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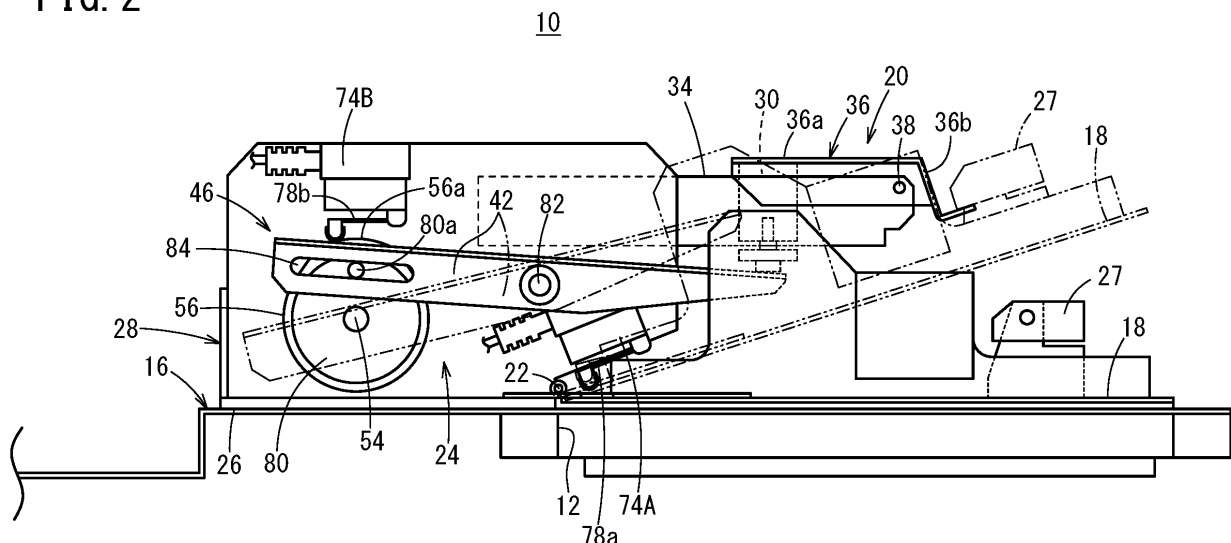
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(54) **DAMPER OPENING/CLOSING DEVICE**

(57) A damper opening/closing device (10) comprises an opening/closing lid (18), a retention mechanism (20), and a return mechanism (24). The retention mechanism (20) retains the opening/closing lid (18) to place an opening (12) in an open state while power is being supplied, and releases the retention of the opening/clos-

ing lid (18) to place the opening (12) in a closed state when the power supply stops. The return mechanism (24) returns the opening/closing lid (18) to a state of retention by the retention mechanism (20) when the opening/closing lid (18) is in a closed state while power is being supplied.

FIG. 2



Description

Technical Field

[0001] The present invention relates to a damper opening/closing device, for example, a damper opening/closing device suitable for opening and closing an air supply port, an exhaust port, or the like, installed in a container or the like.

Background Art

[0002] As a device that serves to control opening and closing of a damper, for example, there is the damper opening/closing device disclosed in JP 2006-187524 A.

[0003] Such a damper opening/closing device is equipped with an opening/closing circuit unit in which there are formed a charging circuit for accumulating an electric charge in an electrical power storage means, and a discharging circuit for discharging the electric charge accumulated in the electrical power storage means, and a relay that switches to either one of the charging circuit or the discharging circuit, in accordance with a connected state of the opening/closing circuit unit and an external power source.

[0004] When the opening/closing circuit unit and the external power source are in an electrically connected energized state, the relay switches to the charging circuit, and an electric charge is accumulated in the electrical power storage means. Further, when the opening/closing circuit unit and the external power source are electrically disconnected, the relay discharges the electric charge that was accumulated in the electrical power storage means by the discharging circuit, and supplies the electric charge to a solenoid to drive a plunger of the solenoid, and by a damper opening/closing mechanism being operatively coupled to the plunger, the damper is changed from an open state into a closed state.

Summary of Invention

[0005] However, in the damper opening/closing device disclosed in JP 2006-187524 A, it is necessary for the electric charge to be accumulated in the electrical power storage means during a period in which electrical power is being supplied from the external power source. Therefore, the charging circuit for accumulating the electric charge, the electrical power storage means for accumulating the electric charge, and the discharging circuit for discharging the electric charge from the electrical power storage means at the time of a power failure are required.

[0006] Further, in the above-described damper opening/closing device, in the case of there being one electrical power storage means, it becomes impossible for the damper to be closed if the electrical power storage means has become damaged. This problem is solved by connecting a plurality of such electrical power storage means in parallel, but a concern arises in that the circuit

system may become complex.

[0007] Further, if the amount of electric charge stored in the electrical power storage means is small, it is not possible to secure sufficient energy to close the damper, and there is a concern that the damper cannot be closed.

[0008] The present invention has been devised with the aim of solving the aforementioned problems, and has the object of providing a damper opening/closing device which, even in the case that supply of electrical power from an external power source is cut off, is capable of closing an air supply port or the like without using an electrical power storage means or the like, and in addition, is capable of being returned to its initial open state in the case that supply of electrical power from the external power source is restarted.

[0009] The damper opening/closing device according to the present invention is installed in an opening used for air conditioning, and comprises an opening/closing lid, a retention mechanism configured to retain the opening/closing lid and place the opening in an open state during a period in which supply of electrical power is being carried out, and to release retention of the opening/closing lid and place the opening in a closed state when the supply of electrical power is stopped, and a return mechanism configured to return the opening/closing lid to the state of being retained by the retention mechanism, in a case that the opening/closing lid is in a closed state during the period in which the supply of electrical power is being carried out.

[0010] In accordance with the damper opening/closing device according to the present invention, even in the case that supply of electrical power from the external power source is cut off, the damper opening/closing device is capable of closing the air supply port or the like without using an electrical power storage means or the like, and in addition, is capable of being returned to its initial open state in the case that supply of electrical power from the external power source is restarted.

Brief Description of Drawings

[0011]

FIG. 1 is a plan view showing a damper opening/closing device according to the present embodiment as viewed from above;

FIG. 2 is a side view showing the damper opening/closing device according to the present embodiment as viewed from the direction of the arrow II in FIG. 1;

FIG. 3 is a front view showing the damper opening/closing device according to the present embodiment as viewed from the direction of the arrow III in FIG. 1;

FIG. 4 is a plan view showing a return mechanism and a retention mechanism as viewed from above; FIG. 5A is a front view showing an assembly of a cam plate and a crank plate;

FIG. 5B is a cross-sectional view taken along line VB-VB in FIG. 5A;

FIG. 6 is a wiring diagram showing a part of a circuit system including a rotation control unit; and

FIG. 7 is a time chart showing operations of the damper opening/closing device according to the present embodiment.

Description of Embodiments

[0012] Hereinafter, an exemplary embodiment of a damper opening/closing device according to the present invention will be described with reference to FIGS. 1 to 7.

[0013] As shown in FIGS. 1 to 3, a damper opening/closing device 10 according to the present embodiment is installed, for example, in an opening 12 such as an air supply port installed on the floor surface of a container or the like.

[0014] The damper opening/closing device 10 includes a base platform 16 having a frame portion 14 mounted so as to surround the opening 12 within the floor surface, an opening/closing lid 18 that is installed to be capable of rotating with respect to the base platform 16 and that opens and closes the opening 12, a retention mechanism 20 fixed to the base platform 16, and a return mechanism 24.

[0015] In addition to the above-described frame portion 14, the base platform 16 integrally includes a pedestal 26, which is installed adjacent to one side of the frame portion 14.

[0016] The opening/closing lid 18 is formed, for example, by a metal plate, and with a sufficient size so as to close the opening 12. In the example shown in FIG. 1, since the opening 12 has a rectangular shape when viewed from above, the opening/closing lid 18 is formed in a rectangular shape in the same manner as the opening 12. Of course, depending on the shape of the opening 12, the shape of the opening/closing lid 18 may be a circular shape, an elliptical shape, a track shape, a polygonal shape, or the like. Moreover, such a track shape is a shape that is made up from two opposing semicircular portions, and two parallel straight line portions connecting the two semicircular portions. Further, a locked metal fixture 27, which is locked and fixed by the retention mechanism 20, is provided on an upper part of the opening/closing lid 18.

[0017] The retention mechanism 20 retains the opening/closing lid 18 and places the opening 12 in the open state during a period in which supply of electrical power from an external power source or the like is being carried out, and releases retention of the opening/closing lid 18 when the supply of electrical power is stopped.

[0018] More specifically, as shown in FIGS. 2 and 4, the retention mechanism 20 includes a motor base 28, and an electromagnetic chuck 30 fixed to a distal end portion of the motor base 28. The motor base 28 includes, on the base platform 16, two metal plates (a first metal plate 32A and a second metal plate 32B: see FIG. 4)

installed in an L-shape when viewed from above. Both the first metal plate 32A and the second metal plate 32B are installed so that plate surfaces thereof extend in a vertical direction, in other words, so that the plate surfaces are oriented along a horizontal direction. The first metal plate 32A is installed on the base platform 16, and the second metal plate 32B is installed from the base platform 16 to a location above the opening/closing lid 18. However, the second metal plate 32B is not fixed to the opening/closing lid 18. Further, a part of a lower portion of the second metal plate 32B is removed or cut off, so as not to interfere with an opening operation of the opening/closing lid 18.

[0019] In addition, a mounting metal fixture 34 used for mounting the electromagnetic chuck 30 and having a U-shaped cross section is attached to the plate surface of the second metal plate 32B, and the electromagnetic chuck 30 is attached to a distal end portion of the mounting metal fixture 34. Further, a retaining metal fixture 36 is rotatably attached by a support shaft 38 to the mounting metal fixture 34. The retaining metal fixture 36 includes an attracted site 36a facing an attracting surface of the electromagnetic chuck 30, and a locking site 36b having, for example, an L-shaped cross section, and integrally provided on a distal end of the attracted site 36a.

[0020] In addition, as shown by the two-dot-dashed line in FIG. 2, in a state in which the mounting metal fixture 34 is retained (attracted) by the electromagnetic chuck 30, a portion of the locked metal fixture 27 provided on the upper part of the opening/closing lid 18 is locked onto the locking site 36b, whereby the opening/closing lid 18 is retained in the open state. When the supply of electrical power is stopped, and retention (attraction) by the electromagnetic chuck 30 is released, the retaining metal fixture 36 is rotated about the support shaft 38 by the weight of the opening/closing lid 18, whereby the locked metal fixture 27 of the opening/closing lid 18 is disengaged from the retaining metal fixture 36. As a result, the opening/closing lid 18 rotates (falls) about hinges 22, and the opening 12 is placed in a closed state (refer to the solid line in FIG. 2).

[0021] The hinges 22 are attached between the opening/closing lid 18 and portions of the frame portion 14 of the base platform 16 where the pedestal 26 is provided. Consequently, at first, the opening/closing lid 18 is retained by the retention mechanism 20 in a state of being oriented obliquely upward with the hinges 22 serving as a fulcrum or point of rotation. When the retention by the retention mechanism 20 is released, the opening/closing lid 18 falls downward due to its own weight, and at this time, the opening/closing lid 18 rotates downward about the hinges 22, and closes the opening 12. Moreover, in the example shown in FIG. 1, a case is shown in which the hinges 22 are attached on both left and right sides of a long side of the opening/closing lid 18 that are adjacent to a portion where the pedestal 26 of the frame portion 14 is provided. Of course, the positions where the hinges 22 are attached and the number of the hinges 22 may

be appropriately set in accordance with the shape of the opening/closing lid 18.

[0022] As shown in FIG. 2, when the supply of electrical power is restarted, the return mechanism 24 lifts the opening/closing lid 18 upward, and causes the opening/closing lid 18 to be returned to the state of being retained by the retention mechanism 20. Further, during the supply of electrical power, even if the retention by the electromagnetic chuck 30 is released and the opening/closing lid 18 is placed in the closed state, the opening/closing lid 18 is lifted upward, and the opening/closing lid 18 is returned to the state of being retained by the retention mechanism 20.

[0023] More specifically, as shown in FIGS. 1 and 3, the return mechanism 24 includes a motor 40, an arm 42 that rotates the opening/closing lid 18 upward accompanying rotation of the motor 40, a rotation control unit 44 that controls rotational driving of the motor 40 (see FIG. 6), and a transmission mechanism 46 that transmits a rotational force of the motor 40 to the arm 42 (see FIGS. 2, 5A, and 5B).

[0024] Further, as shown in FIG. 1, the return mechanism 24 includes a handle 48 provided on an upper surface of the opening/closing lid 18, and a hinge pin 50 provided on the handle 48. The handle 48 is formed by, for example, opposing two L-shaped metal plates 52a and 52b (see FIG. 3) that extend from a side on which the hinges 22 are attached toward a side opposing to that side. The hinge pin 50 is connected between the two metal plates 52a and 52b.

[0025] The motor 40 is installed on the pedestal 26 in a manner so that an output shaft 54 (rotary shaft) of the motor 40 penetrates through the second metal plate 32B (see FIG. 5B) of the motor base 28.

[0026] As shown in FIGS. 5A and 5B, the transmission mechanism 46 includes a cam plate 56 attached to the output shaft 54 of the motor 40 that penetrates through the second metal plate 32B. The cam plate 56 includes a cam surface 56a formed by an outwardly bulging portion of a disk-shaped peripheral surface thereof.

[0027] As shown in FIG. 6, the rotation control unit 44 includes a damper internal circuit 64 connected between a power supply line 60 and a ground line 62, and a first switch 66A and a second switch 66B connected respectively between the power supply line 60 and the damper internal circuit 64. The first switch 66A includes, for example, a normally open type make contact 68a (a-contact), and is turned on when supply of electrical power from the external power source or the like is started. Consequently, electrical power is supplied to the damper internal circuit 64 through the power supply line 60. On the other hand, the second switch 66B includes, for example, a normally closed type break contact 68b (b-contact), and normally, electrical power from the external power source or the like is supplied to the damper internal circuit 64 through the power supply line 60.

[0028] The damper internal circuit 64 includes, for example, four contacts (first through fourth contacts 70a to

70d). The first switch 66A is connected between the power supply line 60 and the first contact 70a, and the second switch 66B is connected between the power supply line 60 and the second contact 70b. The third contact 70c and the fourth contact 70d are connected to the ground line 62.

[0029] Further, the damper internal circuit 64 includes the motor 40 connected between the first contact 70a and the third contact 70c, a first limit switch 74A and a second limit switch 74B connected in parallel between the first contact 70a and the motor 40, and the electromagnetic chuck 30 connected between the second contact 70b and the fourth contact 70d.

[0030] The first limit switch 74A includes, for example, a normally closed type first break contact 78a, and the second limit switch 74B includes, for example, a normally closed type second break contact 78b. Accordingly, as can be understood from FIG. 6, the motor 40 is rotationally driven when at least one of the first break contact 78a and the second break contact 78b is placed in an on state.

[0031] Further, as shown in FIG. 2, the first limit switch 74A is attached, for example, between the mounting metal fixture 34 and the opening/closing lid 18. Preferably, the first limit switch 74A is attached at a position where the first break contact 78a of the first limit switch 74A becomes placed in the off state by the opening/closing lid 18, at a stage when the opening/closing lid 18 transitions to the open state. Of course, the first limit switch 74A may be attached at a position where the first break contact 78a thereof becomes placed in the off state, at a stage when the opening/closing lid 18 is fully opened.

[0032] The second limit switch 74B, for example, is attached to a surface of the second metal plate 32B of the motor base 28, the surface facing the arm 42, above the cam plate 56. Preferably, the second limit switch 74B is attached at a position where the second break contact 78b is placed in the off state by the cam surface 56a of the cam plate 56. In an initial state, specifically, in a state in which the arm 42 is in an initial position, as shown in FIG. 2, a pin 80a of a crank plate 80 is in an upper limit position, and the cam surface 56a of the cam plate 56 presses the second break contact 78b of the second limit switch 74B, whereby the second break contact 78b becomes placed in the off state. Moreover, the upper limit position refers to a position from which the pin 80a is incapable of being moved upward any further.

[0033] Accordingly, when the cam plate 56 is rotated due to rotation of the motor 40, the second break contact 78b becomes placed in the off state over a period of time during which the cam surface 56a presses the second break contact 78b of the second limit switch 74B. When the cam surface 56a separates away from the second break contact 78b, the second break contact 78b is placed in the on state.

[0034] As shown in FIGS. 2, 5A, and 5B, the transmission mechanism 46 includes the crank plate 80, which is disposed on an outer side of the cam plate 56 and is

attached to the output shaft 54 of the motor 40. The crank plate 80 is provided with, on the surface thereof that is opposite to the cam plate 56 side and at an eccentric position, the pin 80a which projects outwardly.

[0035] As shown in FIGS. 1 and 2, the arm 42 is constituted by an elongate metal fixture having an L-shaped cross section and extending from the base platform 16 side toward the opening/closing lid 18 side. As shown in FIG. 2, the arm 42 includes a rotary shaft 82 provided in a central portion thereof, and an elongate hole 84 which is provided on the base platform 16 side, and through which the pin 80a of the crank plate 80 is inserted. The elongate hole 84 is formed so that a major axis thereof lies along the longitudinal direction of the arm 42.

[0036] When the crank plate 80 is rotated in one direction (in a counterclockwise direction when viewed from the output shaft 54 of the motor 40) by rotational driving of the motor 40, the pin 80a of the crank plate 80 slides along the elongate hole 84 of the arm 42 while rotating. Consequently, the arm 42 rotates in a counterclockwise direction about the rotary shaft 82, and the hinge pin 50 of the handle 48 is hooked on a distal end portion 42a (see FIG. 1) on the opening/closing lid 18 side, and is lifted upward. As a result, the opening/closing lid 18 is rotated upward about the hinges 22, and is retained in the open state by the electromagnetic chuck 30.

[0037] In this instance, operations of the damper opening/closing device 10 according to the present embodiment will be described with reference to the time chart shown in FIG. 7.

[0038] First, at time t1, when supply of electrical power to the power supply line 60 from the external power source or the like is carried out, the first switch 66A is placed in the on state, and electrical power is supplied to the motor 40, together with electrical power being supplied to the electromagnetic chuck 30 via the second switch 66B. For example, as shown in FIG. 2, by electrical power being supplied to the motor 40 (see FIG. 3), the cam plate 56 and the crank plate 80 are rotated in a counterclockwise direction, and along therewith, the cam surface 56a of the cam plate 56 separates away from the second break contact 78b of the second limit switch 74B, and the second limit switch 74B becomes placed in the on state (at time t2). Further, the arm 42 is also rotated in a counterclockwise direction about the rotary shaft 82, and gradually lifts the opening/closing lid 18 upward (refer to the two-dot-dashed line in FIG. 2). Consequently, the opening/closing lid 18 rotates upward about the hinges 22.

[0039] In addition, accompanying rotation of the cam plate 56 and the crank plate 80, the pin 80a of the crank plate 80 arrives, for example, at a lower limit position, or alternatively in the vicinity thereof, and at a stage (for example, at time t3) at which the opening/closing lid 18 is fully opened, the opening/closing lid 18 is retained by the electromagnetic chuck 30. Moreover, the lower limit position refers to a position from which the pin 80a is incapable of being moved downward any further. Further,

at this time, in accordance with the first break contact 78a being pressed by the opening/closing lid 18, the first limit switch 74A becomes placed in the off state. At this stage, since electrical power is being supplied to the motor 40 via the second limit switch 74B, the cam plate 56 and the crank plate 80 continue to rotate in the counterclockwise direction.

[0040] Thereafter, accompanying rotation of the cam plate 56 and the crank plate 80, the cam surface 56a of the cam plate 56 presses the second break contact 78b of the second limit switch 74B, whereby the second break contact 78b becomes placed in the off state (at time t4), and supply of electrical power to the motor 40 is stopped. At this time, since the pin 80a arrives at the upper limit position, or alternatively in the vicinity thereof and the cam plate 56 and the crank plate 80 stop rotating, the arm 42 is returned to the initial state (refer to the solid line in FIG. 2).

[0041] If the retention of the opening/closing lid 18 by the electromagnetic chuck 30 is released and the opening/closing lid 18 becomes placed in the closed state due to its own weight, since the first break contact 78a of the first limit switch 74A is placed in the on state (at time t5), rotational driving of the motor 40 is started (restarted) again, the operations at the times t2 to t4 are repeated, and the opening/closing lid 18 is returned to the open state. Such a returning operation is based on priority being given to driving of the opening/closing lid 18 to be opened, because basically, it is necessary for the opening/closing lid 18 to be maintained open (in a state of supplying air) at all times.

[0042] In contrast thereto, at the time of an emergency (at a time when a combustible gas is detected or the like), the opening/closing lid 18 is placed in the closed state by stopping the supply of electrical power to the power supply line 60. More specifically, for example, at time t6, in the case that a combustible gas is detected, the supply of electrical power to the power supply line 60 from the external power source or the like is stopped. Consequently, the supply of electrical power to the electromagnetic chuck 30 and the motor 40 is stopped, and the opening/closing lid 18 becomes placed in the closed state.

[0043] In this manner, in the damper opening/closing device 10 according to the present embodiment, the opening/closing lid 18 is retained by the retention mechanism 20 in a state of being oriented obliquely upward with the hinges 22 serving as a fulcrum or point of rotation, whereby the opening 12 can be placed in the open state. Even if the retention by the electromagnetic chuck 30 is released and the opening/closing lid 18 is placed in the closed state, the opening/closing lid 18 is driven by the return mechanism 24, and the opening/closing lid 18 can be returned to the state of being retained by the retention mechanism 20. In particular, when the opening/closing lid 18 is retained in the open state by the retention mechanism 20, the arm 42 is returned to the initial position. Therefore, the opening/closing lid 18 can be smoothly returned to the open state by the return mechanism 24.

[0044] On the other hand, at the time of an emergency or the like, when the supply of electrical power to the retention mechanism 20 is stopped, the retention by the retention mechanism 20 is released, and the opening/closing lid 18 falls downward due to its own weight. At this time, the opening/closing lid 18 rotates downward about the hinges 22, and closes the opening 12. More specifically, the opening 12 can be placed in the closed state. Even if the supply of electrical power from the external power source is cut off, the opening 12 can be closed without using an electrical means such as an electrical power storage means or the like, and consumption of electrical power (standby power or the like) can be reduced.

[0045] In the case that the supply of electrical power from the external power source is restarted, the opening/closing lid 18 is retained again by the retention mechanism 20 in a state of being oriented obliquely upward with the hinges 22 serving as a fulcrum or point of rotation, whereby the opening 12 can be placed in the open state.

[0046] Further, according to the present embodiment, there are included the crank plate 80 which is rotated by driving of the motor 40, and rotates the arm 42 in a direction to open the opening/closing lid 18, and the cam plate 56 which is rotated together with the crank plate 80 by driving of the motor 40. The cam plate 56 includes the cam surface 56a that places the second break contact 78b in an off state based on the arm 42 being returned to the initial position.

[0047] By rotating the crank plate 80 together with the cam plate 56 by the motor 40, it is possible to perform, by the single motor 40, the operation of rotating the arm 42 in the direction to open the opening/closing lid 18 by the crank plate 80, and the operation of placing the second break contact 78b in the off state by the cam surface 56a of the cam plate 56 based on the arm 42 being returned to its initial position, and it is possible to effectively simplify the structure and reduce the number of component parts.

[0048] The above-described embodiment can be summarized in the following manner.

[1] The damper opening/closing device 10 is a damper opening/closing device installed in the opening 12 used for air conditioning, and comprises the opening/closing lid 18, the retention mechanism 20 that retains the opening/closing lid 18 and places the opening 12 in the open state during a period in which supply of electrical power is being carried out, and releases retention of the opening/closing lid 18 and places the opening 12 in a closed state when the supply of electrical power is stopped, and the return mechanism 24 that returns the opening/closing lid 18 to the state of being retained by the retention mechanism 20, in the case that the opening/closing lid 18 is in the closed state during the period in which supply of electrical power is being carried out. In accordance with these features, initially, during

the period in which electrical power is being supplied, the retention mechanism 20 retains the opening/closing lid 18 and places the opening 12 in the open state. When the supply of electrical power is stopped, the retention mechanism 20 releases the retention of the opening/closing lid 18, and thereby places the opening 12 in the closed state. In this manner, even if the supply of electrical power from the external power source is cut off, the opening 12 can be closed without using an electrical means such as an electrical power storage means or the like, and consumption of electrical power (standby power or the like) can be reduced. Additionally, even if the retention by the retention mechanism 20 is released and the opening/closing lid 18 is placed in the closed state during the period in which supply of electrical power is being carried out, it is possible for the opening/closing lid 18 to be returned to the state of being retained by the retention mechanism 20, by the return mechanism 24.

[2] In the present embodiment, the retention mechanism 20 may be the electromagnetic chuck 30 that electromagnetically retains the opening/closing lid 18. The opening/closing lid 18 can be retained in the open state by supplying electrical power thereto.

[3] In the present invention, movement of the opening/closing lid 18 when retention of the opening/closing lid 18 by the retention mechanism 20 is released takes place due to the weight of the opening/closing lid 18. In accordance with this feature, even if the supply of electrical power from the external power source is cut off, the air supply port or the like can be closed by the opening/closing lid 18 without using an electrical power storage means or the like.

[4] In the present embodiment, the return mechanism 24 includes the first contact 70a and the second contact 70b, the motor 40 which is rotationally driven based on at least one of the first contact 70a and the second contact 70b being placed in an on state, and the arm 42 that rotates in a direction to open the opening/closing lid 18 from the initial position as the motor 40 is rotationally driven. The first contact 70a is placed in the off state based on the open state of the opening/closing lid 18, and the second contact 70b is placed in the off state based on the arm 42 being returned to the initial position. In accordance with these features, when the opening/closing lid 18 is retained in the open state by the retention mechanism 20, the arm 42 is returned to the initial position. Therefore, the opening/closing lid 18 can be smoothly returned to the open state by the return mechanism 24.

[5] In the present embodiment, the open state of the opening/closing lid 18 is a state in which the opening/closing lid 18 is retained by the retention mechanism 20, and the second contact 70b is placed in the off state based on the arm 42 being returned to the initial position, after the first contact 70a has been

placed in the off state.

[6] In the present embodiment, there are further included the crank plate 80 which is rotated by driving of the motor 40, and rotates the arm 42 in the direction to open the opening/closing lid 18, and the cam plate 56 that is rotated together with the crank plate 80 by driving of the motor 40, and the cam plate 56 includes the cam surface 56a that places the second contact 70b in the off state based on the arm 42 being returned to the initial position.

[0049] The crank plate 80 and the cam plate 56 are rotated together by the motor 40. Consequently, it is possible to perform, by a single motor, the operation of rotating the arm 42 in the direction to open the opening/closing lid 18 by the crank plate 80, and the operation of placing the second contact 70b in the off state by the cam surface 56a of the cam plate 56 based on the arm 42 being returned to its initial position, and it is possible to effectively simplify the structure and reduce the number of component parts.

[0050] Moreover, the damper opening/closing device according to the present invention is not limited to the above-described embodiment, and it is a matter of course that various configurations could be adopted therein without departing from the essence and gist of the present invention.

Claims

1. A damper opening/closing device (10) installed in an opening (12) used for air conditioning, the damper opening/closing device (10) comprising:

an opening/closing lid (18);
a retention mechanism (20) configured to retain the opening/closing lid (18) and place the opening (12) in an open state during a period in which supply of electrical power is being carried out, and to release retention of the opening/closing lid (18) and place the opening (12) in a closed state when the supply of electrical power is stopped; and
a return mechanism (24) configured to return the opening/closing lid (18) to the state of being retained by the retention mechanism (20), in a case that the opening/closing lid (18) is in a closed state during the period in which the supply of electrical power is being carried out.

2. The damper opening/closing device (10) according to claim 1, wherein the retention mechanism (20) includes an electromagnetic chuck (30) configured to electromagnetically retain the opening/closing lid (18).

3. The damper opening/closing device (10) according

to claim 1 or 2, wherein movement of the opening/closing lid (18) when retention of the opening/closing lid (18) by the retention mechanism (20) is released takes place due to a weight of the opening/closing lid (18).

4. The damper opening/closing device (10) according to any one of claims 1 to 3, wherein

the return mechanism (24) includes:

a first contact (70a) and a second contact (70b); a motor (40) configured to be rotationally driven based on at least one of the first contact (70a) and the second contact (70b) being placed in an on state; and

an arm (42) configured to rotate in a direction to open the opening/closing lid (18) from an initial position as the motor (40) is rotationally driven, the first contact (70a) is placed in an off state based on an open state of the opening/closing lid (18), and

the second contact (70b) is placed in an off state based on the arm (42) being returned to the initial position.

5. The damper opening/closing device (10) according to claim 4, wherein

the open state of the opening/closing lid (18) is a state in which the opening/closing lid (18) is retained by the retention mechanism (20), and the second contact (70b) is placed in the off state based on the arm (42) being returned to the initial position, after the first contact (70a) has been placed in the off state.

6. The damper opening/closing device (10) according to claim 4 or 5, further comprising:

a crank plate (80) configured to be rotated by driving of the motor (40), and to rotate the arm (42) in the direction to open the opening/closing lid (18); and

a cam plate (56) configured to be rotated together with the crank plate (80) by driving of the motor (40), wherein

the cam plate (56) includes a cam surface (56a) configured to place the second contact (70b) in the off state based on the arm (42) being returned to the initial position.

FIG. 1

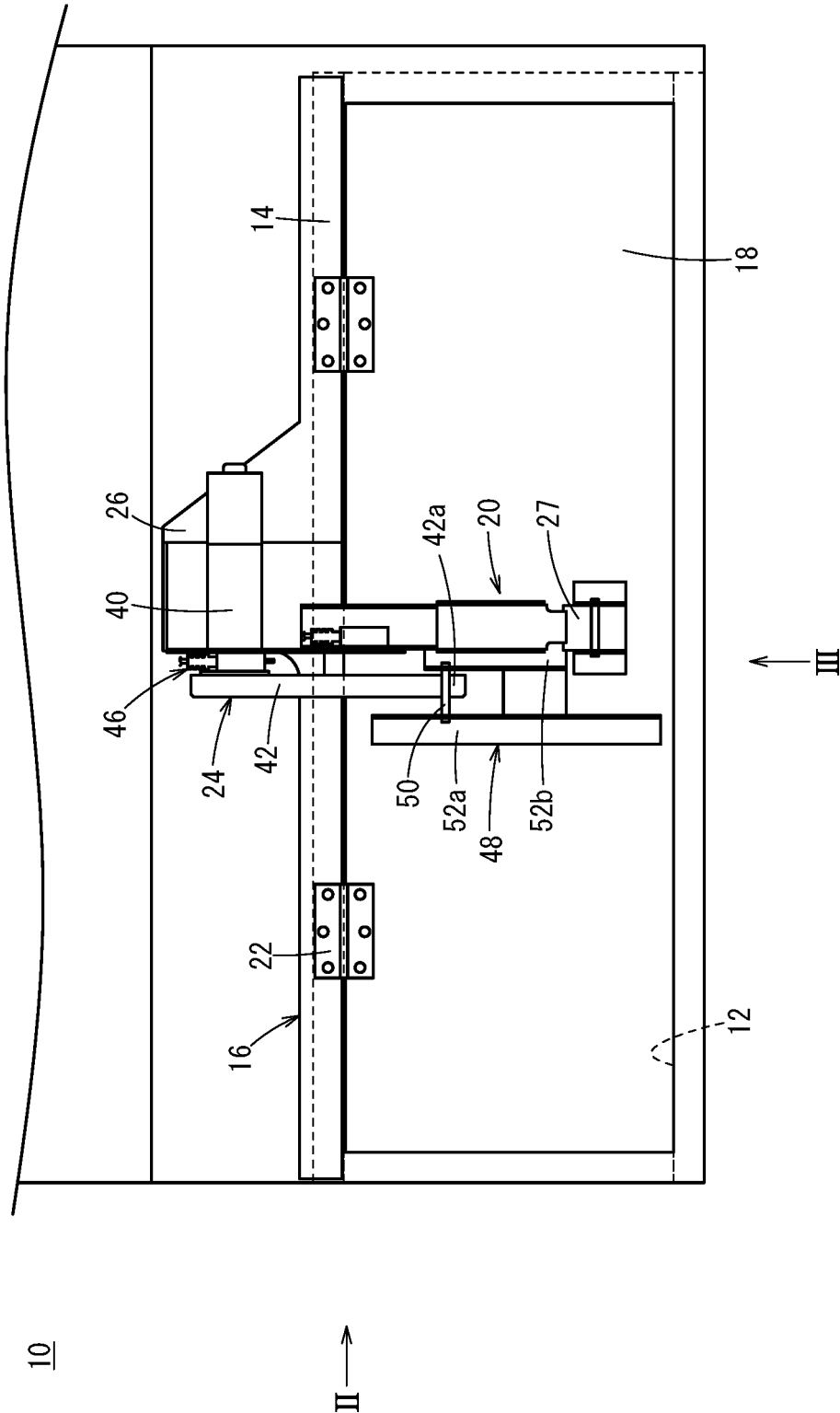


FIG. 2

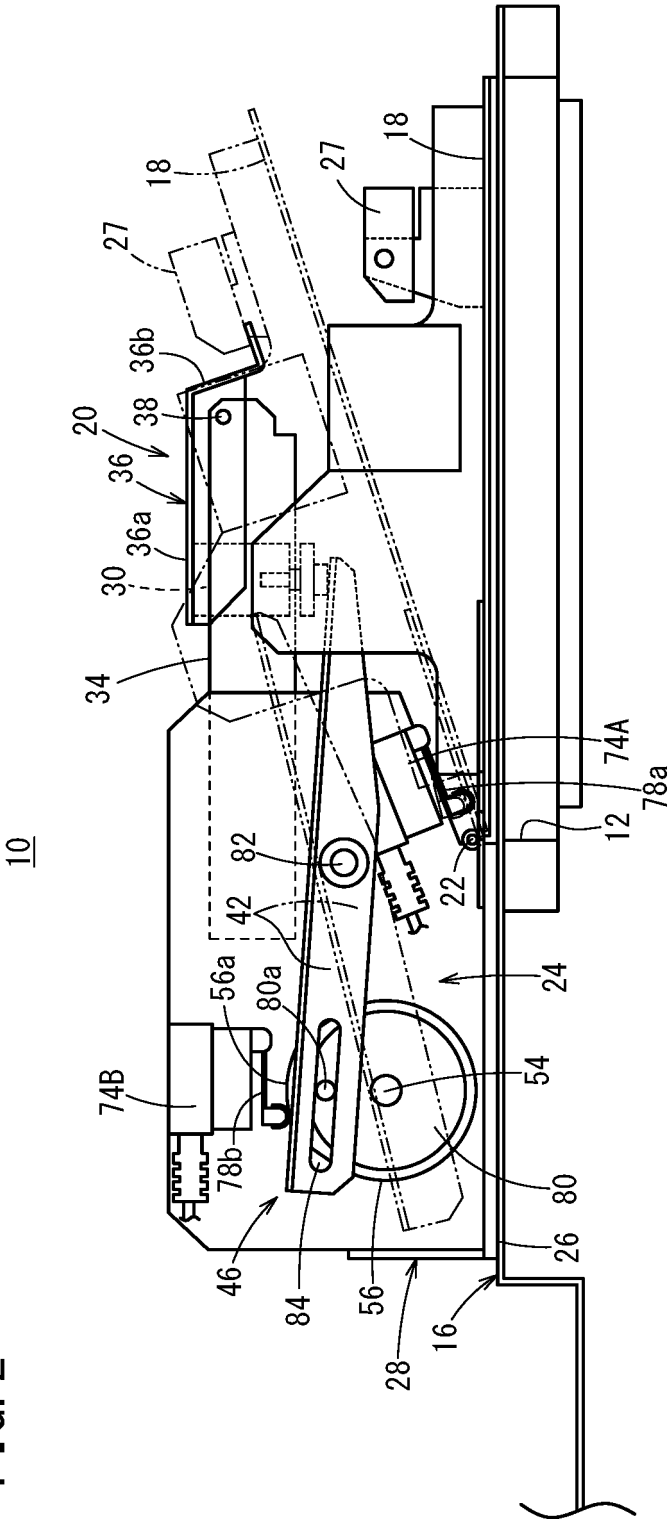


FIG. 3

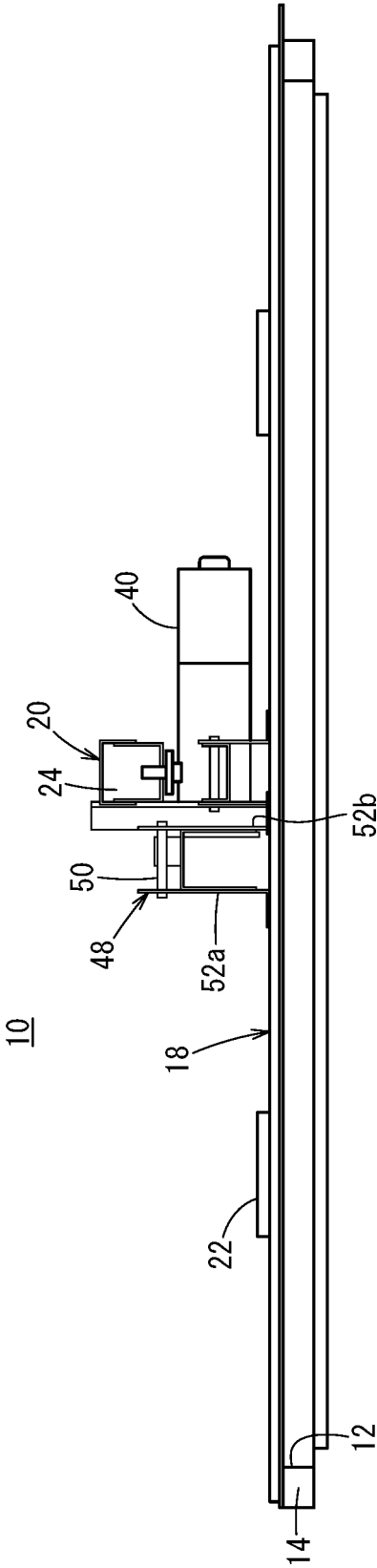


FIG. 4

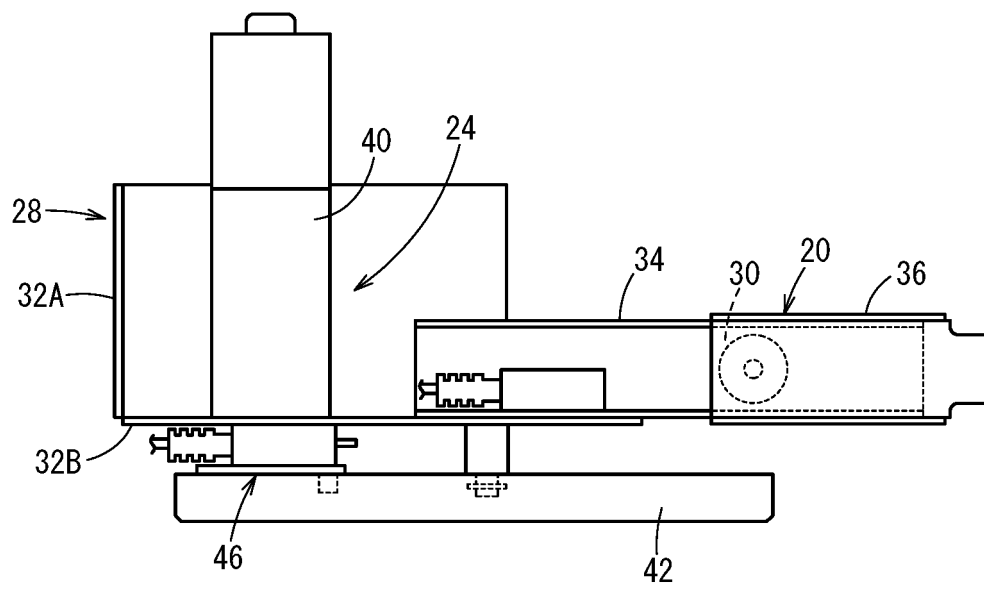


FIG. 5A

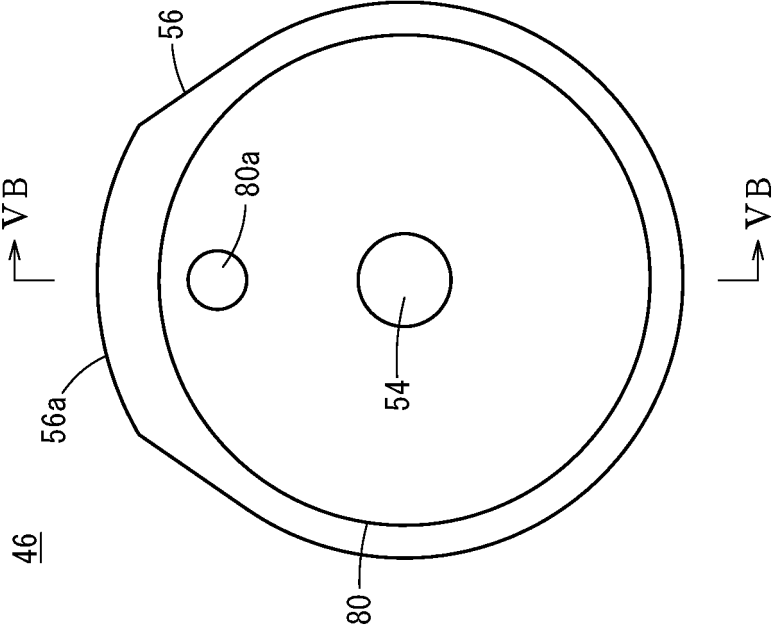
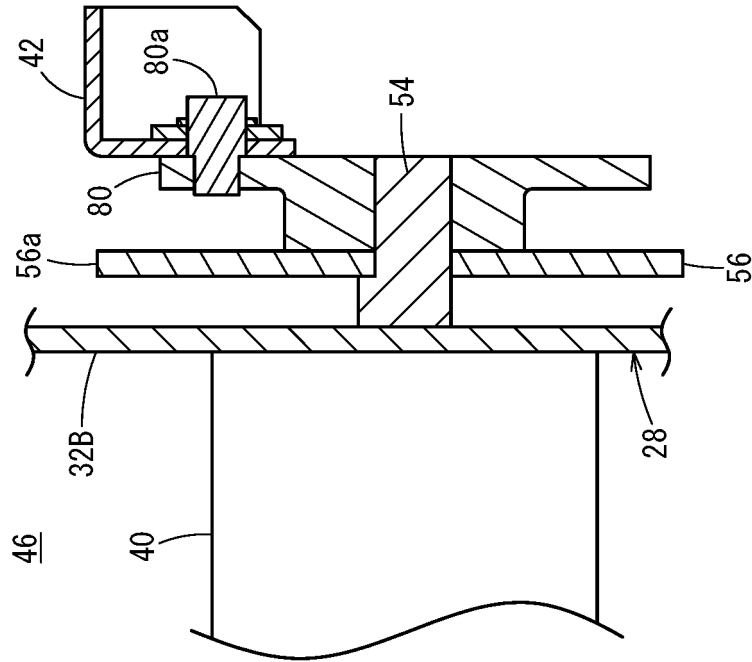


FIG. 5B



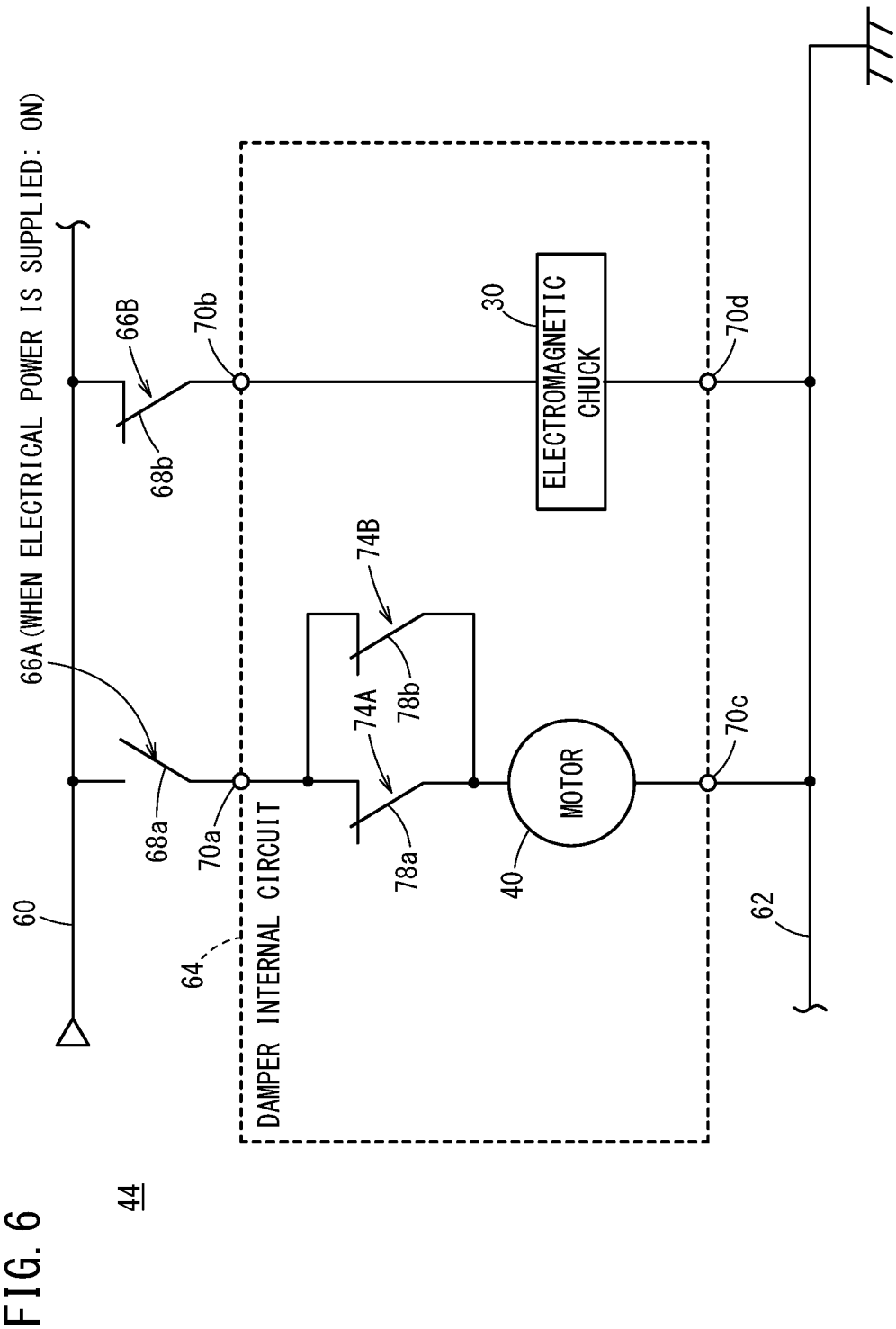
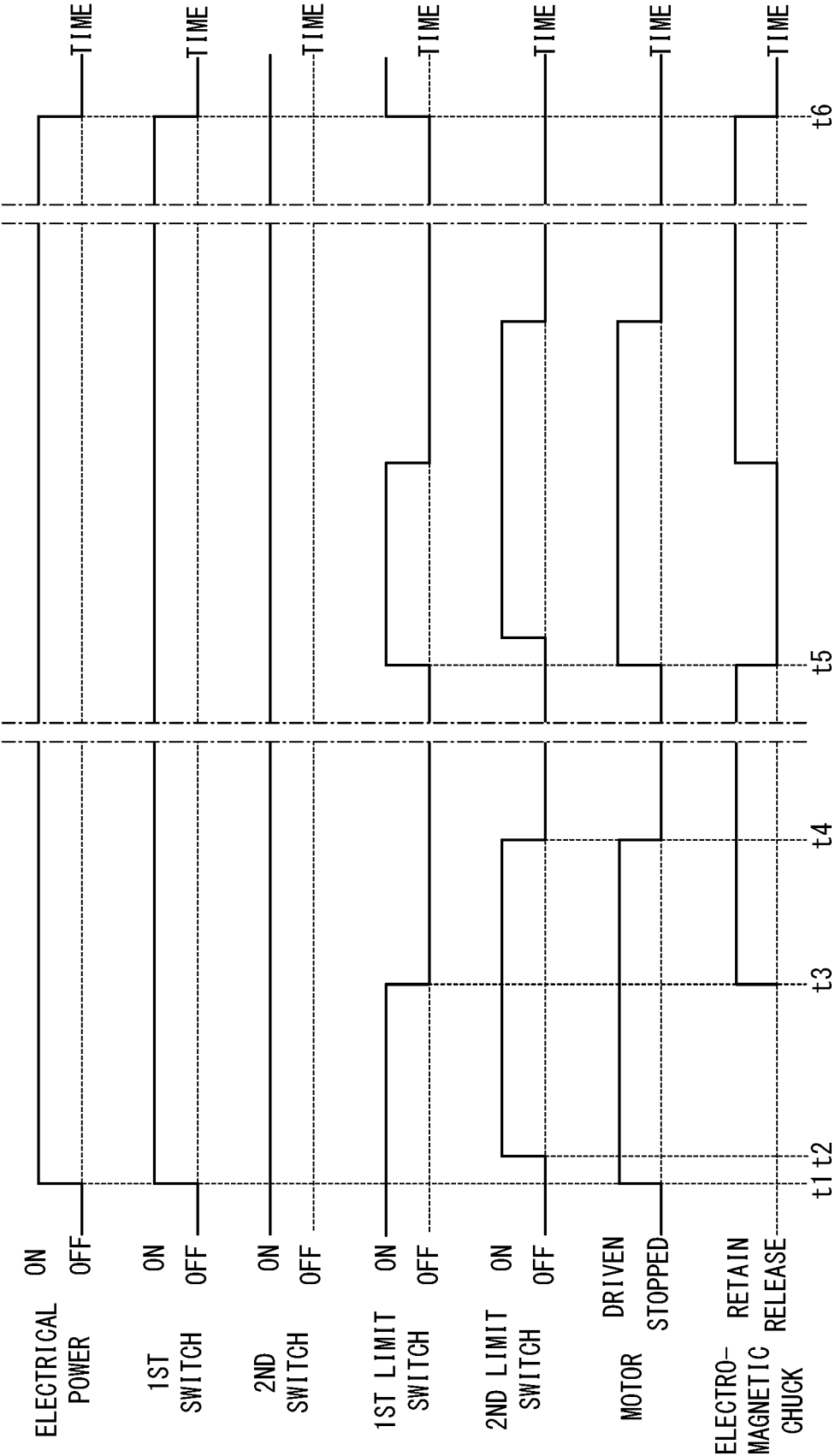


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2020/009162

A. CLASSIFICATION OF SUBJECT MATTER

F24F 13/10 (2006.01) i; F24F 13/14 (2006.01) i
 FI: F24F13/10 A; F24F13/14 H; F24F13/14 D

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)
 F24F13/10; F24F13/14

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 5-277200 A (KUKEN DENKI KK) 26.10.1993 (1993-10-26) paragraphs [0002]-[0028], fig. 1-7	1-2
A	JP 2014-213814 A (SHIN KURUSHIMA DOCKYARD CO., LTD.) 17.11.2014 (2014-11-17) entire text, all drawings	1-6
A	JP 2-10050 A (OBATA, Yukihiro) 12.01.1990 (1990-01-12) entire text, all drawings	1-6
A	JP 2008-39313 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 21.02.2008 (2008-02-21) entire text, all drawings	1-6



Further documents are listed in the continuation of Box C.



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"&" document member of the same patent family

Date of the actual completion of the international search
 02 April 2020 (02.04.2020)

Date of mailing of the international search report
 14 April 2020 (14.04.2020)

Name and mailing address of the ISA/
 Japan Patent Office
 3-4-3, Kasumigaseki, Chiyoda-ku,
 Tokyo 100-8915, Japan

Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/JP2020/009162

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 5-277200 A	26 Oct. 1993	(Family: none)	
JP 2014-213814 A	17 Nov. 2014	(Family: none)	
JP 2-10050 A	12 Jan. 1990	(Family: none)	
JP 2008-39313 A	21 Feb. 2008	(Family: none)	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2006187524 A [0002] [0005]