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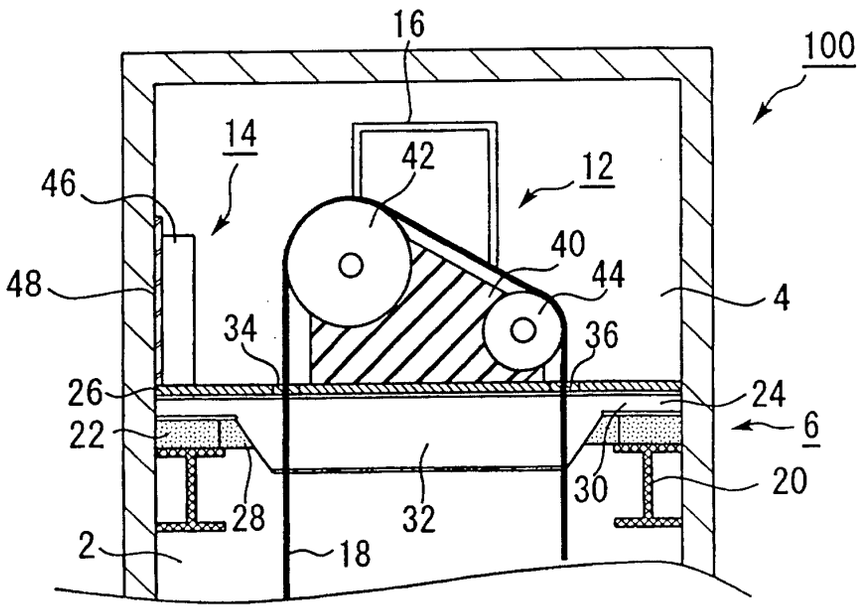
(54) **ELEVATOR**

(57) In an elevator apparatus provided with a shaft (2) in which the cage (8) of the elevator moves up and down, a machinery room (4), a machinery room floor (6) to serve as a partitioning between the machinery room (4) and the shaft (2), and a hoisting machine (12) installed in the machinery room (4) to move up and down the cage (8) of the elevator, wherein the machinery room floor (6) includes supporting parts (20) supported in a prescribed position in the shaft (2) and machinery bases (24) by said supporting parts (20) to accommodate the installation of the hoisting machine (12). These machinery bases (24)have a machinery base installation part (32) to accommodate the installation of the hoisting machine, and machinery base supporting parts (30) supported by the supporting parts (20). The machinery base installation part (32) is formed thicker than the machinery base supporting parts (30).

Fig.3



EP 1 512 658 A1

Description

Technical Field

[0001] The present invention relates to an elevator apparatus, and more particularly to an elevator apparatus for use in the machinery room arranged at the top of the elevator shaft.

Background Art

[0002] Figure 5 is a schematic view illustrating the interior of an elevator apparatus 200 according to the prior art.

[0003] As shown in Figure 5, the elevator apparatus 200 is provided with an elevator shaft 2. The top part of the shaft 2 is partitioned by a machinery room floor 4, and there is arranged a machinery room 6.

[0004] From the shaft 2 are hung a cage 8 and a balance weight 10, and the cage 8 and the balance weight 10 move up and down in the shaft 2.

[0005] The machinery room 6 is also provided with a hoisting machine 12, to which is connected a control device 14. The machinery room 6 is provided with a door 16 for entrance into and exit from the machinery room 6.

[0006] Round the hoisting machine 12 is wound a rope 18, one end of which hangs from the machinery room 6 into the shaft 2 and is connected to the cage 8 to suspend the cage 8 in the shaft 2. The other end hangs from the machinery room 6 into the shaft 2 and is connected to the balance weight 10 to suspend the balance weight 10 in the shaft 2.

[0007] Figure 6 shows a top view of the machinery room 6 of the elevator apparatus 200 and Figure 7, a sectional view of the machinery room 6 along A-A' in Figure 6.

[0008] As shown in Figure 6 and Figure 7, the machinery room floor 4 comprises structural beams 62, a machinery room floor plate 44 and machinery bases 66.

[0009] The structural beams 62 are fixed to walls of the shaft 2 at a prescribed height in the shaft 2. The machinery room floor plate 44 is arranged over the structural beams 62. The structural beams 62 support two ends of the machinery room floor plate 44, namely the right and left ends as viewed in Figure 6 and Figure 7. The machinery room floor plate 44 is also provided with rope passages 68 and 70.

[0010] Above the machinery room floor plate 44 are arranged two parallel machinery bases 66 in a direction normal to the structural beams 62. The machinery bases 66 are pillars of 300 mm to 500 mm in height. On the machinery bases 66 is installed the hoisting machine 12.

[0011] Sufficient strength should be secured for the machinery bases 66 to support the hoisting machine 12 which moves up and down the cage 8 and the balance weight 10 suspended from it. Therefore, the machinery bases 66 need some height.

[0012] As described above, in the machinery room 6, there are provided the machinery bases 66 of 300 to 500 mm in height, and these hoisting machine 12 and control device 14 are further installed among other things. However, when an elevator apparatus is to be installed in a building or elsewhere, often the space it occupies is required to be minimized, and this requirement necessitates a reduction in the dimensions of the machinery room 6 to be arranged at the top of the elevator, inevitably resulting in more or less restrictions on the size of the machinery room 6.

[0013] When the hoisting machine 12, the control device 14 or any other item of equipment is to be inspected or repaired in this limited space of the machinery room, sufficient footholds cannot be secured on account of projections including the machinery bases 66, and the maintenance personnel would have to work in an unnatural posture, such as riding on the machinery bases 66 or keeping away from projections including the machinery bases 66, the hoisting machine 12 and the control device 14. This makes difficult smooth accomplishment of the maintenance work, which would therefore take a longer time and keep the elevator suspended from operation for a long period during a safety check or the like.

[0014] The requirement for a smaller machinery room 6 has become even more stringent, and now it is of ten demanded that the machinery room 6 be equal in width to the shaft 2, i.e. the sectional area of the machinery room 6 in the horizontal direction be equal to that of the shaft 2 as shown in Figures 5 through 7. If this requirement is met, in particular, opening the door 16 of the machinery room 6, the maintenance personnel will find the machinery bases 66 installed just ahead of them, which means a large level gap just inside the entrance. Furthermore, as the machinery bases 66 would span the full width of the room, there would be no space to install the control device 14 elsewhere than on the machinery bases 66. However, since the control device 14 is relatively tall, arranging it on the machinery bases 66 would necessitate some overhead clearance in the machinery room 6.

Disclosure of the Invention

[0015] Therefore, with an eye to solving the problems noted above, the present invention is to intended to propose an improved elevator apparatus which enables a machinery room, limited in dimensions by structural constraints of the elevator, to be used without inconvenient dimensional restriction and to be reduced in projections inside.

[0016] To achieve this object, an elevator apparatus according to the invention comprises a shaft in which the cage of the elevator moves up and down, a machinery room, a machinery room floor to serve as a partitioning between the machinery room and the shaft, and a hoisting machine installed in the machinery room to move up and down the cage of the elevator, wherein the machinery room floor includes supporting parts fixed in

a prescribed position in the shaft, and machinery bases supported by the supporting parts to accommodate the installation of the hoisting machine, wherein each of the machinery bases has a machinery base installation part to accommodate the installation of the hoisting machine, and machinery base supporting parts supported by the supporting parts, wherein the machinery base installation part is formed thicker than the machinery base supporting parts.

[0017] In this way, it is possible to reduce the overall thickness of the machinery room floor while securing the strength of the machinery bases, accordingly to make the whole structure thinner and expand the available space in the machinery room, thereby facilitating maintenance work in the machinery room.

[0018] In an elevator apparatus according to the invention, the machinery room floor may be further provided with a machinery room floor plate supported by the supporting parts and between the supporting parts and the machinery base supporting parts, and the machinery base installation part be fitted into the machinery room floor plate.

[0019] In an elevator apparatus according to the invention, the machinery room floor plate has an opening in the middle part, and the machinery base installation part is engaged with and fitted into the opening.

[0020] In an elevator apparatus according to the present invention, the machinery room floor is further provided with a floor surface plate supported by the machinery bases, covering the machinery room floor all over.

[0021] In an elevator apparatus according to the present invention, it is further provided with a control device for controlling the rotation of the hoisting machine.

[0022] In an elevator apparatus according to the present invention, the control device is partly fitted into the machinery room floor.

[0023] In an elevator apparatus according to the present invention, it is further provided with a control device for controlling the rotation of the hoisting machine control device, wherein the control device includes an L-shaped portion whose two faces cross each other substantially normally, and one of the two faces is fitted into the floor surface plate and supported by the supporting parts.

[0024] In an elevator apparatus according to present invention, the machinery room is formed by partitioning the upper part of the shaft and the sectional area of the shaft in the horizontal direction is equal to the sectional area of the machinery room in the horizontal direction.

Brief Descriptions of Drawings

[0025]

Figure 1 shows a schematic view of an elevator apparatus to describe one of the best modes for carrying out the invention.

Figure 2 shows a top view of the machinery room of the elevator apparatus to describe one of the best modes for carrying out the invention.

Figure 3 shows a sectional view of the machinery room of the elevator apparatus to describe one of the best modes for carrying out the invention.

Figure 4 shows a sectional view of the machinery room of the elevator apparatus to describe one of the best modes for carrying out the invention.

Figure 5 shows a schematic view of an conventional elevator apparatus.

Figure 6 shows a top view of the machinery room of the conventional elevator apparatus.

Figure 7 shows a sectional view of the machinery room of the conventional elevator apparatus.

Best Modes for Carrying Out the Invention

[0026] Modes for implementing the present invention will be described below with reference to the drawings. In these drawings, the same or equivalent constituent parts are denoted by respectively the same reference signs, and their description is either simplified or omitted.

[0027] Figure 1 shows a front view of an elevator apparatus 100 to describe one of the best modes for carrying out the invention, with the front wall of the elevator apparatus 100 removed to reveal the interior. As shown in Figure 1, the elevator apparatus 100 is provided with a shaft 2. The top part of the shaft 2 is partitioned by a machinery room floor 4, and there is arranged a machinery room 6.

[0028] A cage 8 and a balance weight 10 are suspended into the shaft 2.

[0029] The machinery room 6 is provided with a hoisting machine 12, to which is connected a control device 14. The machinery room 6 is provided with a machinery room door 16 for entrance into and exit from the machinery room 6.

[0030] Round the hoisting machine 12 is wound a rope 18, one end of which hangs from the machinery room 6 into the shaft 2 and is connected to the cage 8 to suspend the cage 8 in the shaft 2. The other end hangs from the machinery room 6 into the shaft 2 and is connected to the balance weight 10 to suspend the balance weight 10 in the shaft 2.

[0031] In the elevator apparatus 100 configured in this way, the revolving speed of the hoisting machine 12 is set by the control device 14, and the rotation and stopping of the hoisting machine 12 during the operation of the elevator are also controlled by the control device 14.

[0032] When the control device 14 starts the rotation of the hoisting machine 12, the rope 18 wound round the hoisting machine 12 begins moving according to the direction of rotation, and the cage 8 and the balance weight 10 are thereby caused to move vertically within the shaft 2 in abalancedway inmutuallyreverse directions.

[0033] Figure 2 shows a top view of the machinery room 6 of the elevator apparatus 100, including a partial perspective view. Figure 3 shows a sectional view of the machinery room 6 along the A-A' plane in Figure 2, and Figure 4, a sectional view along the B-B' plane.

[0034] The machinery room floor 4 comprises structural beams 20, a machinery room floor plate 22, machinery bases 24 and an upper floor plate 26.

[0035] The structural beams 20, I-shaped as viewed from front as shown in Figure 3 and Figure 4, are fixed at a prescribed height in the shaft 2, protruding from the two side walls, right and left, of the shaft 2. The machinery room floor plate 22 is a board having a square opening 28 in the central part. The machinery room floor plate 22 is arranged over the structural beams 20, and supported by the structural beams 20 at its two ends, namely the right and left ends as viewed in Figure 2 through Figure 4.

[0036] The machinery bases 24 consist of two beams. Each beam is a basically I-section bar like either machinery bases in the prior art configuration but cut at the right and left ends to be made thinner, and consists of machinery base ends 30 cut to be thinner and a machinery base middle part 32 left in its original thickness. The machinery base middle part 32 is 300 mm to 500 mm thick in its thickest portion. The machinery base ends 30 are so installed over the machinery room floor plate 22 that the lengthwise direction of each beam be normal to the structural beams 20. The machinery base middle part 32 is connected to and supported by the machinery base ends 30, and so arranged as to look positioned at the center of the machinery room floor 4 as viewed from front. The machinery base middle part 32 is fitted into the opening 28 bored in the machinery room floor plate 22 and protrudes below the surface of the machinery room floor plate 22.

[0037] All over the machinery bases 24 is laid the upper floor plate 26, though the upper floor plate 26 is not shown in Figure 2 because this drawing shows the upper face in a state in which the upper floor plate 26 is removed. The upper floor plate 26 is a flat board covering the floor of the machinery room 6 all over. Rope passing holes 34 and 36 are bored in the upper floor plate 26.

[0038] Over the machinery room floor 4 configured as described above is installed the hoisting machine 12. The hoisting machine 12 is provided with supporting boards 40, and a large pulley 42 and a small pulley 44, both rotatably fitted to the supporting boards 40. By rotating the large and small pulleys 42 and 44 of the hoisting machine 12, the rope 18 threaded round the large and small pulleys 42 and 44 is moved right or left, the cage 8 and the balance weight 10 can be raised or lowered by the rope motion.

[0039] The control device 14 comprises a control board 46 and a control board fixture 48. The control board 46 is a small and thin control board, and the control board fixture 48 is a thin L-shaped item whose two faces cross each other at 90 degrees. The control board 46 is fixed by the control board fixture 48. As shown in Figure 4, the bottom portion of the control board fixture 48 is embedded underneath the upper floor plate 26. and installed over the machinery room floor plate 22. A cable for transmitting rotation and stop signals from the control device 14 to the hoisting machine 12 is also laid underneath the upper floorplate 26. Thus, though the upper floorplate 26 is installed over the machinery bases 24, there is void space between the upper floor plate 26 and the machinery room floor plate 22 where the machinery bases 24 is not arranged, because the machinery bases 24 are two beams disposed over the machinery room floor plate 22. By utilizing this void space, the control device 14 is installed, with the lower portion of the control board fixture 48 of the control device 14 and a cable 50 connected to the lower portion of the control board 46 being embedded underneath the upper floor plate 26.

[0040] As hitherto described, in this mode for carrying out the invention, the machinery bases 24 are composed of beams having a shape formed by thinning both end parts of conventional beams. Thus, the machinery base middle part 32 of the machinery bases 24 supporting the hoisting machine 12 is formed somewhat thicker than the machinery base ends 30. This thicker machinery base middle part 32 is fitted into the opening 30 of the machinery room floor plate 22. Accordingly, the machinery room floor 4 can be formed generally thin to enable a larger available space to be secured in the machinery room 6. Therefore, safety check and repair operations in the machinery room 6 can be accomplished more efficiently to reduce the length of time taken for maintenance, resulting in improved elevator servicing.

[0041] In this arrangement of the machinery bases 24, the machinery base middle part 32 on which the hoisting machine 12 is installed is subject to the greatest force due to the up and down movements of the cage 8 and the balance weight 10. Therefore, the greater thickness of the part on which the hoisting machine or some other load are installed makes it possible to provide sufficient strength to the machinery bases 24 to support the hoisting machine 12.

[0042] Further in this mode for carrying out the invention, the upper floor plate 26 prevents the machinery bases 24 from protruding out of the surface of the machinery room floor 4. Therefore, the machinery room floor 4 is flat where there is no equipment installed, such as the hoisting machine 12 or the control device 14. This makes possible suppressing the level gap within the machinery room 6 when entering or leaving the machinery room through the door 16 and ensuring adequate footholds for maintenance personnel working in the machinery room 6 for safety check or repair of the hoisting machine 12 or the control device 14, enabling the personnel to accomplish the work more efficiently and reduce the length of time taken for maintenance, resulting in improved elevator servicing.

[0043] Further in this mode for carrying out the invention, the lower portion of the control board fixture 42 of the control device 14 and the cable 50 are embedded underneath the upper floor plate 26 and installed by utilizing the void space between the upper floor plate 26 and the machinery room floor plate 22. Therefore, as the relatively tall control device 14 can be arranged in a low position away from the machinery bases 24, the control device 14 can be prevented from adding to the height of the machinery room 6.

[0044] In addition, one face of the L-shaped control board fixture 48 is embedded in the machinery room floor 4, and the thin control board 46 is fixed to this control board fixture 48. Therefore, the control device 14 can be installed in a stable state without having to reduce its overall thickness and sacrifice part of its width for parts needed for its installation.

[0045] Although this mode for carrying out the invention has been described with reference to a configuration in which the control device 14 is arranged within the machinery room 6, the invention is not limited to this configuration, but the control device 14 may as well be provided outside the elevator apparatus. Even if the control device is installed within the machinery room 6, the shape of the control device need not be shaped as described above, but may have some other shape. Furthermore, the control device need not be fitted into the machinery room floor 4, but may instead be installed on the top face of the machinery room floor 4 as according to the prior art.

[0046] Further in this mode for carrying out the invention, the machinery room floor plate 22 has the square opening 30, and by fitting the machinery base middle part 42 into this opening, the machinery bases 24 are fitted into the machinery room floor plate 22. However, the opening need not be square, but two rectangular openings, longer laterally, matching the shape of the machinery base middle part 42 may as well be arranged in parallel. In this case, however, additional rope passing holes would be needed. Also, the method of fitting the machinery bases 24 into the machinery room floor plate 22 is not limited to what was described above.

[0047] Further in this mode for carrying out the invention, each of the machinery bases 24 is provided with the thicker machinery room middle part 32 to be arranged in the central part of the machinery room 6, and here is arranged the hoisting machine 12. However, the shape of the machinery bases 24 is not limited to this, but it is only required that the part where the hoisting machine 12 is to be installed is formed thick enough.

[0048] Further with respect to this mode for carrying out the invention, while a case in which the width of the machinery room 6 is equal to that of the shaft 2, i.e. the sectional area of the machinery room 6 in the horizontal direction is equal to that of the shaft 2, was described, the invention is not limited to this case, but the width of the machinery room 6 may be greater than that of the shaft 2 if an even greater available space in the machinery room 6 is required.

[0049] In addition, the mechanism for moving up and down the elevator apparatus and the shape, structure and other features of the hoisting machine 12, the structural beams 20 and other items are not necessarily limited to what were described with reference to this mode for carrying out the invention, but other shape, structure and so forth can be usedwithin the scope of the invention.

[0050] Incidentally, in the present invention, the supporting parts are the parts supporting the machinery room floor, and the structural beams 20 constitute the supporting parts in this mode for carrying out the invention for instance. The machinery base installation part is what is formed thicker than the rest of the machinery bases to bear the installation of the hoisting machine, and the machinery room middle part 32 constitutes this part in this mode for carrying out the invention for instance. The machinery base supporting parts are what are supported by the aforementioned supporting parts, and the machinery room ends 30 constitute these parts in this mode for carrying out the invention for instance.

Industrial Applicability

[0051] As hitherto described, according to the present invention, the parts of the machinery bases where the hoisting machine is to be installed are formed thicker than elsewhere, and these parts are fitted into the machinery room floor plate. Accordingly, the available space in the machinery room can be expanded by thinning the overall thickness of the machinery room floor while maintaining the necessary strength of the parts of the machinery bases where the hoistingmachine and other items are to be installed. Therefore, space saving in the machinery room can be achieved. Work can be done efficiently even in a small machinery room, thereby making possible improved elevator servicing.

[0052] Where a surface floor plate is to be laid over the top face of the machinery bases in a configuration according to the invention, projections from the machinery room floor can be made fewer. Therefore, even more footholds can be secured to enhance the efficiency of work in the machinery room and thereby reduce the length of time taken for maintenance work.

[0053] Further in a configuration according to the invention where the control device is fitted into the machinery room floor, the overall height of the machinery room can be prevented from being increased by the arrangement of a taller control device. Therefore, space saving in the machinery room can be achieved. Also, as part of the control device is so structured as to be fitted in, even a thinner control device can be stably installed.

Claims

1. An elevator apparatus comprising:

a shaft in which the cage of the elevator moves up and down,
a machinery room,
a machinery room floor to serve as a partitioning between said machinery room and said shaft, and
a hoisting machine installed in said machinery room to move up and down said cage of the elevator, **characterized in that**
said machinery room floor includes:
supporting parts fixed in a prescribed position in said shaft; and
machinery bases supported by said supporting parts to accommodate the installation of said hoisting machine, wherein
each of said machinery bases has:
a machinery base installation part to accommodate the installation of said hoisting machine; and
machinery base supporting parts supported by said supporting parts, wherein:
said machinery base installation part is formed thicker than said machinery base supporting parts.

2. The elevator apparatus according to Claim 1 **characterized in that**

said machinery room floor is further provided with a machinery room floor plate supported by said supporting parts and between said supporting parts and said machinery base supporting parts, and
said machinery base installation part is fitted into said machinery room floor plate.

3. The elevator apparatus according to Claim 2 **characterized in that**

said machinery room floor plate has an opening in the middle part, and

said machinery base installation part is engaged with and fitted into said opening.

4. The elevator apparatus according to any of Claims 1 through 3 **characterized in that** said machinery room floor is further provided with a floor surface plate supported by said machinery bases, covering the machinery room floor all over.

5. The elevator apparatus according to any of Claims 1 through 4 **characterized in that** it is further provided with a control device for controlling the rotation of said hoisting machine.

6. The elevator apparatus according to Claim 5 **characterized in that** said control device is partly fitted into said machinery room floor.

7. The elevator apparatus according to Claim 4 **characterized in that**

it is further provided with a control device for controlling the rotation of said hoisting machine control device, wherein
said control device includes an L-shaped portion whose two faces cross each other substantially normally, and
one of said two faces is fitted into said floor surface plate and supported by said supporting parts.

8. The elevator apparatus according to any of Claims 1 through 7 **characterized in that** said machinery room is formed by partitioning the upper part of said shaft and the sectional area of said shaft in the horizontal direction is equal to the sectional area of said machinery room in the horizontal direction.

Fig.1

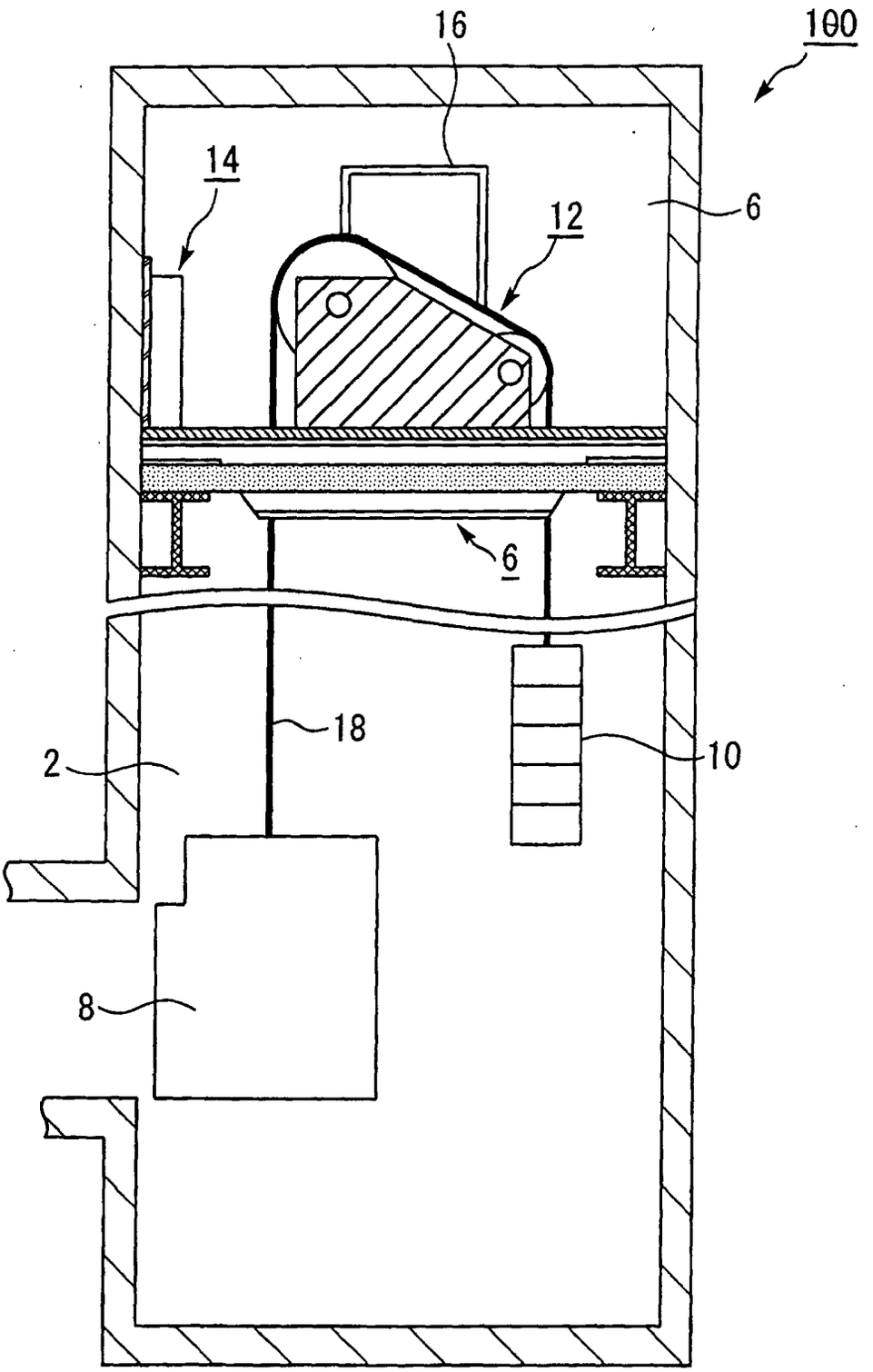


Fig.2

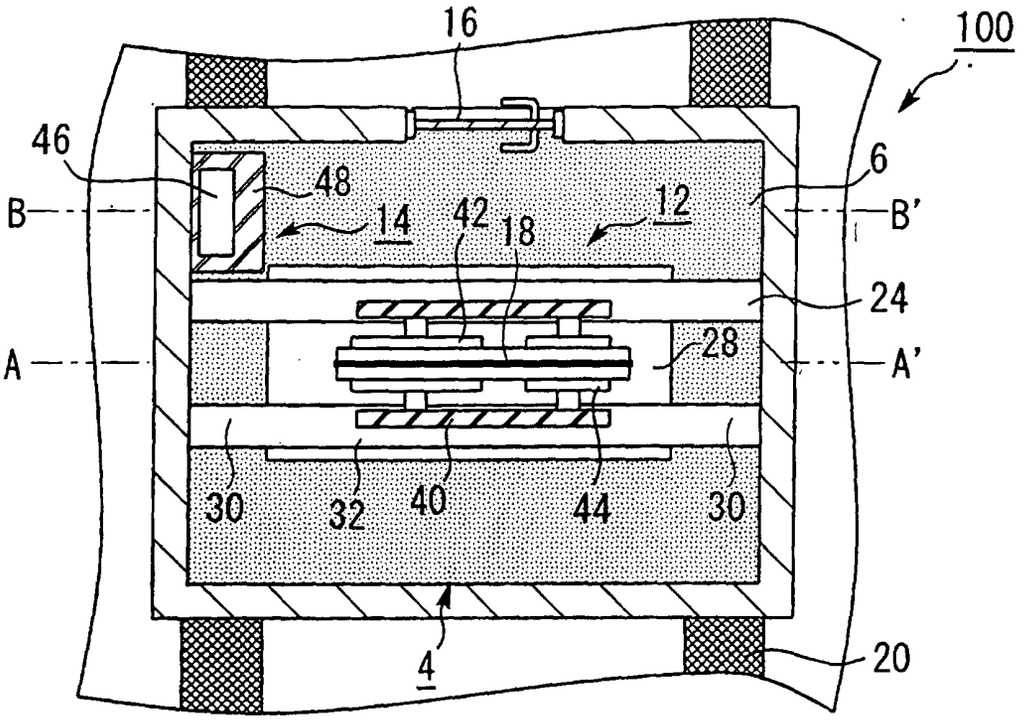

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Fig.3

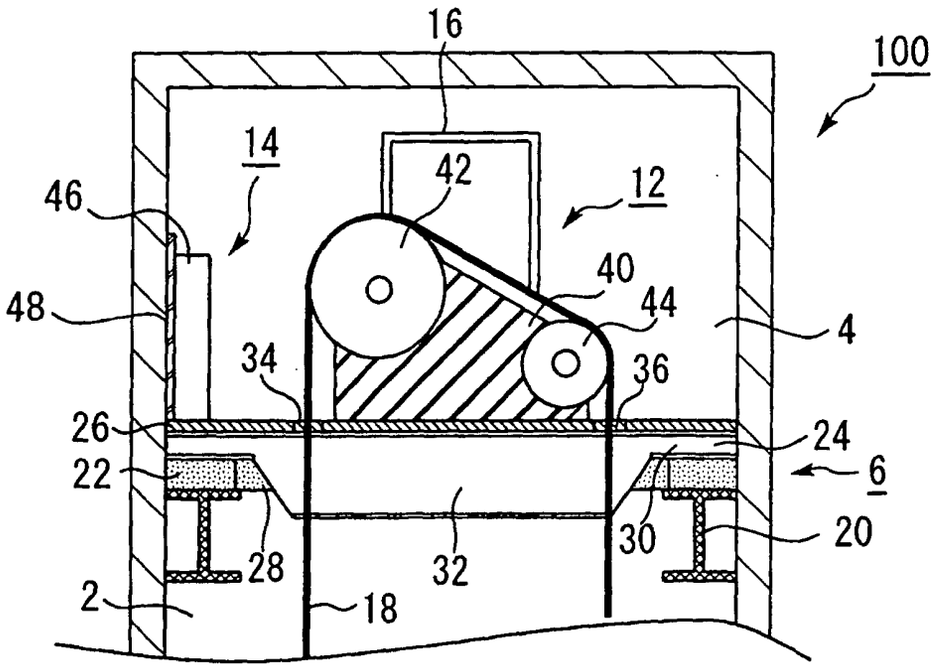
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Fig. 4

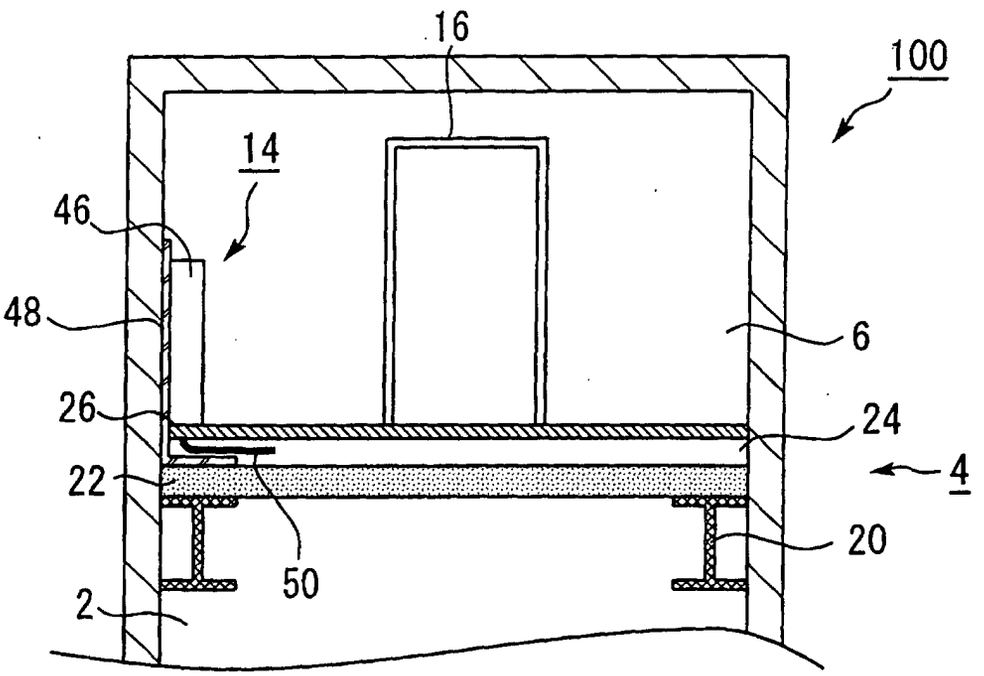


Fig.5

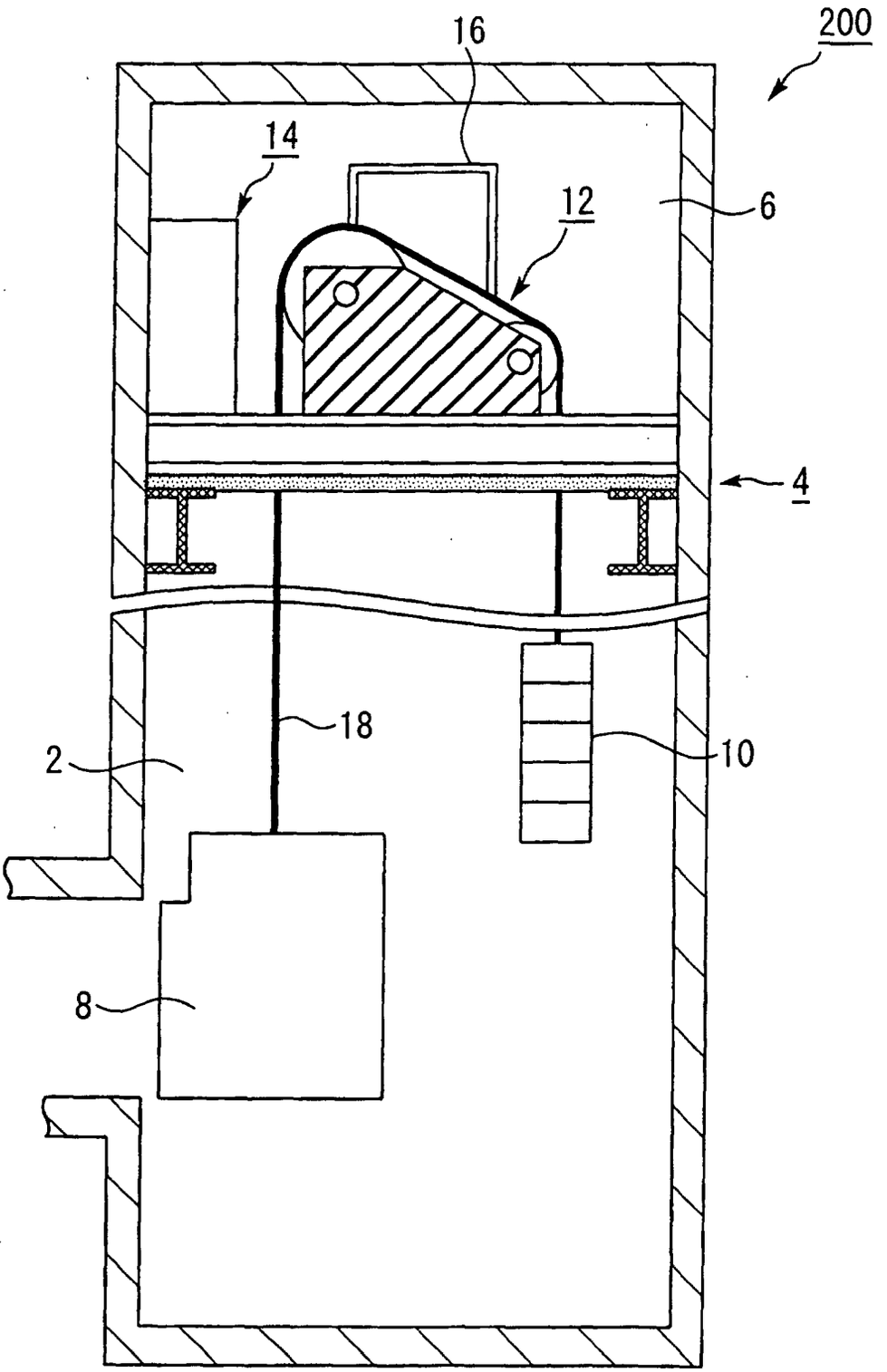


Fig. 6

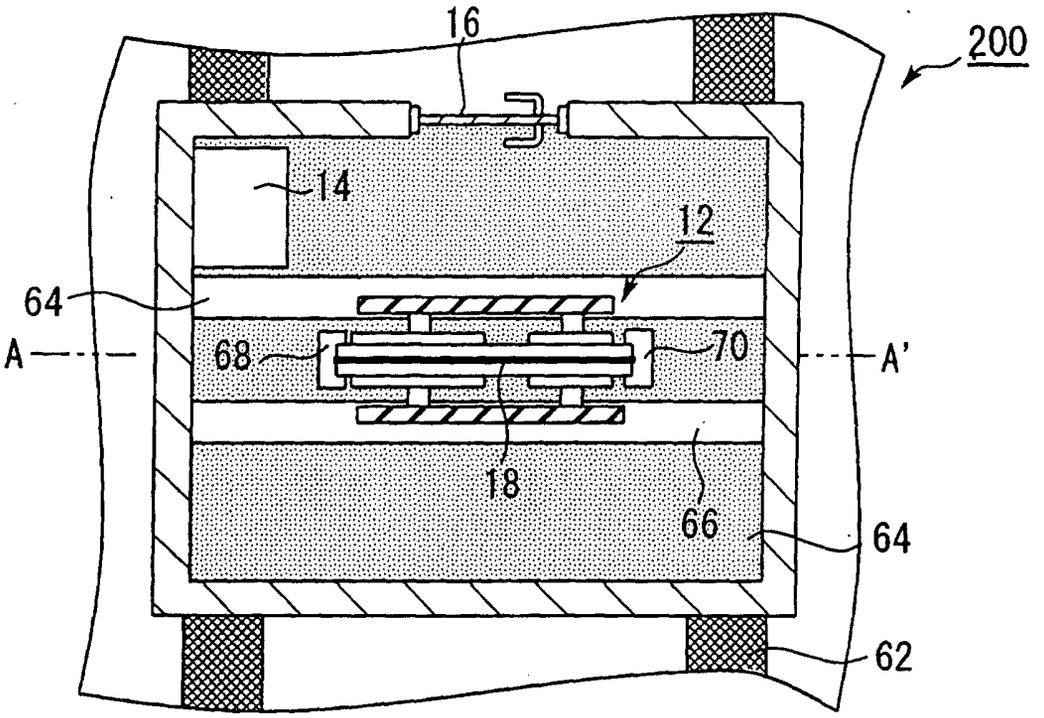
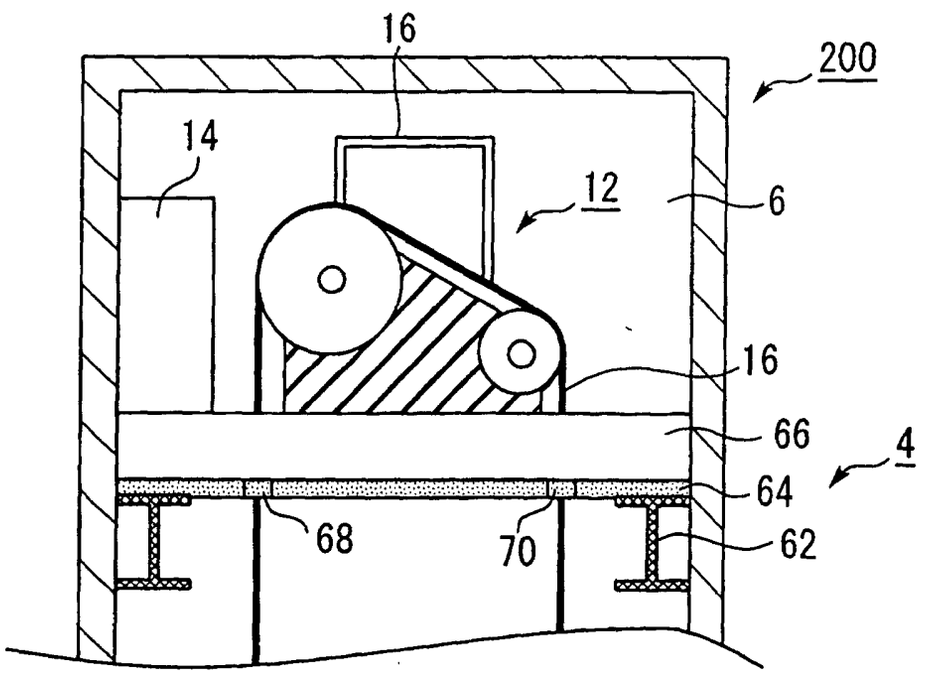


Fig. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP02/05658

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] B66B11/04

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] B66B7/00-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	1996-2003
Kokai Jitsuyo Shinan Koho	1971-2003	Toroku Jitsuyo Shinan Koho	1994-2003

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.
X A	JP 4-7292 A (Mitsubishi Electric Corp.), 10 January, 1992 (10.01.92), Page 1, left column, line 18 to right column, line 15; page 2, upper left column, line 18 to upper right column, line 3; Figs. 3 to 4	1,5,6,8 4,7
A	Page 2, lower right column, line 9 to page 3, upper left column, line 6; Fig. 2 (Family: none)	2-3
A	JP 2001-48448 A (Hitachi Building Systems Co., Ltd.), 20 February, 2001 (20.02.01), Par. Nos. [0012] to [0015]; Fig. 1 (Family: none)	1-3,5,8

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

* Special categories of cited documents:
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
03 March, 2003 (03.03.03)	18 March, 2003 (18.03.03)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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