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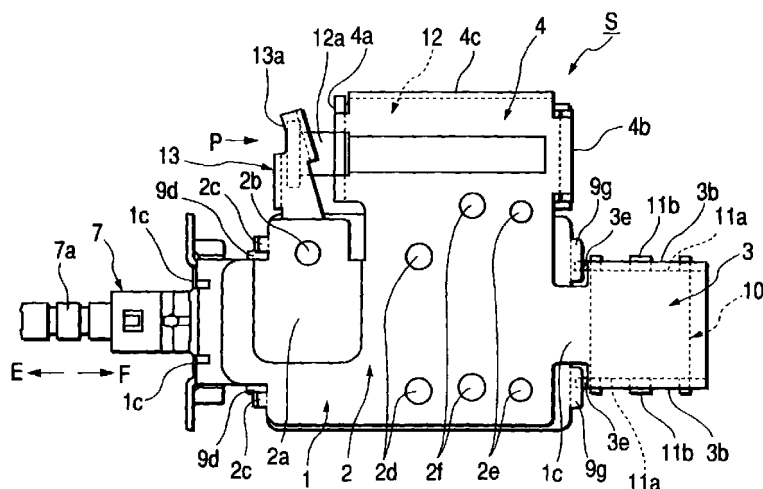
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(54) **Switching device**

(57) The present invention provides a switching device comprising a locking member which, by sliding the operating member, is guided by the cam bottom surface to come in contact with the locking wall and retain the operating member in its lock state. The operating member has an extra stroke to slide from the position of said locked state farther in one direction and is retained

in its locked state while it is moving back and forth in the extra stroke. Then, the operating member in the extra stroke is slid to turn the second switch on, and when a control circuit of the appliance detects the ON signal a predetermined processing before a shut-off of the power circuit of the equipment can be properly done.

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a switching device and more particularly to a switching device suitable for switching power on and off of various electric appliances such as televisions, videocassette recorders, and fan heaters.

2. Description of the Related Art

[0002] With reference to Figs. 11 and 12, a conventional switching device will be described. As shown in Fig. 11, a first frame 20 having an AC switch section 20a and a solenoid section 20b is provided. A second frame 21, separate from the first frame 20, is disposed to the rear, or right as seen in Fig. 11, of the AC switch section 20a. The second frame 21 has a DC switch section 21a. An AC switch 22 is installed in the AC switch section 20a and a DC switch (not shown) is installed in the DC switch section 21a.

[0003] Disposed in the AC switch 22 is a sliding member 23 for turning on and off the AC switch 22 and the DC switch. An operating rod 23a is formed as a unit with the sliding member 23 so as to protrude from the front of the AC switch 22.

[0004] The sliding member 23 is always urged elastically in the arrow A's direction. While the operating rod 23a is in its extreme left position as seen in Fig. 11, the AC switch 22 and the DC switch are off, the switching device resting in its initial state.

[0005] When the sliding member 23 is pushed in the arrow B's direction while the switching device is in its initial state, the AC switch 22 and the DC switch are turned on and the sliding member 23 is locked at the position where it is.

[0006] As shown in Fig. 12, a recessed cam portion 23b of a prescribed depth is formed in the sliding member 23 by carving. Formed on the bottom of the recessed cam portion 23b is the cam bottom surface 23c consisting of slopes and steps. A heart-shaped cam 24 with a locking wall 24a is formed to be projected on the cam bottom surface 23c.

[0007] A locking member 25 is positioned at the recessed cam portion 23b. Both ends of the locking member 25 are bent by 90° in one and the same direction. A swing pivot 25a is formed on one end of the locking member 25 and a locking part 25b is formed on the other end.

[0008] The swing pivot 25a is journaled on a case (not shown) on the AC switch 22's side. When the sliding member 23 moves back and forth in the directions of arrows A and B, the locking part 25b is guided by the cam bottom surface 23c to move around the heart-shaped cam 24 and come in contact with the locking

wall 24a.

[0009] A solenoid 26 is installed in the solenoid section 20b, and its plunger 26a is attracted in the arrow B's direction when the coil (not shown) of the solenoid 26 is energized.

[0010] The solenoid 26 drives a driving cam 27, which is journaled on a pivot 27a supported by the first frame 20. The plunger 26a of the solenoid 26 is engaged with one end 27b of the driving cam 27 so that the driving cam 27 turns as the plunger 26a is attracted.

[0011] A triangular unlocking part 27d is formed on the other end 27c of the driving cam 27.

[0012] The conventional switching device operates as follows. As is shown in Fig. 12, while the solenoid 26 is in its unexcited, or initial, state, the locking part 25b of the locking member 25 is positioned apart from the locking wall 24a of the heart-shaped cam 24 and the AC switch 22 and the DC switch are in their off, or initial, states.

[0013] Then, when the sliding member 23 is moved in the arrow B's direction, the locking part 25b is guided by the cam bottom surface 23c to move onto a deeper cam bottom surface 23d and come in contact with the locking wall 24a. When the locking portion 25b has come in contact with the locking wall 24a, the sliding member 23 is locked and prohibited from moving in the arrow A's direction and, at the same time, the AC switch 22 and the DC switch are turned on.

[0014] The sliding member 23 is released from its locked state as follows. When the solenoid 26 is energized, the plunger 26a is attracted in the arrow B's direction, which causes the driving cam 27 to turn in the arrow C's direction, the unlocking part 27d to move in the arrow D's direction, the locking part 25b in its locked state to depart from the locking wall 24a and move onto a cam bottom surface 23e deeper than the cam bottom surface 23d, and thereby the sliding member 23 to be released from its locked state.

[0015] Then, the sliding member 23 is returned in the arrow A's direction by the elasticity of an elastic member (not shown), and the AC switch 22 and the DC switch are turned off. Thus, the switching device is automatically returned in its initial state.

[0016] Besides, when the sliding member 23 in its locked state is moved farther in the arrow B's direction by hand, the locking part 25b is separated from the locking wall 24a and guided to the cam bottom surface 23e by the cam bottom surface 23d and the step of the cam bottom surface 23e bordering on the cam bottom surface 23d. Thus, the sliding member 23 is released from its locked state and the AC switch 22 and the DC switch are turned off.

[0017] To turn off a fan heater, for example, it has to be put through a preparatory process under the control of a control circuit with a microcomputer, etc. connected to the secondary power circuit in order to stop feeding fuel to its combustion unit and prevent incomplete combustion, before the primary power circuit is turned off.

[0018] If a conventional switching device such as one described above is used in an appliance that requires such a preparatory process, the secondary power circuit including the control circuit with a micro-computer, etc. is also turned off when the primary power circuit is turned off, precluding the appliance from going through the preparatory process.

[0019] Accordingly, it is necessary to equip such an appliance with a separate switch, in addition to such a conventional switching device, to turn on the control circuit of the appliance and start its preparatory process. This switch arrangement makes the user's operation complex in using the appliance.

SUMMARY OF THE INVENTION

[0020] It is therefore an object of the present invention to provide a switching device with an automatic turning-off function which, solving the above problem, is applicable to fan heaters and other electric appliances requiring a preparatory process when they are turned off.

[0021] As the first solution of the above problem, the present invention provides a switching device comprising a driving member having a cam surface on its one end portion, a driving source for driving the driving member, a slidable operating member, a first switch to be turned on and off by switching the operating member between its locked and unlocked states, a recessed cam portion formed in part of the operating member, a cam bottom surface formed at the bottom of the recessed cam portion by combining a plurality of flats of different depths, a locking wall formed to be projected and adjacent to the cam bottom surface, and a locking member which, by sliding the operating member, is guided by the cam bottom surface of the recessed cam portion to come in contact with the locking wall and retain the operating member in its lock state. The operating member has an extra stroke to slide from the position of said locked state farther in one direction and is retained in its locked state while it is moving back and forth in the extra stroke. The operating member is switched automatically from its locked state to its unlocked state by the driving source operating through the driving member.

[0022] As a second solution of the above problem, the present invention provides the switching device wherein a first flat is provided in the cam bottom surface on which the locking member remains while the operating member is moving in the extra stroke, and a part of the wall defining the recessed cam portion around the first flat is formed into a guide wall, which guides the locking member to prevent it from escaping to a second flat adjacent to and lower than the first flat while the operating member moves back and forth in the extra stroke.

[0023] As a third solution of the above problem, the present invention provides the switching device wherein

a second switch is provided in juxtaposition to the first switch. The first switch remains on while the operating member is in its locked state and off while the operating member is in its unlocked state. The second switch is turned on and off while the operating member moves back and forth in the extra stroke.

[0024] As a fourth solution of the above problem, the present invention provides the switching device wherein the driving source comprises a solenoid having a movable core. The operating member is switched from its locked state to its unlocked state automatically by the driving source operating through the driving member or forcibly by operating the movable core by hand.

[0025] As a fifth solution of the above problem, the present invention provides the switching device wherein the driving source, the operating member, and the first and second switches are mounted on a frame.

BRIEF DESCRIPTION OF THE DRAWING

[0026]

Fig. 1 is a top view of a switching device of the present invention;

Fig. 2 is a plan view of a switching device of the present invention;

Fig. 3 is a top view of a first switch in accordance with the present invention;

Fig. 4 is a plan view of a first switch in accordance with the present invention;

Fig. 5 is an enlarged cross sectional view showing a principal part of a switching device of the present invention;

Fig. 6 is a schematic diagram illustrating a cam bottom surface in accordance with the present invention;

Fig. 7 is a schematic diagram illustrating a cam bottom surface in accordance with the present invention;

Fig. 8 is a schematic diagram illustrating a movement of a locking member in accordance with the present invention;

Fig. 9 is a schematic diagram illustrating a movement of a locking member in accordance with the present invention;

Fig. 10 is an enlarged cross sectional view showing a principal part of a second switch of a switching device of the present invention;

Fig. 11 is a top view of a conventional switching device; and

Fig. 12 is an enlarged cross sectional view showing a principal part of a conventional switching device.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0027] An embodiment of the switching device of the present invention will now be described with reference to the drawings. Fig. 1 is a plan view of a switching device in accordance with the present invention. Fig. 2 is a front view of the switching device. Figs. 3 and 4 are plan and front views of the first switch of the switching device. Fig. 5 is an enlarged view of a principal part of the switching device. Figs. 6 and 7 are schematic diagrams of the cam bottom surface of the switching device. Figs. 8 and 9 are schematic diagrams of the operation of the locking member of the switching device. Fig. 10 is a sectional view illustrating the principal part of the second switch of the switching device.

[0028] As shown in Figs. 1 and 2, the switching device S of the present invention is provided on its top with a frame 1 comprising a metal plate stamped by a press or the like. The frame 1 has an AC switch section 2 to mount a first switch 5 comprising an AC-circuit switch (described later), a driving section 4 to mount a driving source 12 (described later), and a DC switch section 3 to mount a second switch 10 comprising a DC-circuit switch (described later). The AC switch section 2 and the driving section 4 are arranged side by side, and the DC switch section 3 is disposed to the rear of the AC switch section 2. A connection 1c is formed between the AC switch section 2 and the DC switch section 3.

[0029] The AC switch section 2 has a flat portion 2a elevated by a prescribed dimension, wherein a downward protrusion 2b is formed.

[0030] As is shown in Fig. 2, the AC switch section 2 has, on its front end, a pair of first caulking parts 2c and 2c, each in a tongue-like shape, which are bent down.

[0031] The AC switch section 2 of the frame 1 has a pair of downward protrusions 2d, a pair of upward protrusions 2e, and a pair of positioning through holes 2f disposed between the downward protrusions 2d and the upward protrusions 2e.

[0032] As is shown in Fig. 1, the right and left side plates 3b and 3b of the DC switch section 3 of the frame 1 are bent down to give the DC switch section 3 the shape of a portal.

[0033] Each side plate 3b has a pair of second caulking parts 3c and 3c, each in a tongue-like shape. Each of two protrusions 11b of a second case 11 (described later) is caught by and between the second caulking parts 3c and 3c in a pair, and thus the DC-circuit switch is held under the DC switch section 3.

[0034] A notch-like catcher 3e for receiving and

supporting the back of the first switch 5 (described later) is formed in a portion of each side plate 3b where the side plate 3b and the connection 1c cross each other. The dimension between the bottom of each notch-like catcher 3e and the back of the connection 1c is slightly larger than the thickness of a lid 9 which will be described later.

[0035] As shown in Fig. 1, front, rear, and left portions 4a, 4b, and 4c of the driving section 4 are bent down.

[0036] The first caulking parts 2c and 2c of the AC switch section 2, the side plates 3b and 3b of the DC switch section 3, and the front, rear, and left portions 4b, 4c, and 4d of the driving section 4 are all bent down in the same direction as shown in Fig. 2.

[0037] The first switch 5, comprising an AC switch, to be mounted under the AC switch section 2 of the frame 1 has a first case 6 as is shown in Figs. 3 and 4, which is made of a resin and open at its top.

[0038] The first case 6 has guiding portions 6a which protrude forward and guide the travel by sliding of an operating member 7 to be described later. A recess 6b is formed in the lower part of the outer side surface of each guiding portion 6a.

[0039] Disposed in the first case 6 is a switch (not shown) comprising fixed and movable contacts, and an operating member 7 is disposed so as to be slidable in the directions of arrows E and F to turn the switch on and off.

[0040] The operating member 7 is made of a resin and is provided with an operating rod 7a which protrudes outside from the front of the first case 6. The operating rod 7a has a built-in elastic member (not shown) which always urges the operating member 7 in the arrow E's direction.

[0041] As is shown in Fig. 5, a recessed cam portion 7b is formed in the operating member 7. The recessed cam portion 7b is defined by the bold line in Fig. 6. The cam bottom surface 7c of the recessed cam portion 7b consists of flats a, c, d, and e, a slope b between flats a and c, and a slope f between flats a and e, those flats and slopes carved at prescribed depths.

[0042] As is shown in Fig. 7, among the flats a, c, d, e of the cam bottom surface 7c, the flat e is formed deepest; the flat a, second deepest; the flat d, third deepest; the flat c, shallowest. The slope f between the flats e and a is so formed that the edge of the slope f bounding the flat a exceeds the flat a in elevation. Besides, the flats a and c are connected to each other by the slope b.

[0043] Formed around the recessed cam portion 7b is a recessed flat g that is shallower than the shallowest flat c in the cam bottom surface 7c. Formed around the flat g is a flat h which constitutes a surface of a sliding member 7.

[0044] In the generally central part of the cam bottom surface 7c, a heart-shaped cam 7e (represented by the blacked-out area in Fig. 6) with a locking wall 7d is

formed to be projected and adjacent to the cam bottom surface 7c.

[0045] The elevation of the top of the heart-shaped cam 7e is the same as the elevation of the flat g around the recessed cam portion 7b.

[0046] The locking part 8a of a locking member 8 to be described later comes in contact with the locking wall 7d to stop and hold the sliding member 7 in its locked state.

[0047] The recessed cam portion 7b is provided with a locking member 8 comprising a metal rod. One end of the locking member 8 is bent generally by 90° to form a locking part 8a, and the other end is also bent generally by 90° to form a swing pivot (not shown), which is supported on the side of the first case 6.

[0048] When the operating member 7 slides in the directions of arrows E and F, the locking part 8a moves around on the cam bottom surface 7c.

[0049] When the operating member 7 is moved in the arrow F's direction against the elasticity of the elastic member (not shown), the locking member 8 is guided by the cam bottom surface 7c to come in contact with the locking wall 7d.

[0050] The locking member 8's coming in contact with the locking wall 7d causes the operating member 7 to be stopped and held in its locked state and thus prohibited from moving in the arrow E's direction. When the operating member 7 is stopped and held in its locked state, the first switch 5 (AC switch) goes on.

[0051] The operating member 7 has an extra stroke Y ranging from the position at which it is locked as is mentioned above to the extreme position in the arrow F's direction up to which the operating member 7 can be moved and at which it is stopped by the locking part 8a's coming in contact with the wall 7g. When the locking member is within the extra stroke Y, the operating member 7 is not unlocked even if it is operated slidably.

[0052] Besides, while the operating member 7 is moving in the extra stroke Y, the first switch 5 remains on.

[0053] Disposed on the top of the first case 6 is a lid 9 that is made of a metal plate and closes an opening (not shown) of the first case 6. As is shown in Fig. 3, a rectangular opening 9a is formed in the front portion of the lid 9 so that the recessed cam portion 7b of the operating member 7 below the lid 9 can be seen through it.

[0054] As is shown in Fig. 4, formed before the opening 9a (closer to the operating rod 7a) are a pair of base-mounting parts 9b and a pair of front caulking parts 9c, all the parts bent down. In addition, as is shown in Fig. 6, formed to the rear of the pair of front caulking parts 9c is a pair of front engaging parts 9d and 9d, which protrude beyond the front of the first case 6. The front engaging parts 9d and 9d correspond positionally with the first caulking parts 2c and 2c of the AC switch section 2 of the frame 1.

[0055] Moreover, a round positioning through hole

9e and an oval positioning through hole 9f are formed in the lid 9.

[0056] Furthermore, formed at the rear end of the lid 9 shown on the right side in the drawing is a pair of rear engaging parts 9g, which protrude beyond the back of the first case 6 and have a spacing H between them.

[0057] As is shown in Fig. 4, a bent-down rear caulking part 9h is formed between the rear engaging parts 9g and 9g. The lid 9 is coupled with the first case 6 by caulking the front and rear caulking parts 9c and 9h. In addition, a rectangular operating hole 9j is formed in the rear portion of the lid 9.

[0058] The rear engaging parts 9g and 9g of the lid 9 are received in the catchers 3e of the frame 1, and the front engaging parts 9d and 9d are caught by the first caulking parts 2c and 2c of the frame 1. Thus, the first switch 5 is held under the AC switch section 2 of the frame 1.

[0059] The DC switch section 3 of the second installing portion 1b of the frame 1 is fitted with a second switch 10 comprising a DC switch. The second switch 10 (DC switch) has a second case 11 made of the same resin as the first case 6. As is shown in Fig. 1, a protrusions 11b is vertically formed on each side plate 11a of the second case 11.

[0060] As is shown in Fig. 10, the second switch 10 has an operating rod 10a, which protrudes from the second switch 10 and enters the operating hole 9j of the lid 9. When the operating member 7 is slid in the arrow F's direction, its rear end 7f comes in elastic contact with the operating rod 10a.

[0061] When the operating member 7 is slid in the arrow F's direction, its rear end 7f pushes the operating rod 10a to turn it about its pivot 10b in the arrow G's direction. Accordingly, a movable contact 10c made of an elastic member such as a phosphor-bronze plate moves toward a terminal 10d to open the circuit between the terminal 10d and a terminal 10e. Thus, the second switch 10 is turned on.

[0062] When the second switch 10 is turned on, the locking part 8a comes in contact with the side wall 7g, as shown in Fig. 9, to stop the sliding of the operating member 7 in the arrow F's direction.

[0063] Then, when the pressure on the operating rod 7a is removed, the operating member 7 moves in the arrow E's direction, allowing the operating rod 10a to be turned in the arrow H's direction by the elasticity of the movable contact 10c. Accordingly, the movable contact 10c moves towards the terminal 10e to turn off the second switch 10.

[0064] The second caulking parts 3c catches the protrusions 11b to support the second switch 10 under the DC switch section 3 of the frame 1.

[0065] As is shown in Fig. 1, installed in the driving section 4 of the first installing portion 1a of the frame 1 is a driving source 12, which comprises a solenoid, etc. and turn off the switching device S automatically. The driving source 12 comprises a coil (not shown) and a

movable core 12a. The coil is supported by and between the front and back plates 4a and 4b of the frame 1 and, thereby, the driving source 12 is held in the driving section 4.

[0066] When the coil is energized from its unexcited state, or initial state, to its excited state, the movable core 12a is attracted by a prescribed force.

[0067] The front end of the movable core 12a engages with an engaging part 13a of a driving member 13. The driving member 13 has the engaging part 13a on its one end and a cam surface 13b on the other end. A pivot hole 13c, between the engaging part 13a and the cam surface 13b, is formed in the driving member 13. The engaging part 13a of the driving member 13 engages with the front end of the movable core 12a, and the protrusion 2b of the frame 1 is inserted in the pivot hole 13c. Thus, the driving member 13 is mounted on the frame 1 so as to be freely turnable about the protrusion 2b.

[0068] Accordingly, when the movable core 12a is attracted while the locking member 8 is in contact with the locking wall 7d and hence the operating member 7 is in its locked state, the driving member 13 is turned clockwise about the pivot hole 13c and, then, the cam surface 13b removes the locking part 8a in its locked state from the locking wall 7d. Thus, the operating member 7 is automatically released from its locked state.

[0069] As is described above, the switching device S of the present invention has the automatic turning-off function to release the operating member 7 from its locked state and, at the same time, turn off the first switch 5 automatically under the operation of the driving source 12.

[0070] With reference to Figs. 8 and 9, the operation of the locking member 8 to retain the operating member 7 in its locked or unlocked state will now be described.

[0071] While the switching device S is in its initial state with the operating member 7 in its extreme left position and the first switch 5 being off, the locking part 8a is at the position (7) on the flat a. When the operating member 7 is pushed in the arrow F's direction, the locking part 8a is guided from the flat a through the slope b to the shallowest flat c. Thereafter, the locking part 8a falls from the flat c to the flat d (first flat) to come in contact with the side wall 7g of the recessed cam portion 7b, moving from the position (1) to the position (2), and thereby stop the movement of the operating member 7 in the arrow F's direction.

[0072] When the pressure applied on the operating member 7 in the arrow F's direction is removed, the operating member 7 is slid in the arrow E's direction by the action of the elastic member (not shown) and the locking part 8a is guided by a guide wall 7h, a part of the side wall defining the recessed cam portion 7b, and comes in contact with the locking wall 7d, taking the position (3), to retain the operating member 7 in its locked state.

[0073] At the time, the first switch 5 is switched from its off state to its on state. As for the driving member 13 at this time, because the driving source 12 is in its unexcited state, the cam surface 13b of the driving member 13 is freely attachable to and detachable from the locking part 8a in its locked state.

[0074] The operating member 7 has the extra stroke Y ranging from the position of the operating member 7 where the locking part 8a takes the position (3) and the locking member 8 is in contact with the locking wall 7d (as shown in Fig. 8) to the position of the operating member 7 where the locking member 8 takes the position (4) or (2) and is in contact with the side wall 7g (as shown in Fig. 9) when pressed in the arrow F's direction.

[0075] While the operating member 7 is traveling the extra stroke Y, the locking member 8 moves on the same smoothly continuous flat d (first flat) of the cam bottom surface 7c.

[0076] Besides, the guide wall 7h, which is a part of the side wall 7g making up the recessed cam portion 7b around the flat d and slanted relatively to the axis of the operating member 7, is provided to guide the locking member 8 while the operating member 7 is moving back and forth in the extra stroke Y so that the locking member 8 on the flat d does not go towards the deeper flat e (second flat).

[0077] Accordingly, while the operating member 7 is moving back and forth in the extra stroke Y, the operating member 7 can not be released from its locked state.

[0078] Although the locking part 8a was explained with reference to Figs. 8 and 9 as if it moves around the heart-shaped cam 7e with the locking wall 7d, it is in fact prohibited from moving in the directions of arrows E and F, but the sliding member 7 moves back and forth in the directions of arrows E and F, and the locking part 8a of the locking member 8 is guided by the cam bottom surface 7c and just moves around in the recessed cam portion 7b.

[0079] Next, to release the operating member 7 to bring it in the unlocked state and, at the same time, to turn off the first switch 5, the coil (not shown) of the driving source 12 is energized to attract the movable core 5a in the direction of the arrow P shown in Fig. 5. Subsequently, the driving member 11 is turned clockwise and the cam surface 13b moves in the direction of the arrow G. Then the cam surface 13b removes the locking part 8a being in contact with the locking wall 7d so as to be located at the position (5) on the deepest flat e (a second flat) from the flat d. Accordingly, the operating member 7 is released from its locked state to be kept in the unlocked state.

[0080] When the operating member 7 moves in the arrow E's direction by the action of an elastic member (not shown), the locking part 8a is guided from the position (6) of the slope f to the flat a, to return to the initial position (7), the switching device S automatically returns to the initial state and the first switch 5 is turned

off.

[0081] In the switching device S of the present invention, the operating member 7 can be manually switched from its locked state to its unlocked state without using the driving source 12. As for an alternative way of carrying out this method, when the operating member is in its locked state, the front end of the movable core 12a of the driving member 12 is pressed in the arrow P's direction by hand to rotate the driving member 13 so that the locking member 8 positioned on the locking wall 7d is released therefrom and the operating member 7 is switched from its locked state to its unlocked state.

[0082] As mentioned above, the switching device S of the present invention can retain the operating member 7 in its locked state by moving the operating member 7 in arrow F's direction by hand and, at the same time, can turn the first switch 5 on. Moreover, when the operating member 7 is moving back and forth in the extra stroke Y, the operating member 7 is retained in its locked state.

[0083] Further, the release of the operating member 7 from its locked state is done not by the guidance of the cam bottom surface 7c but by releasing the engagement between the locking member 8a and the locking wall 7d through the driving member 13, which can be carried out by switching the operating member 7 automatically from its locked state to its unlocked state by the driving source 12 comprising a solenoid.

[0084] Also, it is possible to turn on and off the second switch 10 by moving the locked operating member 7 back and forth in the extra stroke Y.

[0085] Therefore, when the switching device S of the present invention is used for a power circuit of a fan heater or other electric appliances, for example, and the first switch 5 is turned on to retain the operating member 7 in its locked state, the operating member 7 in the extra stroke Y is slid in the arrow F's direction to turn on the second switch 10 so that the combustion of the fan heater (not shown) is stopped.

[0086] When a control circuit (not shown) with a micro computer, etc. of the fan heater detects the ON signal of the second switch 10, a preparatory process under the control of the control circuit is carried out for a given length of time so that incomplete combustion while the fan heater is being turned off is prevented or feeding fuel to the combustion unit is shut off and so forth. Then, the driving source 12 is activated under the control circuit to automatically turn off the first switch 5 and properly extinguish the fan heater.

[0087] Also, when the control circuit has problems including a runaway because of some reasons, the movable core 12a of the driving source 12 comprising a solenoid can be forcibly operated by hand to release the operating member 7 from its locked state and, at the same time, turn off the first switch 5. Therefore, the fan heater is forcibly extinguished so that the control circuit can be prevented from being damaged by troubles

including a fire which may be caused by the runaway and so on.

[0088] Thus, in the switching device S of the present invention, the driving source 12 comprises a solenoid and the operating member 7 is switched from its locked state to its unlocked state automatically by the driving source 12 operating through the driving member 13 or forcibly by operating the movable core 12a by hand.

[0089] For that purpose, the switching device S also has a forcible turning-off mechanism to forcibly turn off the first switch 5.

[0090] Further, the operation of the second switch 10 can be switched not only by the extra stroke of the operation member 7 but also in such a way that the second switch 10 connected to the control system circuit is provided on an operation panel of an equipment and directly operated.

[0091] In the switching device of the present invention, the operation member is retained in its locked state while it is moving back and forth in the extra stroke and is switched automatically from its locked state to its unlocked state by the driving source operating through the driving member. Accordingly, when the operating member moves back and forth within the extra stroke, the operation member is retained in its locked state. Further, when the operating member is released from its locked state, such operation is done not by the operating member but by the automatic operation through the driving member. Therefore, the primary circuit may not be accidentally shut off by the operation of the operating member, a predetermined processing before a shut-off of a power circuit of an equipment is done with reliability, and the power circuit of the equipment is shut off afterward.

[0092] Accordingly, an appliance, which needs less power consumption in the dormant state of the primary circuit and is environmentally friendly, can be provided even if such appliance is the one requiring a preparatory process when being turned off.

[0093] Further, a first flat is provided in the cam bottom surface on which the locking member remains while the operating member is moving in the extra stroke, and a part of the side wall defining the recessed cam portion around the first flat is formed into a guide wall, which guides the locking member to prevent it from escaping to a second flat adjacent to and lower than the first flat while the operating member moves back and forth in the extra stroke. Accordingly, while the operating member is moving back and forth in the extra stroke, the operating member can be firmly retained in its locked state by the guide wall. Therefore, a predetermined processing before a shut-off of the power circuit of the equipment can be done with reliability.

[0094] Further, a second switch is provided in juxtaposition to the first switch, the first switch remaining on while the operating member is in its locked state and off while the operating member is in its unlocked state, the

second switch being turned on and off while the operating member moves back and forth in the extra stroke. Subsequently, the operating member 7 in the extra stroke Y is slid to turn the second switch on, and when a control circuit of a fan heater, etc. detects the ON signal, the first switch can be automatically turned off by the driving source after a preparatory process is carried out for a given length of time. Therefore, it is not necessary to equip a control panel of the appliance with an additional separate switch, thereby simplifying the configuration of the operation part of the appliance.

[0095] Further, the driving source comprises a solenoid having a movable core, the operating member being switched from its locked state to its unlocked state automatically by the driving source operating through the driving member or forcibly by operating the movable core by hand. Therefore, even when the driving source cannot be driven because of some abnormal conditions, it is possible to forcibly shut off the power circuit of the appliance such as a fan heater, for example, by manually pressing the movable core and to prevent troubles caused by abnormal conditions, thereby providing a switching device with a superior level of safety.

[0096] Further, since the driving source, the operating member, and the first and second switches are mounted on a frame, it is possible to provide a switching device which is easy to assemble and operate.

Claims

1. A switching device comprising:

a driving member having a cam surface on its one end portion;

a driving source for driving the driving member;

a slidable operating member;

a first switch to be turned on and off by switching the operating member between its locked and unlocked states;

a recessed cam portion formed in part of the operating member;

a cam bottom surface formed at the bottom of the recessed cam portion by combining a plurality of flats of different depths;

a locking wall formed to be projected and adjacent to the cam bottom surface; and

a locking member which, by sliding the operating member, is guided by the cam bottom surface of the recessed cam portion to come in contact with the locking wall and retains the operating member in its locked state,

the operating member having an extra stroke to slide from the position of the locked state farther in one direction and being retained in its locked state while it is moving back and forth in the extra stroke and being switched automatically from its locked state to its unlocked state by the driving source operating through the driving member.

2. A switching device according to claim 1, wherein:

a first flat is provided in the cam bottom surface on which the locking member remains while the operating member is moving in the extra stroke; and

a part of the side wall defining the recessed cam portion around the first flat is formed into a guide wall, which guides the locking member to prevent it from escaping to a second flat adjacent to and lower than the first flat while the operating member moves back and forth in the extra stroke.

3. A switching device according to claim 1 or 2, wherein a second switch is provided in juxtaposition to the first switch, the first switch remaining on while the operating member is in its locked state and off while the operating member is in its unlocked state, and the second switch being turned on and off while the operating member moves back and forth in the extra stroke.

4. A switching device according to claim 1, 2, or 3, wherein the driving source comprises a solenoid having a movable core and the operating member is switched from its locked state to its unlocked state automatically by the driving source operating through the driving member or forcibly by operating the movable core by hand.

5. A switching device according to claim 1 or 3, wherein the driving source, the operating member, and the first and second switches are mounted on a frame.

FIG. 1

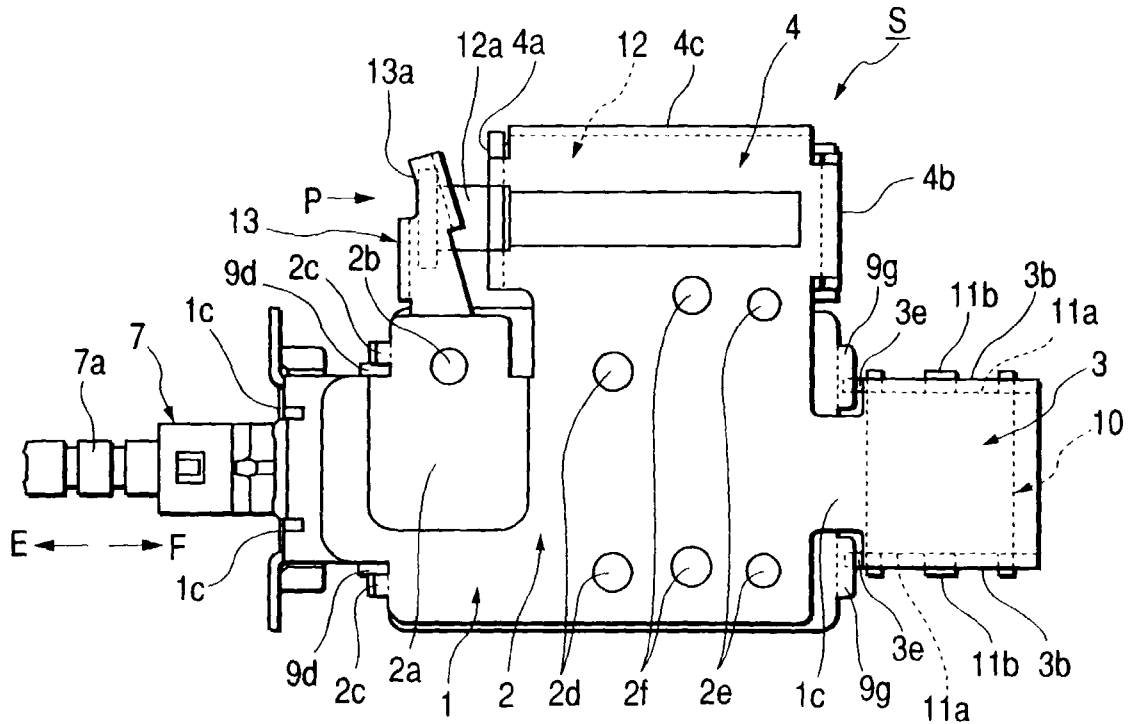


FIG. 2

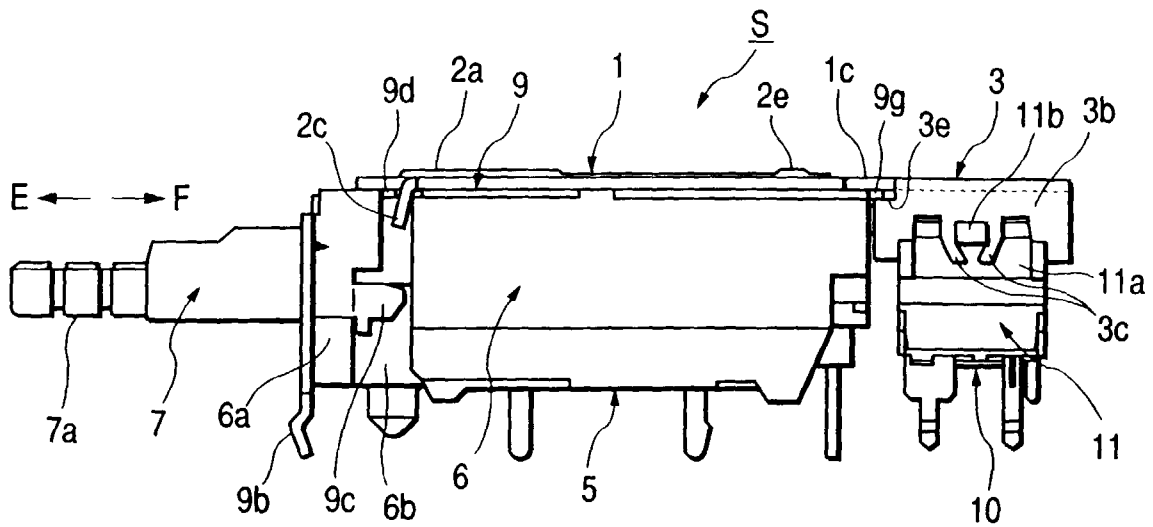


FIG. 3

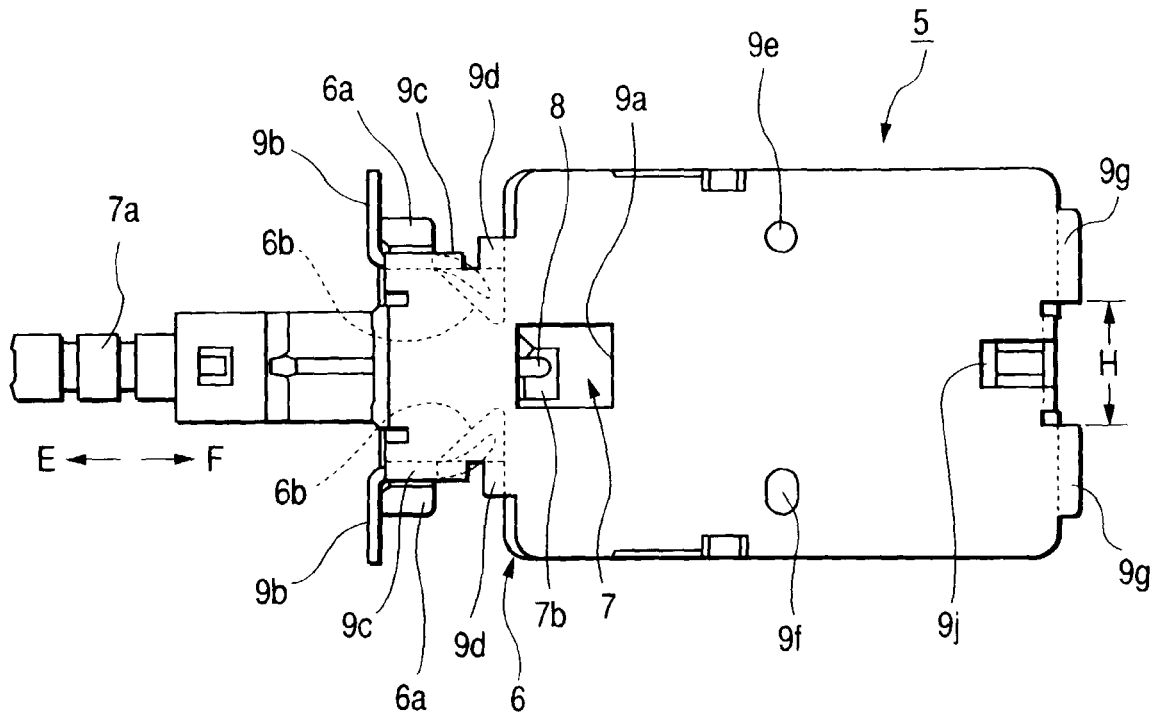


FIG. 4

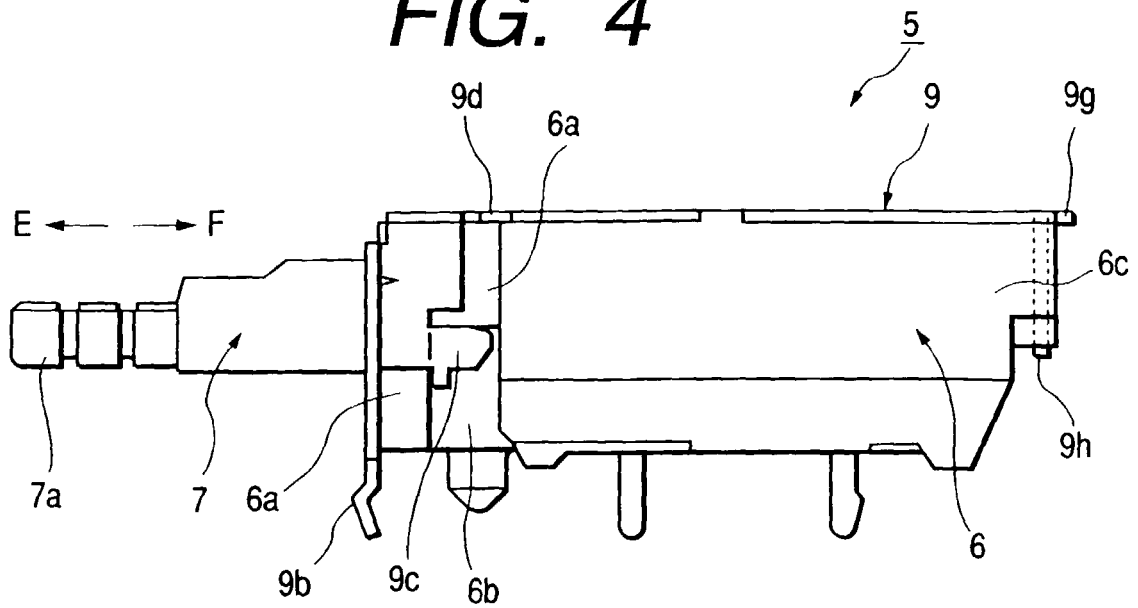


FIG. 5

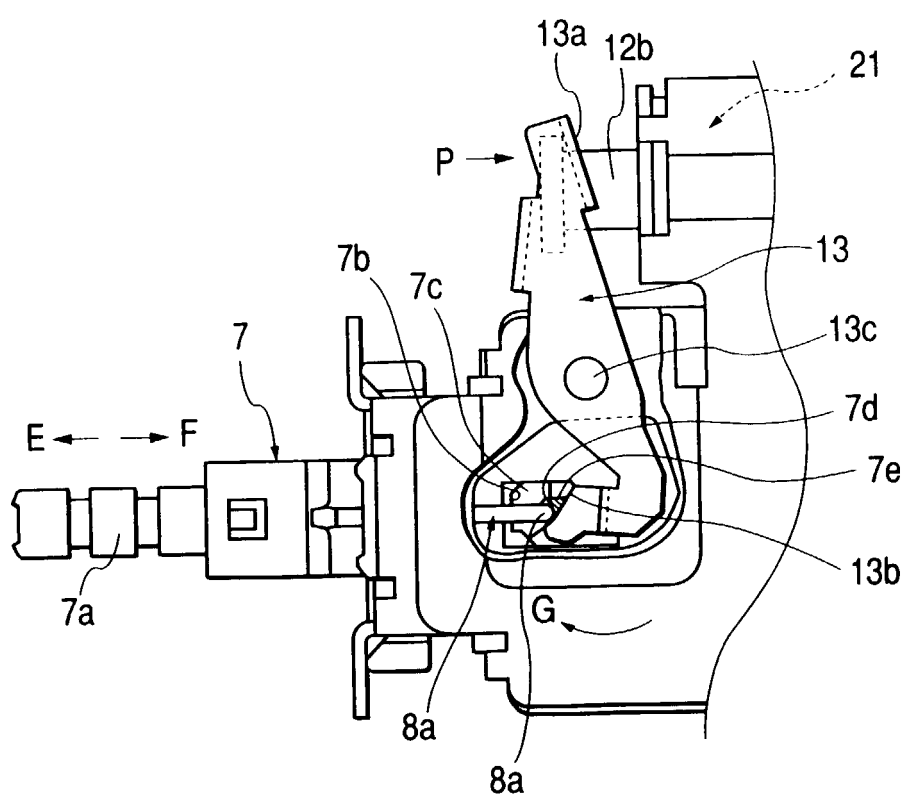


FIG. 6

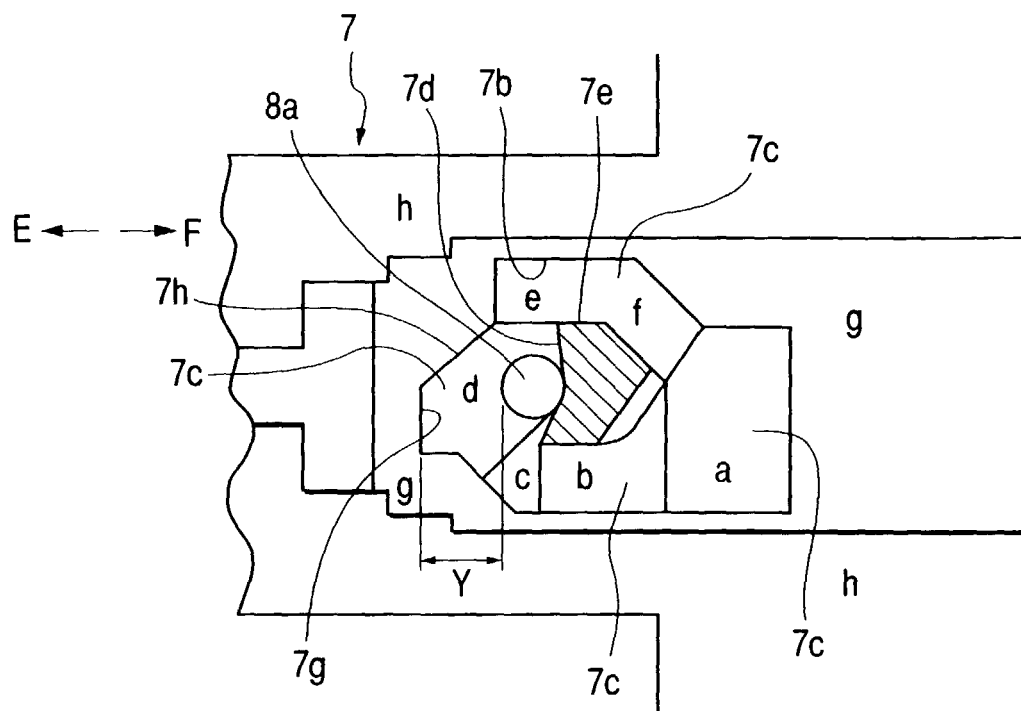


FIG. 7

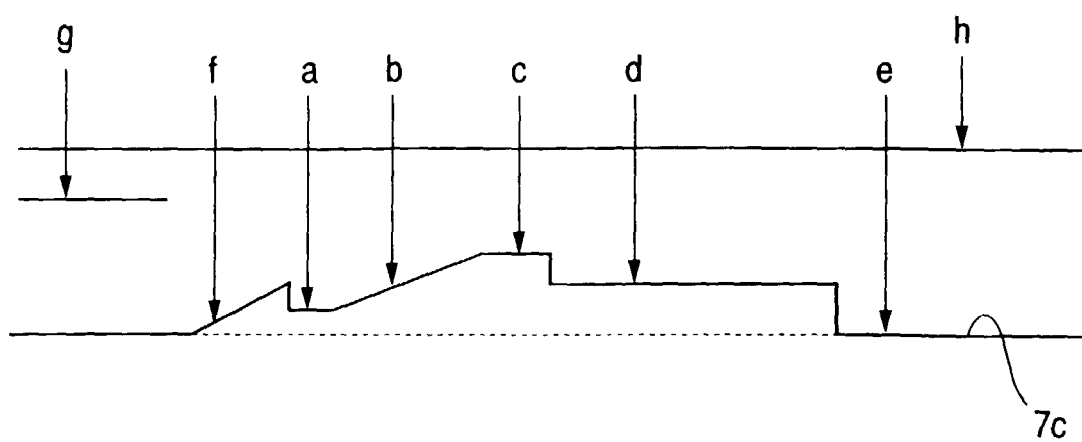


FIG. 8

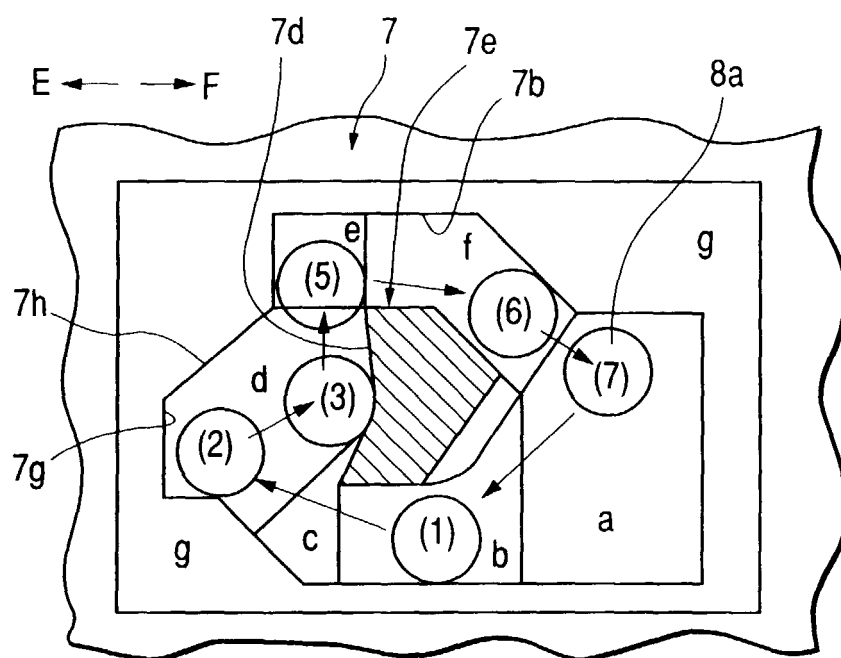


FIG. 9

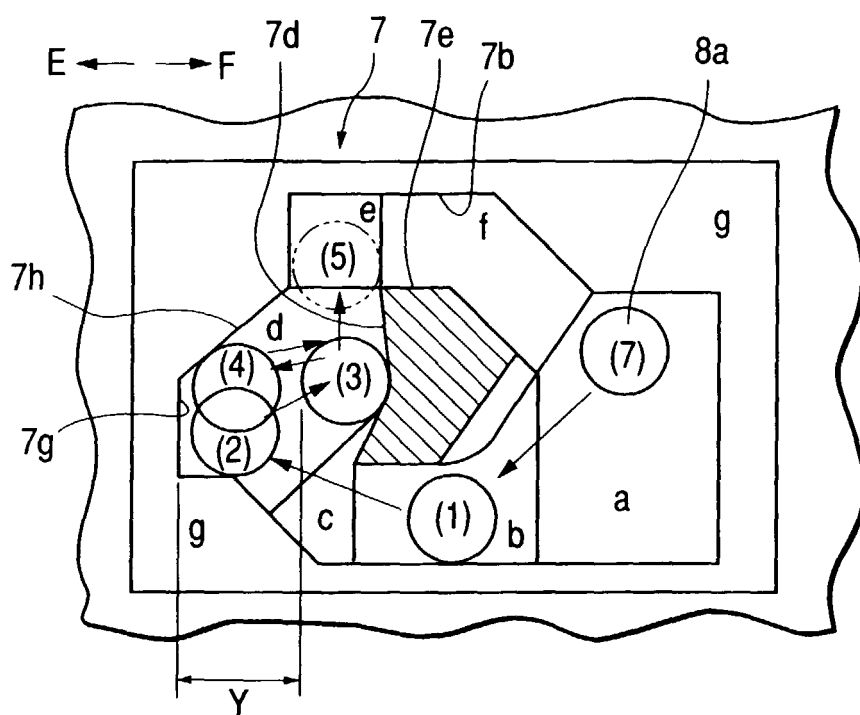


FIG. 10

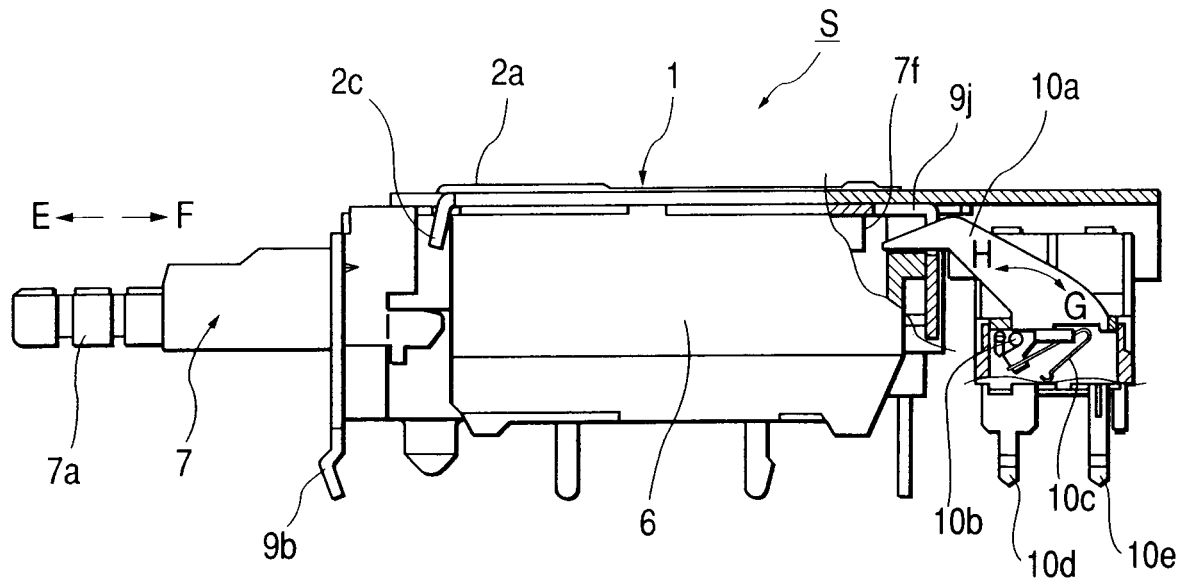


FIG. 11 PRIOR ART

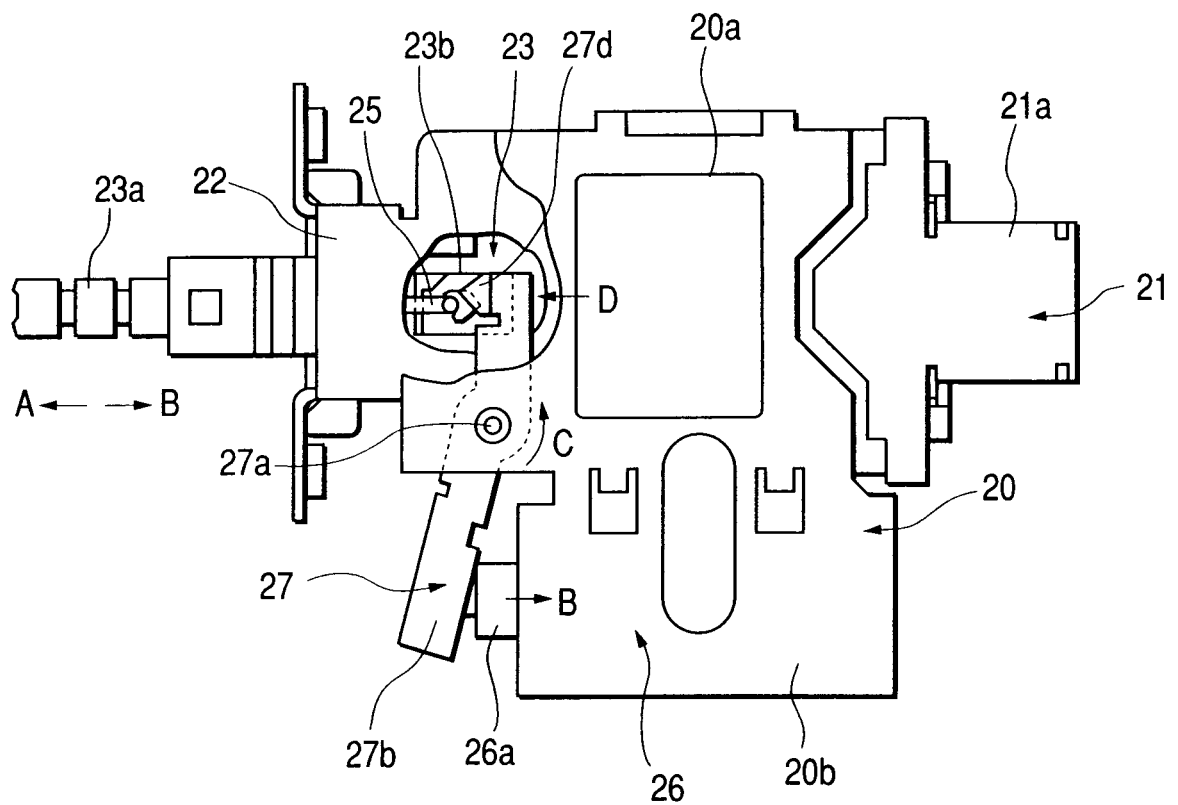
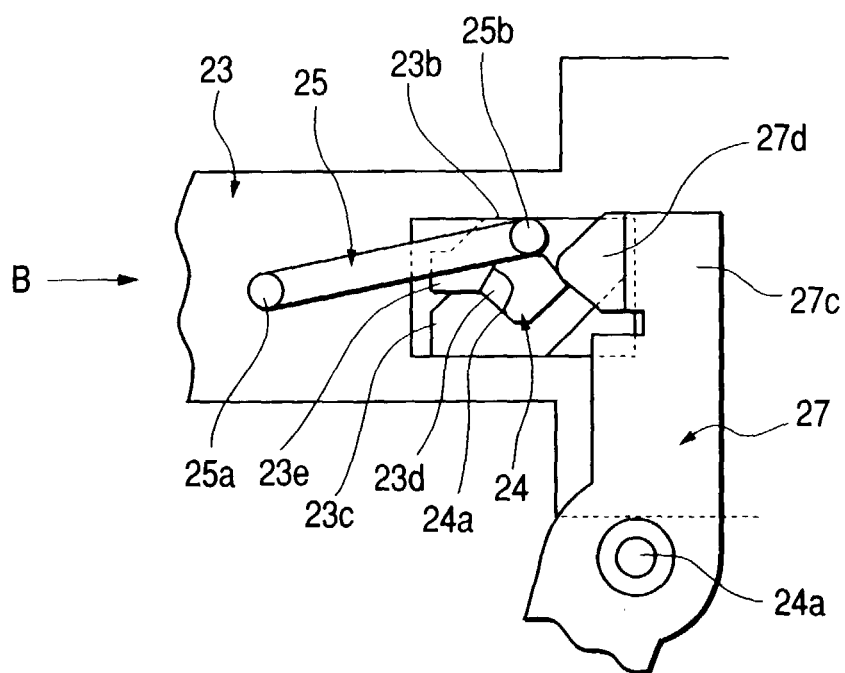


FIG. 12 PRIOR ART





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 99 12 4137

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 195 19 181 A (ALPS ELECTRIC CO LTD) 30 November 1995 (1995-11-30) * the whole document * -----	1-5	H01H13/56
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01H
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 8 March 2000	Examiner Mausser, T
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08-03-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82