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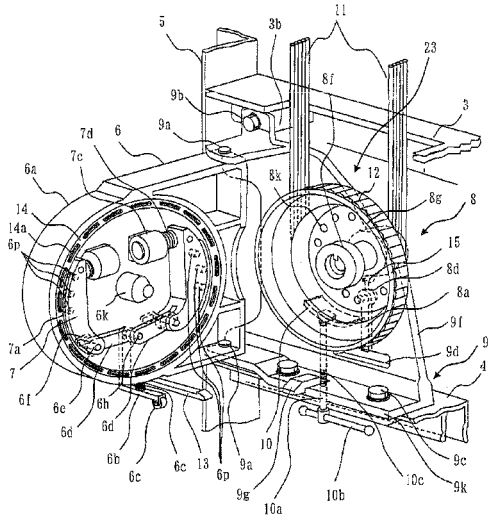
(54) ELEVATOR HOIST

(57) Disclosed is a hoisting machine 23 that opens a housing 6a of the stator side attaching a brake arm 7 against a rotor side attaching a sheave 8 and a brake drum 8g, by turning about a shaft pin 9a, as an axis. Also, according to this hoisting machine 23, a fixing bolt 8d is inserted to an engaging rod 8a when opening the housing 6a, whereby the engaging rod 8a moves to an upper direction to release a lock apparatus 13 of the housing 6a. At this time, an end of the engaging rod 8a is inserted to a screw hole 8k of the brake drum 8g thereby fixing the brake drum 8g to preclude rotation. Further, as a result of inserting the fixing bolt 8d to move the engaging rod 8a to the upper direction, a sheave fixing confirmation switch 15 that positions at an upper direction of the engaging rod 8a is pressed, the power supply to the hoisting machine 23 is cut off, to preclude the brake drum 8g from start rotating. In this way, the simplicity and the safety factors in the maintenance inspection operation of the hoisting machine 23 are improved.

FIG. 2



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Description

TECHNICAL FIELD

[0001] The present invention relates to, for example, a hoisting machine of a machine room less elevator that provides simplicity and safety factors in maintenance and checking operation.

BACKGROUND ART

[0002] The installation number of the machine room less elevator is on the increase because it does not require the machine room, and its hoistway pit dimension and a top part gap can be made small.

[0003] Patent document 1 (see Fig. 1) shows positions of whereabouts an elevator car, a counter weight and a hoisting machine are disposed in the hoistway, for a typical machine less elevator. In patent document 1, return sheaves are attached to a top part of the hoistway, and the hoisting machine is placed at a lower direction in the hoistway. A rope from a return sheave is passed over to a lower half of the sheave of the hoisting machine, to be pulled up to a return sheave of the upper direction.

[0004] Patent document 2 (see Fig. 1) illustrates a rotating body and a sheave of the hoisting machine joined by a bolt to allow their dismantling separately.

Patent document 1: WO2004/080875A1
Patent document 2: JP2005-200221A

DISCLOSURE OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0005] As discussed in patent document 1, the machine less elevator has the elevator car and the counter weight in the hoistway. The hoisting machine is placed at a spacing between the elevator car and a hoistway wall.

Upon inspection of the hoisting machine, a space around the hoisting machine is secured by moving the elevator car to the upper direction away from the hoisting machine, and further, a loosening operation of the hoisting rope being passed over the sheave of the hoisting machine is performed. For example, lifting up the elevator car and the counter weight by a chain block or a winch loosens the hoisting rope. Then, the hoisting machine is removed, a necessary portion is dismantled, and an inspection of the hoisting machine is carried out.

Although, patent document 2 improves on the convenience of the dismantling operation of the rotating body and the sheave of the hoisting machine, however, it is difficult to dismantle the hoisting machine without securing the space around the hoisting machine and loosening operation of the hoisting rope.

As discussed above, there is an issue of taking too much work in preparation for carrying out the maintenance inspection of the hoisting machine.

[0006] The present invention, for example, aims to improve the simplicity and safety factors in the maintenance inspection operation of the hoisting machine.

MEANS TO SOLVE THE PROBLEMS

[0007] According to present invention, an elevator hoisting machine comprising a rotor housing attaching a rotor and a stator housing attaching a stator; wherein the stator housing is arranged to face the rotor housing, couples an end portion of the stator housing to an end portion of the rotor housing with a shaft pin, and turns about the shaft pin.

[0008] The stator includes a rotating shaft that rotates, a brake drum that rotates in response to the rotating shaft, and a sheave that winds a suspension rope for suspending an elevator car and that rotates in response to the brake drum; wherein the stator includes a brake arm, which is arranged at an inner peripheral side of the brake drum when the stator housing is arranged to face the rotor housing, whichproceeds to and retracts from the brake drum, and which presses an inner peripheral face of the brake drum for braking the break drum when proceeding to the brake drum.

[0009] The rotor housing and the stator housing are arranged to face one another and to orthogonally cross with the rotating shaft; and wherein the stator housing turns and opens by intersecting with respect to the rotating shaft.

[0010] The stator housing encloses the brake drum when the stator housing is arranged to face the rotor housing, and exposes the brake drum at turning.

[0011] The stator housing has a stator cylindrical part that forms a cylindrical shape in which one end is opened and the other end is closed and that encloses the brake drum from the opened end, and an inner peripheral face of the stator cylindrical part faces an outer peripheral face of the brake drum when the brake drum is enclosed.

[0012] The elevator hoisting machine having a plane face that orthogonally crosses a turning axis of the stator housing and that includes the rotating shaft of the brake drum, wherein, at a front side of the rotating shaft of the turning axis, a distance between an end portion of the opened side of the inner peripheral face of the stator cylindrical part and the turning axis is shorter than a minimum distance between the outer periphery face of the brake drum and the turning axis, and wherein, at a depth side of the rotating shaft of the turning axis, a minimum distance between the inner peripheral face of the stator cylindrical part and the turning axis is longer than a distance between an end portion of the outer peripheral face of the brake drum of a side closed by the stator cylindrical part and the turning axis.

[0013] The stator housing further comprises a stator engaging piece that engages with a mating part, wherein the rotor housing, as the mating part, comprises a rotor engaging piece capable of proceeding to and retracting

from the stator engaging piece, and wherein the rotor engaging piece suppresses a turning of the stator housing by engaging to the stator engaging piece, when proceeding to the stator engaging piece, and releases the suppression of the turning of the stator housing by dislocating from the stator engaging piece, when retracting from the stator engaging piece.

[0014] The rotor engaging piece includes an insertion hole portion where a taper attached insertion tool is inserted in and pulled out, by moving along an inclination of the taper of the insertion tool inserted in and pulled out from the insertion hole portion, retracts from the stator engaging piece when the insertion tool is inserted to the insertion hole portion, and proceeds to the stator engaging piece side when the insertion tool is pulled out from the insertion hole portion.

[0015] The sheave includes a fixing hole portion to which one end of the insertion tool inserted to the insertion hole portion of the rotor engaging piece is inserted, and is fixed to preclude rotation by inserting the end of the insertion tool to the fixing hole portion.

[0016] The elevator hoisting machine, further comprising a sheave power cut off switch that is attached to the rotor housing in a retracting destination of the rotor engaging piece, and that cuts off power to a rotation apparatus that rotates the sheave when entering the switch; and wherein the rotor engaging piece enters the sheave power cut off switch when retracting from the stator engaging piece.

[0017] The elevator hoisting machine, further comprising an insertion tool operation switch that inserts the insertion tool to the insertion hole portion of the rotor engaging piece when the switch is entered.

[0018] The elevator hoisting machine, further comprising a rope restraining tool that includes a screw cut rod having a columnar shape which is screw cut in a circumferential direction, a rope restraining unit that faces the suspension rope and that couples to one end of the screw cut rod, and a handle that rotates the screw cut rod in the circumferential direction of the screw cut rod and that moves the screw cut rod forward and backward in a lengthwise direction of the screw cut rod by a screwing effect of the screw cut rod; wherein the rope restraining tool includes the screw cut rod rotated by the handle proceeds to the rope restraining unit side, and the screw cut rod that proceeded to the rope restraining side restrains the suspension rope by pressing the rope restraining unit against the suspension rope.

[0019] The elevator hoisting machine, further comprising a rope restraining tool that faces the suspension rope, and a restraining tool operation switch that restrains the suspension rope by pressing the rope restraining tool against the suspension rope when the switch is entered.

[0020] The elevator hoisting machine, wherein the stator housing further comprises a brake arm link piece that couples to the brake arm; a brake arm guidance rod that couples to the brake arm link piece; and a brake arm guidance cam having a projecting portion; wherein, before turning of the stator housing, the brake arm link piece is elongated in a retracting direction of the brake arm, and the brake arm guidance rod is arranged to adjoin to the brake arm guidance cam at an end portion of the brake arm guidance rod; and wherein, during turning of the stator housing, the brake arm guidance rod at the end portion rides over the projecting portion by moving over the brake arm guidance cam, accompanied by the turning of the stator housing; the brake arm link piece is pushed out at a coupling part with the brake arm guidance rod, by the brake arm guidance rod riding over the projecting portion at the end portion, and the brake arm retracts by pulling a coupling part with the brake arm link piece by the brake arm link piece pushed out at the coupling part with the brake arm guidance rod.

[0021] The brake arm guidance rod includes a guidance elastic body that is stretchable, wherein, after turning of the stator housing, the brake arm guidance rod separates from the brake arm guidance cam, and is pushed back by the guidance elastic body in a reverse direction from a turning time of the stator housing, the brake arm link piece is pulled back at the coupling part with the brake arm guidance rod by the brake arm guidance rod, and the brake arm is pushed back by the brake arm link piece in a proceeding direction.

[0022] The brake arm guidance rod has an elongate hole which extends in an elongated direction of the brake arm guidance rod, and which is serving as a bearing of a pin for coupling the brake arm link piece.

[0023] The stator housing has an elongate hole which extends in a proceeding and retracting direction of the brake arm, and which is serving as a bearing of a pin for coupling the brake arm and the brake arm link piece.

[0024] The elevator hoisting machine, further comprising a brake arm operating switch that retracts the brake arm to a position of non-braking time when the switch is entered.

[0025] The stator housing has an inspection hole that is opened on a facing portion of the brake arm and the brake drum.

[0026] The elevator hoisting machine, further comprising a sheave fixing mechanism that fixes the sheave during stopping the rotation; and a housing lock mechanism that suppresses turning of the stator housing when the stator housing is closed, and releases suppression of the turning of the stator housing inresponse to fixing of the sheave by the sheave fixingmechanism.

[0027] The elevator hoisting machine, further comprising a sheave power cut off mechanism that cuts off power to a rotation apparatus for rotating the sheave, in response to the fixing of the sheave by the sheave fixing mechanism.

[0028] The elevator hoisting machine, further comprising a rope restraining mechanism that restrains a movement of the suspension rope.

[0029] The elevator hoisting machine, further comprising an arm operation mechanism that retracts the brake arm when the stator housing is turning.

[0030] The arm operation mechanism pushes out the brake arm in a proceeding direction before turning of the stator housing, draws the brake arm in a retracting direction during turning of the stator housing, and pushes back the brake arm in the proceeding direction after turning of the stator housing.

EFFECTS OF THE INVENTION

[0031] According to the present invention, for example, the stator housing and the rotor housing are rotably coupled with a shaft pin, therefore, an operation of removing the stator housing from the rotor housing using a tool is no longer required. The maintenance inspection is facilitated by externally exposing the rotor and stator.

PREFERRED EMBODIMENTS FOR CARRYING OUT THE INVENTION

First Embodiment

[0032] The hoisting machine of the first embodiment is configured to allow inspection of its inner portion by opening a main body of the hoisting machine (the housing) after fixing the sheave to preclude its rotation while the hoisting rope is being passed over the sheave.
In other words, the hoisting machine of the first embodiment can be inspected without having to heretofore suspend the elevator car and the counter weight by using the chain block or the winch for releasing a load put on the hoisting rope that passes over the sheave.
Due to this, the inspection of the inner portion of the hoisting machine is readily carried out while the hoisting rope is wound around the sheave of the hoisting machine of the elevator, thereby remarkably reducing time and cost of the maintenance inspection.
Hereinbelow, the details of the hoisting machine according to the first embodiment will be described.
[0033] Fig. 1 illustrates the perspective view showing the closed state of the hoisting machine 23 according to the first embodiment.
Fig. 2 illustrates the perspective view showing the opened state of the hoisting machine 23 according to the first embodiment.
Opening and closing of the housing 6a for the hoisting machine 23 of the first embodiment will be described below based on Figs. 1 and 2.
One of the characteristics of the hoisting machine 23 of the first embodiment is to allow an opening movement (a turning movement) of the housing 6a for the maintenance inspection.
[0034] The hoisting machine 23 is divided into a rotor having a sheave 8 and a brake drum 8g, and a stator having the brake arm 7, an electromagnet 14, and a coil 14a.
The rotor is something that rotates, something that rotates as a driving force, or something that is rotated by something that rotates as a driving force. The stator is something that does not rotate, or something that stops rotation of the rotor.
The rotor is attached to a shaft bearing supporting board 9f (a rotor housing) of a hoisting machine base 9, and rotates about a rotating shaft that is the attachment portion of the rotor with the shaft bearing supporting board 9f. The stator is attached to the housing 6a (a stator housing). The housing 6a, in the closed state, is arranged to face the shaft bearing supporting board 9f of the hoisting machine base 9. The housing 6a is coupled to an end portion of the shaft bearing supporting board 9f, with a shaft pin 9a, at an end portion of a housing frame 6 (the stator housing) joined to the housing 6a, and turns about the shaft pin 9a that is a turning axis. With turning of the housing 6a, the hoisting machine 23 becomes the opened state in which the housing 6a exposes the brake drum 8g (see Fig. 2), from the closed state in which the housing 6a covers and encloses the brake drum 8g (see Fig. 1).
The housing 6a and the shaft bearing supporting board 9f, in the closed state of the hoisting machine 23, are arranged to orthogonally cross with the rotating shaft of the rotor. The housing 6a turns and opens so as to intersect with respect to the rotating shaft of the rotor.
The housing 6a and the shaft bearing supporting board 9f, as in a bivalve shell and a suitcase, turn about the turning axis, and form the closed state concealing the inner portions and the opened state exposing the inner portions. The shaft bearing supporting board 9f is fixed as a portion of the hoisting machine base 9, and the housing 6a is the object that turns.
[0035] The maintenance inspection of the hoisting machine 23 of the first embodiment can be carried out by exposing to outside, the brake drum 8g and the sheave 8 serving as the rotor and the brake arm 7 serving as the stator.
Also, the hoisting machine 23 can engage the rotor attached to the shaft bearing supporting board 9f and the stator attached to the housing 6a, because the housing 6a and the shaft bearing support board 9f are facing one another.
Moreover, the hoisting machine 23 can conceal the brake drum 8g before turning, and can exposes the brake drum 8g after the turning.
Furthermore, the hoisting machine 23, because an outer peripheral face of the brake drum 8g and an inner peripheral face of the housing 6a are facing one another, can rotate the sheave 8 moving in response to the operation of the brake drum 8g, by installing a permanent magnet 12 along a circumference of the brake drum 8g, by installing the electromagnet 14 along a circumference of the housing 6a, and by generating an electromagnetic force on the electromagnet 14 of the housing 6a.
[0036] Referring to Fig. 2, the housing 5a (a stator cylindrical part) forms a cylindrical shape having an open end and a closed end, and encloses the brake drum 8g from the open end side. Upon enclosing the brake drum 8g, the inner peripheral face of the housing 6a faces with

the outer peripheral face of the brake drum 8g. The housing 6a comprises the electromagnet 14 and the coil 14a that rotate the brake drum 8g, at its circumferential portion. The housing 6a provides the brake arm 7 that brakes the brake drum 8g and a fixing shaft 6k that couples to a rotor side (an encoder 8f which will be described later), at its inner cylindrical portion.

The brake arm 7, when the housing 6a is closed as in Fig. 1, retracts from the inner peripheral side of the brake drum 8g and proceeds to the inner peripheral face of the brake drum 8g, and brakes a rotation of the brake drum 8g by pressing the inner peripheral face of the brake drum 8g when the brake arm 7 proceeds to the inner peripheral face of the brake drum 8g.

Also, the sheave 8 on the rotor side is rotably coupled to the shaft bearing supporting board 9f of the hoisting machine base 9, and winds around a hoisting rope 11 (a suspension rope) that moves the counter weight and the elevator car up and down. Also, the sheave 8 joins with the cylindrical brake drum 8g and the encoder 8f that counts the number of rotations, and rotates in response to the brake drum 8g.

[0037] Referring to Figs. 1 and 2, the hoisting machine 23 is fixed to an attachment block 3b attached to a hoisting machine attachment upper frame 3 with a bolt 9b. Also, the hoisting machine base 9 of the hoisting machine 23 is fixed to a hoisting machine attachment lower frame 4 with a bolt 9c. The hoisting machine attachment upper frame 3 and the hoisting machine attachment lower frame 4 are fixed to a hoisting machine attachment vertical frame 5, and an attachment block 3a is attached to the hoisting machine attachment upper frame 3 and the hoisting machine attachment lower frame 4, and a car guide rail 2 is attached on the attachment block 3a.

[0038] Fig. 3 is the vertical cross sectional view of the hoisting machine 23 according to the first embodiment, showing the vertical cross section of a central portion of the hoisting machine 23 viewed from the side A indicted on Fig. 1. Also, Fig. 3 sees through portions of the bolt 9b and the attachment block 3b.

Fig. 4 is the horizontal cross sectional view of the hoisting machine 23 according to the first embodiment, showing the horizontal cross section of a central portion of the hoisting machine 23 viewed from the side B indicated on Fig. 1. Also, Fig. 4 sees through a portion of a pin 6h.

Fig. 5 is a plan view of the hoi st ing machine 23 according to the first embodiment.

Figs. 3 to 5 respectively show the hoisting machine 23 where the housing 6a of Fig. 1 is in the closed state.

[0039] Referring to Fig. 3, the fixing shaft 6k of the stator side is engaged to a hollow portion of the encoder 8f of the rotor side. Referring to Fig. 4, the brake drum 8g of the rotor side is stored in between the electromagnet 14 of the stator side and the brake arm 7. As illustrated in Fig. 2, the electromagnet 14, having a plurality of coils 14a on the circumference, passes electricity through to the coils 14a, and rotates the brake drum 8g by the generated electromagnetic force. The permanent magnet 12 is attached on the outer periphery of the brake drum 8g. Also, the sheave 8 moves the hoisting rope 11 rotating in response to the movement of the brake drum 8g. The encoder 8f counts the number of rotations of the sheave 8. Further, during a rotation of the sheave 8, an electromagnet apparatus 7c of Fig. 2 passes through the electricity, and the brake arm 7 is pulled by the generated electromagnetic force to pull the brake arm 7 apart from the brake arm 8g.

Further, the passage of electricity to the coil 14a is cut off during stopping time of the rotation of the sheave 8, and thereby stopping the rotation of the brake drum 8g. Further, the passage of electricity to the electromagnet apparatus 7c is cut off during stopping time of the rotation of the sheave 8, and thereby pushing out the brake arm 7 by a brake operating spring 7d. Then, in Fig. 4, thepushed-out brake arm 7 presses the inner peripheral face of the brake drum 8g at a brake shoe 7a attached at a front, and brakes the brake drum 8g where a rotational torque is exerted. During the stopping time of the rotation of the sheave 8, the rotational torque is exerted on the brake drum 8g due to a balancing force of the elevator car 27 and the counterweight 32 suspended by the hoisting rope 11.

[0040] Fig. 6 illustrates a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment, showing an enlarged lower portion of the hoisting machine 23 for the cross section of Fig. 3. Further, Fig. 6 shows a state in which the fixing bolt 8d has not been fastened.

Fig. 7 is an enlarged view of the engaging rod 8 a and the fixing bolt 8d that the hoisting machine 23 of the first embodiment provides.

Fig. 8 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment, showing an enlarged lower portion of the hosting machine 23 for the cross section of Fig. 3. Further, Fig. 8 shows a state in which the fixing bolt 8d has been fastened.

Fig. 9 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment, showing an enlarged arrangement portion of the fixing bolt 8d, a detection rod 15c and a sheave fixing confirmation switch 15 for the cross section of Fig. 8.

The following mechanisms that the hosting machine 23 of the first embodiment has will be described based on Figs. 6 to 9. A sheave fixing mechanism that fixes the sheave 8 during the stopping time of the rotation, for opening the housing 6a; a housing lock mechanism that releases and suppresses opening of the housing 6a while suppressing opening (turning) of the housing 6a when the housing 6a is closed, by operating in response to the fixing of the sheave 8 of the sheave fixing mechanism; and a sheave power cut off mechanism that cuts off a power to a rotation apparatus (the electromagnet 14 and the coil 14a) for rotating the sheave, by operating in response to the fixing of the sheave 8 of the sheave fixing

mechanism.

One of the characteristics of the hoisting machine 23 of the first embodiment is to ensure the safety of the maintenance operation by applying mechanical and electrical brakes to the sheave 8 at the same time as releasing the lock of the housing 6a that is locked and does not open during the normal operation.

[0041] Referring to Fig. 6, the hoisting machine 23 comprises a bar-type or a board-type engaging rod 8a. The engaging rod 8a is incorporated to the shaft bearing supporting board 9f of the hoisting machine base 9. In the closed state of the housing 6a, an engaging portion 8e at a lower end of the engaging rod 8ais protruded to a lock apparatus escape window 9d. Also, the hoisting machine 23 comprises a bar-type or a board-type lock apparatus 13 having a checkmark shape in cross section. The lock apparatus 13 at one end has a protruded engaging portion 13b, and the other end is fixed to the housing 6a with a screw 13a. The lock apparatus 13 extends from the housing 6a to the shaft bearing supporting board 9f, and the engaging rod 8a extends to an intersecting direction with respect to the lock apparatus 13 (especially, an orthogonal direction). In the closed state of the housing 6a, the engaging portion 13b of the lock apparatus 13, positioned at the lock apparatus escape window 9d, engages to the engaging portion 8e of the engaging rod 8a. The hoisting machine 23, in the closed state of the housing 6a, since the engaging rod 8a engages to the lock apparatus 13, prevents opening of the housing 6a during the normal operation.

The engaging rod 8a (a rotor engaging piece) proceeds and retracts with respect to the lock apparatus 13, and when proceeding to the lock apparatus 13 (a stator engaging piece), suppresses opening of the housing 6a (the stator housing) by engaging to the engaging portion 13b of the lock apparatus 13, and suppresses the opening of the housing 6a by dislocating from the engaging portion 13b of the lock apparatus 13 when retracting from the lock apparatus 13.

[0042] Referring to Fig. 7, the engaging rod 8a at its upper portion has a taper hole 8b (an insertion hole part) which is conically inclined in a thickness direction. The fixing bolt 8d (an insertion tool) is inserted to the taper hole 8b. Also, the fixing bolt 8d has a taperportion 8nthat is conically inclined. When the fixing bolt 8d is inserted to the taper hole 8b, the engaging rod 8a is pulled up along an inclination of the taper hole 8b and an inclination of the taper portion 8n, and the engaging portion 8e of the engaging rod 8a is dislocated from the engaging portion 13b of the lock apparatus 13, and thereby allowing opening of the housing 6a.

[0043] Referring to Fig. 6, the fixing bolt 8d is inserted to the taper hole 8b of the engaging rod 8a from a bolt hole 8r of the shaft bearing supporting board 9f, and an end of the screw portion is screwed into a screw hole 8k of the sheave 8 with a bolt tool 16. As shown in Fig. 2, a plurality of screw holes 8k, circumferentially aligned, is being open on the sheave 8. with screwing of the fixing bolts 8d to the screw holes 8k, the sheave 8 is fixed to preclude it from rotating.

That is, the hoisting machine 23, as shown in Fig. 8, when the fixing bolt 8d attached to the shaft bearing supporting board 9f is fastened, the housing 6a is opened by the release of the lock apparatus 13, at the same time, the sheave 8 is mechanically fixed by the fixing bolt 8d.

The fixing bolt 8d and the screw hole 8k constitute the sheave fixing mechanism, and the engaging rod 8a and the lock apparatus 13 constitute the housing lock mechanism.

[0044] Further, in Fig. 9, the hoisting machine 23 comprises, on an upper part of the engaging rod 8a, the detection rod 15c incorporated to the shaft bearing supporting board 9f of the hoisting machine base 9, and further comprises, on an upper part of the detection rod 15c, the sheave fixing confirmation switch 15 (a sheave power cut off switch) incorporated to the shaft bearing supporting board 9f of the hoisting machine base 9.

When the engaging rod 8a is pulled up by fastening of the fixing bolt 8d to the screw hole 8k, an upper end of the engaging rod 8a pushes up a spring bearing 15d positioned at a lower end of the detection rod 15c. Then, an upper end of the detection rod 15c pushes a detection portion 15a of the sheave fixing confirmation switch 15. The sheave fixing confirmation switch 15, while the detection portion 15a is being pushed, cuts off a power to the hoisting machine 23 (the coil 14a and the electromagnet apparatus 7c) to preclude the sheave 8 from start rotating.

That is, the hoisting machine 23, when the fixing bolt 8d attached to the hoistingmachine base 9 is fastened, the housing 6a is opened with the release of the lock apparatus 13, at the same time, the sheave 8 is electrically braked by the sheave fixing confirmation switch 15.

The sheave fixing confirmation switch 15, the detection portion 15a, the detection rod 15c, and the spring bearing 15d constitute the sheave power cut off mechanism.

[0045] Further, when the fixing bolt 8d is unfastened, the engaging rod 8a is pushed down along the inclinationof the papered portion 8n of the fixing bolt 8d by a return spring 15e attached to the detection rod 15c.

Due to this, when the fixing bolt 8d is unfastened and removed from the screw hole 8k, the fixing of the sheave 8 by the fixing bolt 8d is released, at the same time, the power cut off to the hoisting machine 23 is released by the sheave fixing confirmation switch 15 that detected a non-pressing down state of the detection portion 15a. Also, the lock apparatus 13 is locked by the engaging rod 8a.

[0046] Fig. 10 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment, showing a state that the hoisting rope 11 is fixed by an auxiliary brake 10, from the state of Fig. 8. The auxiliary brake 10 that fixes the hoisting rope 11 provided by the hoisting machine 23 of the first embodiment will be described below based on Fig. 10.

One of the characteristics of the hoisting machine 23 of

the first embodiment is to increase the safety factor at the maintenance inspection by comprising the auxiliary brake 10 that fixes the hoisting rope 11.

[0047] The auxiliary brake 10 includes a rod 10a, a clamping portion 10e, a handle 10b, and a rotating neck 10d.

The rod 10a (a screw cut randy forming a columnar shape, has a screw portion 10c that is screw cut in the circumferential direction. The rod 10a penetrates through the hoisting machine base fixing board 9k, and the screw portion 10c is positioned on a screw cut hole of the hoisting machine base fixing board 9k.

The clamping portion 10e (a rope restraining unit) is coupled to an upper end of the rod 10a, and faces with the hoisting rope 11 so as to clamp the hoisting rope 11 (the suspension rope) .

The handle 10b is attached at a lower end of the rod 10a, and moves the rod 10a back and forth in a lengthwise direction of the rod 10a by a screwing effect of the rod 10a rotating in the circumferential direction of the rod 10a. Further, the clamping portion 10e and the rod 10a are coupled through the rotating neck 10d so that the clamping portion 10e does not rotate even if the rod 10a rotates. When the handle 10b is rotated in a direction of fastening the screw portion 10c of the rod 10a with respect to the hoisting machine base fixing board 9k, the rod 10a is pushed upward. Then, the clamping portion 10e is pushed up by the rod 10a. The hoisting rope 11 and the sheave 8 is pressed from below and restrained.

[0048] The auxiliary brake 10 (a rope restraining tool, a rope restraining mechanism), wherein the rod 10a rotated by the handle 10b proceeds to the clamping portion 10e side, and the rod 10a proceeded to the clamping portion 10e side pushes the clamping portion 10e against the hoisting rope 11 to restrain the hoisting rope 11.

[0049] Upon opening the housing 6a, the sheave 8 is fixed by the sheave fixing confirmation switch 15 and the fixing bolt 8d, and further, the hoisting rope 11 is fixed by the auxiliary brake 10, thereby allowing an opening of the housing 6a safely.

[0050] The lock apparatus 13 may be attached not only at a lower side of the hoisting machine 23, but it may also be attached to any directions such as an upper side, a right side or a left side. The engaging rod 8a extending to the lock apparatus 13 is arranged to concord with the position of the lock apparatus 13, and the sheave fixing confirmation switch 15 that positions at an end portion of the engaging rod 8a is arranged to concord with an elongated direction of the engaging rod 8a.

[0051] Figs. 11, 12 and 13 illustrate partially enlarged views of the vertical cross section of the hoisting machine 23 according to the first embodiment, showing operation of the rod 6b when the housing 6a is opened from the state of Fig. 10.

[0052] As shown in Fig. 11, the hoisting machine base 9 has a cam 9g (a brake arm guidance cam) which is undulated in a shape of trapezoid in cross section at the hoisting machine base fixing board 9k fixed to the hosting machine attachment lower frame 4. Also, in the brake arm 7 arranged inside of the housing 6a, there is the rod 6b (a brake arm guidance rod) coupled through the link 6d (a brake arm link piece) which will be described later. The rod 6b forms a L-shaped rod including a vertical piece and a horizontal piece. The rod 6b couples to the brake arm 7 at an upper portion of the vertical piece. A spring 6n is attached to a central portion of the horizontal piece. A roller 6c is attached to an end portion of the horizontal piece.

The cam 9g, the rod 6b, and the link 6d constitute an arm operation mechanism.

[0053] Accompanied by the opening of the housing 6a, the roller 6c of the rod 6b climbs up a slope of the cam 9g (see Fig. 11), rides over a top of the cam 9g (see Fig. 12), and goes down a slope of the cam 9g (see Fig. 13). At this time, the roller 6c climbing up the cam 9g lifts the rod 6b up. In other words, the rod 6b is lifted up during the opening of the housing 6a. Further, the rod 6b, during the closed state of the housing 6a before opening and during the opened state of the housing 6a after the opening, is pressed down by the spring 6n (a guidance elastic body).

[0054] Fig. 14 illustrates an enlarged view of the brake arm 7, the link 6d, and the rod 6b that the hoisting machine 23 of the first embodiment comprises.

A coupling structure of the brake arm 7, the link 6d, and the rod 6b that the hoisting machine 23 of the first embodiment comprises will be described below based on Fig. 14.

[0055] Inside of the housing 6a of the hoisting machine 23, there is provided a pair of brake arms 7 that positions on the right and left. The two brake arms 7 are coupled to two links 6d. The brake arm 7 and the link 6d are rotably coupled with a pin 6e, and further, the pin 6e is inlay into a horizontally extending elongate hole 6f provided on the housing 6a. The two links 6d at other end are rotably coupled with each other by a pin 6h, and are coupled to the rod 6b. The pin 6h is inlay into a vertically extending elongate hole 6m provided to an upper part of the vertical piece of the rod 6b. The pair of brake arms 7 and the rod 6b is coupled through the two links 6d.

[0056] Figs. 15 and 16 illustrate the inner portion of the housing 6a of the hoisting machine 23 according to the first embodiment.

Fig. 15 illustrates a state in which a position of the rod 6b is lowered before opening the housing 6a. Fig. 16 illustrates a state in which a position of the rod 6b is lifted up during opening of the housing 6a. Fig. 15 corresponds to Fig. 10, and Fig. 16 corresponds to Fig. 12.

An operation of the brake arm 7, the link 6d, and the rod 6b that the hoisting machine 23 of the first embodiment provides will be described below based on Fig. 14.

[0057] Referring to Fig. 15, when the housing 6a is closed, the link 6d is extended to a retracting direction (the horizontal direction) of the brake arm 7. The rod 6b is arranged so that the roller 6c adjoins the cam 9g.

Further, during an non-braking time when the brake drum

8g is rotating, the electromagnet apparatus 7c passes an electricity through a coil 7f whereby an electromagnetic force generated pulls in the brake arm 7 to separate the brake shoe 7a of the brake arm 7 from the inner peripheral face of the brake drum 8g. Also, during a braking time when the rotation of the brake drum 8g is stopped, the electromagnet apparatus 7c stops supplying electricity to the coil 7f whereby the brake operating spring 7d pushes out the brake arm 7 to the brake drum 8g. The pushed-out brake arm 7 suppresses a rotational torque exerted on the brake drum 8g by pressing the brake shoe 7a against the inner peripheral face of the brake drum 8g. The electromagnet apparatus 7c is fixed to the housing 6a, and the brake arm 7 is coupled to a coupling rod 7e of the electromagnet apparatus 7c with a pin 7b at an end portion opposite side from an end portion coupled to the link 6d. Also, the brake arm 7 is connected to the brake operating spring 7d attached to the electromagnet apparatus 7c.

The brake arm 7 is attached in such a way that the brake shoe 7a will come close to the inner peripheral face of the brake drum 8g during the non-braking time. For example, the brake arm 7 is attached by adjusting a spacing between the brake shoe 7a and the inner peripheral face of the brake drum 8g to come to some tenth of millimeters during the non-braking time. This is done, for example, to increase braking performance or to suppress a crashing noise between the brake shoe 7a and the brake drum 8g.

[0058] The maintenance operation of the hoisting machine 23 is performed during the braking time when the rotation of the brake drum 8g is stopped, for securing safety. The maintenance inspection, for example, adjusts a spacing between the brake shoe 7a of the brake arm 7 and the inner peripheral face of the brake drum 8g.

[0059] Herein, the hoisting machine 23 according to the first embodiment, as shown in Fig. 16, when opening the housing 6a, the rod 6b is lifted up due to the roller 6c riding over the cam 9g, and the brake shoe 7a of the brake arm 7 is pulled apart from the inner peripheral face of the brake drum 8g via the link 6d. This facilitates opening of the housing 6a.

That is, the rod 6b, accompanied by the opening of the housing 6a, rides over a projecting portion as the roller 6c moves over the cam 9g, and a coupling part of the link 6d and the rod 6b is pushed out by the rod 6b riding over the projecting portion of the cam 9g by the roller 6c. The brake arm 7 retracts by pulling a coupling part with the link 6d by the link 6d having been pushed out by the coupling part with the rod 6b.

Also, the case of closing the housing 6a, likewise, the hoisting machine 23, due to the rod 6b which is lifted up by the roller 6c riding over the cam 8g, pulls apart the brake shoe 7a of the brake arm 7 from the inner peripheral face of the brake drum 8g. This facilitates closing of the rod 6b. At this time, the brake arm 7 rotates about the pin 7b as an axis. Also, an elongate hole 6m provided on the rod 6b supports a smooth operation of the rod 6b and the link 6d in the vertical direction, as a bearing of the pin 6h. An elongate hole 6f provided on the housing 6a supports a smooth operation of the brake arm 7 and the link 6d, in the horizontal direction, as a bearing of the pin 6e. The elongate hole 6m may be provided on the housing 6a. Further, the elongate hole 6f may be provided on the link 6d or the brake arm 7.

Further, instead of placing the brake arm 7 on the right and left, it may be placed above and below. The link 6d, the rod 6b, the cam 9g, or the elongate hole 6f is arranged depending on the position of the brake arm 7. Also, the link 6d may be coupled at a center portion of the lengthwise direction of the brake arm 7, instead of the end portion of the brake arm 7.

Further, the hoisting machine 23 according to the first embodiment, as described previously, brakes the sheave 8 by the fixing bolt 8d and the sheave fixing confirmation switch 15, and fixes the hoisting rope 11 by the auxiliary brake 10.

Therefore, the brake drum 8g will not rotate even if the brake arm 7 is pulled apart from the brake drum 8g, and the safety is secured.

One of the characteristics of the hoisting machine 23 of the first embodiment is to facilitate opening and closing of the housing 6a by widening a spacing between the brake shoe 7a of the brake arm 7 and the brake drum 8g.

[0060] Also, the hoisting machine 23 of the first embodiment comprises a maintenance operation power circuit (not illustrated) for supplying a power to the electromagnet apparatus 7c for use in the maintenance operation. When a switch of the maintenance operation power circuit (the brake arm operating switch) is pressed down, the maintenance operation power circuit supplies the power to the electromagnet apparatus 7c, and the brake arms 7 are retracted back, to set forth the non-braking state.

[0061] A maintenance worker, when carrying out the maintenance operation, presses down the switch of the maintenance operation power circuit before opening the housing 6a to set the brake arm 7 to the non-braking state, and confirms a spacing between the brake shoe 7a of the brake arm 7 and the inner peripheral face of the brake arm 8g through a brake shoe spacing checking hole 6p provided on the housing 6a. Then, the maintenance worker opens the housing 6a, and adjusts an installation position of the brake arm 7 based on the spacing confirmed. As shown in Figs. 1, 2 and 4, three brake shoe spacing checking holes 6p each are provided on the right and left on the housing 6a. The three brake shoe spacing checking holes 6p on the right and left are arranged respectively along the inner peripheral face of the brake drum 8g at upper, intermediate, and lower portions of the brake shoe 7a of the brake arm 7. Also, a cap 6r is mounted on the brake shoe spacing checking hole 6p to avoid intrusion of dusts inside the housing 6a.

Also, when the housing 6a is opened, the rod 6b is pressed down by the spring 6n, and the brake arm 7 is returned to a position of the braking time, therefore, the

maintenance worker can also adjust an installation position of the brake arm 7 based on the spacing with the inner peripheral edge (or the electromagnet 14) of the housing 6a. For example, the maintenance worker presses down the switch of the maintenance operation power circuit while the housing 6 is in the opened state, sets the brake arm 7 from the braking state to the non-braking state, measures an inner diameter of the inner peripheral edge of the housing 6a and an outer diameter (a linear distance between the brake shoe 7a of the brake arms 7 on the right and left) of the brake arm 7, and adjusts the installation position of the brake arm 7 based on its difference.

One of the characteristics of the hoisting machine 23 according to the first embodiment is to facilitate the adjustment of the spacing between the brake shoe 7a of the brake arm 7 and the inner peripheral face of the brake drum 8g by providing the maintenance operation power circuit and the brake shoe spaceing checking hole 6p.

[0062] The hoisting machine 23 according to the first embodiment comprises the link 6d coupled to the brake arm 7 and the rod 6b coupled to the link 6d, wherein the brake arm 7 is separated from the brake drum 8g when the housing 6a turns, due to the rod 6b moving over the cam 9g accompanied by the turning of the housing 6a. Therefore, the turning of the housing 6a can be facilitated. Moreover, the hoisting machine 23 provides the spring 6n to the rod 6b, so that the brake arm 7 returns to the original position when the housing 6a is opened, thereby facilitating the position adjustment of the brake arm 7.

Further, the hoisting machine 23 has the elongate hole 6m as the bearing of the rod 6b and the link 6d, thereby making the operation of the rod 6b smooth.

Further, the hoisting machine 23 has the elongate hole 6f as the bearing of the brake arm 7 and the link 6d, thereby making the operation of the link 6d smooth.

Further, the hoisting machine 23 comprises the switch for operating the brake arm 7, whereby the brake arm 7 moves to the position of the non-braking time when the housing 6a is opened, thereby facilitating the position adjustment of the brake arm 7.

Further, the hoisting machine 23 has the brake shoe spacing checking hole 6p on the housing 6a to allow checking of the spacing between the brake arm 7 and the brake drum 8g when the housing 6a is open, thereby facilitating the position adjustment of the brake arm 7.

Further, by opening the housing 6a of the hoisting machine 23, the maintenance worker can perform adjustments of the coil 14a, the encoder 8f, the electromagnet apparatus 7c, the bearing, and the like, oiling of various sliding portions, and cleaning of brake powders.

[0063] Fig. 17 is a horizontal cross section of the housing 6a and the stator of the hoisting machine 23 according to the' first embodiment. Among the configuration of Fig. 4, the housing 6a, the brake drum 8g, the sheave 8, and the bolt 9a are illustrated. Further, each configuration shown on Fig. 17, in terms of convenience of explanation, is illustrated by using a dimension and a spacing that are different from that shown in Fig. 4.

For the hoisting machine 23 of the first embodiment, a relation between the housing 6a, the rotor comprised of the brake drum 8g and the sheave 8, and the bolt 9b will be described below based on Fig. 17.

The hoisting machine 23 of the first embodiment opens the housing 6a without hitting the brake drum 8g, by having the following relation between the housing 6a, the rotor comprised of the brake drum 8g and the sheave 8, and the bolt 9b.

[0064] Fig. 17 showing the state of turning of the housing 6a is a cross sectional view in plan that orthogonally crosses the turning axis of the housing 6a and includes a rotating shaft of the sheave 8 and the brake drum 8g. Referring to Fig. 17, a point p is the turning axis, an 1-dot dashed line is the rotating shaft of the brake drum 8g and the sheave 8, and a dotted line is an axis that orthogonally crosses the turning axis and the rotating shaft. Also, (1) indicates the housing 6a (a stator cylindrical part) before turning, (2) indicates the housing 6a in a process of turning, and shows the housing 6a that has most approached the brake drum 8g at a depth side (a lower part of Fig. 17) viewed from the turning axis p, (3) indicates the housing 6a in the process of turning, and shows the housing 6a that has most approached the brake drum 8g at a frontal side (an upper part of Fig. 17) viewed from the turning axis p.

In the description below, the electromagnet 14 and the coil 14a are regarded as a part of the housing 6a, and the permanent magnet 12 is regarded as a part of the brake drum 8g.

[0065] According to the hoisting machine 23, a distance between an end portion a of the inner peripheral face at the opened side of the housing 6a and the turning axis p is shorter than a minimum distance between an outer peripheral face of the brake drum 8g and the turning axis p, in other words, a distance between a point b of the brake drum 8g intersecting first on the dotted line starting from the turning axis p and the turning axis p in (1) of Fig. 17.

Also, according to the hoisting machine 23, the minimum distance between the inner peripheral face of the housing 6a and the turning axis p, in other words, a distance between the turning axis p and a point c of the housing 6a intersected by the dotted line in Fig. 17, is longer than a distance between an end portion d of the outer peripheral face of the brake drum 8g at the closed side of the housing 6a and the turning axis p.

According to the hoisting machine 23, the shaft pin 9a i s placed to acquire the above relation, also, a gap i s provided between the housing 6a and the brake drum 8g to satisfy the above relation.

According to the hoisting machine 23, by satisfying the above relation, the housing 6a can turn without sliding to the brake drum 8g.

[0066] Fig. 18 is a perspective view showing a layout of the machine room less elevator 101.

Fig. 19 is a plan view showing a layout of the machine

room less elevator 101.

The hoisting machine 23 of the first embodiment may be placed on the same position as the conventional machine room less elevator.

For example, the hoisting machine 23 of the first embodiment, as illustrated in Figs. 18 and 19, isplacedinbetween the elevator car 27 and the hoistway wall 1a at a lower portion of the hoistway 1 of the machine room less elevator 101. Further, the hoistway 1 shown on Figs. 18 and 19 suspends the elevator car 27 and the counterweight 32 by changing a proceeding direction of the hoisting rope 11 by a return sheave 30 and a return sheave 31 placed on top of the hoistway 1.

During the maintenance inspection of the hoisting machine 23, the elevator car 27 is moved to an upper part to separate it away from the hoisting machine 23. The maintenance inspection is performed after securing a working space around the hoisting machine 23.

[0067] The maintenance operation of the hoisting machine 23 of the first embodiment is performed according to the procedures stated below.

(1) secures a working space around the hoisting machine 23 for the maintenance operation by moving the elevator car 27 to the upper direction.

(2) applies brakes mechanically and electrically to the sheave 8 and releases the lock apparatus 13 of the housing 6a, by fastening the fixing bolt 8d.

(3) fixes the hoisting rope 11 by the auxiliary brake 10.

(4) presses the switch of the maintenance operation-power circuit, and checks a spacing between the brake shoe 7a of the brake arm 7 and the inner peripheral face of the brake drum 8g through the brake shoe spacing checking hole 6p.

(5) opens the housing 6a and performs the position adjustment of the brake arm 7 and the other maintenance operation.

(6) closes the housing 6a, releases the auxiliary brake 10, and releases the lock of the housing 6a and the mechanical and electrical brakes of the sheave 8 by fastening the fixing bolt 8d.

[0068] In the first embodiment, the elevator hoisting machine apparatus as per below is described.

The hoistingmachine 23 of the machine room less elevator 101 includes the hoisting rope 11 winding around the sheave 8 of the hoisting machine 23, the elevator car 27 and the counter weight 32 moving up and down with respect to one another within the hoistway 1 via the hoisting rope 11. Then, the hoisting machine 23 comprises a rotor side including the sheave 8 and the permanent magnet 12 and a stator side including the electromagnet 14 wounded by the coil 14a at its iron core and the brake arm 7, wherein the rotor side and the stator side are connected by the shaft pin 9a. The hoisting machine 23 is configured to allow the opening of the stator side.

Also, the hoisting machine 23 provides the lock apparatus 13 operating in response to the fastening of the fixing bolt 8d that fixes the rotation of the sheave 8, which is provided to the axis bearing supporting board 9f of the sheave 8, and the sheave fixing confirmation switch 15. The power is cut off after confirming that the sheave 8 is fixed.

Further, the hoisting machine 23 comprises the auxiliary brake 10 that fixes the sheave 8 and the hoisting rope 11 from outside, besides the fixing bolt 8d. The sheave 8 and the hoisting rope 11 are fixed by fastening the rod 10a having the screw portion 10c with the handle 10b.

Further, the hoisting machine 23 comprises the rod 6b attaching a roller 6c that moves on the cam 9g in response to the opening operation of the stator side main body of the hoisting machine 23, the link 6d, and the elongate hole 6f extending in the horizontal direction as a bearing of the lower pivot pin (the pin 6e) of the break arm 7 for guiding the lower pivot pin of the brake arm 7, and allowing automatic widening of the spacing between the sheave 8 and the brake arm 7 upon opening the stator side main body of the hoisting machine 23.

Further, the effect of widening the spacing between the sheave 8 and the brake arm 7 in case of opening the stator side main body of the hoisting machine 23 operates at a start of opening and at a closingonly. In the opened state of the housing 6a, it is configured in such a way that the position of the brake arm 7 is in a position of the braking state of applying the brake during the normal elevator operation.

Further, the hoisting machine 23 provides the switch and power used in the maintenance operation for operating the brake arm 7 by supplying electricity to the electromagnet apparatus 7c so as to have the same spacing between the sheave 8 and the brake arm 7 of the hoisting-machine 23 as the non-braking state of releasing the brake during the elevator normal operation.

Further, the rod 6b attaching the roller 6c comprises the spring 6n and the vertical elongate hole 6m serving as a link supporting pin hole. The main brake operation of the elevator will not fail since an effect force from the cam 9g is not applied to the rod 6b during the normal operation of the elevator when the housing 6a of the hoisting machine 23 is in the closed state.

Further, according to the hoisting machine 23 , an outer diameter of the sheave 8 is smaller than an inner diameter of the housing 6a.

[0069] As described in the foregoing configuration, even in the state of winding the hoisting rope 11 around the sheave 8 of the hoisting machine 23 of the elevator, inside of the hoisting machine 23 can be inspected readily, thereby reducing the time and expense involved in the maintenance inspection remarkably.

Moreover, the safe maintenance operation is possible without a need of suspending the elevator car 27 and the counter weight 32.

Second Embodiment

[0070] Fig. 20 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the second embodiment, which corresponds to Fig. 6 of the first embodiment.
The hoisting machine 23 of the second embodiment is characterized in providing an electromagnetic rod 18 and an auxiliary brake 10 that are electrically operated, in place of the manually-operated fixing bolt 8d and the auxiliary brake 10 of the first embodiment.
Other configurations and effects of the hoisting machine 23 of the second embodiment is the same as the hoisting machine 23 of the first embodiment.

[0071] Referring to Fig. 20, an electromagnet 17 proceeds and retracts a rod end portion 18a of the electromagnetic rod 18 from a fixing hole 22 provided on the sheave 8. Also, the auxiliary brake 10 is attached to an electromagnetic rod 19, and the electromagnetic rod 19 proceeds and retracts from the hoisting rope 11 by an electromagnet 20 fixed to an attachment bracket 21.

[0072] The hoisting machine 23 comprises a press button for fixing the sheave 8 (an insertion tool operation switch, and a restraining tool operation switch) (not illustrated), and when pressing the press button, the power is supplied to the electromagnet 17, and, the power supply to the electromagnet 20 is cut off.
The electromagnet 17 to which the power is supplied upon pressing of the push button, pushes out the electromagnetic rod 18 by the electromagnetic force generated by the passage of electricity through a coil 17a, and inlays the rod end unit 18a into the fixing hole 22 provided on the sheave 8. In this way, similar to the first embodiment, the brake drum 8g is fixed, the power supply to the hoisting machine 23 is cut off, and the lock apparatus 13 of the housing 6a is released.
Further, the electromagnet 20 to which the power supply is cut off upon pressing of the push button, pushes out the electromagnetic rod 19 by a spring 20b, and the hoisting rope 11 is pressed against by the auxiliary brake 10. In this way, similar to the first embodiment, the hoisting rope 11 and the sheave 8 is fixed by the auxiliary brake 10.

[0073] Further, the hoisting machine 23 cuts off the power supply to the electromagnet 17 and supplies the power to the electromagnet 20 upon repressing the push button.
The electromagnet 17 to which the power supply has been cut off upon repressing of the push button, pulls out the rod end unit 18a of the electromagnet rod 18 from the fixing hole 22 provided on the sheave 8 by using the spring 17b.
Further, the electromagnet 20 to which the power is supplied upon repressing of the push button, draws the electromagnetic rod 19 by the electromagnetic force generated by the passage of electricity through the coil 20a, and pulls the auxiliary brake 10 apart from the hoisting rope 11.

[0074] The hoisting machine 23, by providing the insertion tool operation switch, can electrically insert the electromagnetic rod 18 to the fixing hole 22 of the sheave 8.

[0075] In the second embodiment, the elevator hoisting machine apparatus as per below has been described. The hoisting machine 23 comprises the electromagnet 17 and the electromagnet rod 18 in place of the fixing bolt 8d that fixes the rotation of the sheave 8. The hoisting machine 23 further comprises the lock apparatus 13 that operates in response to the effect of fixing the sheave 8 by the operation button and the sheave fixing confirmation switch 15 that confirms the fixing of the sheave 8. The power is cut off when fixing of the sheave 8 is confirmed.
Further, the hoisting machine 23 comprises the electromagnetic rod 19 and the electromagnet 20 that operate the auxiliary brake 10 for fixing the sheave 8 and the hoisting rope 11 from outside. The sheave 8 and the hoisting rope 11 are fixed by the operation button.

BRIER DESCRIPTION OF THE DRAWINGS

[0076]

Fig. 1 is a perspective view illustrating a closed state of the hoisting machine 23 according to a first embodiment.
Fig. 2 is a perspective view illustrating an opened state of the hoisting machine 23 according to the first embodiment.
Fig. 3 is a vertical cross sectional view of the hoisting machine 23 according to the first embodiment.
Fig. 4 is a horizontal cross sectional view of the hoisting machine 23 according to the first embodiment.
Fig. 5 is a plan view of the hoisting machine 23 according to the first embodiment.
Fig. 6 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment.
Fig. 7 is an enlarged view of an engaging rod 8a and a fixing bolt 8d that the hoisting machine 23 according to the first embodiment provides.
Fig. 8 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment.
Fig. 9 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment.
Fig. 10 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment.
Fig. 11 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment.
Fig. 12 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment.

Fig. 13 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to the first embodiment.
Fig. 14 is an enlarged view of a brake arm 7, a link 6d, and a rod 6b that the hoisting machine 23 according to the first embodiment provides.
Fig. 15 is a drawing illustrating an inner portion of a housing 6a of the hoisting machine 23 according to the first embodiment.
Fig. 16 is a drawing illustrating an inner portion of the housing 6a of the hoisting machine 23 according to the first embodiment.
Fig. 17 is a horizontal cross sectional view of the housing 6a and the stator of the hoisting machine 23 according to the first embodiment.
Fig. 18 is a perspective view illustrating a layout of the machine room less elevator 101.
Fig. 19 is a plan view illustrating a layout of the machine room less elevator 101.
Fig. 20 is a partially enlarged view of the vertical cross section of the hoisting machine 23 according to a second embodiment.

REFERENCE SIGNS LIST

[0077] 1 Hoistway; 1a hoistway will; 2 car guide rail; 2a rail clip; 2b bolt; 3 hoisting machine attachment upper frame; 3a attachment block; 3b attachment block; 4 hoisting machine attachment lower frame; 5 hoisting machine attachment vertical frame; 6 housing frame; 6a housing; 6b rod; 6c roller; 6d link; 6e pin; 6 f elongate hole; 6h pin; 6k fixing shaft; 6n spring; 6m elongate hole; 6p brake shoe spacing checking hole; 6r cap; 7 brake arm; 7a brake shoe; 7b pin; 7c electromagnetic apparatus; 7d brake operating spring; 7e coupling rod; 7f coil; 8 sheave; 8a engaging rod; 8b taper hole; 8c spring ; 8d fixing bolt; 8e engaging portion; 8f encoder; 8g brake drum; 8h shaft bearing; 8k screw hole; 8n tapered portion; 8r bolt hole; 9 hoisting machine base; 9a shaft pin; 9b, 9c bolts; 9d lock apparatus escape window ; 9e shaft bearing; 9f shaft bearing supporting board; 9g cam; 9h shaft; 9k hoisting machine base fixing board ; 10 auxiliary brake; 10a rod; 10b handle; 10c screw portion; 10d rotation neck; 10e clamping portion; 11 hoisting rope; 12 permanent magnet; 13 lock apparatus ; 13a screw; 13b engaging portion; 14 electromagnet; 14a coil; 15 sheave fixing confirmation switch; 15a detecting portion; 15c detection rod; 15d spring bearing; 15e return spring; 16 bolt tool; 17 electromagnet; 17a coil; 17b spring; 18 electromagnetic rod; 18a rod end portion; 19 electromagnetic rod; 20 electromagnet; 20a coil; 20b spring; 21 attachment bracket; 22 fixing hole; 23 hoisting machine; 24 rail stand; 25 counter weight rail; 26 rail stand; 27 elevator car; 28 car floor; 29 car suspension sheave; 30 return sheave; 31 return sheave; 32 counter weight; 33 suspension sheave; 34 sheave stopping block; 35 sheave stopping beam; 101 machine room less elevator

Claims

1. An elevator hoisting machine comprising a rotor housing attaching a rotor and a stator housing attaching a stator;
wherein the stator housing is arranged to face the rotor housing, couples an end portion of the stator housing to an end portion of the rotor housing with a shaft pin, and turns about the shaft pin.

2. The elevator hoisting machine according to claim 1, wherein the stator includes a rotating shaft that rotates, a brake drum that rotates in response to the rotating shaft, and a sheave that winds a suspension rope for suspending an elevator car and that rotates in response to the brake drum;
wherein the stator includes a brake arm, which is arranged at an inner peripheral side of the brake drum when the stator housing is arranged to face the rotor housing, which proceeds to and retracts from the brake drum, and which presses an inner peripheral face of the brake drum for braking the break drum when proceeding to the brake drum.

3. The elevator hoisting machine according to claim 2, wherein the rotor housing and the stator housing are arranged to face one another and to orthogonally cross with the rotating shaft; and
wherein the stator housing turns and opens by intersecting with respect to the rotating shaft.

4. The elevator hosing machine according to claim 3, wherein the stator housing encloses the brake drum when the stator housing is arranged to face the rotor housing, and exposes the brake drum at turning.

5. The elevator hoisting machine according to claim 3, wherein the stator housing has a stator cylindrical part that forms a cylindrical shape in which one end is opened and the other end is closed and that encloses the brake drum from the opened end, and an inner peripheral face of the stator cylindrical part faces an outer peripheral face of the brake drum when the brake drum is enclosed.

6. The elevator hoisting machine according to claim 5 having a plane face that orthogonally crosses a turning axis of the stator housing and that includes the rotating shaft of the brake drum, wherein, at a front side of the rotating shaft of the turning axis, a distance between an end portion of the opened side of the inner peripheral face of the stator cylindrical part and the turning axis is shorter than a minimum distance between the outer periphery face of the brake drum and the turning axis, and wherein, at a depth side of the rotating shaft of the turning axis, a minimum distance between the inner peripheral face of the stator cylindrical part and the turning axis is long-

er than a distance between an end portion of the outer peripheral face of the brake drum of a side closed by the stator cylindrical part and the turning axis.

7. The elevator hoisting machine according to any one of claims 1 to 6, wherein the stator housing further comprises a stator engaging piece that engages with a mating part, wherein the rotor housing, as the mating part, comprises a rotor engaging piece capable of proceeding to and retracting from the stator engaging piece, and wherein the rotor engaging piece suppresses a turning of the stator housing by engaging to the stator engaging piece, when proceeding to the stator engagingpiece, and releases the suppression of the turning of the stator housing by dislocating from the stator engaging piece, when retracting from the stator engaging piece.

8. The elevator hoisting machine according to claim 7, wherein the rotor engaging piece includes an insertion hole portion where a taper attached insertion tool is inserted in and pulled out, by moving along an inclination of the taper of the insertion tool inserted in and pulled out from the insertion hole portion, retracts from the stator engaging piece when the insertion tool is inserted to the insertion hole portion, and proceeds to the stator engaging piece side when the insertion tool is pulled out from the insertion hole portion.

9. The elevator hoisting machine according to claim 8, wherein the sheave includes a fixing hole portion to which one end of the insertion tool inserted to the insertion hole portion of the rotor engaging piece is inserted, and is fixed to preclude rotation by inserting the end of the insertion tool to the fixing hole portion.

10. The elevator hoisting machine according to any one of claims 7 to 9 , further comprising a sheave power cut off switch that is attached to the rotor housing in a retracting destination of the rotor engaging piece, and that cuts off power to a rotation apparatus that rotates the sheave when entering the switch; and
wherein the rotor engaging piece enters the sheave power cut off switch when retracting from the stator engaging piece.

11. The elevator hoisting machine according to any one of claim 8 or 9, further comprising an insertion tool operation switch that inserts the insertion tool to the insertion hole portion of the rotor engaging piece when the switch is entered.

12. The elevator hoisting machine according to any one of claims 2 to 11, further comprising a rope restraining tool that includes a screw cut rod having a columnar shape which is screw cut in a circumferential direction, a rope restraining unit that faces the suspension rope and that couples to one end of the screw cut rod, and a handle that rotates the screw cut rod in the circumferential direction of the screw cut rod and that moves the screw cut rod forward and backward in a lengthwise direction of the screw cut rod by a screwing effect of the screw cut rod;
wherein the rope restraining tool includes the screw cut rod rotated by the handle proceeds to the rope restraining unit side, and the screw cut rod that proceeded to the rope restraining side restrains the suspension rope by pressing the rope restraining unit against the suspension rope.

13. The elevator hoisting machine according to any one of claims 2 to 11, further comprising a rope restraining tool that faces the suspension rope, and a restraining tool operation switch that restrains the suspension rope by pressing the rope restraining tool against the suspension rope when the switch is entered.

14. The elevator hoisting machine according to any one of claims 2 to 13, wherein the stator housing further comprises a brake arm link piece that couples to the brake arm; a brake arm guidance rod that couples to the brake arm link piece; and a brake arm guidance cam having a projecting portion;
wherein, before turning of the stator housing, the brake arm link piece is elongated in a retracting direction of the brake arm, and the brake arm guidance rod is arranged to adjoin to the brake arm guidance cam at an end portion of the brake arm guidance rod; and
wherein, during turning of the stator housing, the brake arm guidance rod at the end portion rides over the projecting portion by moving over the brake arm guidance cam, accompanied by the turning of the stator housing; the brake arm link piece is pushed out at a coupling part with the brake arm guidance rod, by the brake arm guidance rod riding over the projecting portion at the end portion, and the brake arm retracts by pulling a coupling part with the brake arm link piece by the brake arm link piece pushed out at the coupling part with the brake arm guidance rod.

15. The elevator hoisting machine according to claim 14, wherein the brake arm guidance rod includes a guidance elastic body that is stretchable, wherein, after turning of the stator housing, the brake arm guidance rod separates from the brake arm guidance cam, and is pushed back by the guidance elastic body in a reverse direction from a turning time of the stator housing, the brake arm link piece is pulled back at the coupling part with the brake arm guidance rod by the brake arm guidance rod, and the brake arm is pushed back by the brake arm link piece in a pro-

ceeding direction.

16. The elevator hoisting machine according to any one of claim 14 or 15, wherein the brake arm guidance rod has an elongate hole which extends in an elongated direction of the brake arm guidance rod, and which is serving as a bearing of a pin for coupling the brake arm link piece.

17. The elevator hoisting machine according to any one of claims 14 to 16, wherein the stator housing has an elongate hole which extends in a proceeding and retracting direction of the brake arm, and which is serving as a bearing of a pin for coupling the brake arm and the brake arm link piece.

18. The elevator hoisting machine according to any one of claims 2 to 17, further comprising a brake arm operating switch that retracts the brake arm to a position of non-braking time when the switch is entered.

19. The elevator hoisting machine according to any one of claims 2 to 18, wherein the stator housing has an inspection hole that is opened on a facing portion of the brake arm and the brake drum.

20. The elevator hoisting machine according to claim 2, further comprising a sheave fixing mechanism that fixes the sheave during stopping the rotation; and a housing lock mechanism that suppresses turning of the stator housing when the stator housing is closed, and releases suppression of the turning of the stator housing in response to fixing of the sheave by the sheave fixing mechanism.

21. The elevator hoisting machine according to claim 20, further comprising a sheave power cut off mechanism that cuts off power to a rotation apparatus for rotating the sheave, in response to the fixing of the sheave by the sheave fixing mechanism.

22. The elevator hoisting machine according to claim 2, further comprising a rope restraining mechanism that restrains a movement of the suspension rope.

23. The elevator hoisting machine according to claim 2, further comprising an arm operation mechanism that retracts the brake arm when the stator housing is turning.

24. The elevator hoisting machine according to claim 23, wherein the arm operation mechanism pushes out the brake arm in a proceeding direction before turning of the stator housing, draws the brake arm in a retracting direction during turning of the stator housing, and pushes back the brake arm in the proceeding direction after turning of the stator housing.

FIG. 1

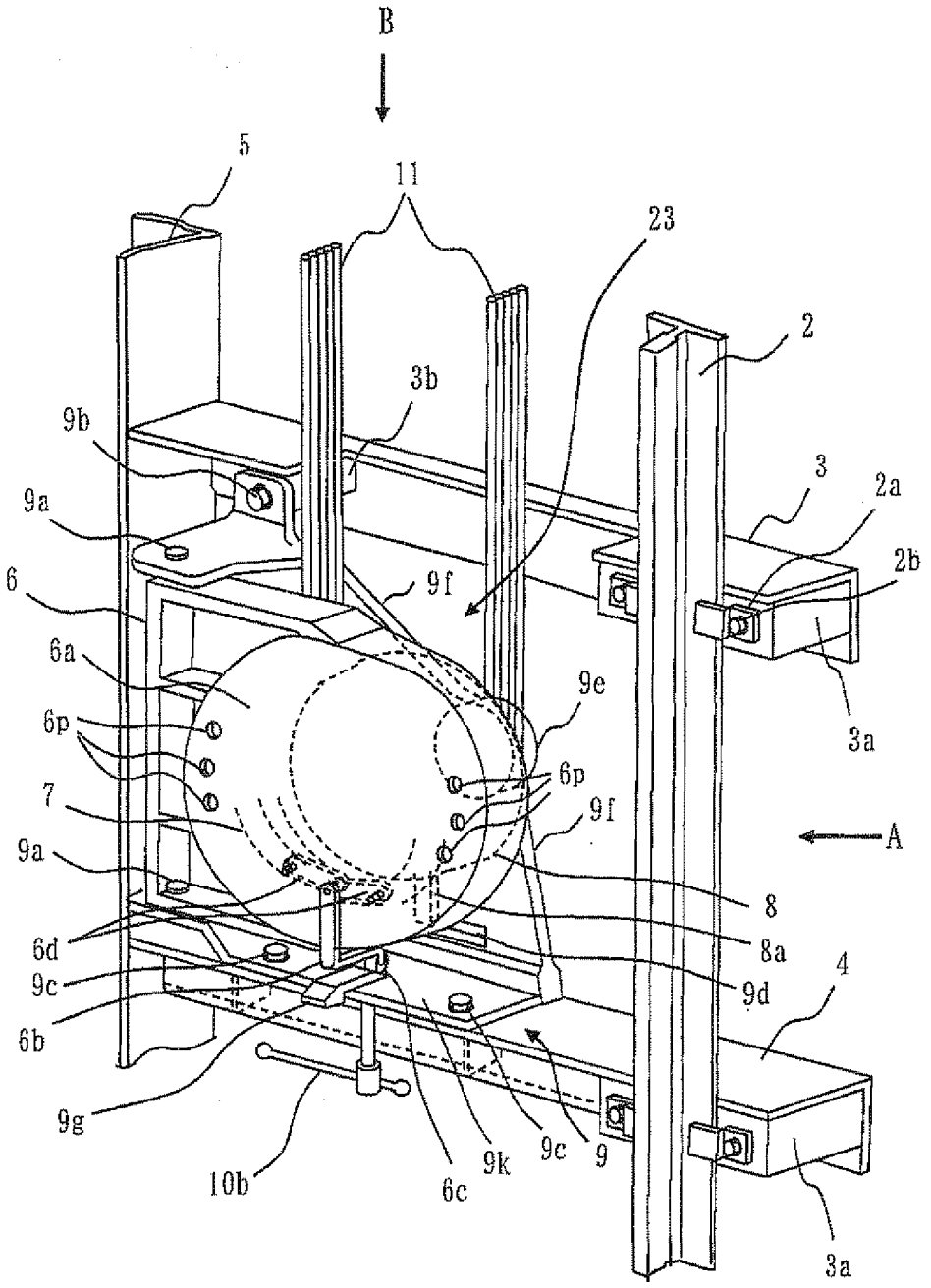
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FIG. 2

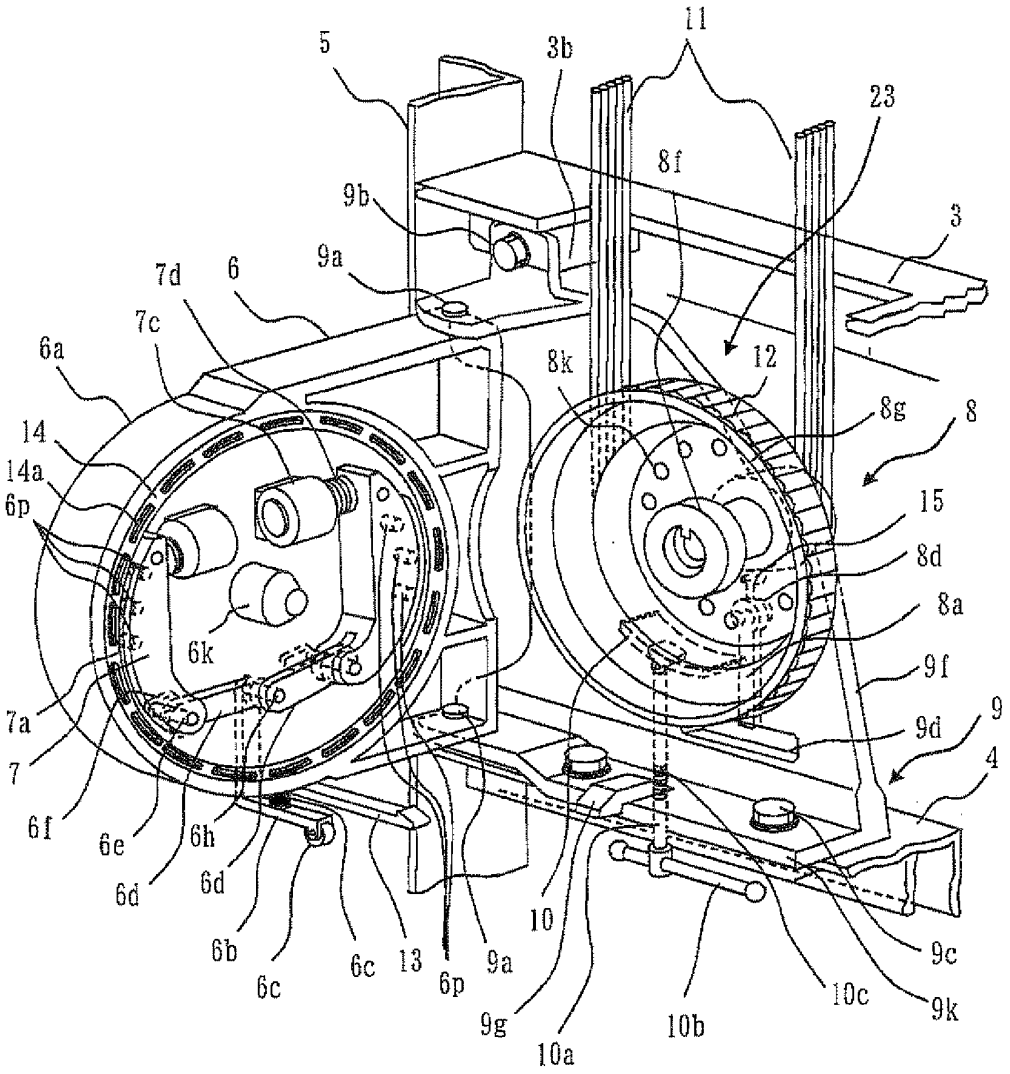
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FIG. 3

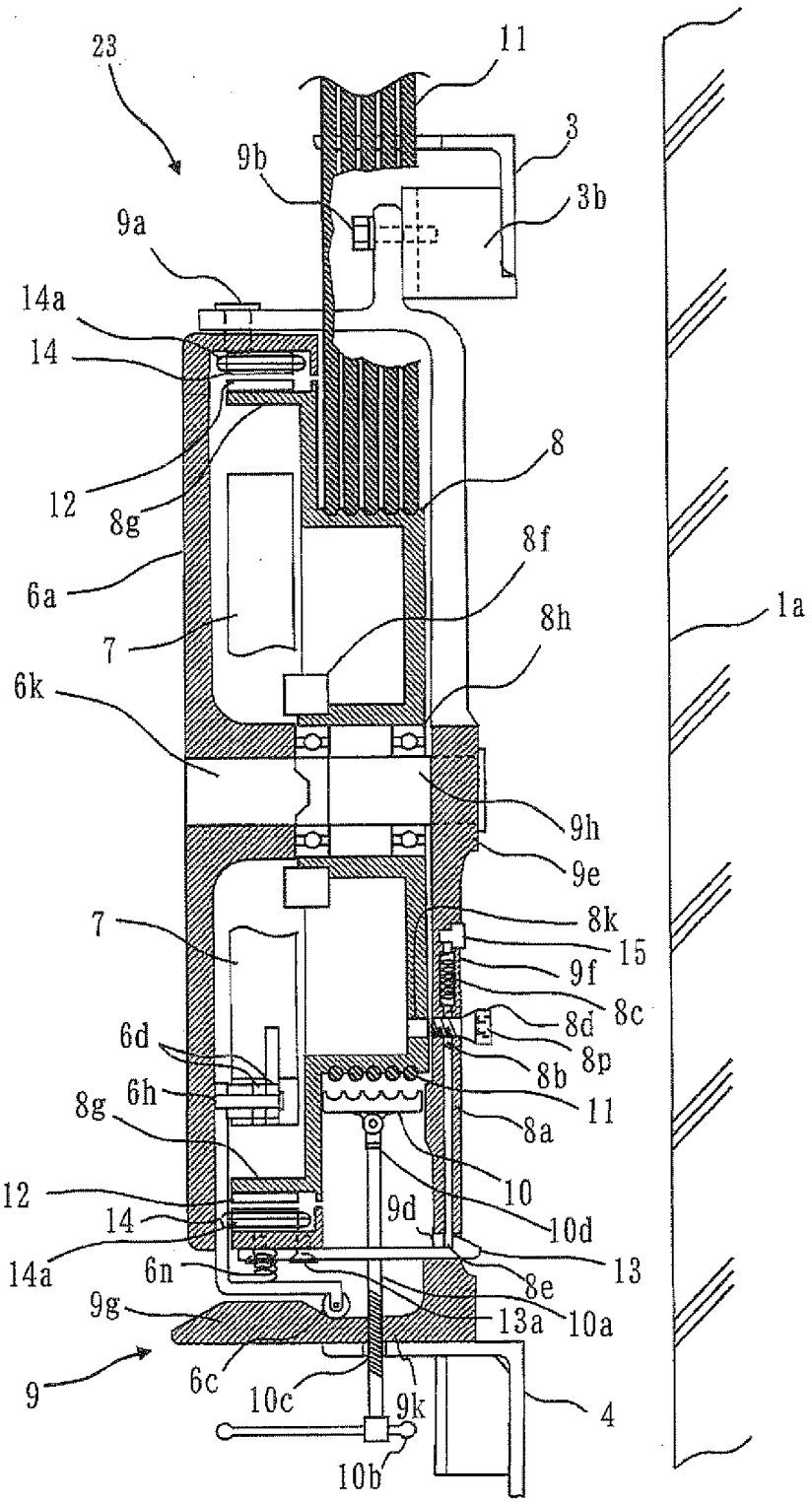
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FIG. 4

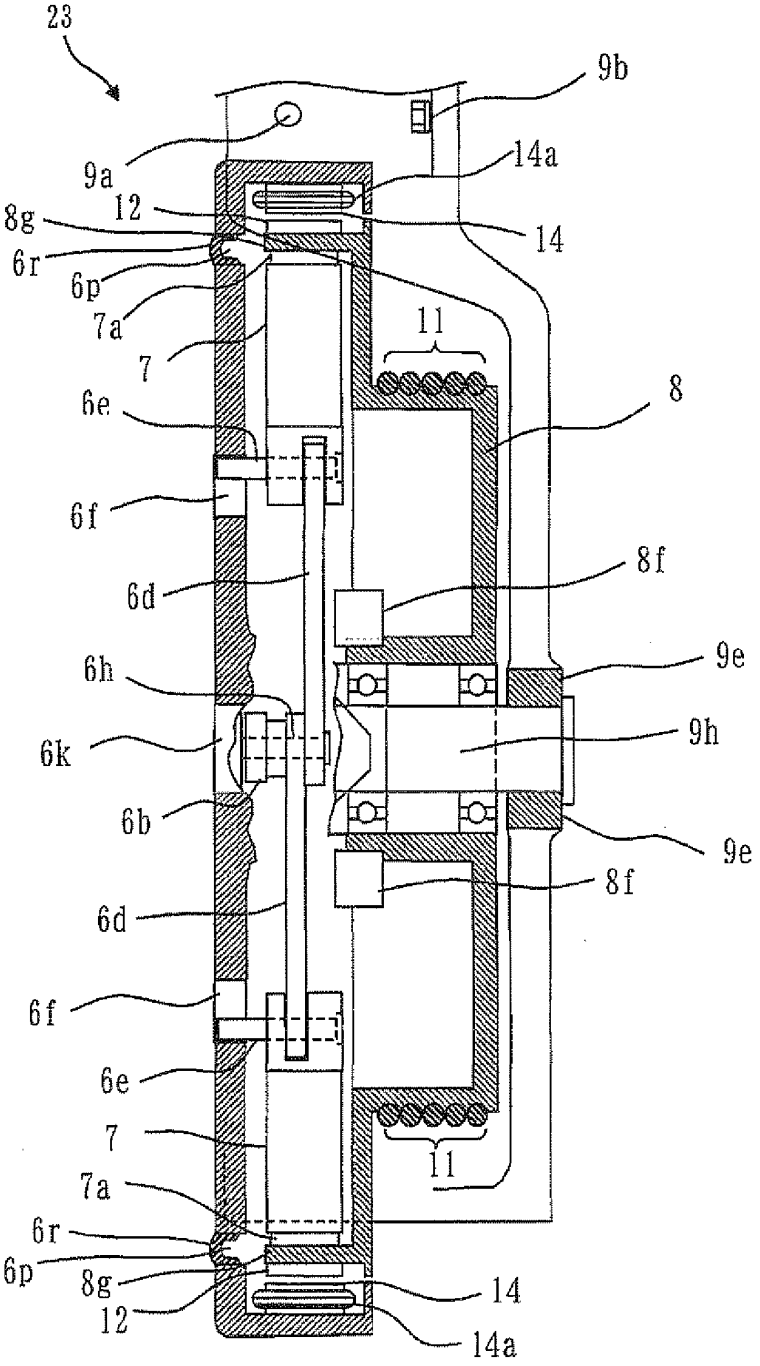
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FIG. 5

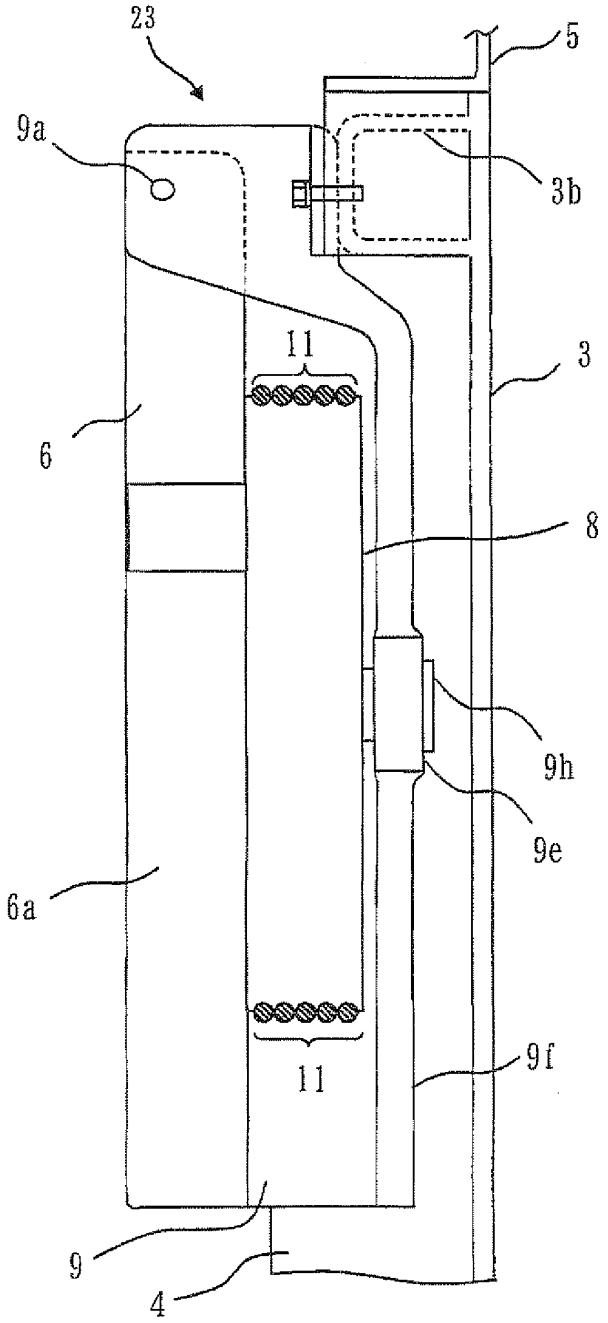

FIG. 6

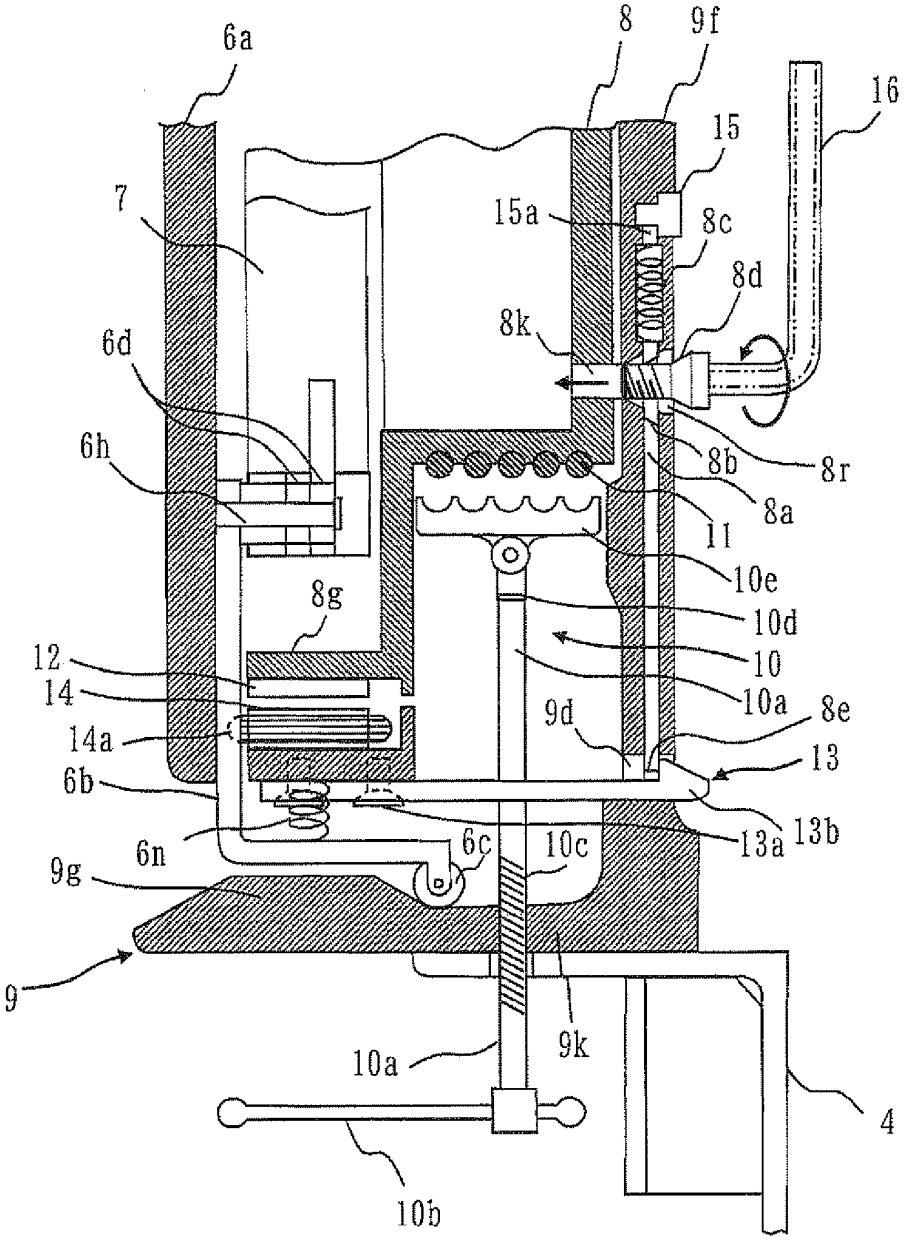
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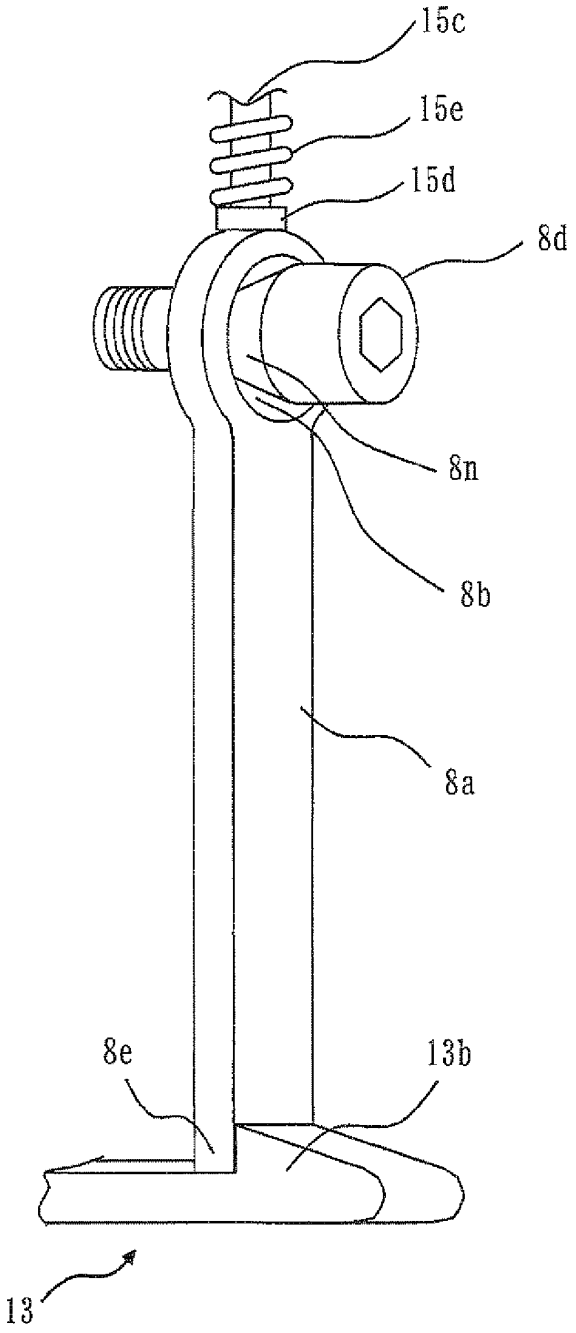
FIG. 7



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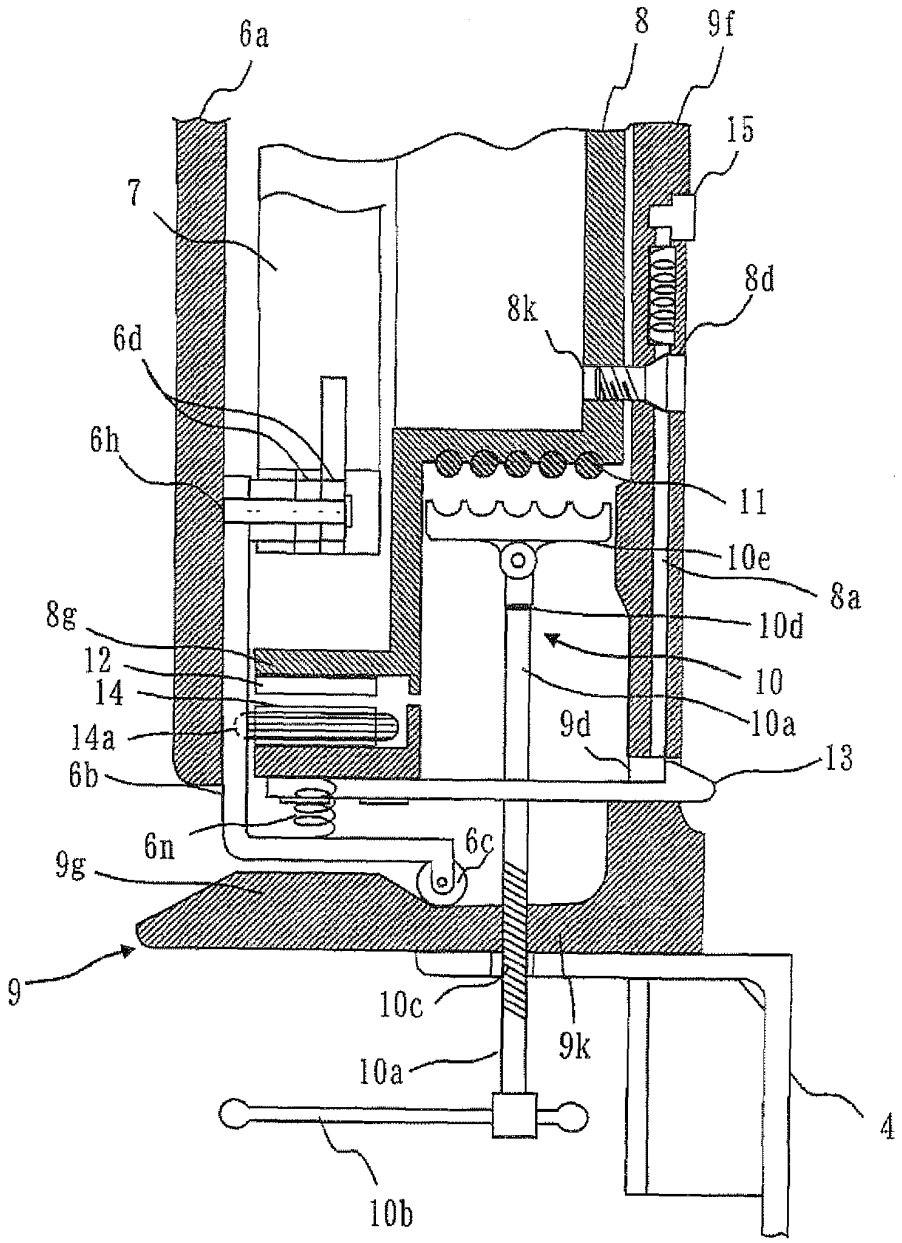
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FIG. 9

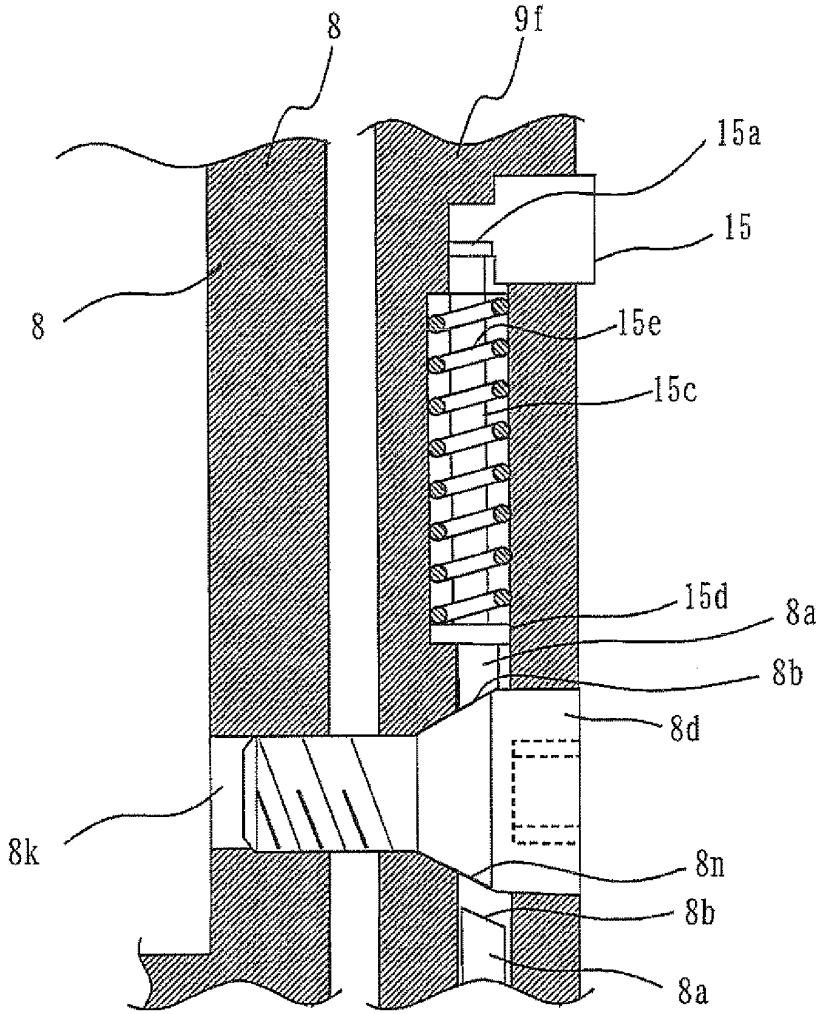

FIG. 10

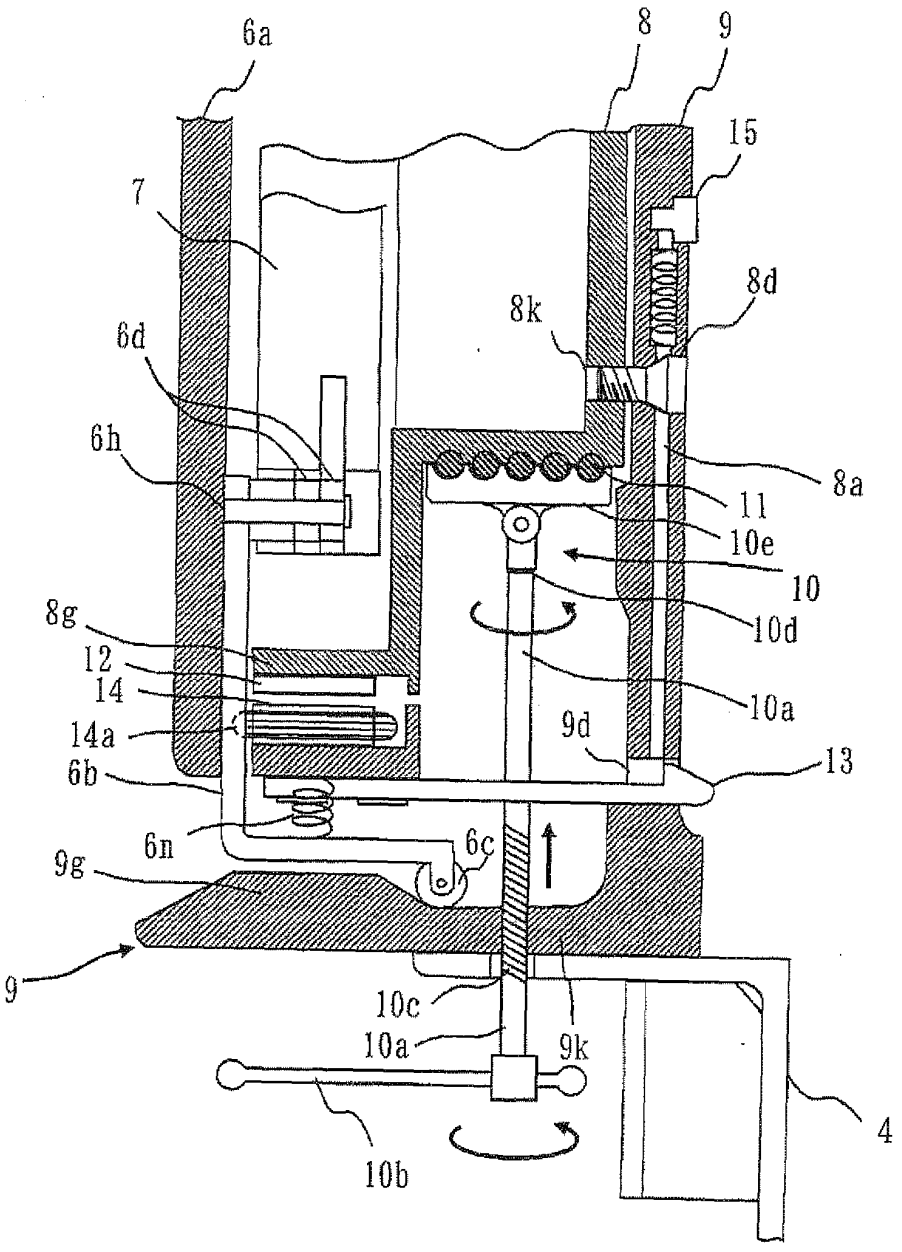
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FIG. 11

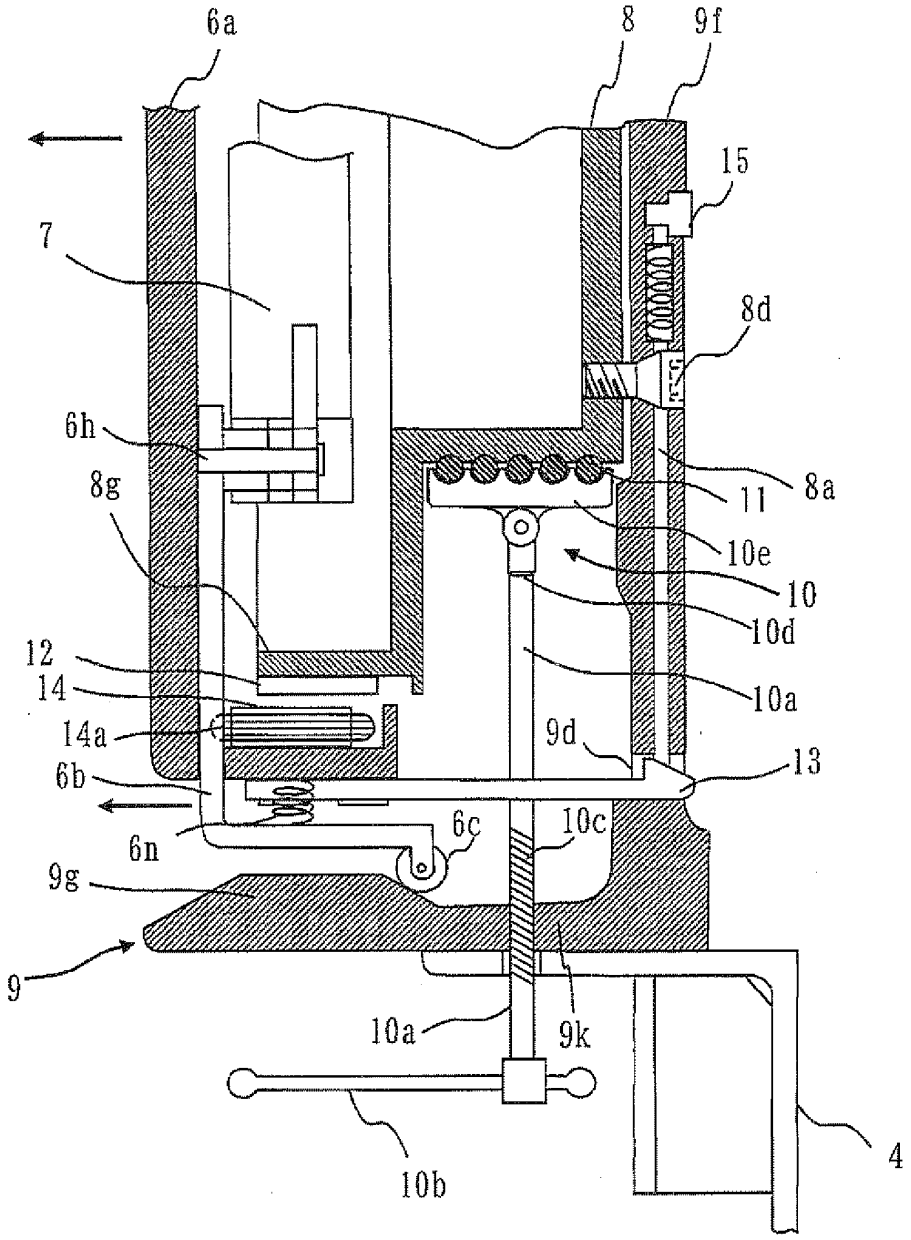
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FIG. 12

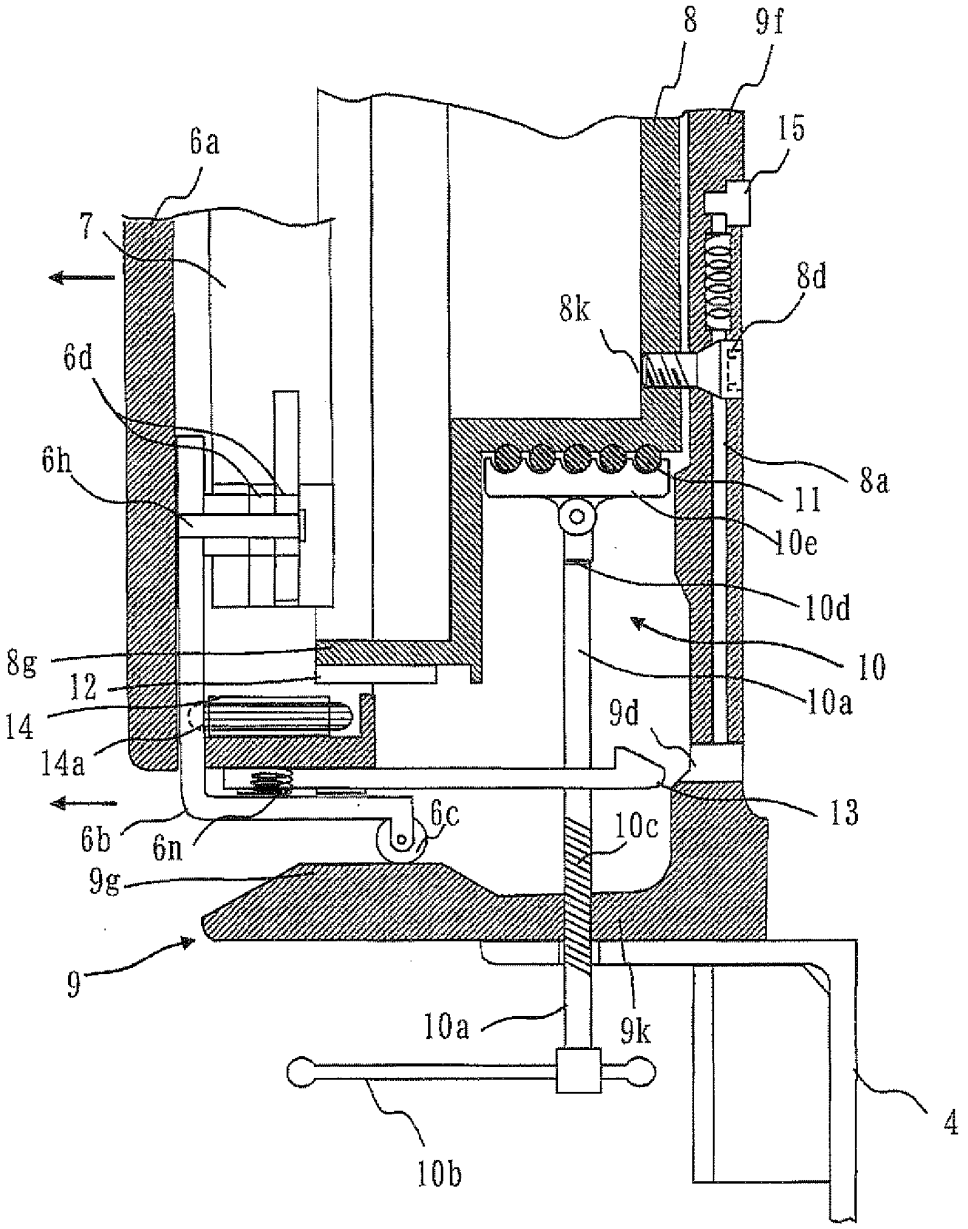
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FIG. 13

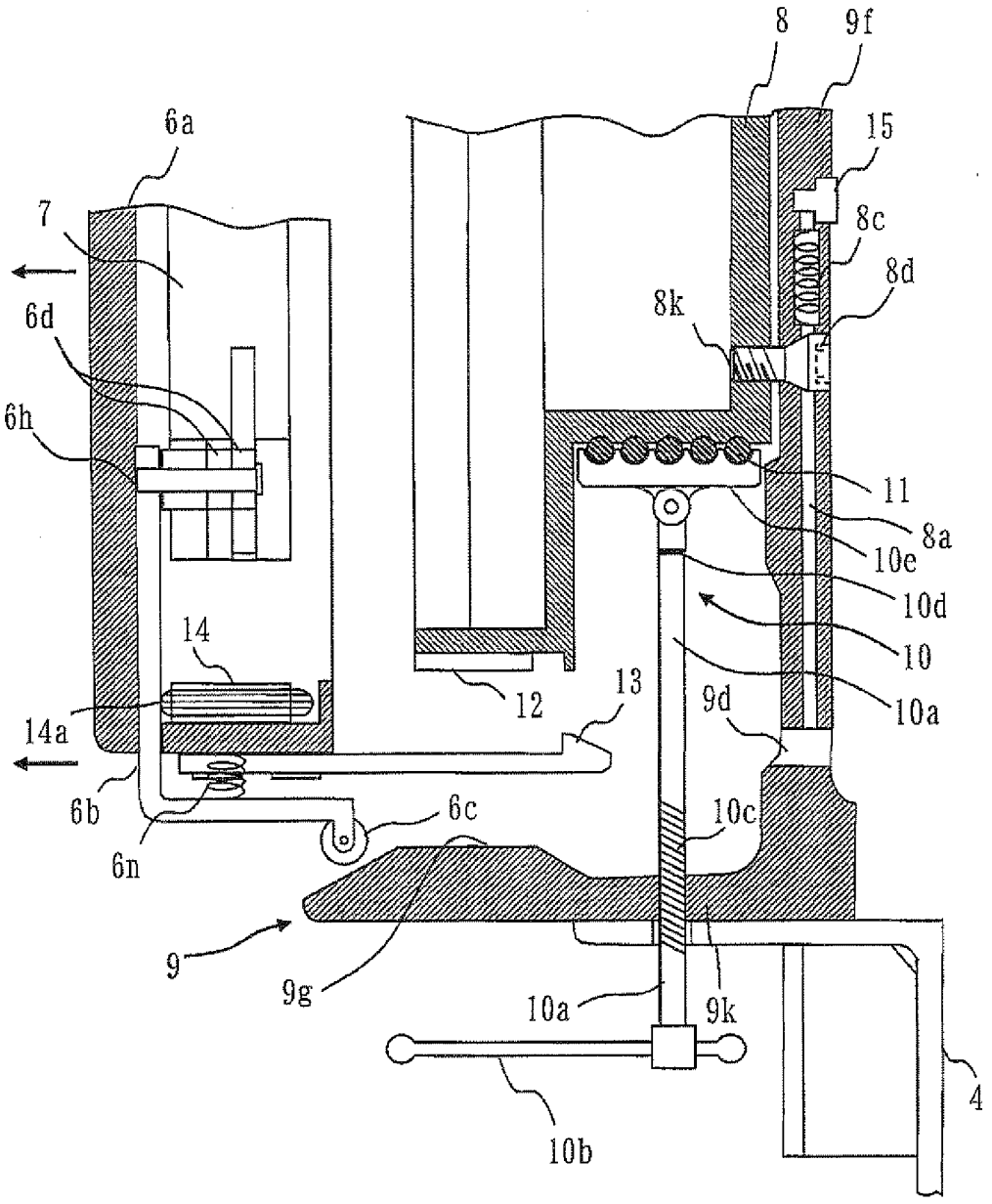
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FIG. 14

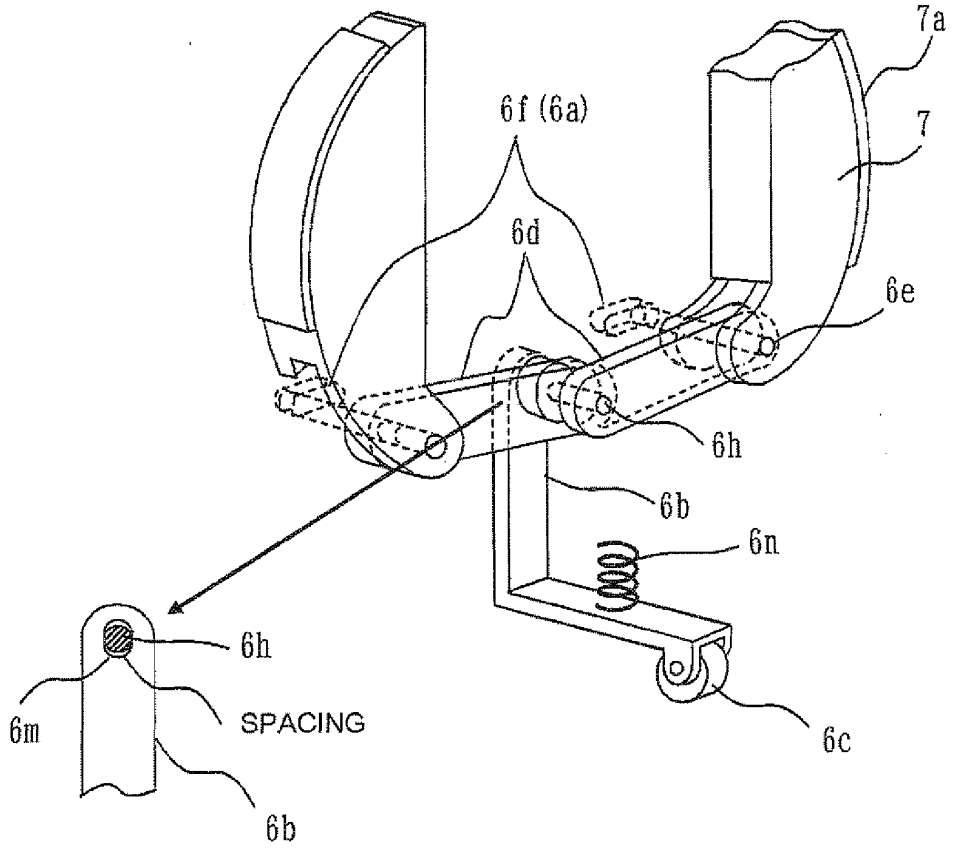

FIG. 15

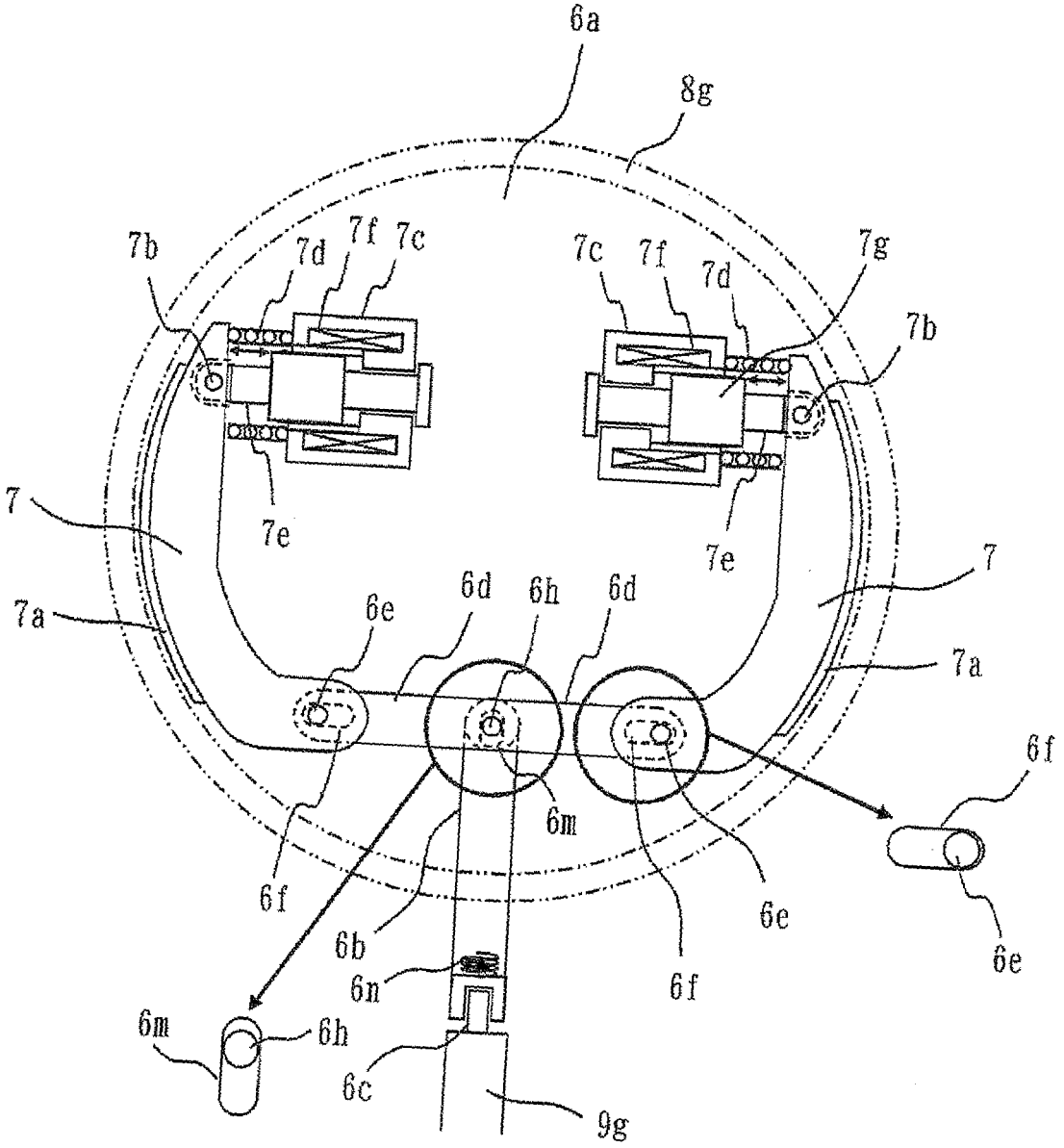
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FIG. 16

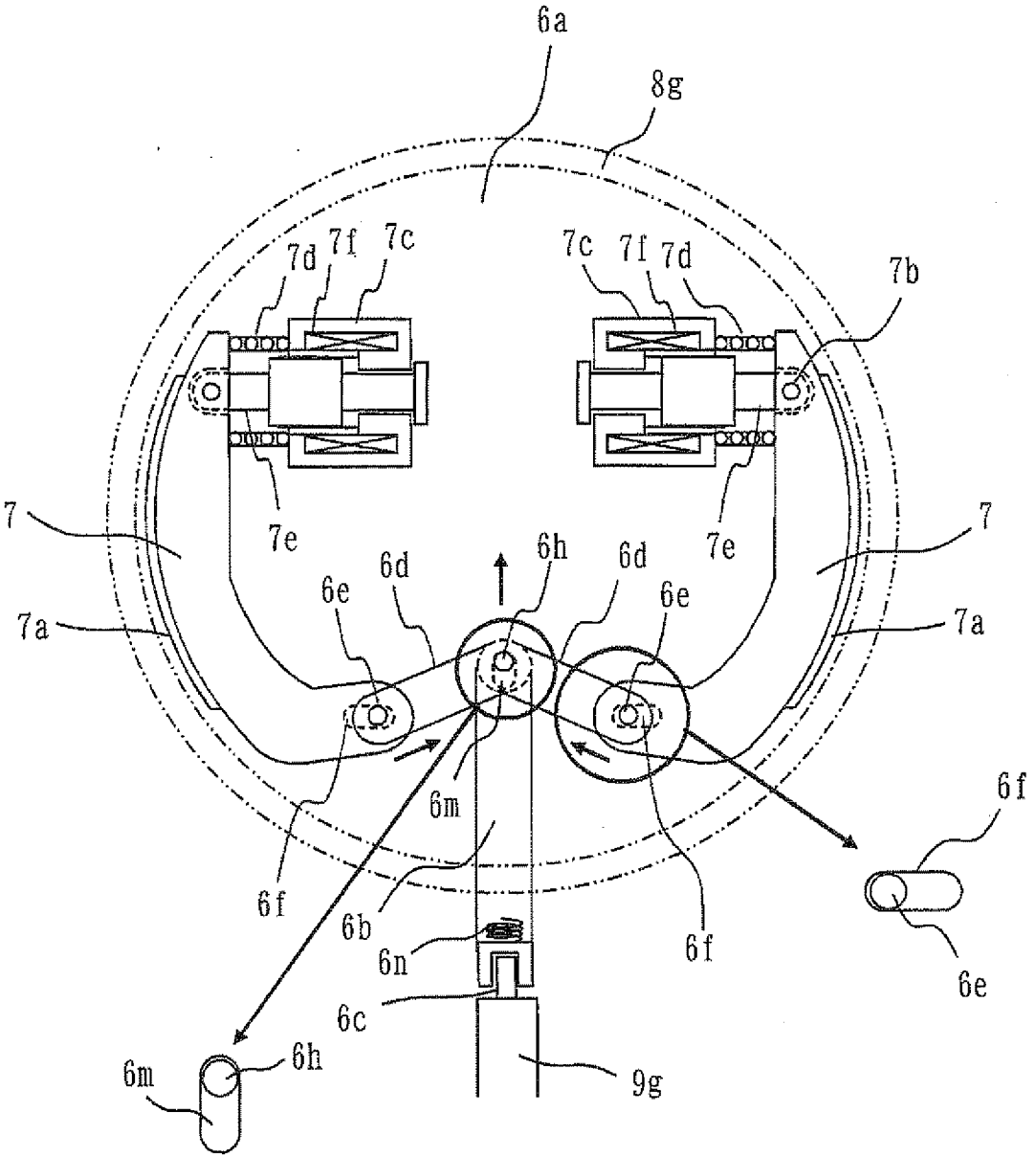
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FIG. 17

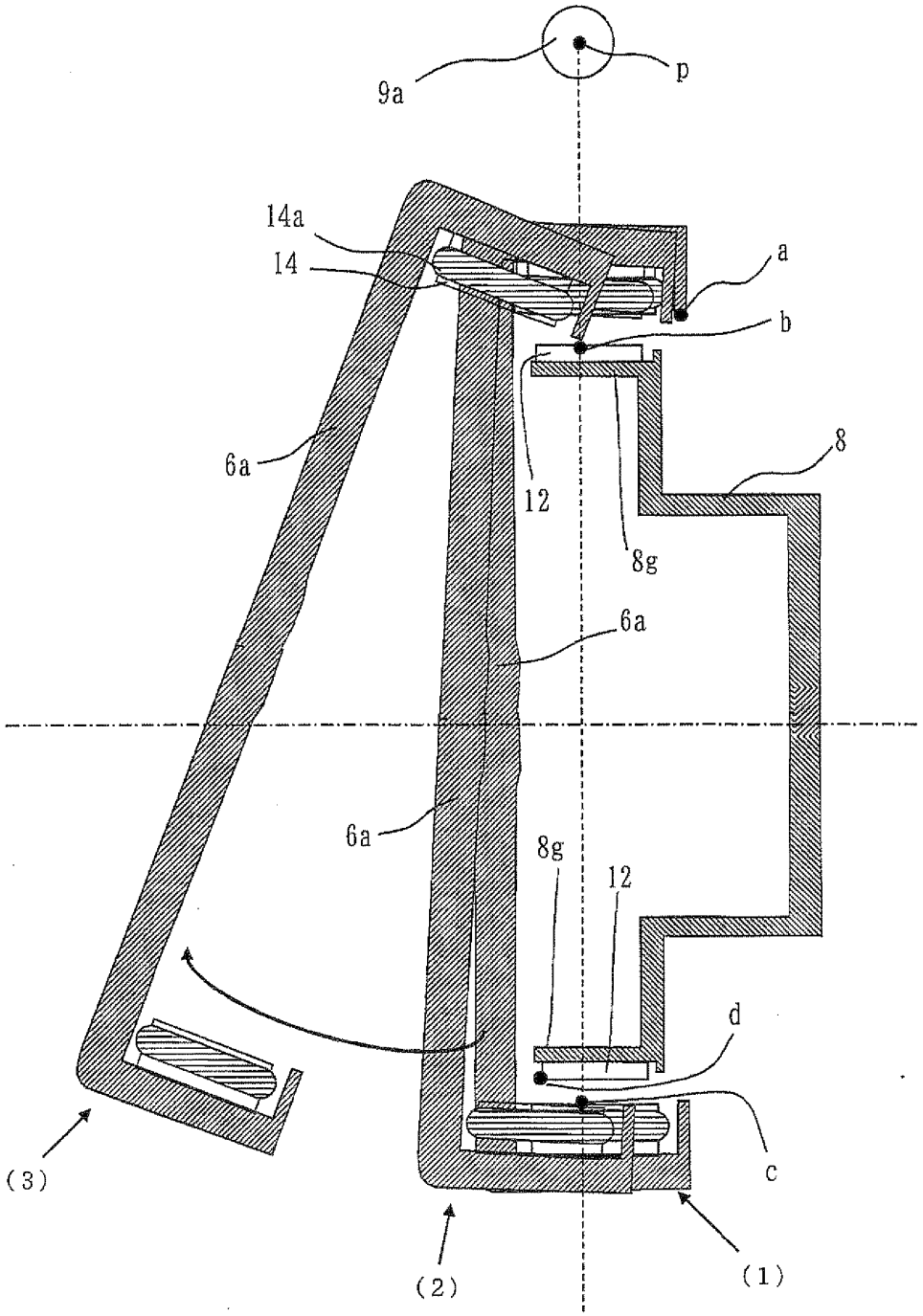


FIG. 18

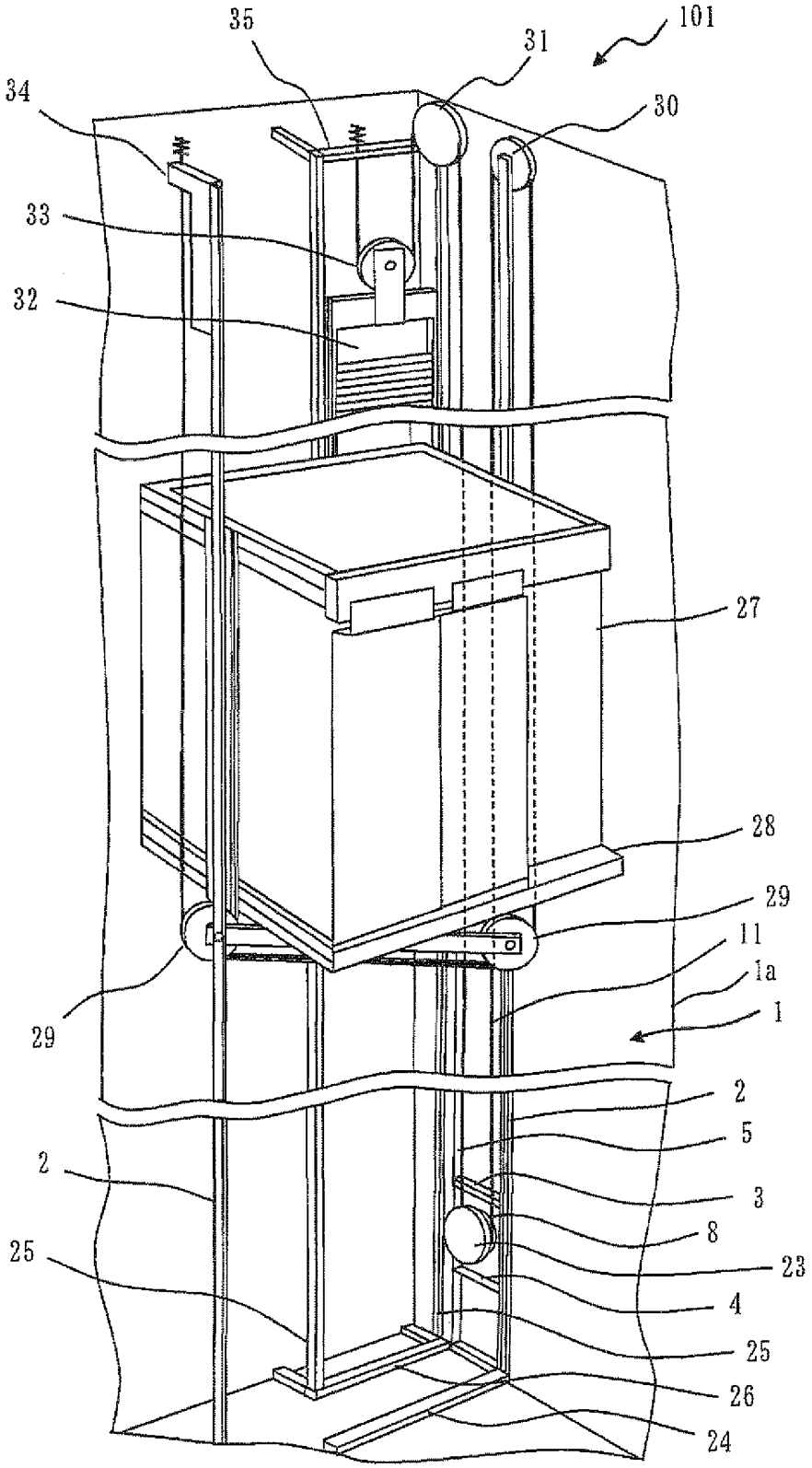


FIG. 19

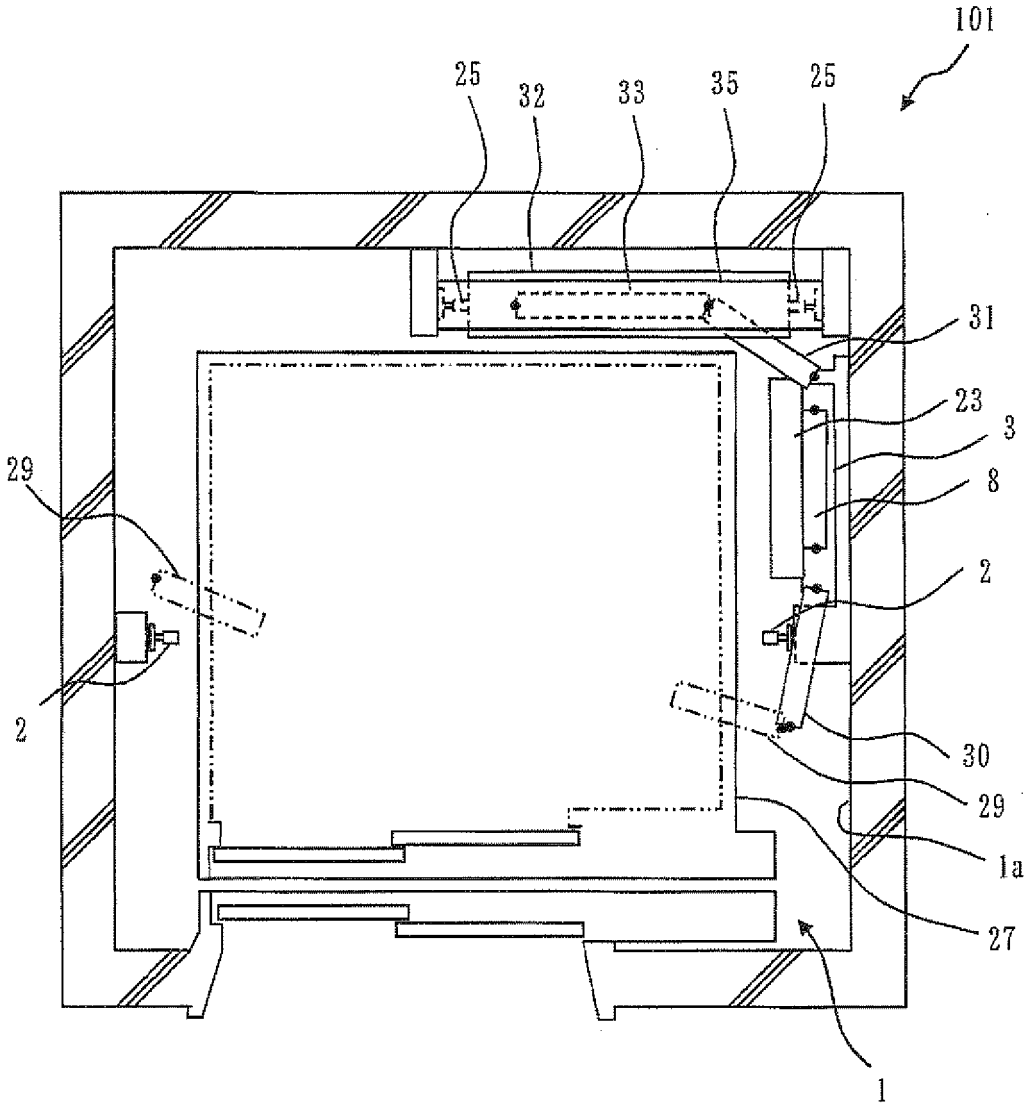
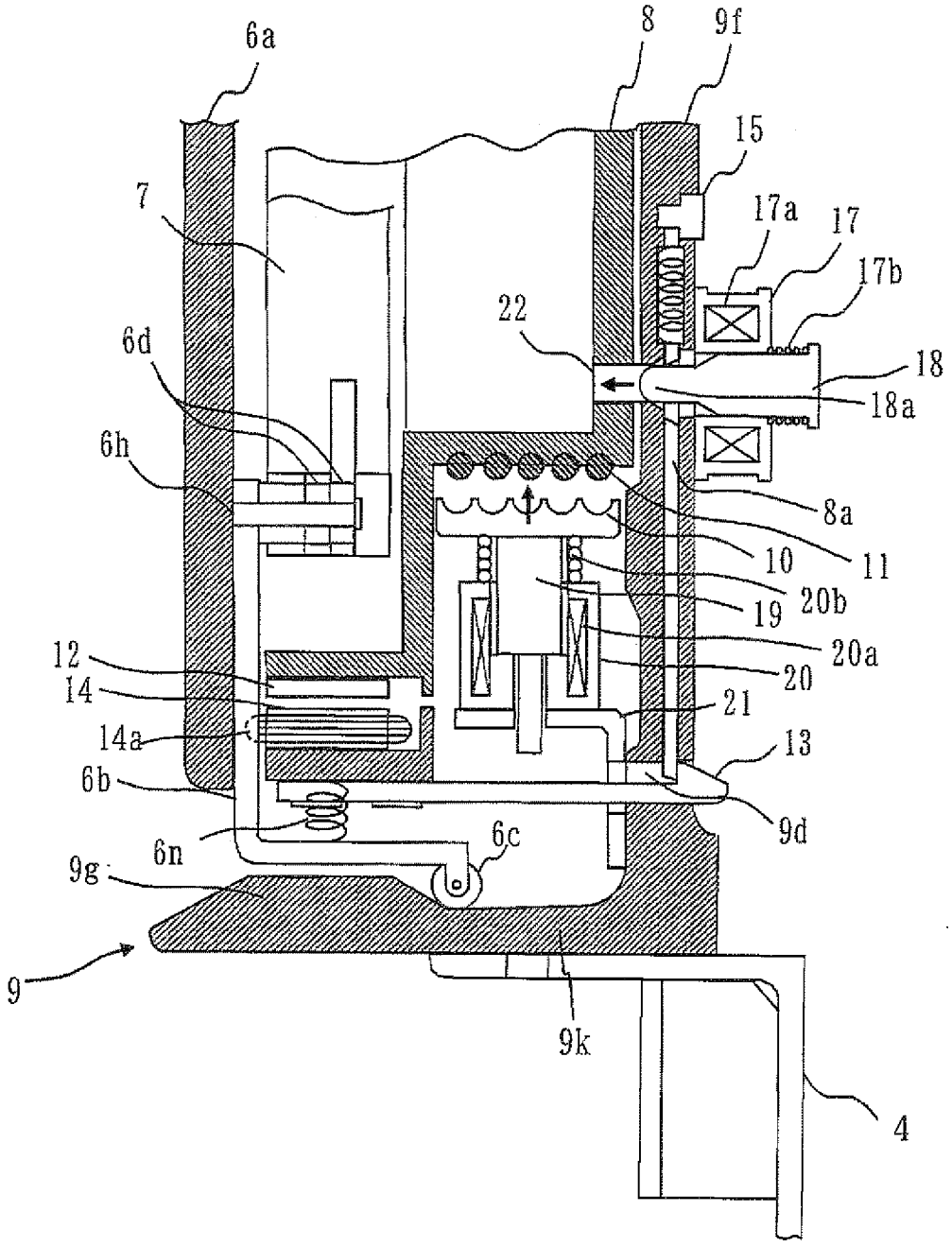


FIG. 20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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2007/068817

A. CLASSIFICATION OF SUBJECT MATTER
B66B11/08(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)
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 1996-2008
Kokai Jitsuyo Shinan Koho 1971-2008 Toroku Jitsuyo Shinan Koho 1994-2008

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 2000-289954 A (Mitsubishi Electric Corp.), 17 October, 2000 (17.10.00), Claim 9; Par. Nos. [0033] to [0036]; Figs. 7 to 8 & EP 1043261 A2 & EP 1394096 A1 & DE 60007579 D & DE 60007579 T & DE 60031177 D & DE 60031177 T & CN 1269323 A	1-7,10, 12-13,18-19, 22-23 8-9,11, 14-17,20-21, 24
Y	JP 2006-143469 A (Mitsubishi Electric Corp.), 08 June, 2006 (08.06.06), Par. Nos. [0016] to [0018]; Fig. 1 & DE 102005047404 A & KR 10-2006-0052146 A & CN 1762784 A	1-7,10, 12-13,18-19, 22-23

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Date of the actual completion of the international search	Date of mailing of the international search report
26 May, 2008 (26.05.08)	03 June, 2008 (03.06.08)
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/JP2007/068817

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2003-252554 A (Fujitec Co., Ltd.), 10 September, 2003 (10.09.03), Claim 8; Par. No. [0013] (Family: none)	10
Y	WO 2002/053485 A1 (Mitsubishi Electric Corp.), 11 July, 2002 (11.07.02), Description, page 5, lines 25 to 28 & EP 1352869 A1	12-13,22
Y	JP 48-44320 Y1 (Sansei Yusoki Co., Ltd.), 20 December, 1973 (20.12.73), Full text; Figs. 1 to 3 (Family: none)	12-13,22
A	WO 2006/027841 A1 (Mitsubishi Electric Corp.), 16 March, 2006 (16.03.06), Full text; Figs. 1 to 9 & EP 1792865 A1	1-24

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Patent documents cited in the description

- WO 2004080875 A1 **[0004]**
- JP 2005200221 A **[0004]**