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

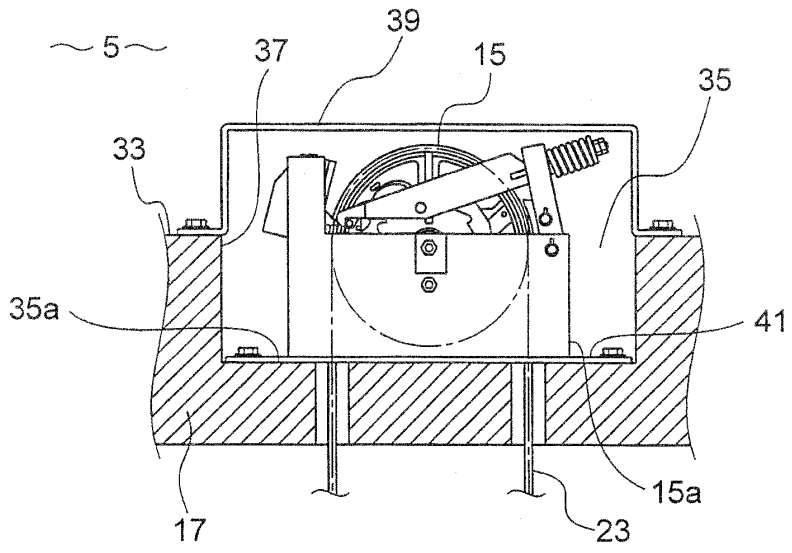
(72) Inventor: **NIIKAWA, Takeshi**
Tokyo 100-8310 (JP)

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

(54) **ELEVATOR**

(57) Provided is an elevator in which a governor can be located so as to avoid interference with equipment provided in a machine room and to ensure a passage for a worker and a maintenance space. An elevator (1) includes: a hoistway (3); and a machine room (5) located in an upper part of the hoistway, the machine room including at least a hoisting machine (13) and a governor (15) provided inside. The machine room includes a governor-housing space (35), which is open on a machine-room floor upper surface and is formed in a machine-room floor (17) constituting a bottom surface of the machine room. The governor is provided in the governor-housing space so that a governor bottom-portion is located at a position lower than the machine-room floor upper surface (33).

FIG. 2



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Description

Technical Field

[0001] The present invention relates to an elevator including a governor.

Background Art

[0002] An elevator includes a hoistway, which extends vertically, and a car provided so as to be movable therein. In an upper part of the hoistway, a machine room is provided. Inside the machine room, a hoisting machine, a governor, a control panel, and the like are housed. The hoisting machine drives a rope connected to the car to raise and lower the car. The governor regulates a speed at which the car is raised and lowered. When the raising/lowering speed exceeds a defined value, a governor rope is restrained to actuate an emergency braking device through an emergency-stop lifting device provided in the vicinity of lateral parts of the car.

[0003] As a mode of installation of the hoisting machine in the machine room, there is a mode, for example, as disclosed in Patent Literature 1. In the mode, machine beams are placed on a floating base provided in the machine room. The hoisting machine is placed on the machine beams.

[0004] As a mode of installation of the governor in the machine room, there is a mode, for example, as disclosed in Patent Literature 2. The mode is to enable the adjustment of a tension of the governor rope. A pair of guide rails is vertically provided onto a floor slab of the machine room. The governor is mounted to the guide rails. By moving the governor along the guide rails, the tension of the governor rope can be changed.

[0005] Aposition of installation of the governor in the machine room of the elevator is required to be determined in consideration of avoidance of interference with other equipment provided in the machine room, such as the hoisting machine, the machine beams, and the control panel, and ensuring of a passage for a maintenance person or a maintenance space for each piece of equipment. When each piece of the equipment cannot be provided at a required position, there arises a problem in that the size of the machine room is required to be significantly changed.

Citation List

Patent Literature

[0006]

[PTL 1] JP 63-012580 A
[PTL 2] JP 07-125946 A

Summary of Invention

Technical Problem

[0007] The present invention has been made to solve the problem described above, and therefore has an object to provide an elevator in which a governor can be located so as to avoid interference with equipment provided in a machine room and to ensure a passage for a worker and a maintenance space.

Solution to Problems

[0008] In order to achieve the above-mentioned object, according to the present invention, there is provided an elevator, including: a hoistway; and a machine room located in an upper part of the hoistway, the machine room including at least a hoisting machine and a governor provided inside, in which: the machine room includes a governor-housing space, which is open on a machine-room floor upper surface and is formed in a machine-room floor constituting a bottom surface of the machine room; and the governor is provided in the governor-housing space so that a governor bottom-portion is located at a position lower than the machine-room floor upper surface.

Advantageous Effects of Invention

[0009] According to the elevator of the present invention, the governor can be located so as to avoid interference with equipment provided in the machine room and to ensure the passage for a worker and the maintenance space.

Brief Description of Drawings

[0010]

[FIG. 1] A diagram schematically illustrating a configuration of an elevator according to embodiments of the present invention.
[FIG. 2] A diagram illustrating a mode of installation of a governor according to a first embodiment of the present invention.
[FIG. 3 A diagram illustrating a mode of installation of the governor as a comparative example.
[FIG. 4] A diagram illustrating the same mode as that of FIG. 2 according to a second embodiment of the present invention.
[FIG. 5] A diagram illustrating a lowered position of the governor according to a third embodiment of the present invention.
[FIG. 6] A diagram illustrating a raised position of the governor according to the third embodiment.
[FIG. 7] A diagram illustrating a floor-leveling position of the governor according to a fourth embodiment of the present invention.
[FIG. 8] A diagram illustrating a governor-mainte-

nance position of the governor according to the fourth embodiment.

[FIG. 9] A diagram illustrating the floor-leveling position of the governor according to a fifth embodiment of the present invention.

[FIG. 10] A diagram illustrating the governor-maintenance position of the governor according to the fifth embodiment.

[FIG. 11] A plan view illustrating, in a projecting manner, the positional relationship between a machine room and components provided in a hoistway, for an elevator according to a sixth embodiment of the present invention.

[FIG. 12] A diagram illustrating a normal position and a retreat position of the governor according to the sixth embodiment.

[FIG. 13] A plan view relating to the governor and a placement plate illustrated in FIG. 12.

[FIG. 14] A diagram illustrating the governor in the floor-leveling position and the normal position according to a seventh embodiment of the present invention.

[FIG. 15] A diagram illustrating the governor in the governor-maintenance position and the retreat position according to the seventh embodiment.

[FIG. 16] A plan view relating to the governor and the placement plate illustrated in FIG. 15.

[FIG. 17] A diagram illustrating the same mode as that of FIG. 12 according to an eighth embodiment of the present invention.

[FIG. 18] A diagram illustrating the same mode as that of FIG. 14 according to a ninth embodiment of the present invention.

[FIG. 19] A diagram illustrating the same mode as that of FIG. 15 according to the ninth embodiment.

Description of Embodiments

[0011] In the following, an elevator according to embodiments of the present invention is described referring to the accompanying drawings. In the drawing, the same reference symbols denote the same or corresponding parts.

First Embodiment

[0012] FIG. 1 is a diagram schematically illustrating a configuration of an elevator according to this embodiment. An elevator 1 includes a hoistway 3 which extends vertically, and a machine room 5 located th.ereabave. In the hoistway 3, a car 7 and a counterweight 9 are provided. The car 7 is provided to be guided by a pair of car guide rails 11 extending vertically in the hoistway 3 so as to be raised and lowered. The counterweight 9 is also provided to be guided by similar guide rails (not shown) so as to be raised and lowered.

[0013] In the machine room 5, a hoisting machine 13, a governor 15, and a control panel and an incoming panel, which are not shown in FIG. 1, and the like are at least provided. As is known, a floating base (not shown) is provided on a machine-room floor 17. Machine beams (not shown) are placed thereon. Further, the hoisting machine 13 is placed on the machine beams. The control panel, the incoming panel, the floating base, and the machine beams may be located, for example, as illustrated in FIG. 11 referred to below.

[0014] A main rope 19 is looped around a sheave of the hoisting machine 13. One end side of the main rope 19 is connected to the car 7, whereas the counterweight 9 is connected to another end side thereof. When the main rope 19 is driven by the hoisting machine 13, the car 7 and the counterweight 9 are raised and lowered in the directions opposite to each other.

[0015] A tension sheave 21 is provided below the governor 15 in the hoistway 3. A governor rope 23 is looped between the governor 15 and the tension sheave 21. An emergency braking device 25 is provided to the car 7. The emergency braking device 25 is connected to the governor rope 23 through an emergency-stop lifting device 31 including a lift rod 27, a safety link 29, and the like.

[0016] During a normal operation of the elevator, the governor rope 23 performs a circulating operation in accordance with the raising/lowering of the car 7. The raising/lowering speed of the car 7 is regulated through the governor 15. For example, when a lowering speed of the car 7, which is regulated by the governor 15, exceeds a predetermined value due to some factor while the car 7 is being lowered, the governor 15 grips the governor rope 23 to restrain the operation of the rope. As a result, the safety link 29 moves so as to absorb a relative positional change between the governor rope 23 which is going to stop and the car 7 which is going to still continue being lowered. Along with the movement, the lift rod 27 is lifted up as viewed from the car 7. By the operation of the lift rod 27, abrakingmember (not shown) included in the emergency braking device 25 is actuated to apply an emergency brake to the car 7.

[0017] Subsequently, also referring to FIG. 2, a mode of installation of the governor is described. FIG. 2 is a diagram illustrating the vicinity of the governor installed in the machine room. In the machine-room floor 17 constituting a bottom surface of the machine room 5, a governor-housing space 35, which is opened on a machine-room floor upper surface 33, is formed. The governor-housing space 35 includes a housing-space bottom surface 35a formed by the machine-room floor 17. A supporting plate 41 is fixed on the housing-space bottom surface 35a. The governor 15 is placed on the supporting plate 41. The governor 15 is provided in the governor-housing space 35 so that a governor bottom-portion 15a is located at a lower position than the machine-room bottom upper surface 33.

[0018] An opening 37 of the governor-housing space 35, which is formed on the machine-room floor upper surface 33, is covered with a cover 39 in a state in which the governor 15 is housed within the governor-housing

space 35. The cover 39 is removably mounted to the machine-room floor 17 and is formed of a steel plate in this embodiment as an example.

[0019] With the elevator according to this embodiment, which is configured as described above, the governor can be provided in a mode in which a passage for a worker and a maintenance space are ensured while the interference with equipment provided in the machine room is avoided. Specifically, when the governor 15 is directly provided on a machine-room floor upper surface 33' which is uniformly flat as illustrated in FIG. 3 as a comparative mode, there is a problem in that the governor 15 interferes with other pieces of equipment provided in the machine room, such as the hoisting machine, the machine room, and the control panel and it becomes difficult to ensure the passage for the maintenance person and the maintenance space for each piece of the equipment. Further, if all the pieces of equipment cannot be provided at positions which allow the above-described problem to be solved, there arises another problem in that the size of the machine room is required to be significantly changed. On the other hand, in this embodiment, the governor 15 is installed so as to be embedded in the machine-room floor 17, as illustrated in FIG. 2. Therefore, the space of the machine room 5 can be effectively used to allow the avoidance of the interference with the equipment provided in the machine room. As an example, even with a layout in which the governor is located below the machine beams and the governor and a part of the machine beams are arranged vertically, the interference between the governor and the machine room can be avoided or the maintenance floating base required for the governor can be ensured even when the machine room is located thereabove. Moreover, when the governor is provided at a position far away from the machine beams only in view of the avoidance of the interference between the governor and the machine beams, there may in turn arise a problem in that the passage for the maintenance person and the maintenance space for each piece of the equipment is intruded by the presence of the governor. In this embodiment, however, even such a problem can be avoided by the configuration described above.

[0020] Further, in this embodiment, the opening 37 of the governor-housing space 35 housing the governor 15 therein is entirely covered with the removable cover 39. Even in this manner, the effective use of the space of the machine room is achieved. Specifically, when the cover 39 is removed, the maintenance of the governor 15 can be per formed without any problem. For the maintenance of the equipment other than the governor 15, the space above the governor 15 can be effectively used as the passage for the worker or the maintenance space, by mounting the cover 39.

Second Embodiment

[0021] FIG. 4 is a diagram illustrating a mode of installation of the governor, for an elevator according to a second embodiment of the present invention. The elevator according to this embodiment is the same as the elevator according to the first embodiment described above except for a mode of installation of the governor, which is described below. In the machine-room floor 17 constituting the bottom surface of the machine room 5, a governor-housing space 235, which is open on the machine-room floor upper surface 33, is formed.

[0022] The governor-housing space 235 is a through space without a bottom surface. From a lower surface of the machine-room floor 17 in a peripheral portion of the governor-housing space 235, a plurality of supporting rods 248 extend down toward the hoistway. Aplacement plate 243 is fixed by the supporting rods 248 in a suspended manner. The governor 15 is placed on the placement plate 243 described above. Specifically, the governor 15 is supported in a suspended mode from the machine-room floor 17. Moreover, the governor 15 is provided in the governor-housing space 235 so that a governor bottom-portion is located at a position lower than the machine-room floor upper surface 33.

[0023] Even according to the second embodiment configured as described above, the space of the machine room 5 can be effectively used, and hence there can be provided the arrangement of the governor, which allows the interference with the equipment provided in the machine room to be avoided and allows the passage for the worker and the maintenance space to be easily ensured, as in the first embodiment. In addition, in this embodiment, the space of the hoistway can be used to arrange the governor. Even in this manner, the ensured passage and space in the machine room can be further achieved. Further, a thickness of the machine-room floor is sometimes inevitably required to be reduced for some buildings. Even in such a case, according to this embodiment, the machine-room floor is not required to be deeply dug down so as to ensure the governor-housing space as in the first embodiment described above. Therefore, the governor can be arranged so as to allow the avoidance of the interference and the ensuring of the space described above. Alternatively, according to this embodiment, the reduced thickness of the machine-room floor can be realized while the advantages in the avoidance of the interference and the ensured space described above are produced.

Third Embodiment

[0024] FIGS. 5 and 6 are diagrams illustrating a mode of installation of the governor, for an elevator according to a third embodiment of the present invention. The elevator according to this embodiment is the same as the elevator according to the first embodiment described above except for a mode of installation of the governor, which is described below. In the machine-room floor 17 constituting the bottom surface of the machine room 5, a governor-housing space 135, which is open on the ma-

chine-room floor upper surface 33, is formed. The governor 15 is provided in the governor-housing space 135 in a mode in which the governor can be raised and lowered between a raised position and a lowered position as described below.

[0025] The governor-housing space 135 includes a housing-space bottom surface 135a formed by the machine-room floor 17. On the housing-space bottom surface 135a, a supporting plate 141 is fixed. Further, a placement plate 143 is provided above the supporting plate 141 in the governor-housing space 135. The governor 15 is placed on the placement plate 143.

[0026] A supporting structure 145 is provided between a lower surface of the placement plate 143 and the housing-space bottom surface 135a. The supporting structure is configured so that the governor 15 is raised and lowered by changing the amount of extension of the supporting structure 145, which extends above the housing-space bottom surface 135a. The supporting structure 145 includes a plurality of jack bolts 147 in this embodiment. At least two fixing nuts 149 are screwed onto each of the jack bolts 147. The supporting plate 141 is provided so as to be interposed between the fixing nuts 149. By performing an operation of fastening or loosening the fixing nuts 149, the positions of the jack bolts 147 are (the above-mentioned amount of extension is) changed or fixed with respect to the supporting plate 141 (housing-space bottom surface 135a). The plurality of jack bolts are used, and therefore can also be used for the horizontal adjustment of the governor.

[0027] A plurality of rope passage paths 151, through which the governor rope 23 is inserted, are formed through the housing-space bottom surface 135a. The respective lower end portions of the jack bolts 147 are housed in the corresponding rope passage paths 151. The respective upper ends of the jack bolts 147 are connected to a lower surface of the placement plate 143.

[0028] FIG. 6 is a diagram illustrating the raised governor. The position of the governor 15 illustrated in FIG. 6 is an example of the raised position, whereas the position of the governor 15 illustrated in FIG. 5 is an example of the lowered position. As an example, the governor 15 is provided in the governor-housing space 135 so that the governor bottom-portion is located at a lower position than the machine-room floor upper surface 33 in both the raised position and the lowered position.

[0029] The opening 37 of the governor-housing space 135, which is formed on the machine-room floor upper surface 33, is covered with the cover 39 when the governor 15 is present in the lowered position. The cover 39 is removably mounted to the machine-room floor 17.

[0030] According to the third embodiment configured as described above, the space of the machine room 5 can be effectively used as in the case of the first embodiment. Therefore, there can be provided the arrangement of the governor, which allows the interference with the equipment provided in the machine room to be avoided and allows the passage for the worker and the maintenance space to be easily ensured. Moreover, when the governor is raised as illustrated in FIG. 6, maintenance performance is improved in hand reachability to a further lower portion of the governor and the like.

[0031] Further, in this embodiment, the lower surface of the placement plate is supported from below. Therefore, a large number of components such as the rail means and the guiding means which come into engagement with the rails as described in, for example, Patent Literature 2 described above are not required to be used. As a result, a complex structure can be avoided. Further, the lower surface of the placement plate itself is supported from below. Therefore, the support can be performed in a mode in which the support is directly opposed to a gravity direction. Further, the housing-space bottom surface itself of the governor-housing space, which is a part of the machine-room floor, provides a supporting force. Therefore, there can be provided a configuration which allows strength to be more easily ensured.

[0032] In addition, for using the jack bolts as the supporting structure, in this embodiment, the jack bolts are respectively provided by using the rope passage paths, through which the governor rope is to be inserted. Therefore, a special housing space for raising and lowering the jack bolts is not required tobe independently provided. As a result, an increase in complexity of construction and in construction cost can be avoided.

Fourth Embodiment

[0033] FIGS. 7 and 8 are diagrams illustrating a mode of installation of the governor, for an elevator according to a fourth embodiment of the present invention. The elevator of this embodiment is the same as the elevator of the first embodiment described above except for a mode of installation of the governor, which is described below. The detailed description is omitted for a part of the configuration denoted by the same reference symbols as those of the third embodiment described above.

[0034] In this embodiment, the governor 15 is provided in the governor-housing space 135 in a mode in which the governor can be raised and lowered between a governor-maintenance position (raised position) and a floor-leveling position (lowered position) as described below.

[0035] FIG. 8 is a diagram illustrating the raised governor. A position of the governor 15 illustrated in FIG. 8 is an example of the governor-maintenance position. The governor-maintenance position is a position at which an upper end of the governor 15 provided in the governor-housing space 135 is located higher than the machine-room floor upper surface 33. A position of the governor 15 illustrated in FIG. 7 is an example of the floor-leveling position. The floor-leveling position is a position at which the upper end of the governor 15 provided in the governor-housing space 135 is located lower than the machine-room floor upper surface 33. As an example, the governor 15 is provided in the governor-housing space 135 so that the governor bottom-portion is located at a

position lower than the machine-room floor upper surface 33 in both the governor-maintenance position and the floor-leveling position.

[0036] The opening 37 of the governor-housing space 135, which is formed on the machine-room floor upper surface 33, is covered witha cover 139 when the governor 15 is in the floor-leveling position. The cover 139 is removably mounted to the machine-room floor 17. Moreover, as illustrated in FIG. 7, the upper end of the governor 15 does not project upward beyond the machine-room floor upper surface 33 when the governor is in the floor-leveling position. Therefore, the cover 139 of this embodiment has a flat-plate like shape. Thus, when the cover 139 is mounted, the cover 139 extends along the machine-room floor upper surface 33 to bring about a state as if the opening 37 were not originally present and provides an approximately flat machine-room floor above the governor 15.

[0037] According to the fourth embodiment configured as described above, as in the first embodiment, the space of the machine room 5 can be effectively used. As a result, there can be provided the arrangement of the governor, which allows the interference with the equipment provided in the machine room to be avoided and allows the passage for the worker and the maintenance space to be easily ensured. In addition, in the third embodiment, the following peculiar advantages are obtained.

[0038] First, in this embodiment, the governor-housing space 135 is obtained by digging more deeply than for the governor-housing space 35 of the first embodiment. As a result, in the floor-leveling position illustrated in FIG. 7, the upper end of the governor 15 becomes lower than the machine-room floor upper surface 33. Therefore, the space above the governor 15, which is covered with the cover 139, can be used freely, specifically, can be used at the same level as a portion of the machine-room floor upper surface 33, in which the governor-housing space 135 is not formed. On the other hand, if the upper end of the governor 15 is located lower than the machine-room floor upper surface 33 so as to realize the use of the space with few restrictions as described above, there arises a problem of lowered workability as a tradeoff of the lowered upper end when the maintenance work is to be performed for the governor 15. In this embodiment, however, when the maintenance work is to be performed for the governor 15, a state in which the maintenance is easily performed can be obtained by raising the governor 15 to the governor-maintenance position illustrated in FIG. 8. Specifically, both the space usability and the maintenance facility can be realized at a higher level.

[0039] Moreover, in this embodiment, the lower surface of the placement plate is supported from below. Therefore, a large number of components such as the rail means and the guiding means which come into engagement with the rails as described in, for example, Patent Literature 2 described above are not required to be used. As a result, a complex structure can be avoided. Further, the lower surface of the placement plate itself is supported from below. Therefore, the support can be performed in a mode in which the support is directly opposed to the gravity direction. Further, the housing-space bottom surface itself of the governor-housing space, which is a part of the machine-room floor, provides a supporting force. Therefore, a configuration, which allows strength to be more easily ensured, can be provided.

[0040] In addition, for using the jack bolts as the supporting structure, in this embodiment, the jack bolts are respectively provided by using the rope passage paths, through which the governor rope is to be inserted. Therefore, a special housing space for raising and lowering the jack bolts is not required to be independently provided. As a result, an increase in complexity of construction and in construction cost can be avoided.

Fifth Embodiment

[0041] FIGS. 9 and 10 are diagrams illustrating the same mode as that of FIGS. 7 and 8 according to the fourth embodiment described above, for an elevator according to a fifth embodiment of the present invention. The elevator of this embodiment is the same as the elevator of the first embodiment described above except for a mode of installation of the governor, which is described below. In the machine-room floor 17 constituting the bottom surface of the machine room 5, the governor-housing space 235, which is open on the machine-room floor upper surface 33, is formed. Even in this embodiment, the governor 15 is provided in the governor-housing space 235 in a mode in which the governor can be raised and lowered between the governor-maintenance position (raised position) and the floor-leveling position (lowered position).

[0042] The governor-housing space 235 is a through space without a bottom surface. From the lower surface of the machine-room floor 17 in the peripheral portion of the governor-housing space 235, a plurality of jack bolts 247 extend down toward the hoistway. The placement plate 243 is mounted to the plurality of jack bolts 247 so that the placement plate can be raised and lowered. The governor 15 is placed on the placement plate 243 described above.

[0043] At least two fixing nuts 249 are screwed onto each of the jack bolts 247. The placement plate 243 is provided so as to be interposedbetween the fixing nuts 249. By performing an operation of fastening or loosening the fixing nuts 249, the position of the placement plate 243 is changed or fixed with respect to the jack bolts 247. By changing the position of the placement plate 243 with respect to the plurality of jack bolts 247 as described above, the governor 15 is raised and lowered.

[0044] FIG. 10 is a diagram illustrating the raised governor. A position of the governor 15 illustrated in FIG. 10 is an example of the governor-maintenance position. The governor-maintenance position is a position at which an upper end of the governor 15 provided in the governor-housing space 235 is located higher than the machine-

room floor upper surface 33. A position of the governor 15 illustrated in FIG. 9 is an example of the f loor-leveling position. The floor-leveling position is a position at which the upper end of the governor 15 provided in the governor-housing space 235 is located lower than the machine-room floor upper surface 33. As an example, the governor 15 is provided in the governor-housing space 235 so that the governor bottom-portion is located at a position lower than the machine-room floor upper surface 33 in both the governor-maintenance position and the floor-leveling position.

[0045] The opening 37 of the governor-housing space 235, which is formed on the machine-room floor upper surface 33, is covered with the cover 139 when the governor 15 is in the floor-leveling position. The cover 139 is removably mounted to the machine-room floor 17. Moreover, as illustrated in FIG. 9, the upper end of the governor 15 does not project upward beyond the machine-room floor upper surface 33 when the governor is in the floor-levelingposition. Therefore, the cover 139 of this embodiment has a flat-plate like shape. Thus, as in the fourth embodiment described above, when the cover 139 is mounted, the cover 139 extends along the machine-room floor upper surface 33 to bring about a state as if the opening 37 were not originally present and provides an approximately flat machine-room floor above the governor 15.

[0046] According to the fifth embodiment configured as described above, as in the first embodiment, the space of the machine room 5 can be effectively used. As a result, there can be provided the arrangement of the governor, which allows the interference with the equipment provided in the machine room to be avoided and allows the passage for the worker and the maintenance space to be easily ensured. In addition, in the fifth embodiment, the following peculiar advantages are obtained.

[0047] First, in this embodiment, the governor-housing space 235 is the through space without a bottom. As a result, in the floor-leveling position illustrated in FIG. 9, the upper end of the governor 15 can be set lower than the machine-room floor upper surface 33. Therefore, the space above the governor 15, which is covered with the cover 139, can be used freely, specifically, can be used at the same level as a portion of the machine-room floor upper surface 33, in which the governor-housing space 135 is not formed. On the other hand, as in the fourth embodiment, if the upper end of the governor 15 is located lower than the machine-room floor upper surface 33, there arises a problem of lowered maintenance workability for the governor 15. For the above-mentioned problem, in this embodiment, by raising the governor 15 to the governor-maintenance position, a state, in which the maintenance is easily performed, can be obtained. Specifically, both the space usability and the maintenance facility can be realized at a higher level.

[0048] Moreover, in this embodiment, the lower surface of the governor is supported. Therefore, a large number of guiding means used as in the case where the lateral portions of the governor are supported, for example, as described in Patent Literature 2 described above are not required to be used. As a result, a complex structure can be avoided. In this embodiment, the space of the hoistway can be used to arrange the governor in the floor-leveling position as illustrated in FIG. 9. As a result, the ensured passage and space in the machine room can be further achieved. Further, even when the thickness of the machine-room floor is inevitably required to be reduced, the above-mentioned arrangement of the governor, which allows the interference to be avoided and the space to be ensured, can be provided without deeply digging the machine-room floor so as to ensure the governor-housing space. Alternatively, a reduction in thickness of the machine-room floor can be realized.

Sixth Embodiment

[0049] An elevator according to a sixth embodiment of the present invention is described referring to FIGS. 11 to 13. The elevator of this embodiment is the same as the elevator of the first embodiment described above except for a configuration described below.

[0050] FIG. 11 is a plan view illustrating, in a projecting manner, the positional relationship of components provided in the machine room and the hoistway, for the elevator according to the sixth embodiment. The machine room 5 is constituted by machine-room walls 351. Inside the machine room 5, the hoisting machine 13, the governor 15, a control panel 353, an incoming panel 355, and the like are mainly housed. The reference symbol 357 denotes a door for entering and exiting the machine room 5.

[0051] A floating base 359 is provided on the machine-room floor 17. Machine beams 361 are provided on the floating base 359. The hoisting machine 13 is placed on the machine beams 361. The car 7 and the counterweight 9 are present below the machine beams 361 inside the hoistway 3. In the vicinity of the region below a part of the machine beams 359 and the governor 15 inside the hoistway, 3, the emergency braking device as denoted by the reference symbol 25 and the emergency-stop lifting device as denoted by the reference symbol 31 in FIG. 1 are provided although the illustration thereof is omitted in FIG. 11.

[0052] Referring to FIGS. 12 and 13, a mode of illustration of the governor according to this embodiment is described. The position of the governor 15 can be shifted between a normal position (position when the elevator is operated, as an example) and a retreat position (position when the elevator is not operated, as an example) which are arranged in a lateral direction (horizontal direction, for example).

[0053] As is indicated by a solid line in FIG. 12, the governor 15 is locatedbelow the machine beams 361. Specifically, the governor 15 and at least a portion of the machine beams 361 are arranged in a vertical direction. This state corresponds to an example of the normal po-

sition of the governor 15. The normal position is the position at which the governor 15 at least partially overlaps the machine beams 361 in plan view. On the other hand, the position of the governor 15 indicated by a dotted line in FIG. 12 is the retreat position. The retreat position is a position at which the governor 15 is shifted from the machine beams 361 in plan view.

[0054] A governor-housing space 335, which is open on the machine-room floor upper surface 33, is formed in the machine-room floor 17. The governor-housing space 335 is a through space without a bottom surface. From the lower surface of the machine-room floor 17 in a peripheral portion of the governor-housing space 335, the plurality of supporting rods 248 are provided so as to extend down toward the hoistway. A placement plate 343 is mounted to the plurality of supporting rods 248 so that the placement plate can be raised and lowered. The governor 15 is placed on the placement plate 343.

[0055] The placement plate 343 extends so as to include the range below the machine beams 361 and the range laterally shifted from the machine beams 361 inplanview. Inotherwords, the placement plate extends laterally to such an extent that the governor can be located in the normal position and the retreat position as described below.

[0056] FIG. 13 is a plan view of the governor in the retreat position and the placement plate. A path for providing a rope, corresponding sliding facilitating means, that is, an elongated through hole 365 in this embodiment is formed through the placement plate 343 which is a part for supporting the governor 15 from below. The governor rope 23 is inserted through the elongated through hole 365 so as to extend into the hoistway. The elongated through hole 365 is formed to extend in a direction in which the movement of the governor rope 23 in accordance with a change of the lateral position of the governor 15 is allowed. Therefore, when the governor 15 is slid between the normal position and the retreat position, the governor rope 23 is not required to be looped around and removed from the governor 15 each time. In this manner, the work for sliding the governor 15 is easily performed.

[0057] Returning to FIG. 12, the opening 37 of the governor-housing space 335 is covered with a cover 339 when the governor 15 is in the floor-leveling position. The cover 339 is removably mounted onto the machine-room floor 17 and has the same function as that of the cover 139 illustrated in FIG. 7 to provide an approximately flat machine-room floor as if the opening 37 were not originally present, above the governor 15.

[0058] Even according to the sixth embodiment configured as described above, the space of the machine room 5 can be effectively used as in the case of the first embodiment. As a result, there can be provided the arrangement of the governor, which allows the interference with the equipment provided in the machine room to be avoided and the passage for the worker and the maintenance space to be easily ensured. In addition, in the sixth embodiment, the following peculiar advantages can be obtained.

[0059] First, in this embodiment, the governor-housing space 335 is the through space without a bottom. Therefore, in the floor-leveling position illustrated in FIG. 12, the upper end of the governor 15 can be located lower than the machine-room floor upper surface 33. Therefore, the space above the governor 15, which is covered with the cover 339, can be freely used. Specifically, the space canbe used at the same level as a portion of the machine-room floor upper surface 33, in which the governor-housing space 335 is not formed.

[0060] As a layout inside the machine room, it is preferred to provide the governor in the vicinity of a position immediately above the emergency-stop lifting device provided in the hoistway in view of the functions of the governor. In the case where the governor is desired to be provided in alignment with the emergency-stop lifting device as described above, however, there may arise a problem in that the maintenance performance for the governor cannot be well maintained due to the proximity of the machine beams which support the hoisting machine and the like and the governor or it becomes difficult to provide the governor in alignment with the emergency-stop lifting device due to the interference between the governor and the machine beams themselves under some conditions. As measures to avoid the problem described above, a configuration, in which a cutout is provided to the machine beams so as to eliminate the interference between the machine beams and the governor, is conceivable. In this case, however, how to ensure the strength of the machine beams becomes a problem. Further, for the situations described above, the arrangement of the governor in the vicinity of the position immediately above the emergency-stop lifting device is abandoned and a configuration, in which the governor is provided so as to be greatly shifted from the vicinity of the position immediately above the emergency-stop lifting device, is also conceivable. In this case, however, there arise new problems such as the interference of the governor rope with the equipment provided in the hoistway due to a positional shift between the governor and the emergency-stop lifting device and an increase in types of equipment provided in the hoistway with the arrangement of the governor rope in a shifted manner. In order to cope with the above-mentioned problems due to the positional relationship between the governor and the machine beams, in this embodiment, for example, in the case where the elevator is operated or the maintenance of the governor is not performed even when the elevator is not operated, the governor is located in the normal position as indicated by the solid line illustrated in FIG. 12. As a result, the governor can be arranged at a desired position, that is, approximately immediately above the emergency-stop lifting device without being disturbed by the presence of the machine beams.

[0061] On the other hand, when the governor is located at the position approximately immediately above the emergency-stop lifting device as described above, there

is a fear in that the maintenance workability for the governor is fairly lowered by the presence of the machine beams. For the above-mentioned problem, however, the governor is slid to the retreat position as indicated by the dotted line illustrated in FIG. 12 so that the governor can move away from the position immediately below the machine beams at the time of maintenance of the governor. As described above, in this embodiment, the realization of the difficult layout, in which the emergency-stop lifting device, the governor, and the machine beams are approximately aligned vertically during the operation of the elevator, and the maintenance facility can be both achieved.

Seventh Embodiment

[0062] Referring to FIGS. 14 to 16, an elevator according to a seventh embodiment of the present invention is described. The elevator of this embodiment is the same as the elevator of the sixth embodiment described above except for a configuration described below.

[0063] The governor 15 of this embodiment can be raised and lowered between the governor-maintenance position (raised position) and the floor-leveling position (lowered position). Besides, the position of the governor can be shifted in the lateral direction (horizontal direction, for example) between the normal position and the retreat position.

[0064] As illustrated in FIG. 14, the governor 15 is located below the machine beams 361. Specifically, the governor 15 and at least a portion of the machine beams 361 are arranged in a vertical direction. A state illustrated in FIG. 14 is an example of the floor-leveling position of the governor 15 as well as an example of the normal position. The normal position is a position at which the governor 15 overlaps at least a part of the machine beams 361 in plan view.

[0065] The governor-housing space 335, which is open on the machine-room floor upper surface 33, is formed in the machine-room floor 17. The governor-housing space 335 is a through space without a bottom surface. From the lower surface of the machine-room floor 17 in a peripheral portion of the governor-housing space 335, the plurality of jack bolts 247 are provided so as to extend down toward the hoistway. The placement plate 343 is mounted to the plurality of jack bolts 247 so that the placement plate can be raised and lowered. The governor 15 is placed on the placement plate 343.

[0066] The placement plate 343 extends so as to include the range below the machine beams 361 and the range laterally shifted from the machine beams 361 inplanview. Inotherwords, the placement plate extends laterally to such an extent that the governor can be located in the normal position and the retreat position as described below.

[0067] At least the two fixing nuts 249 are screwed onto each of the jack bolts 247. The placement plate 343 is provided so as to be interposed between the fixing nuts 249. By performing the operation of fastening or loosening the fixing nuts 249, the position of the placement plate 343 is changed or fixed with respect to the jack bolts 247. By the change in position of the placement plate 343 with respect to the plurality of jack bolts 247 in this manner, the governor 15 is raised and lowered between the governor-maintenance position and the floor-leveling position.

[0068] FIG. 15 is a diagram illustrating an example when the governor is in the governor-maintenance position as well as in the retreat position. FIG. 16 is a plan view illustrating the governor and the placement plate in the state illustrated in FIG. 15. The retreat position is a position at which the governor 15 is shifted from the machine beams 361 in plan view.

[0069] The path for providing a rope, corresponding the sliding facilitating means, that is, the elongated through hole 365 in this embodiment is formed through the placement plate 343. The governor rope 23 is inserted through the elongated through hole 365 so as to extend into the hoistway. The elongated through hole 365 is formed to extend in a direction in which the movement of the governor rope 23 in accordance with a change of the lateral position of the governor 15 is allowed. Therefore, when the governor 15 is slid between the normal position and the retreat position, the governor rope 23 is not required to be looped around and removed from the governor 15 each time. In this manner, the work for sliding the governor 15 is easily performed.

[0070] Returning to FIG. 14, the opening 37 of the governor-housing space 335 is covered with the cover 339 when the governor 15 is in the floor-leveling position. The cover 339 is removably mounted onto the machine-room floor 17 and has the same function as that of the cover 139 illustrated in FIG. 7 to provide an approximately flat machine-room floor as if the opening 37 were not originally present, above the governor 15.

[0071] Even according to the seventh embodiment configured as described above, the space of the machine room 5 can be effectively used as in the case of the first embodiment. As a result, there can be provided the arrangement of the governor, which allows the interference with the equipment provided in the machine room to be avoided and the passage for the worker and the maintenance space to be easily ensured. In addition, in the seventh embodiment, the following peculiar advantages can be obtained.

[0072] First, in this embodiment, the governor-housing space 335 is the through space without a bottom. Therefore, in the floor-leveling position illustrated in FIG. 14, the upper end of the governor 15 can be located lower than the machine-room floor upper surface 33. Therefore, the space above the governor 15, which is covered with the cover 339, can be freely used. Specifically, the space canbe used at the same level as aportion of the machine-room floor upper surface 33, in which the governor-housing space 335 is not formed.

[0073] Further, in this embodiment, the lower surface

of the governor is supported. Therefore, for example, a large number of guidingmeans, which are used as in the case where the lateral portions of the governor are supported, are not required to be used. As a result, a complex structure can be avoided. Moreover, in this embodiment, the space of the hoistway can be used to arrange the governor in the floor-leveling position as illustrated in FIG. 14. Therefore, the ensured passage and space in the machine room can be further achieved.

[0074] Moreover, in order to cope with the problems caused by the positional relationship between the governor and the machine beams, which are described for the sixth embodiment described above, the governor is located in the floor-leveling position and the normal position as illustrated in FIG. 14 in this embodiment. As a result, the governor can be provided at a desired position, that is, approximately immediately above the emergency-stop lifting device without being disturbed by the presence of the machine beams.

[0075] On the other hand, if the governor is provided at the position approximately immediately above the emergency-stop lifting device as described above and, in addition, the upper end of the governor is located lower than the machine-room floor upper surface, there is a fear in that the maintenance workability for the governor is fairly lowered. For this fear, however, the governor is slid to the retreat position and is raised to the governor-maintenance position as illustrated in FIG. 15 at the time of maintenance of the governor. As a result, a sufficient maintenance space can be obtained without being disturbed by the machine beams. Specifically, if the governor is kept in the normal position, the governor cannot be jacked up to the governor-maintenance position. Moreover, the maintenance performance is not good. By allowing the governor to be located in the retreat position, the governor can be jacked up. At the same time, in the governor-maintenance position after the jack-up, a desirable maintenance state, in which the machine beams are not present immediately above the governor, can be realized. As described above, in this embodiment, therealizationofadifficult layout, in which the emergency-stop lifting device, the governor, and the machine beams are substantially vertically aligned during the operation of the elevator, and the maintenance facility can be both achieved.

Eighth Embodiment

[0076] The surface for supporting the governor from below may be inclined between the normal position and the retreat position. As an example thereof, the surface for supporting the governor from below described above in the sixth embodiment is inclined in the eighth embodiment. As illustrated in FIG. 17, a placement plate 443 as a surface for supporting the governor from below is mounted in an inclined manner in a direction in which the placement plate becomes higher on the retreat position side than on the normal position side. In this manner, when the governor 15 is shifted from the normal position to the retreat position, the governor 15 not only moves away from the position immediately below the machine beams 361 but also moves upward. Although the governor rope and the elongated through hole are provided even in this embodiment (and a ninth embodiment described below), the illustration thereof is omitted in FIG. 17 (FIGS. 18 and 19).

[0077] According to the eighth embodiment described above, the same advantages as those of the sixth embodiment described above are obtained. In addition, the two results, that is, the movement of the governor away from the position immediately below the machine beams and the raising of the position of the governor, which are preferred in terms of maintenance, can be obtained only by a single step of the lateral movement of the governor 15.

Ninth Embodiment

[0078] In the present invention, besides the inclination of the surface for supporting the governor from below between the normal position and the retreat position, the surface may be configured so as to be raised and lowered as a whole. A ninth embodiment of the present invention is an example thereof, and corresponds to a configuration obtained by adding a vertical movement mechanism for the placement plate 443 of the seventh embodiment to the configuration of the eighth embodiment described above. According to the ninth embodiment described above, the same advantages as those of the eighth embodiment are obtained. In particular, the governor can be set to be raised higher.

[0079] The contents of the present invention have been specifically described above referring to the preferred embodiments. However, it is apparent that various modified modes are possible by those skilled in the art based on the basic technological thought and teaching of the present invention.

[0080] For example, the embodiments described above can also be carried out by setting the governor bottom-portion at a lower position than the machine-room floor upper surface when the governor is in the lowered position and by setting the governor bottom-portion at a higher position than the machine-room floor upper surface when the governor is in the raised position.

[0081] Moreover, the embodiments described above can also be carried out by setting the upper end of the governor at a lower position than the machine-room floor upper surface when the governor is in the raised position. The sixth to ninth embodiments, in which the position of the governor can be changed in the lateral direction, can be carried out with an appropriate modification of the height at the position of the upper end of the governor with respect to the machine-room floor upper surface.

[0082] Similarly to the second embodiment which is obtained by modifying the mode of support of the governor in the first embodiment to the suspending mode il-

lustrated in FIG. 4, the third embodiment can also be carried out with a modification of the mode of support of the governor to the suspending mode. Similarly, the sixth to ninth embodiments can be carried out with a modification of the governor so that the governor is supported by the supporting structure provided on the machine-room floor as in the third embodiment. The sixth to ninth embodiments can also be carried out, for example, with the rail means provided between the governor and the placement plate to allow the lateral movement and the selection of the position to be performed in a continuous manner.

[0083] Regarding the fourth and fifth embodiments, the plurality of rope passage paths for the governor rope are formed so that the jack bolts are respectively inserted into the corresponding rope passage paths in the description given above. However, the embodiments are not limited thereto. At least one jack bolt only needs to be inserted to the rope passage paths. Therefore, the plurality of jack bolts may be collectively inserted into a large rope passage path which extends over a large range. Alternatively, a part of the plurality of jack bolts may be inserted into a hole other than the rope passage paths.

[0084] By providing supplementary means for assisting the maintenance of the attitude of the governor or supplementary means for assisting the maintenance of the height of the governor, the embodiments described above can also be carried out by using only one jack bolt itself.

Reference Signs List

[0085] 1 elevator, 3 hoistway, 5 machine room, 13 hoisting machine, 15 governor, 17 machine-room floor, 33 machine-room floor upper surface, 35 governor-housing space, 37 opening, 39, 139, 339 cover, 135a housing-space bottom surface, 143, 243, 343, 443 placement plate, 145 supporting structure, 147, 247 jack bolt, 151 rope passage path, 361 machine beam,365 elongated through hole (path for providing rope)

Claims

1. An elevator, comprising:

a hoistway; and
a machine room located in an upper part of the hoistway, the machine room comprising at least a hoisting machine and a governor provided inside, wherein:

the machine room comprises a governor-housing space, which is open on a machine-room floor upper surface and is formed in a machine-room floor constituting a bottom surface of the machine room; and
the governor is provided in the governor-housing space so that a governor bottom-portion is located at a position lower than the machine-room floor upper surface.

2. An elevator according to claim 1, further comprising a cover for covering an opening of the governor-housing space, the opening being formed on the machine-room floor upper surface in a state in which the governor is housed within the governor-housing space,
the cover is mountable to and removable from the machine-room floor.

3. An elevator according to claim 1 or 2, wherein:

the governor-housing space comprises a housing-space bottom surface formed by the machine-room floor; and
the governor is supported by the housing-space bottom surface.

4. An elevator according to claim 1 or 2, wherein:

the governor-housing space comprises a through space without a bottom surface; and
the governor is supported by the machine-room floor in a suspended manner.

5. An elevator according to claim 1 or 2, wherein:

the governor is provided so as to be vertically-movable between a raised position and a lowered position; and
the governor bottom-portion of the governor is located at a position lower than the machine-room floor upper surface at least when the governor is in the lowered position.

6. An elevator according to claim 5, wherein:

the governor is provided so that the governor can be raised and lowered between a floor-leveling position and a governor-maintenance position;
the floor-leveling position is the lowered position and a position at which an upper end of the governor provided in the governor-housing space is lower than the machine-room floor upper surface; and
the governor-maintenance position is the raised position and a position at which the upper end of the governor provided in the governor-housing space is higher than the machine-room floor upper surface.

7. An elevator according to claim 6, wherein:

the governor-housing space comprises a housing-space bottom surface;
the governor is supported on a placement plate in the governor-housing space;
the elevator further comprises a supporting structure provided between a lower surface of the placement plate and the housing-space bottom surface; and
the governor is raised and lowered by changing an amount of extension of the supporting structure, extending upward beyond the housing-space bottom surface.

8. An elevator according to claim 7, wherein:

the housing-space bottom surface comprises at least one rope passage path formed therethrough, the at least one rope passage path allowing insertion of a governor rope looped around the governor and extending into the hoistway;
the supporting structure comprises at least one jack bolt;
and
the at least one jack bolt is partially housed in the at least one rope passage path.

9. An elevator according to claim 6, wherein:

the governor-housing space comprises a through space without a bottom surface;
the elevator further comprises:

at least one jack bolt provided to a lower surface of the machine-room floor in a peripheral portion of the governor-housing space so as to extend down toward the hoistway;
and
a placement plate mounted to the at least one jack bolt so that the placement plate can be raised and lowered;
the governor is supported on the placement plate; and the governor is raised and lowered by changing a position of the placement place with respect to the at least one jack bolt.

10. An elevator according to any one of claims 1 to 9, wherein:

the machine room further comprises machine beams provided inside;
the hoisting machine is placed on the machine beams; and
the governor is present below the machine beams, and the governor and a part of the machine beams are aligned vertically.

11. An elevator according to any one of claims 1 to 9, wherein:

the machine room further comprises machine beams provided inside;
the hoisting machine is placed on the machine beams;
the governor is present below the machine beams, and the governor and a part of the machine beams are aligned vertically;
a position of the governor can be changed between a normal position and a retreat position arranged in a lateral direction;
the normal position is a position at which the governor partially overlaps the machine beams in plan view; and
the retreat position is a position at which the governor is shifted from the machine beams in plan view.

12. An elevator according to claim 11, further comprising a path for providing a rope, in which the governor rope looped around the governor extends into the hoistway, the path for providing the rope being provided to a portion for supporting the governor from below,
wherein the path for providing the rope is formed so as to extend in a direction in which movement of the governor lope in accordance with a change of a lateral position of the governor is allowed.

13. An elevator according to claim 11 or 12, wherein:

a surface for supporting the governor from below is inclined between the normal position and the retreat position; and
a lateral position of the governor between the normal position and the retreat position changes along with a change of a height at a position of the governor.

FIG. 1

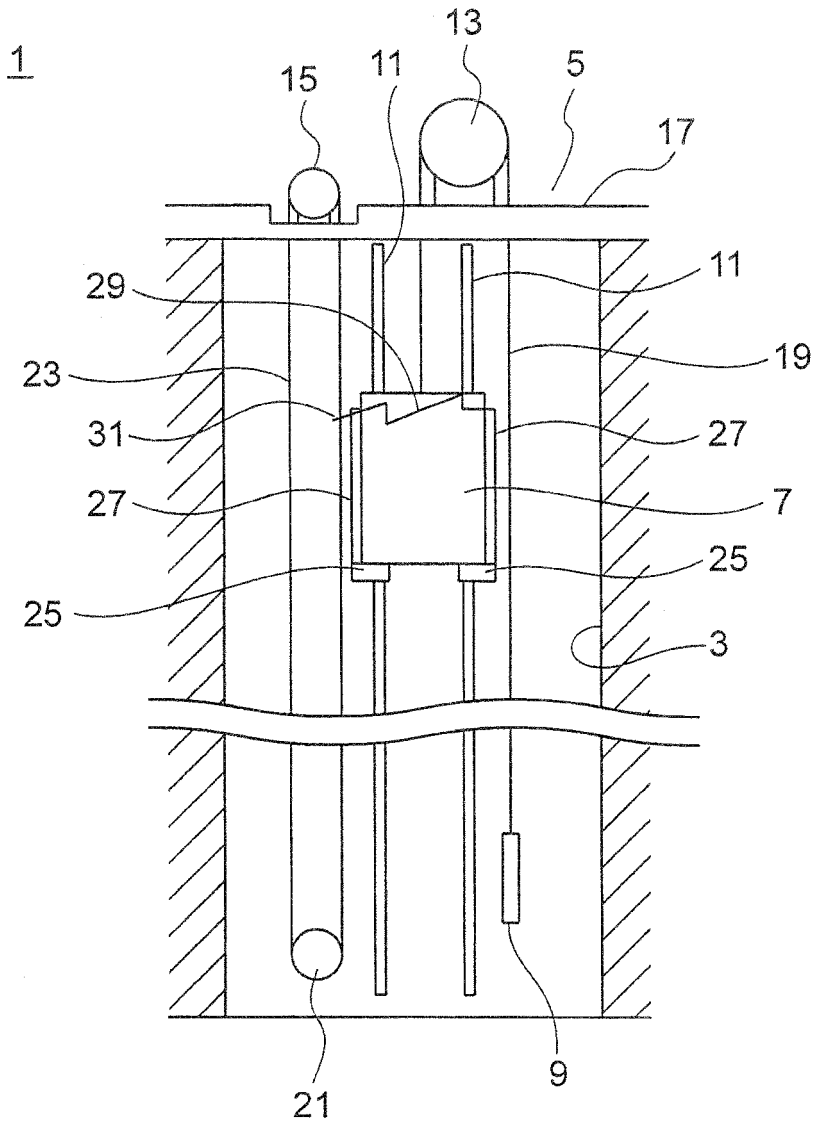

FIG. 2

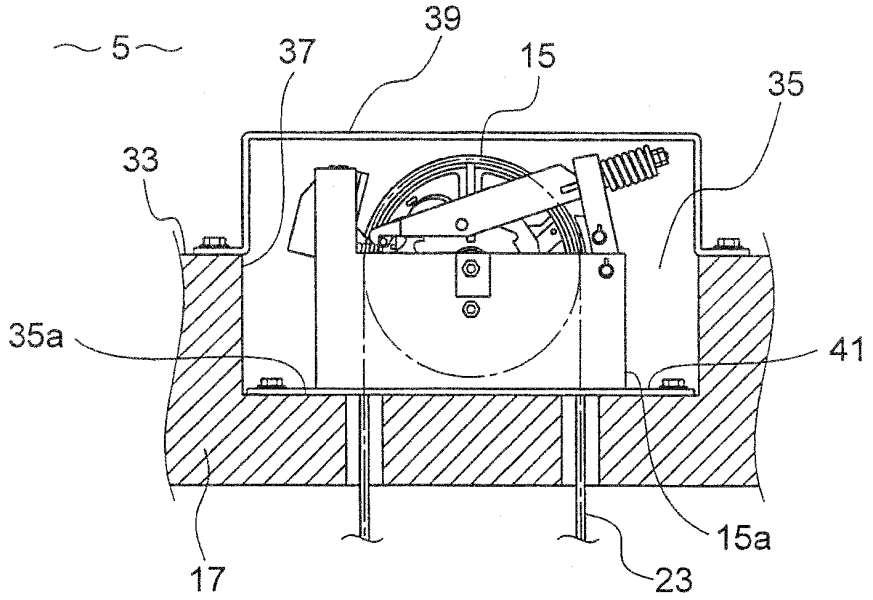

FIG. 3

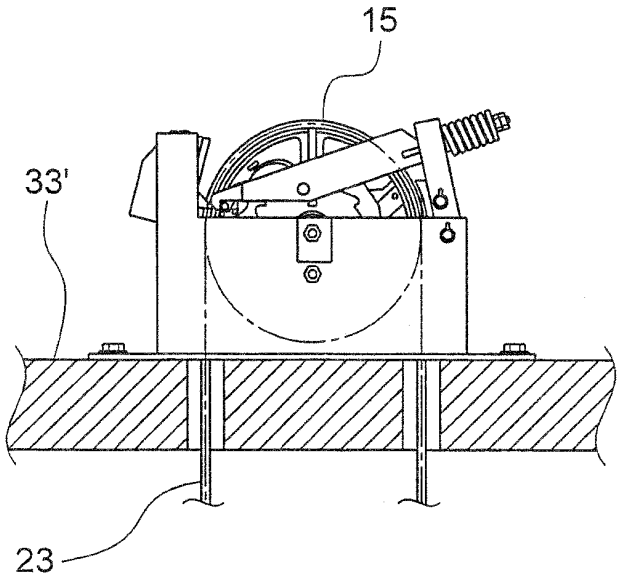

FIG. 4

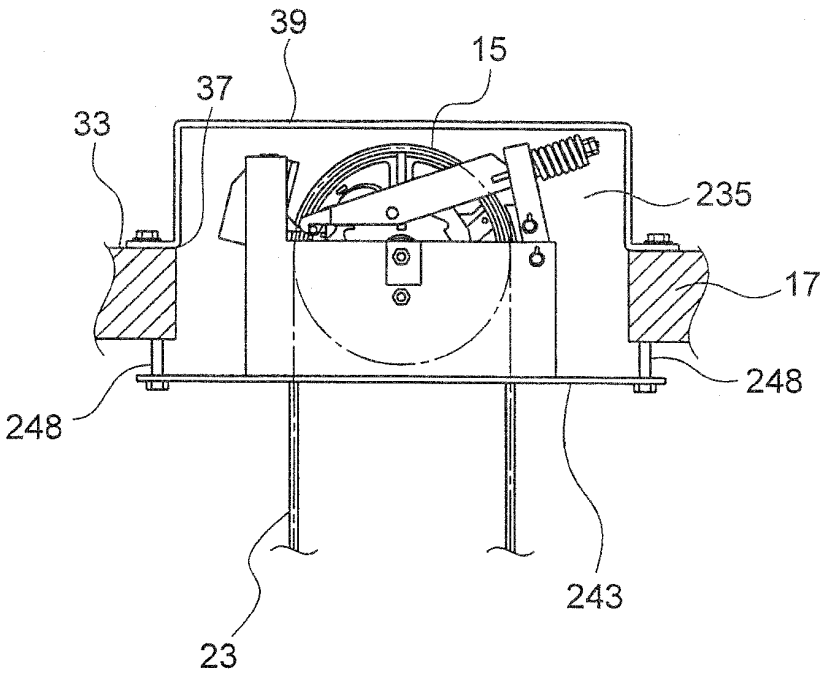

FIG. 5

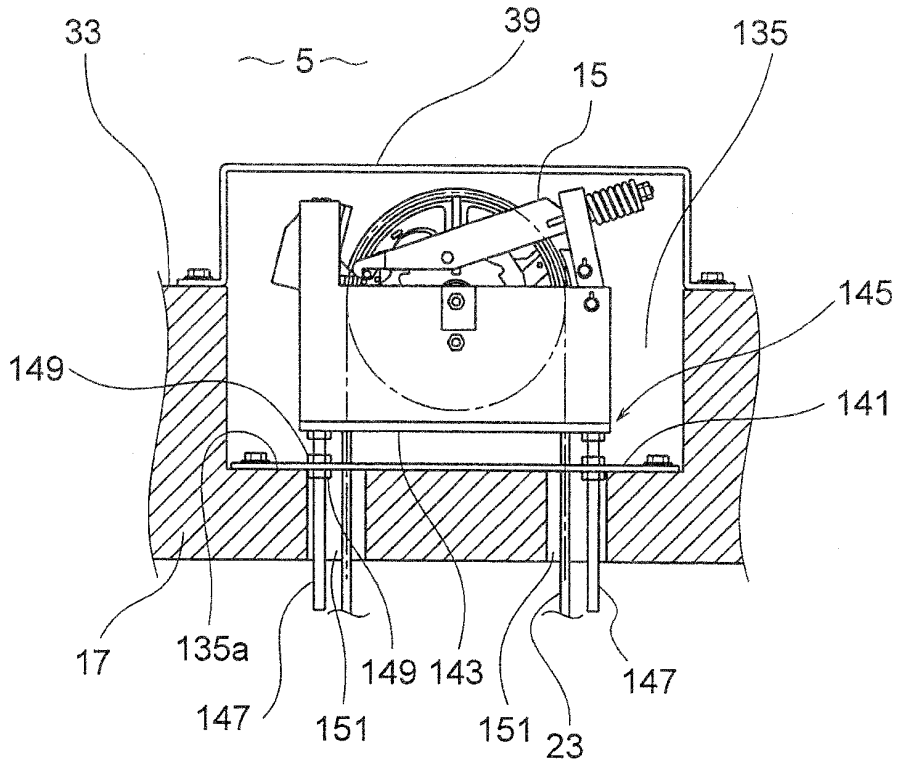
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FIG. 6

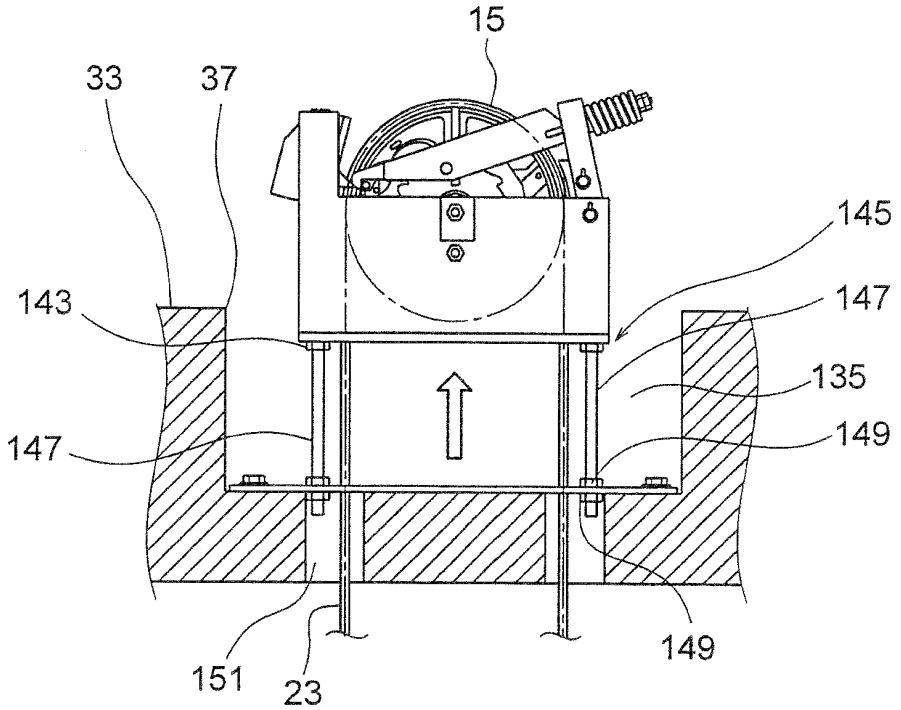
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FIG. 7

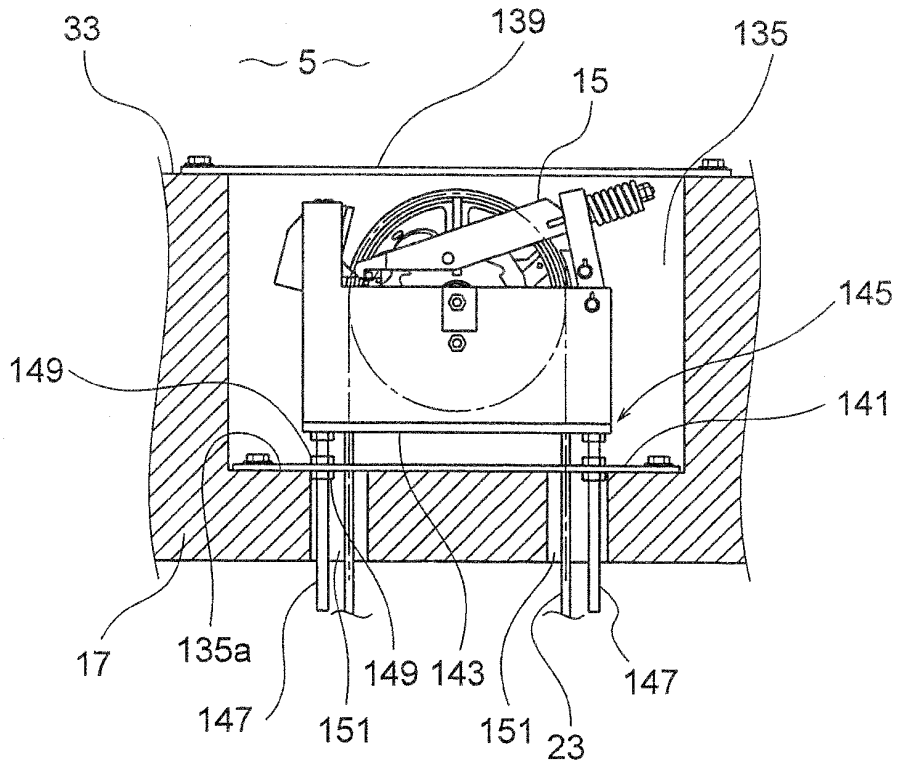
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FIG. 8

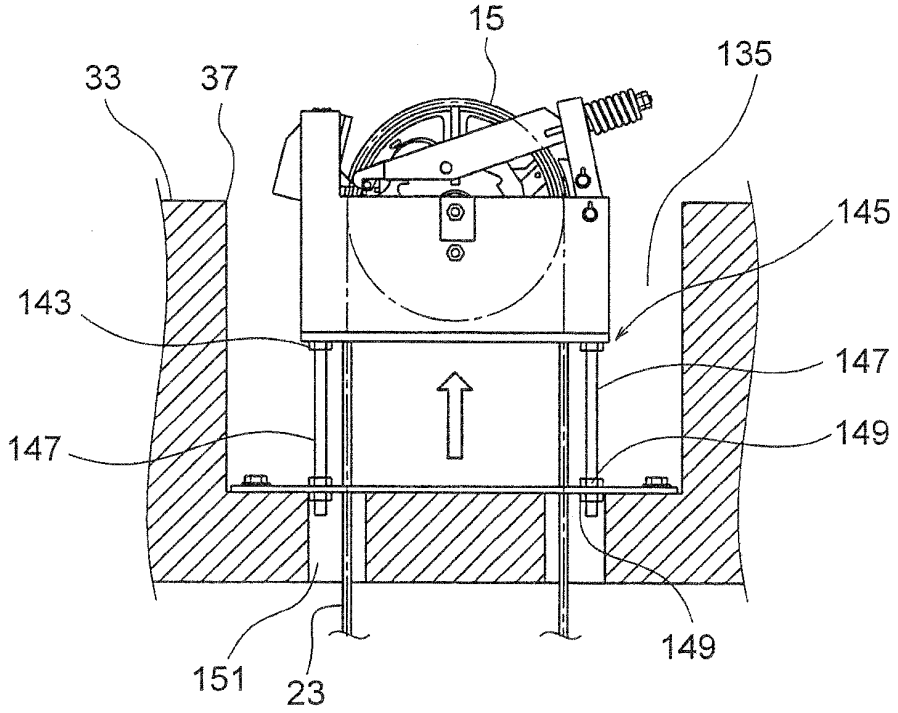
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FIG. 9

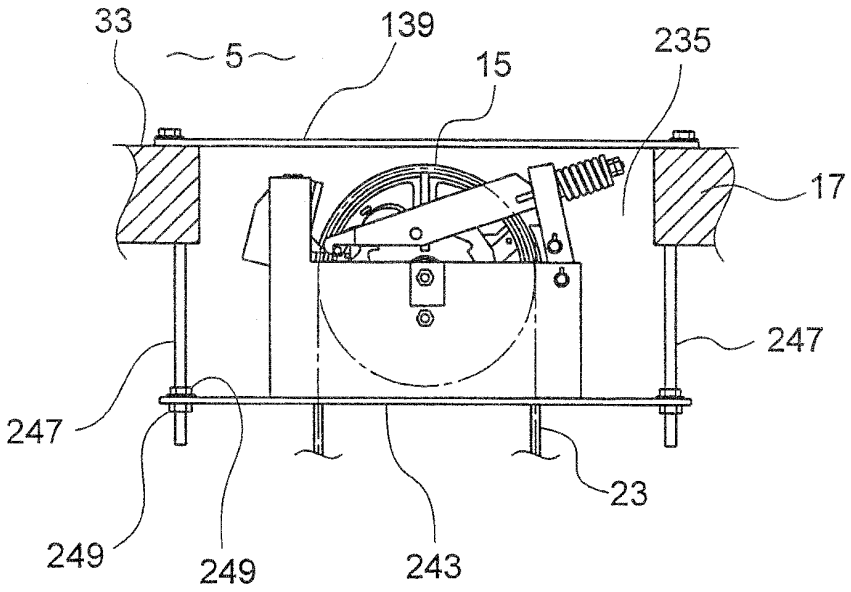
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FIG. 10

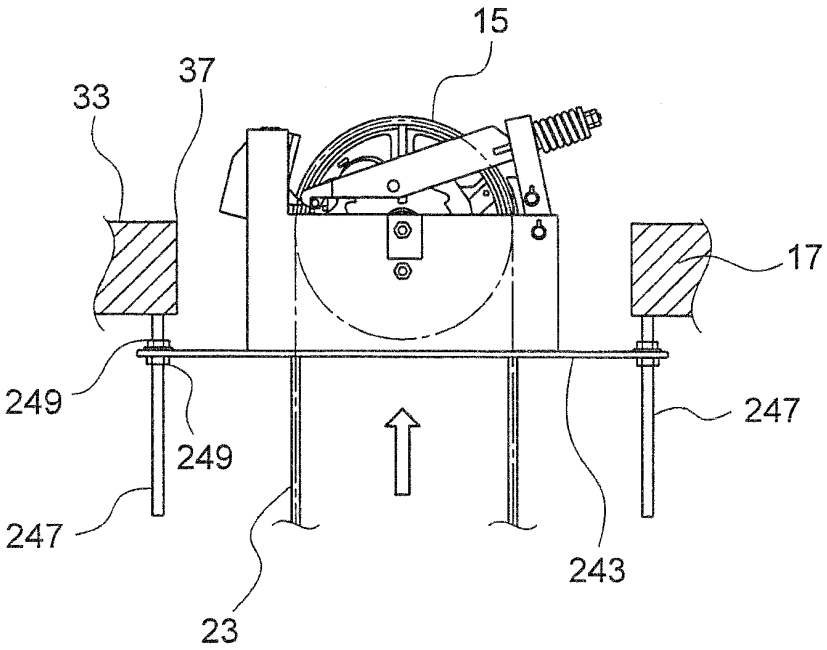
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FIG. 11

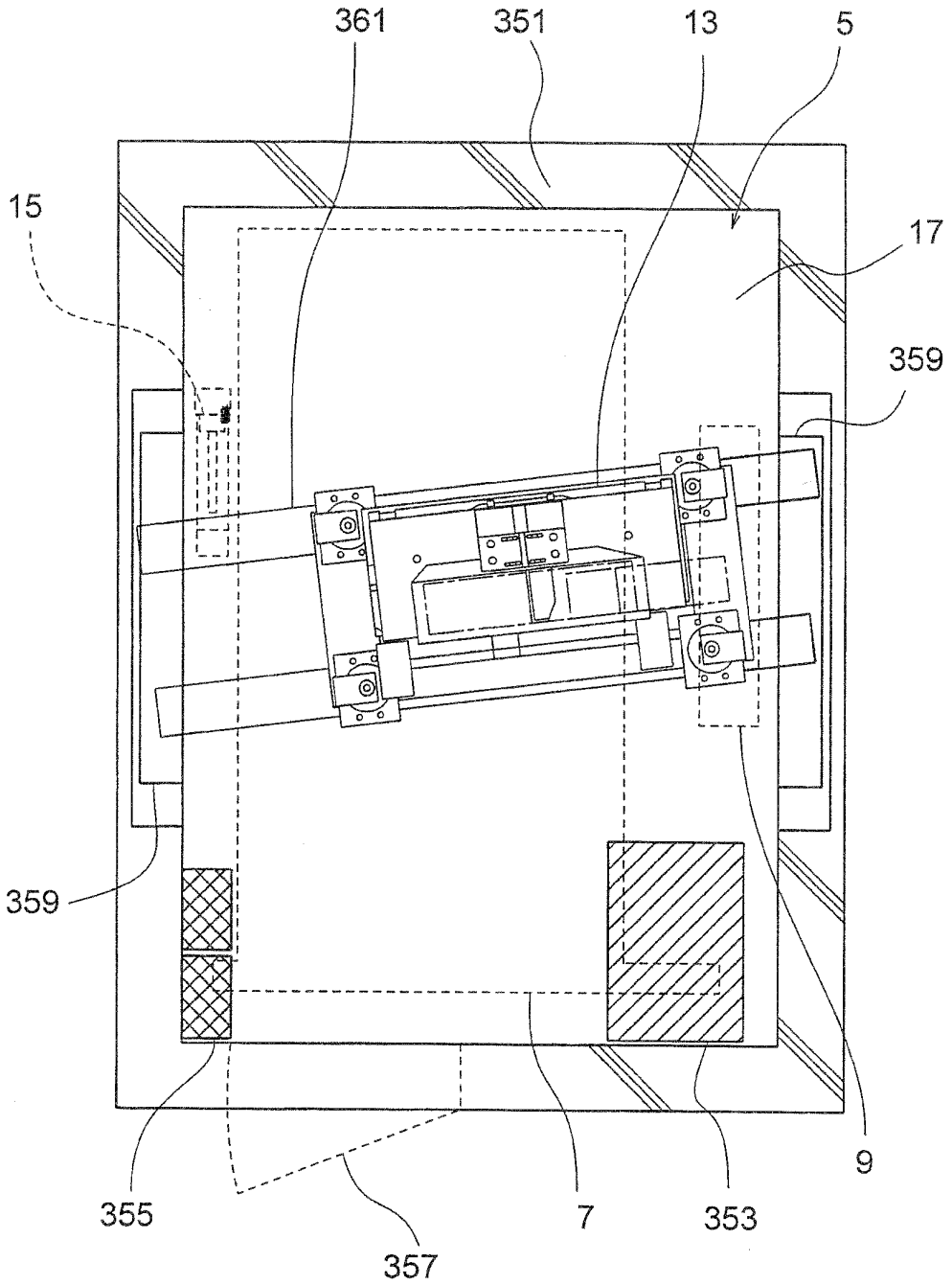


FIG. 12

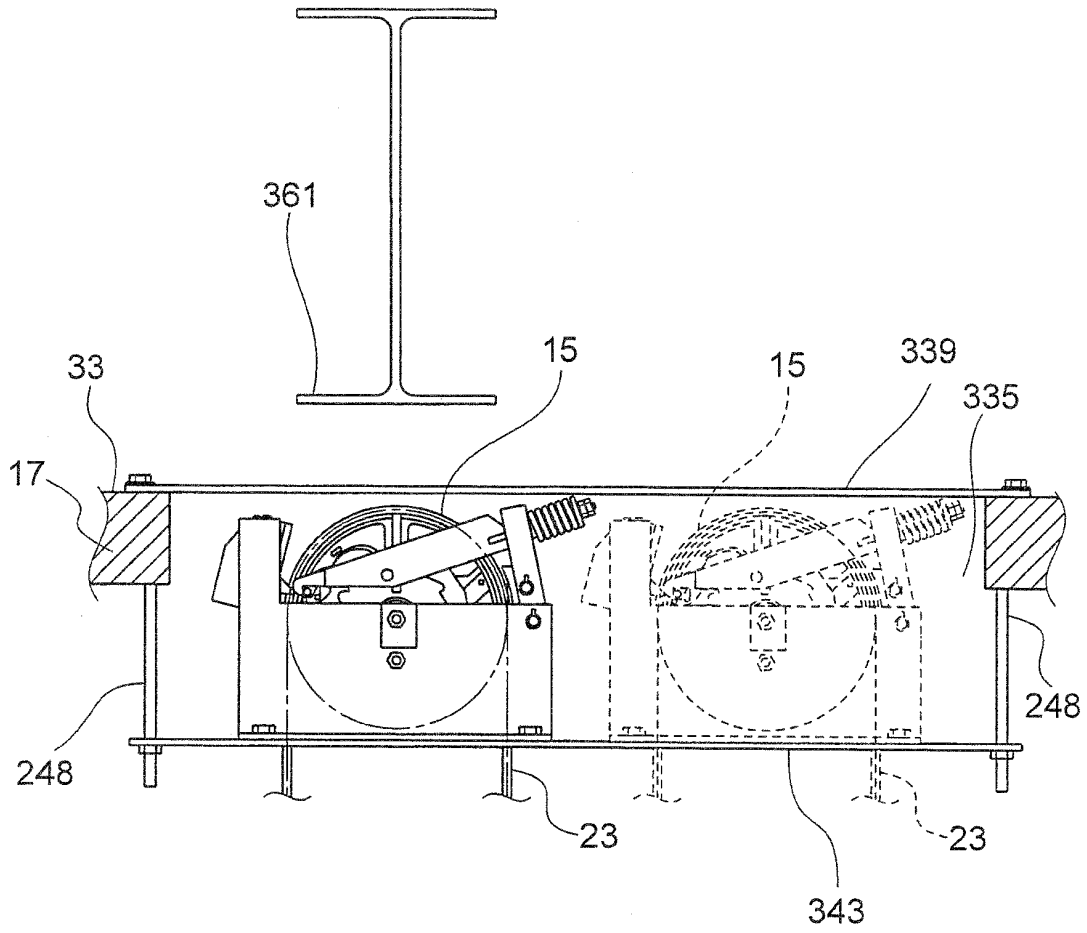


FIG. 13

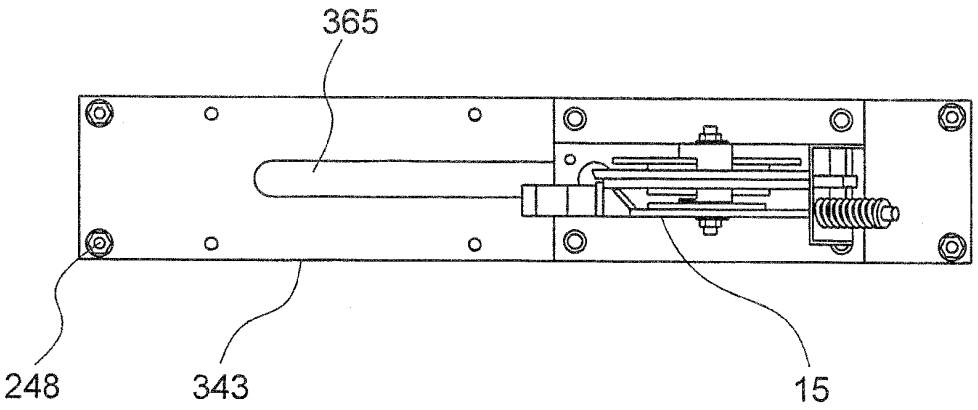


FIG. 14

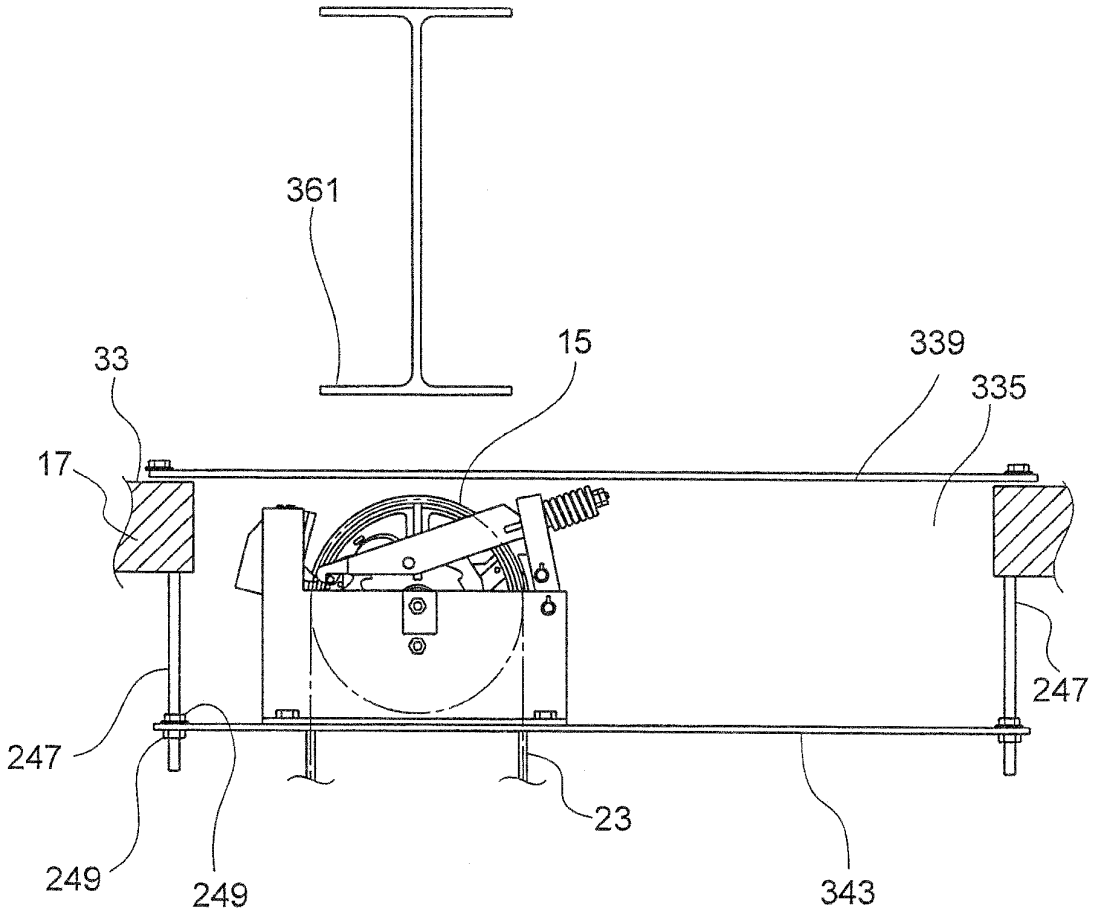


FIG. 15

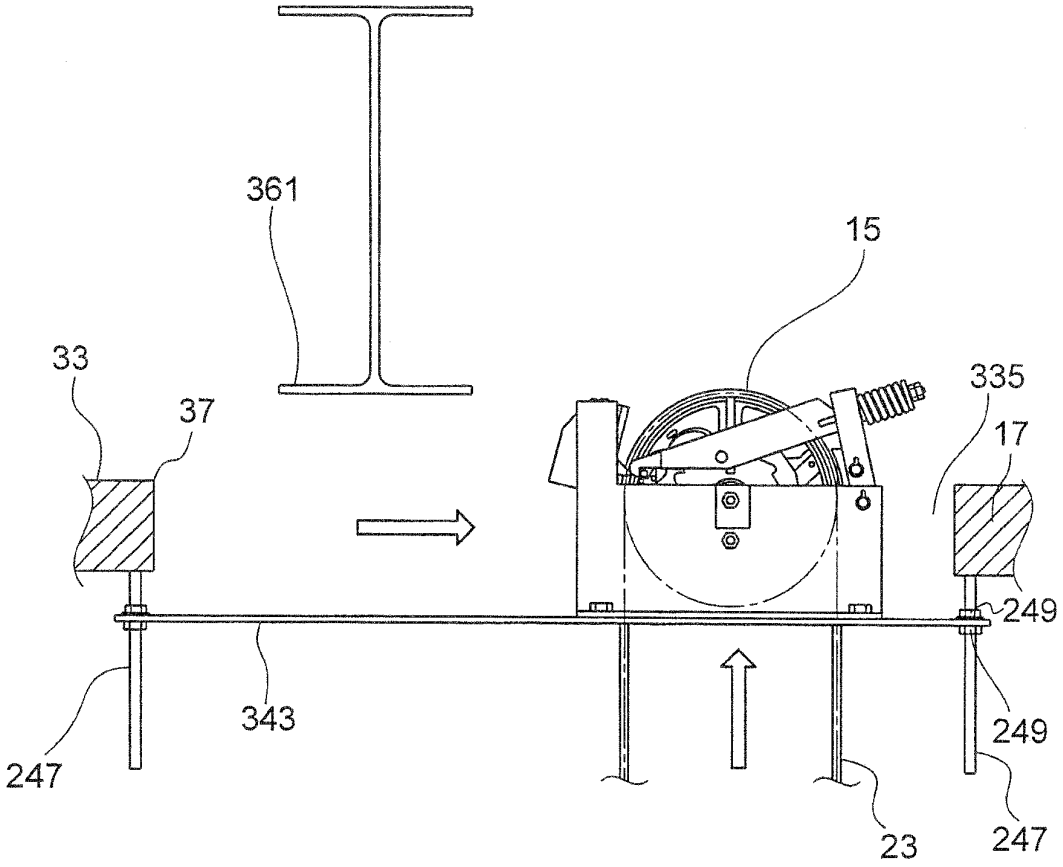


FIG. 16

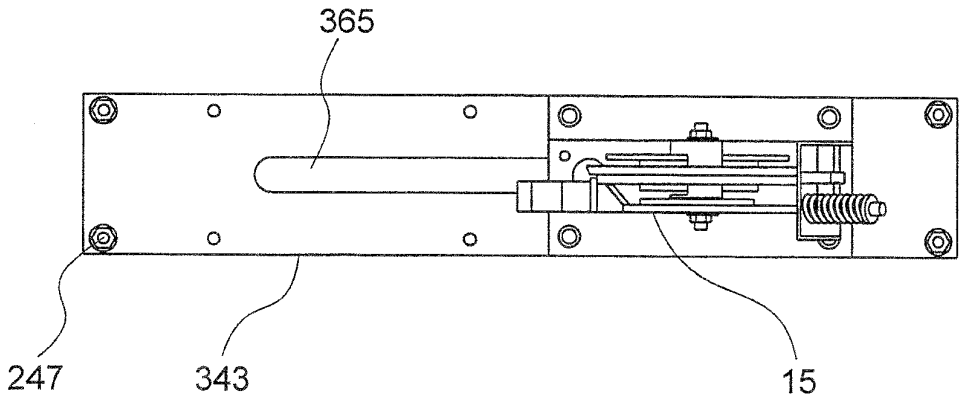


FIG. 17

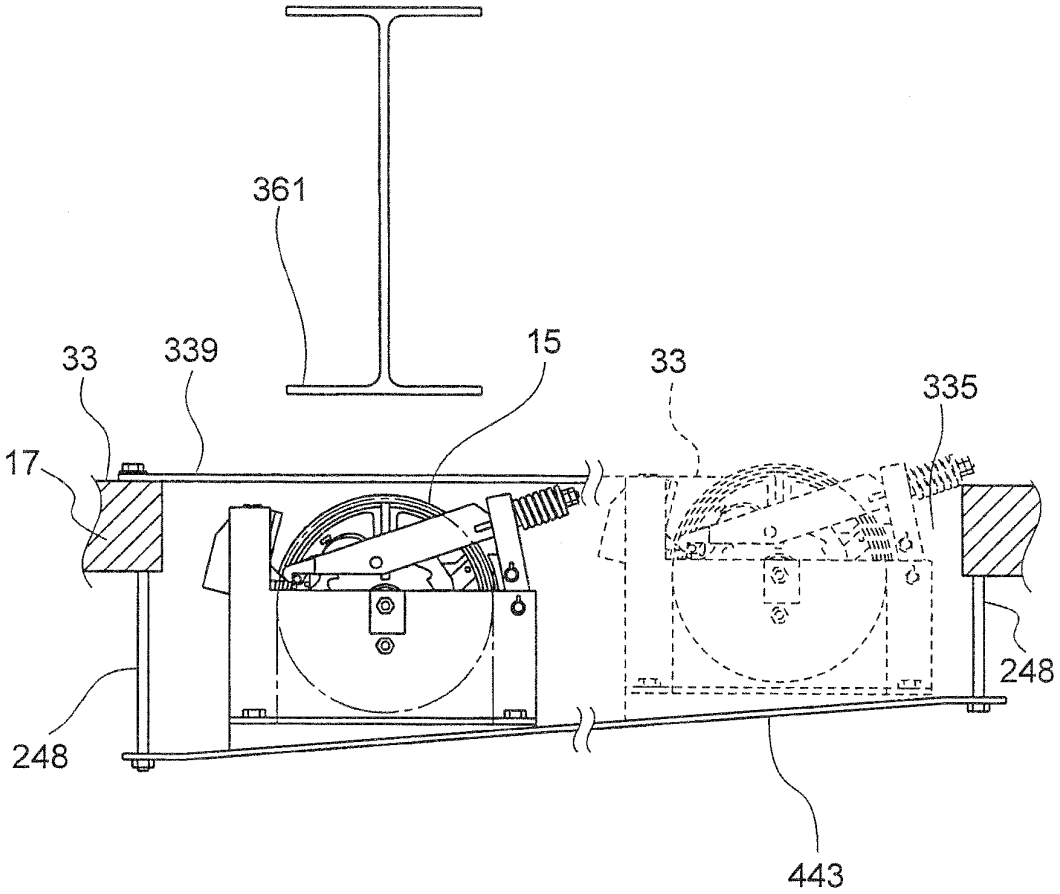


FIG. 18

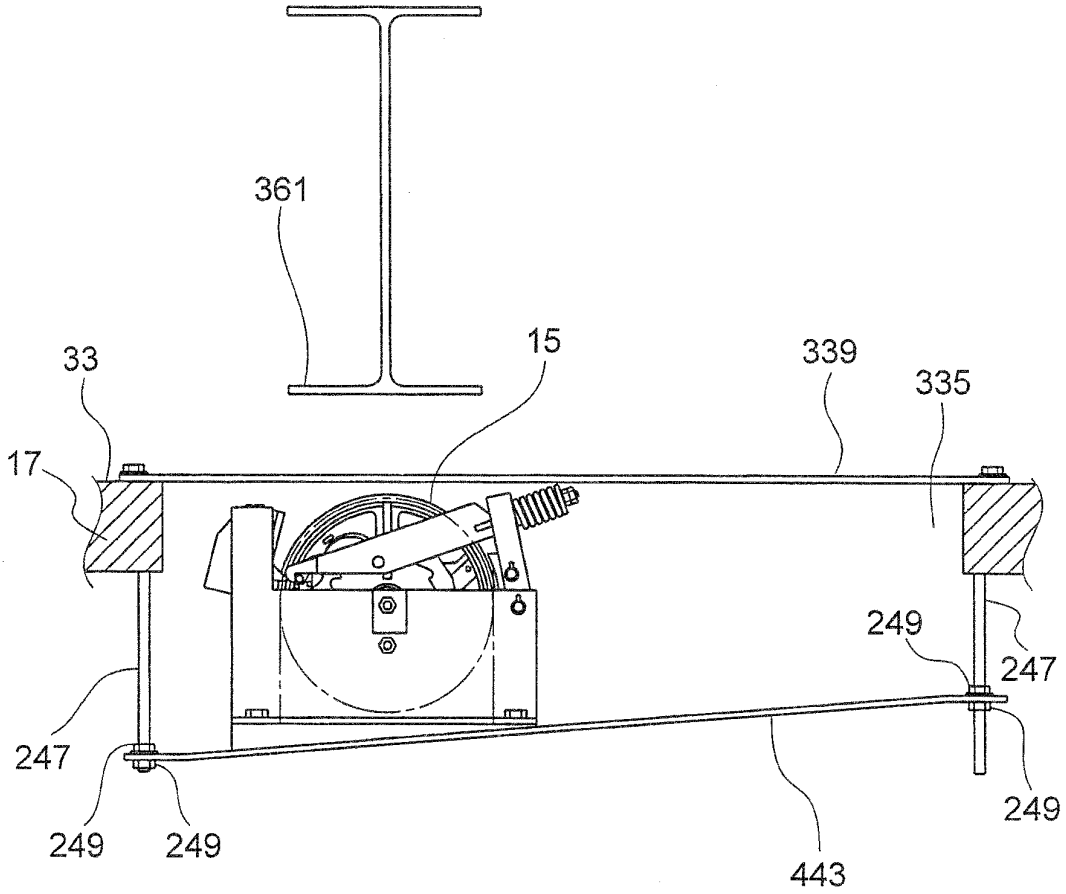
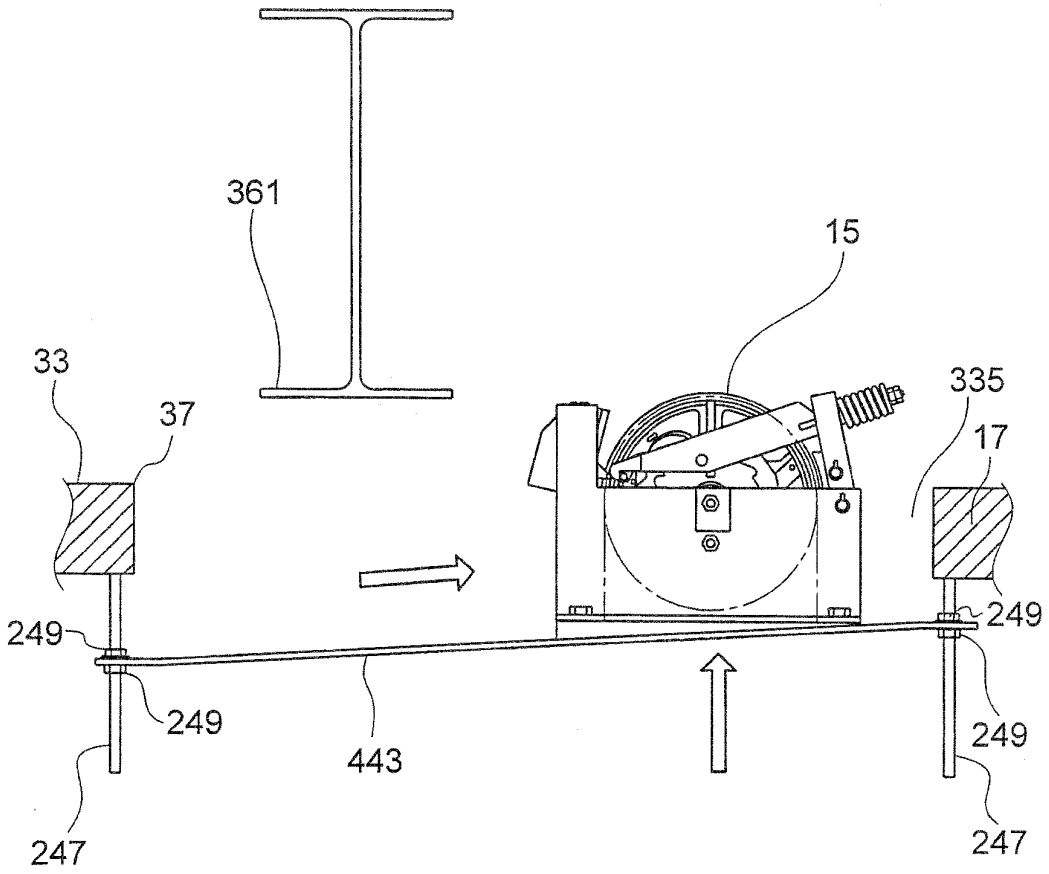


FIG. 19



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/069681

A. CLASSIFICATION OF SUBJECT MATTER
B66B5/04(2006.01)i, *B66B11/04*(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)
B66B5/04, B66B11/04

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 1996-2011
Kokai Jitsuyo Shinan Koho 1971-2011 Toroku Jitsuyo Shinan Koho 1994-2011

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	JP 5-301687 A (Mitsubishi Electric Corp.), 16 November 1993 (16.11.1993), paragraph [0013]; fig. 1 (Family: none)	1-5 6-12
Y A	JP 2004-504239 A (Otis Elevator Co.), 12 February 2004 (12.02.2004), paragraphs [0014] to [0015]; fig. 1 to 3 & US 6619433 B1 & EP 1311452 A2 & WO 2002/008108 A2 & CN 1446173 A	1-5 6-12

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

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Date of the actual completion of the international search	Date of mailing of the international search report
27 January, 2011 (27.01.11)	08 February, 2011 (08.02.11)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2010/069681

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 93247/1986(Laid-open No. 1866/1988) (Hitachi Elevator Service Kabushiki Kaisha) 08 January 1988 (08.01.1988), page 3, lines 11 to 20; fig. 1 (Family: none)	2
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 69851/1987(Laid-open No. 178277/1988) (Mitsubishi Electric Corp.), 18 November 1988 (18.11.1988), claims; fig. 3 (Family: none)	11

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 63012580 A **[0006]**
- JP 7125946 A **[0006]**