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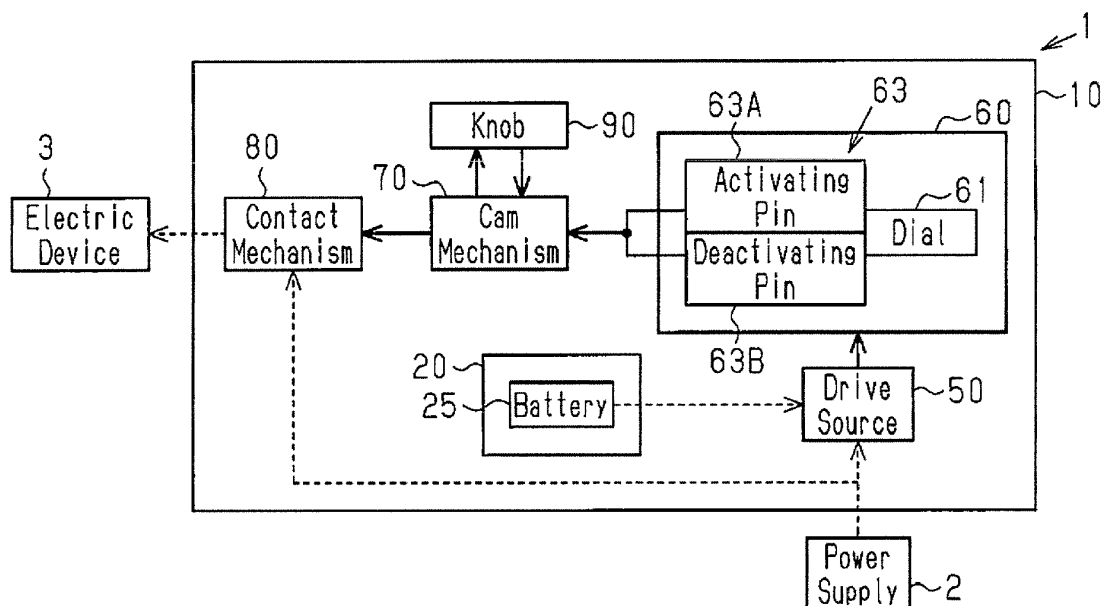
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(54) **TIME SWITCH**

(57) A time switch (1) includes a case (10), a timer mechanism (60), a battery holder (20), a lid (30), and a tool insertion hole (40). The case (10) accommodates a drive source (50). The timer mechanism (60) is driven by the drive source (50). The battery holder (20) is capable of accommodating a power failure backup battery (25) that supplies power to the drive source (50) during a power

failure. The battery holder (20) includes an opening (22) that opens in a front surface or a side surface of the case (10). The lid (30) is capable of opening and closing the opening (22). The tool insertion hole (40) allows for insertion of a tool (100) between the case (10) and the lid (30).

Fig.1



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Description

[0001] The present invention relates to a time switch that includes a power failure backup battery.

[0002] A time switch, which is arranged in an electric power line that electrically connects a power supply and an electric device, manages the time at which the supply of power from the power supply to the electric device is started and the time at which the supply of power from the power supply to the electric device is stopped. Japanese Laid-Open Patent Publication No. 2005-63923 discloses one example of a conventional time switch that includes a contact mechanism, a cam mechanism, and a timer mechanism. The contact mechanism is switched between an activation state in which the contact mechanism closes the electric power line and a deactivation state in which the contact mechanism opens the electric power line. The cam mechanism switches the operation state of the contact mechanism. The timer mechanism operates the cam mechanism in accordance with the measured time. The time switch further includes an electric motor, which drives the timer mechanism with power supplied from a commercial power supply, and an activating pin and a deactivating pin, which are attached to the timer mechanism to switch the operation state of the contact mechanism. The activating pin and the deactivating pin are coupled to the timer mechanism in a removable manner.

[0003] In the above time switch, the timer mechanism to which the activating pin and the deactivating pin are attached is driven to change the rotation positions of the activating pin and the deactivating pin relative to the cam mechanism as time elapses. For example, if the activating pin comes into contact with the cam mechanism when the contact mechanism is deactivated, the torque of the timer mechanism moves the cam mechanism so that the operation state of the contact mechanism is switched from the deactivation state to the activation state. This starts the supply of power from the power supply to the electric device. If the deactivating pin comes into contact with the cam mechanism when the contact mechanism is activated, the torque of the timer mechanism moves the cam mechanism so that the operation state of the contact mechanism is switched from the activation state to the deactivation state. This stops the supply of power from the power supply to the electric device.

[0004] However, when a power failure occurs, the electric motor of the time switch stops. This stops the timer mechanism. Thus, the timer mechanism cannot measure the present time. Even if the power supply is restored, the time measured by the timer mechanism is later than the present time. In this case, the time when the activating pin or the deactivating pin comes into contact with the cam mechanism is later than the scheduled time, and the time for starting or stopping the supply of power from the power supply to the electric device is later than the scheduled time.

[0005] To solve this problem, the time switch may in-

clude, for example, a power failure backup battery that supplies power to the electric motor during a power failure. In the time switch including the power failure backup battery (hereinafter referred to as the "reference example time switch"), the timer mechanism continues to operate even when a power failure occurs. Thus, the time switch accurately measures the present time. This reduces situations in which the time for starting or stopping the supply of power from a power supply to an electric device is later than the scheduled time.

[0006] If the working efficiency for replacing the power failure backup battery is not taken into account, the reference example time switch may have the following problem. For example, when a battery holder that holds the power failure backup battery has an opening located in the back surface of the time switch, a lid that closes the opening is arranged on the back surface of the time switch. Since the time switch is normally attached to a wall, the user needs to remove the time switch from the wall when replacing the power failure backup battery.

[0007] This problem can be solved by, for example, forming a battery holder that includes an opening in the front surface of the time switch. However, the lid is more noticeable when arranged on the front surface of the time switch than when arranged on the back surface of the time switch. Thus, someone may erroneously remove the lid. The same problem occurs when the opening of the battery holder is located in a side surface of the time switch.

[0008] It is an object of the present invention is to provide a time switch that allows for easy replacement of the power failure backup battery and restricts erroneous removal of the lid from the battery holder.

[0009] One aspect of the present invention is a time switch that includes a case, a timer, a battery holder, a lid, and a tool insertion hole. The case accommodates a drive source. The timer mechanism is driven by the drive source. The battery holder is capable of accommodating a power failure backup battery that supplies power to the drive source during a power failure. The battery holder includes an opening that opens in a front surface or a side surface of the case. The lid is capable of opening and closing the opening. The tool insertion hole allows for insertion of a tool between the case and the lid.

[0010] The time switch according to the above aspect allows for easy replacement of a power failure backup battery and restricts erroneous removal of the lid from the battery holder. Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

[0011] The invention, together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a block diagram showing one embodiment of a time switch;

Fig. 2 is a front view showing one example of the time switch of Fig. 1;

Fig. 3 is a front view of a lid shown in Fig. 2;

Fig. 4 is a cross-sectional view taken along line D4-D4 in Fig. 2;

Fig. 5 is a perspective view of a tool that is inserted into a tool insertion hole shown in Fig. 2; and

Fig. 6 is a perspective view showing the lid of Fig. 2 when removed from a case.

[0012] Fig. 1 is a block diagram showing the relationship between the main components of a time switch 1 according to one embodiment. In Fig. 1, the solid lines show the mechanical connection between the components of the time switch 1, and the broken lines show the electrical connection between the components of the time switch 1.

[0013] The time switch 1 is arranged in an electric power line that electrically connects a power supply 2 and an electric device 3. One example of the power supply 2 is a commercial power supply. One example of the electric device 3 is an electric lock installed in a building. When a contact mechanism 80 of the time switch 1 is activated, the power supply 2 and the electric device 3 are electrically connected. When the contact mechanism 80 of the time switch 1 is deactivated, the power supply 2 and the electric device 3 are electrically disconnected.

[0014] In addition to the contact mechanism 80, the time switch 1 includes a cam mechanism 70, which switches the operation state of the contact mechanism 80, a timer mechanism 60, which operates the cam mechanism 70 in accordance with the measured time, and a drive source 50, which drives the timer mechanism 60. One example of the drive source 50 is an electric motor. The timer mechanism 60 includes a dial 61, which is rotated by the drive force of the drive source 50. The dial 61 is essentially a clock that measures the present time.

[0015] The time switch 1 further includes a case 10, which forms the contour of the time switch 1, a setting pin 63, which uses the torque of the timer mechanism 60 to operate the cam mechanism 70, and a knob 90, which is operated to switch the operation state of the contact mechanism 80. The contact mechanism 80, the cam mechanism 70, the timer mechanism 60, and the drive source 50 are accommodated in the case 10.

[0016] The setting pin 63, which is coupled to the dial 61 in a removable manner, rotates integrally with the dial 61 when attached to the dial 61. The time switch 1 includes two types of setting pins 63, namely, an activating pin 63A and a deactivating pin 63B. The activating pin 63A is attached to the dial 61 to switch the operation state of the contact mechanism 80 to the activation state. The deactivating pin 63B is attached to the dial 61 to switch the operation state of the contact mechanism 80 to the deactivation state.

[0017] The case 10 includes a battery holder 20, which

is able to accommodate a battery 25. The battery 25 is a power failure backup battery that supplies power to the drive source 50 during a power failure. When using the time switch 1, the user attaches the battery 25 to the battery holder 20. The battery 25 attached to the battery holder 20 is electrically connected to the drive source 50. When a power failure occurs in the power supply 2, the power of the battery 25 drives the drive source 50. Thus, even when a power failure occurs in the power supply 2, the timer mechanism 60 continues to function as a timer.

[0018] The knob 90 may be located at a first operation position, at which the knob 90 sets the operation state of the contact mechanism 80 to the activation state, and a second operation position, at which the knob 90 sets the operation state of the contact mechanism 80 to the deactivation state. The operation position of the knob 90 is changed by the user. When the operation position of the knob 90 is set to the first operation position, the cam mechanism 70 is operated regardless of the rotation position of the activating pin 63A. This switches the operation state of the contact mechanism 80 to the activation state. When the operation position of the knob 90 is set to the second operation position, the cam mechanism 70 is operated regardless of the rotation position of the deactivating pin 63B. This switches the operation state of the contact mechanism 80 to the deactivation state.

[0019] Fig. 2 is a front view showing one example of the time switch 1.

[0020] The case 10 includes a main wall 11, which forms the front surface of the case 10, side walls 12, which form the side surfaces of the case 10, and a dial arrangement portion 13, in which the dial 61 is arranged. The dial arrangement portion 13 is a recess that is formed in the substantially middle portion of the case 10 and opens in the main wall 11. The battery holder 20 is a recess located diagonally downward from the dial arrangement portion 13 in the case 10 and opens in the main wall 11.

[0021] The time switch 1 further includes a terminal group 14, to which power supply wires (not shown) and device wires (not shown) are connected. The power supply wires are connected to the power supply 2 (refer to Fig. 1), and the device wires are connected to the electric device 3 (refer to Fig. 1). The terminal group 14, which is located in the lower portion of the case 10, includes a first terminal 14A, a second terminal 14B, a third terminal 14C, and a fourth terminal 14D.

[0022] A power supply wire connected to the positive terminal of the power supply 2 is connected to the first terminal 14A. A power supply wire connected to the negative terminal of the power supply 2 is connected to the second terminal 14B. A device wire connected to the negative terminal of the electric device 3 is connected to the third terminal 14C. A device wire connected to the positive terminal of the electric device 3 is connected to the fourth terminal 14D. The first and second terminals 14A and 14B may be referred to as power input terminals. The third and fourth terminals 14C and 14D may be re-

ferred to as power output terminals.

[0023] In addition, the time switch 1 includes a transparent protection cover 15, which is coupled to the case 10 in a removable manner, a lid 30, which is coupled to the case 10 in a removable manner, and a tool insertion hole 40, into which a tool 100 can be inserted (refer to Fig. 5). The protection cover 15 is attached to the case 10 to cover the front surface of the case 10. The lid 30 is attached to the case 10 to close the opening of the battery holder 20.

[0024] The timer mechanism 60 includes the dial 61 and a time plate 62, which indicates the present time. In one example, the dial 61 rotates once every twenty-four hours. The front surface of the dial 61 includes time marks (not shown) indicating twenty-four hours of time.

[0025] The time plate 62 includes a present time indicator 62A, which indicates the present time, and a rotation direction indicator 62B, which is represented by an arrow that indicates the rotation direction of the dial 61. When the rotation position of the dial 61 relative to the time plate 62 is set so that the time mark indicating the present time on the dial 61 is aligned with the present time indicator 62A of the time plate 62, the time measured by the dial 61 corresponds to the present time. From this state, when the dial 61 continues to be operated by the drive force of the drive source 50 (refer to Fig. 1), the time mark of the dial 61 corresponding to the present time indicator 62A of the time plate 62 will indicate the present time.

[0026] The contact mechanism 80 (refer to Fig. 1) includes a first metal plate (not shown) and a second metal plate (not shown), which form contacts. In one example, the first metal plate is electrically connected to the fourth terminal 14D, and the second metal plate is electrically connected to the first terminal 14A. Each of the metal plates partially contacts the cam mechanism 70 (refer to Fig. 1).

[0027] When the activating pin 63A comes into contact with the cam mechanism 70 as the dial 61 rotates, the torque of the dial 61 rotates the cam mechanism 70 so that the contacts of the metal plates come into contact with each other. This electrically connects the power supply 2 and the electric device 3. When the deactivating pin 63B comes into contact with the cam mechanism 70 as the dial 61 rotates, the torque of the dial 61 rotates the cam mechanism 70 so that the contacts of the metal plates are separated from each other. This electrically disconnects the power supply 2 and the electric device 3.

[0028] The time switch 1, which is electrically connected to the power supply 2 and the battery 25, further includes a control circuit (not shown). The control circuit switches the electrical connection state of the battery 25 and the drive source 50. When the control circuit does not receive a signal indicating the occurrence of a power failure in the power supply 2, the control circuit does not electrically connect the battery 25 and the drive source 50. When the control circuit receives a signal indicating the occurrence of a power failure in the power supply 2,

the power circuit electrically connects the battery 25 and the drive source 50.

[0029] Fig. 3 is a front view of the lid 30.

[0030] The lid 30 includes a flat body 31, a hook 32, which projects from the back surface of the body 31 toward the back side of the case 10 (refer to Fig. 2), and an insertion portion 33, which projects from the back surface of the body 31 in the planar direction. The body 31 is pentagonal.

[0031] The periphery of the body 31 includes a first side 31 A, a second side 31 B, a third side 31 C, a fourth side 31 D, and a fifth side 31 E. The first side 31 A is close to the side wall 12 (refer to Fig. 2) and extends in the longitudinal direction of the case 10. The third side 31 C is parallel to and shorter than the first side 31 A. The second side 31 B, which extends in the lateral direction of the case 10, connects the first side 31 A and the third side 31 C. The fourth side 31 D is parallel to and shorter than the second side 31 B. The fifth side 31 E, which is an arcuate side curved in conformance with the shape of the dial arrangement portion 13 (refer to Fig. 2), connects the third side 31 C and the fourth side 31 D.

[0032] Fig. 4 shows the cross-sectional structure of the battery holder 20.

[0033] The case 10 includes the main wall 11, the side walls 12, an inner wall 16, which extends from the back surface of the main wall 11 toward the back side of the case 10, and an inner bottom wall 17, which is connected to the side wall 12 and the inner wall 16. The inner bottom wall 17 is pentagonal. One side of the inner bottom wall 17 is connected to the side wall 12. The inner wall 16 extends from the other four sides of the inner bottom wall 17 toward the front of the case 10.

[0034] The battery holder 20 includes an accommodation cavity 21 and an opening 22. The accommodation cavity 21 is encompassed by the side wall 12, the inner wall 16, and the inner bottom wall 17 of the case 10. The opening 22, which is an opening of the accommodation cavity 21, opens in the main wall 11 of the case 10. The battery 25 is arranged in the accommodation cavity 21.

[0035] A fitting hole 23 extends through a portion of the side wall 12 that forms the battery holder 20. The hook 32 of the lid 30 is fitted into the fitting hole 23 to fix the lid 30 to the case 10 and close the opening 22. A hole 24 extends through a portion of the inner wall 16 that opposes the side wall 12. When the lid 30 is attached to the case 10, the insertion portion 33 is first inserted into the hole 24. Then, the hook 32 is fitted into the fitting hole 23. The tool 100 (refer to Fig. 5) can be inserted into the fitting hole 23, which substantially functions in the same manner as the tool insertion hole 40. Thus, the fitting hole 23 can be used as a second tool insertion hole.

[0036] The tool insertion hole 40 extends between the hook 32 of the lid 30 and the inner surface of the side wall 12. The portion of the inner surface of the side wall 12 that forms the tool insertion hole 40 defines a guiding surface 22A. The guiding surface 22A is inclined so that the tool insertion hole 40 is wider at the opening of the

tool insertion hole 40 than at a deep portion of the insertion hole 40. When inserting the tool 100 into the tool insertion hole 40, the inclination of the guiding surface 22A smoothly guides the distal end of the tool 100.

[0037] The replacement of the battery 25 will now be described with reference to Figs. 5 and 6.

[0038] The battery 25 of the time switch 1 is replaced, for example, in the following manner. First, the tool 100 is inserted into the tool insertion hole 40. In Fig. 5, a flat-blade screwdriver, which is one example of the tool 100, is inserted to the tool insertion hole 40. Second, the tool 100 is tilted. That is, the handle of the tool 100 is tilted toward the side wall 12. This removes the hook 32 from the fitting hole 23 and lifts the lid 30 from the case 10.

[0039] Third, the insertion portion 33 (refer to Fig. 6) is drawn out of the hole 24 (refer to Fig. 6), and the lid 30 is removed from the case 10 to open the opening 22 (refer to Fig. 6). Fig. 6 shows the opening 22 when open. Fourth, the battery 25 is removed from the accommodation cavity 21, and a new battery 25 is attached to the battery holder 20.

[0040] Fifth, the insertion portion 33 is inserted into the hole 24, and the hook 32 is guided by the guiding surface 22A (refer to Fig. 4) and fitted into the fitting hole 23. This attaches the lid 30 to the case 10 and closes the opening 22.

[0041] The time switch 1 has the advantages described below.

(1) The time switch 1 includes the battery 25, which supplies power to the drive source 50 during a power failure. In this structure, the timer mechanism 60 is continuously driven even when a power failure occurs. This allows the timer mechanism 60 to accurately measure the present time. Thus, delays from the scheduled time are reduced for the starting or stopping of the supply of power from the power supply 2 to the electric device 3.

(2) The battery holder 20 includes the opening 22, which opens in the main wall 11. This allows the battery 25 to be replaced more easily than when the battery holder 20 opens in the back surface of the case 10.

(3) The structure of a lid configured to close the opening of the battery holder 20 may include, for example, a handle used to remove the lid (hereinafter referred to as "handle-attached lid") from the battery holder 20, in addition to the lid 30 that is removable by the tool 100. In such a handle-attached lid, one holds and pulls the handle to remove the lid from the case 10. The handle acts as an indicator that shows how to remove the handle-attached lid. If the user recognizes the handle, this may prompt the user to remove the handle-attached lid. In contrast, the time switch 1 includes the tool insertion hole 40, which is used to remove the lid 30, and the lid 30 does not include the above handle. In this structure, the user is less likely to be prompted to remove the lid 30. Further,

even if the user recognizes the lid 30, the user would need the tool 100 to remove the lid 30. Thus, the time switch 1 restricts erroneous removal of the lid 30.

(4) As described in advantages (2) and (3), the battery 25 of the time switch 1 is easily replaceable. The time switch 1 contributes to reducing situations in which the lid 30 is removed erroneously.

(5) The battery holder 20 includes the fitting hole 23. The lid 30 includes the hook 32. This structure allows the lid 30 to be removed more easily from the case 10 than when, for example, the lid 30 is fixed to the case 10 by a fastener that is separate from the lid 30.

(6) The battery holder 20 includes the hole 24. The lid 30 includes the insertion portion 33. In this structure, when attaching the lid 30 to the case 10, the insertion portion 33 is first inserted into the hole 24 to position the lid 30 relative to the case 10. This facilitates the attachment of the lid 30 to the case 10.

[0042] The description of the above embodiment illustrates the time switch according to one embodiment of the the present invention and is not considered to be restrictive. In addition to the above embodiment, the time switch according to the present invention may include, for example, the following modified examples and an embodiment in which at least two of the modified examples that do not contradict with one another are combined.

[0043] The case 10 of a modified example includes a battery holder that opens in the side wall 12 instead of the battery holder 20 that opens in the main wall 11.

[0044] The battery holder 20 of a modified example includes a recess into which the insertion portion 33 is inserted, instead of the hole 24 into which the insertion portion 33 is inserted. In one example, the recess opens in an inner surface of the inner wall 16 that opposes the side wall 12 and faces the battery holder 20.

[0045] The side wall 12 of a modified example includes a recess into which the hook 32 is fitted instead of the fitting hole 23 into which the hook 32 is fitted. In one example, the recess opens in the inner surface of the side wall 12.

[0046] The time switch 1 of a modified example does not include the tool insertion hole 40. The time switch 1 of the modified example includes the fitting hole 23, which may function as a tool insertion hole. Thus, even if the tool insertion hole 40 does not exist, the time switch of the modified example has the advantages of the embodiment.

[0047] In the time switch 1 of a modified example, the battery holder 20 does not include the hole 24, and the insertion portion 33 does not include the lid 30. In this case, for example, the lid 30 can be connected to the case 10 in a manner allowing the lid 30 to open and close the case 10. In one example, a hinge couples the third side 31C of the lid 30 and the battery holder 20.

[0048] The structure for removing the lid 30 from the case 10 may be changed to any structure. Instead of the

structure in which the hook 32 of the lid 30 is fitted into the fitting hole 23 of the case 10, the time switch 1 of a modified example includes a structure in which the lid 30 is fixed to the case 10 by a fastener that is removable by a tool. One example of the fastener is a screw. The time switch 1 of the modified example does not have to include the tool insertion hole 40.

[0049] The disclosure further encompasses various example(s) described below.

[Clause 1] A time switch comprising:

a case that accommodates a drive source;
 a timer mechanism driven by the drive source;
 a battery holder capable of accommodating a power failure backup battery that supplies power to the drive source during a power failure, wherein the battery holder includes an opening that opens in a front surface or a side surface of the case;
 a lid capable of opening and closing the opening;
 and
 a tool insertion hole that allows for insertion of a tool, wherein the tool insertion hole extends through a portion of the case that forms the battery holder.

[Clause 2] A time switch comprising:

a case that accommodates a drive source;
 a timer mechanism driven by the drive source;
 a battery holder capable of accommodating a power failure backup battery that supplies power to the drive source during a power failure, wherein the battery holder includes an opening that opens in a front surface or a side surface of the case;
 a lid capable of opening and closing the opening;
 and
 a fastener that is removable by a tool, wherein the fastener fixes the lid to the case.

[0050] The above description is intended to be illustrative, and not restrictive. For example, the above-described examples (or one or more aspects thereof) may be used in combination with each other. Other embodiments can be used, such as by one of ordinary skill in the art upon reviewing the above description. Also, in the above detailed description, various features may be grouped together to streamline the disclosure. This should not be interpreted as intending that an unclaimed disclosed feature is essential to any claim. Rather, inventive subject matter may lie in less than all features of a particular disclosed embodiment. Thus, the following claims are hereby incorporated into the detailed description, with each claim standing on its own as a separate embodiment. The scope of the invention should be determined with reference to the appended claims, along

with the full scope of equivalents to which such claims are entitled.

5 Claims

1. A time switch (1) comprising:

a case (10) that accommodates a drive source (50);
 a timer mechanism (60) driven by the drive source (50);
 a battery holder (20) capable of accommodating a power failure backup battery (25) that supplies power to the drive source (50) during a power failure, wherein the battery holder (20) includes an opening (22) that opens in a front surface or a side surface of the case (10);
 a lid (30) capable of opening and closing the opening (22); and
 a tool insertion hole (40) that allows for insertion of a tool (100) between the case (10) and the lid (30).

2. The time switch (1) according to claim 1, wherein the case (10) includes a side wall, the side wall forms a portion of the battery holder (20), the side wall includes a hole that extends through the side wall or a recess that opens in an inner surface of the side wall, and the lid (30) includes a hook that is fitted into the hole or the recess.

3. The time switch (1) according to claim 2, wherein the case (10) includes an inner wall formed at a location opposing the side wall, the inner wall forms a portion of the battery holder (20), the inner wall includes a hole that extends through the inner wall or a recess that opens in an inner surface of the inner wall that faces the battery holder (20), and the lid (30) includes an insertion portion (33) that is allowed to be inserted into the hole or the recess.

Fig.1

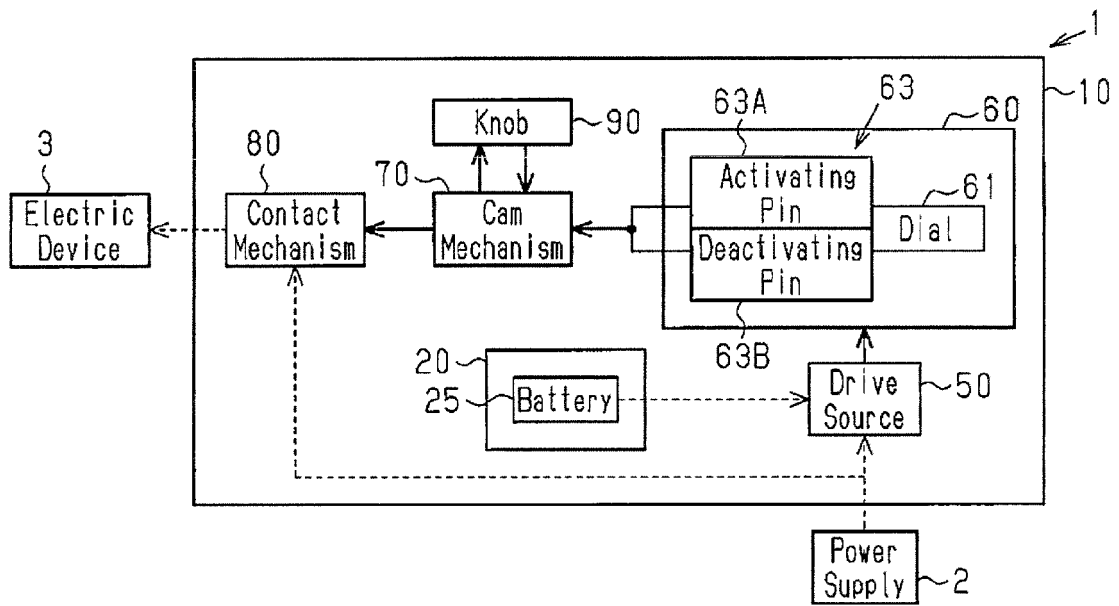


Fig.2

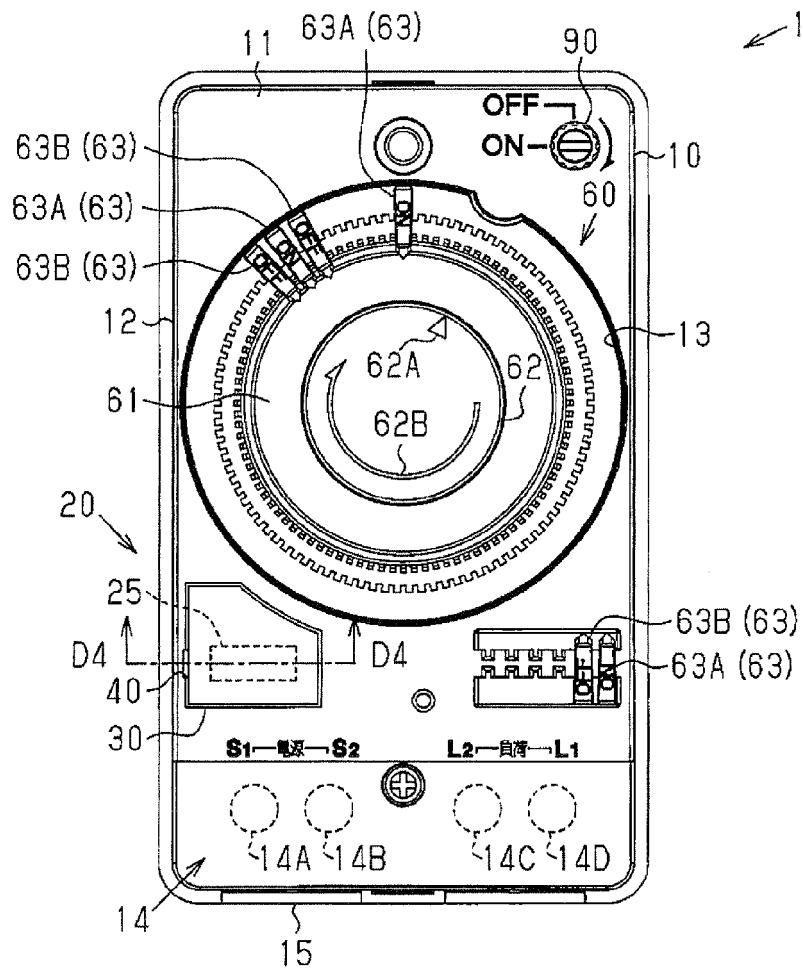


Fig.3

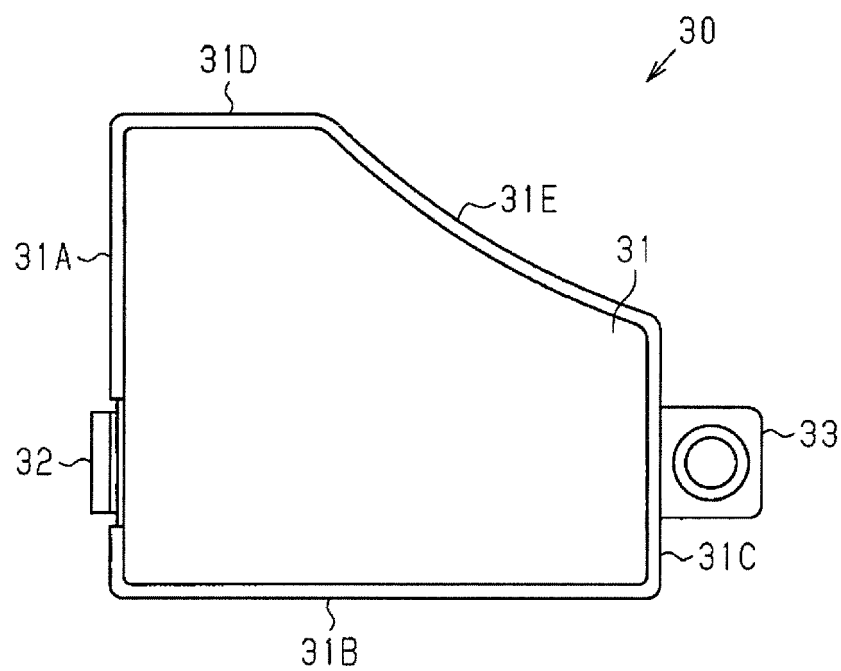


Fig.4

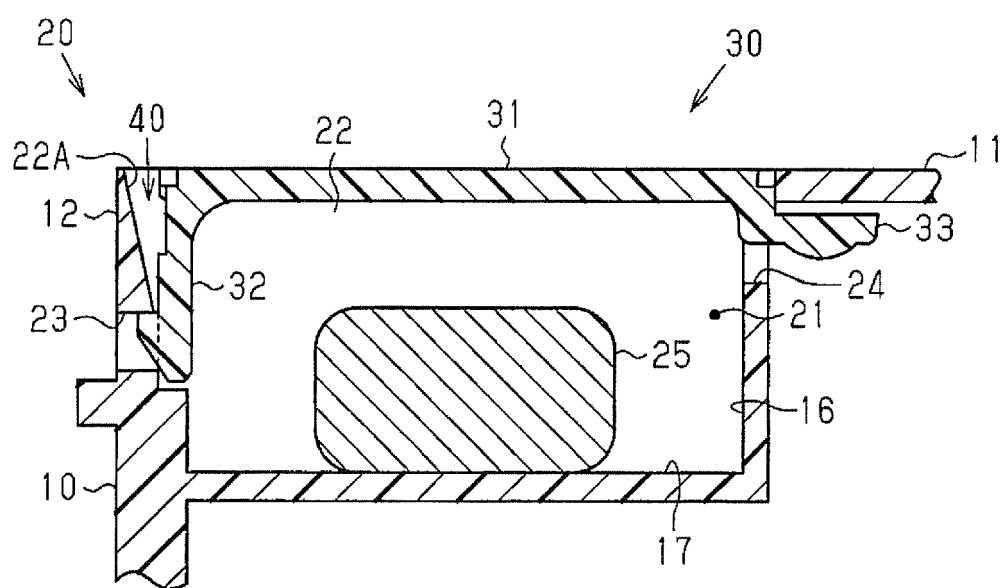


Fig.5

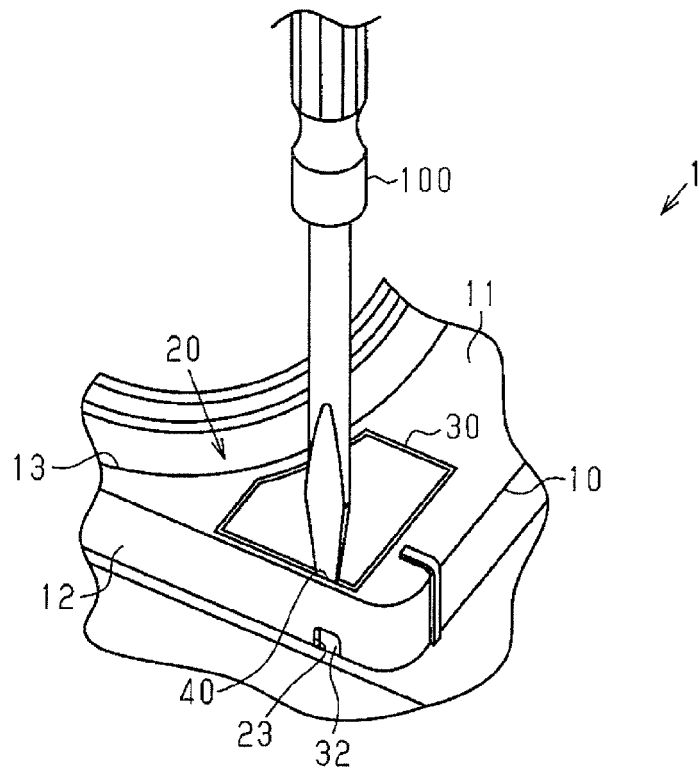
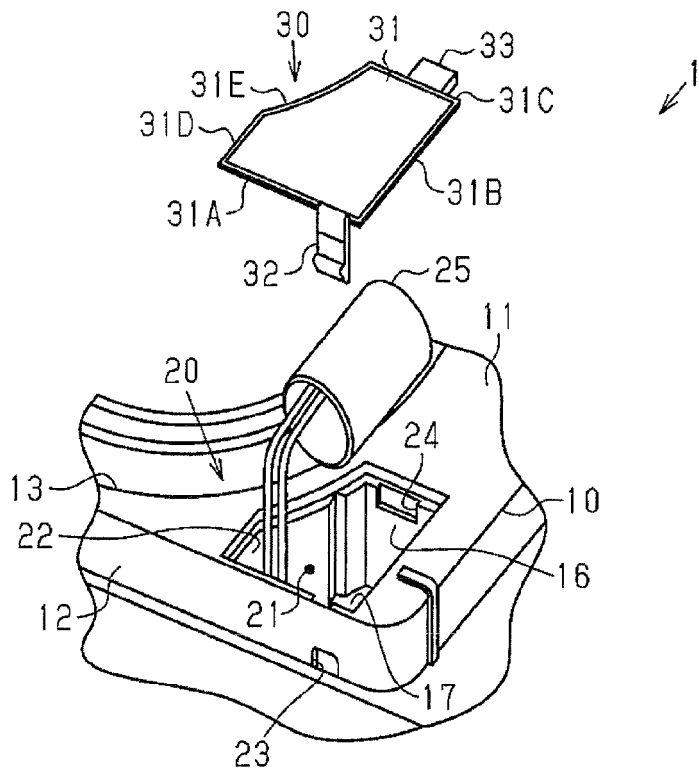


Fig.6





EUROPEAN SEARCH REPORT

Application Number
EP 15 19 9477

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 82 35 064 U1 (EBERLE ANLAGEN KG) 13 October 1983 (1983-10-13) * page 1, line 1 - line 5 * * page 3, line 5 - line 10 * * page 3, line 13 - line 14 * * page 4, line 7 - line 10 * * page 4, line 11 - line 13 * * claim 1 * * figures 1, 2, 5 * -----	1-3	INV. G04C23/02
			TECHNICAL FIELDS SEARCHED (IPC)
			G04C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		7 June 2016	Ordavo, Ivan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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10	Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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