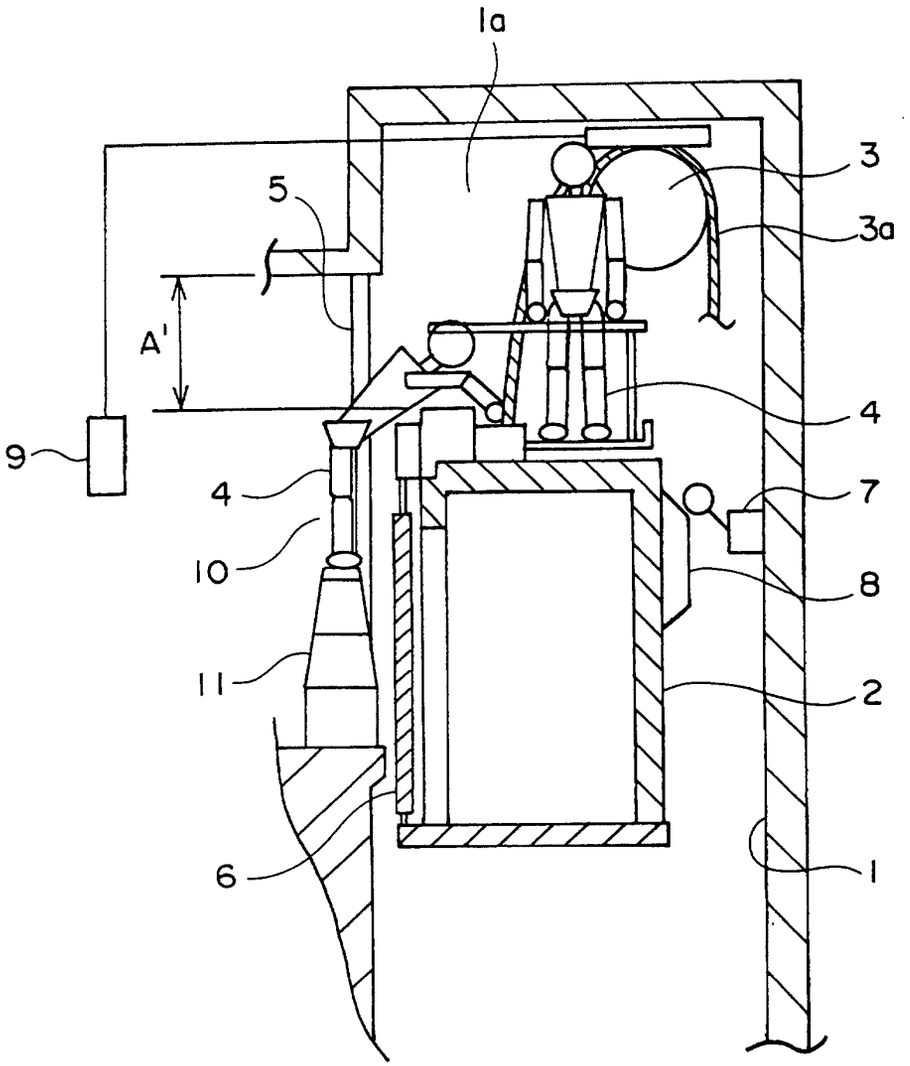
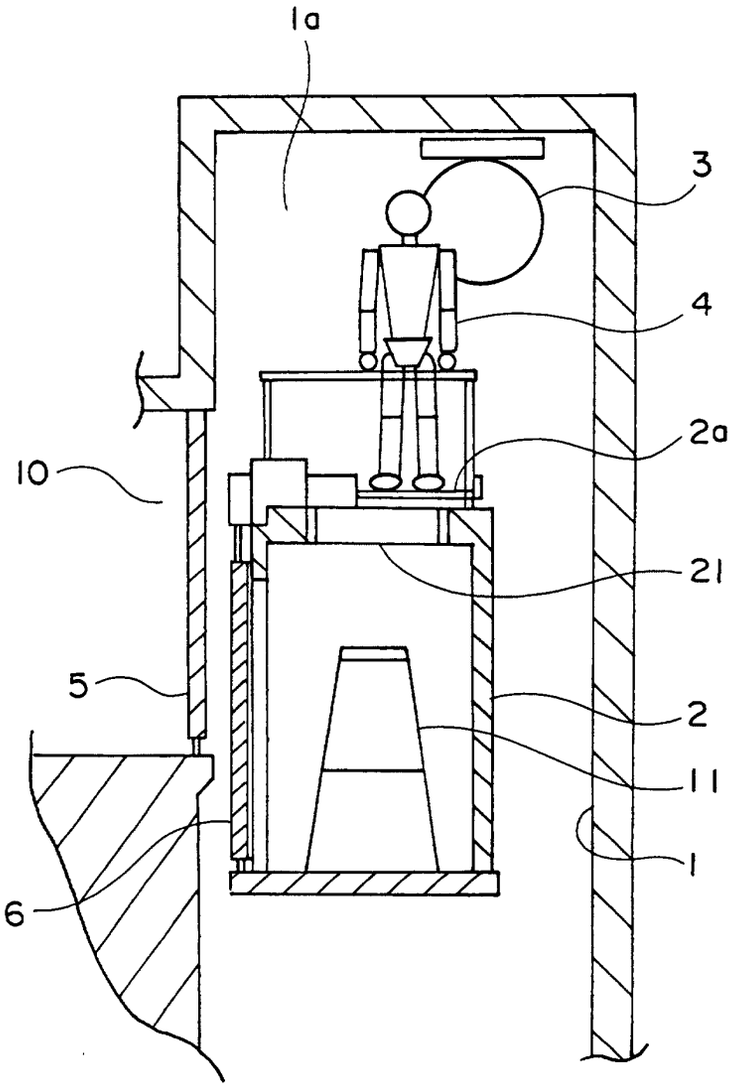


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/06421

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B 5/00, B66B11/02

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)
Int.Cl[7] B66B 5/00-B66B11/08

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 1996-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Toroku Jitsuyo Shinan Koho 1994-2001

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 A	US 6006865 A (Inventio AG), 28 December, 1999 (28.12.99), & JP 10-139321 A	1,6 2-5
Y	JP 2000-238976 A (Mitsubishi Electric Corporation), 05 September, 2000 (05.09.00), (Family: none)	1
Y	JP 5-15636 B2 (Toshiba Corporation), 02 March, 1993 (02.03.93), & JP 62-96285 A	6
Y A	JP 2000-86104 A (Toshiba Elevator K.K., Toshiba Corporation), 28 March, 2000 (28.03.00), (Family: none)	6 1-5
A	JP 2000-233878 A (Inventio AG), 29 August, 2000 (29.08.00), & AU 1491800 A & BR 260 A & CN 1263862 A & NO 20000581 A	1-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 January, 2001 (19.01.01)	06 February, 2001 (06.02.01)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP00/06421

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5490578 A (Kone Oy), 13 February, 1996 (13.02.96), & BR 9402574 A & CN 1038573 B & EP 0631966 B1 & FI 98210 C & JP 2889125 B2	1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)