Aug. 16, 1932. J. R. COOK 1,872,122

ELECTRIC SWITCH.

Original Filed Dec. 4, 1922 2 Sheets-Sheet 1

Fig-1

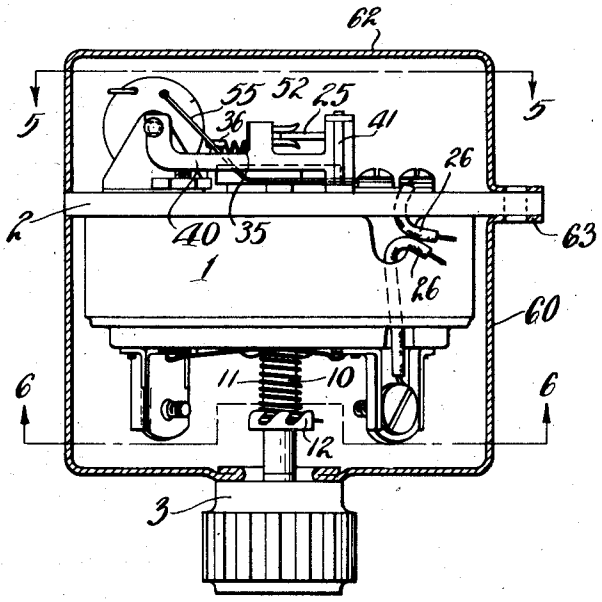
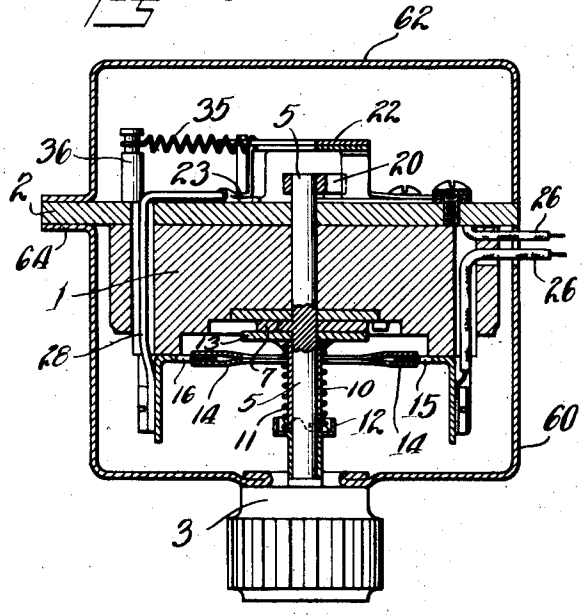


Fig-2



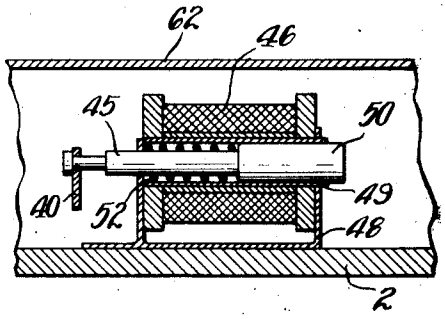


Fig-3

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ELECTRIC SWITCH

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Fig. 4

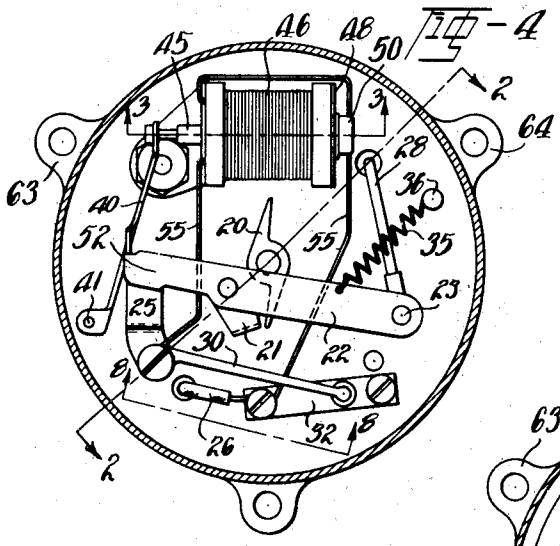


Fig. 7

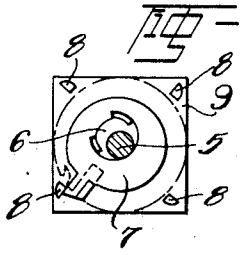
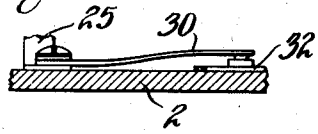


Fig. 8



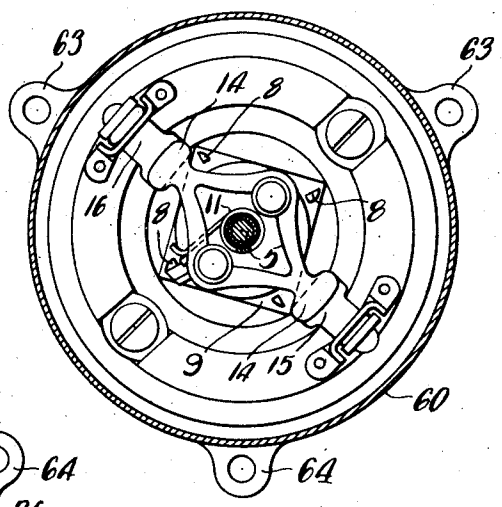
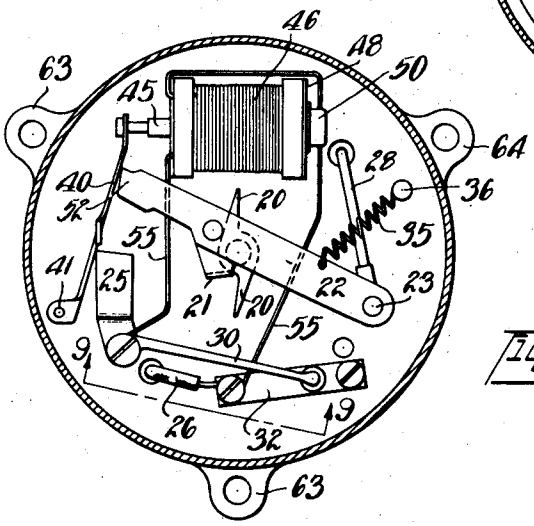


Fig. 6

Fig. 5



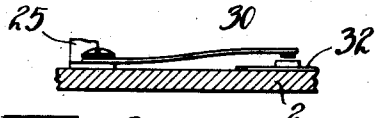


Fig. 9

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UNITED STATES PATENT OFFICE

JOEL R. COOK, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

ELECTRIC SWITCH

Application filed December 4, 1922, Serial No. 604,762. Renewed January 31, 1930.

This invention relates to circuit breakers and is particularly concerned with that type wherein an electro-responsive tripping device may release a circuit closer responsive to changes in the value of the current, and includes manual means for resetting the tripping device and closing the circuit. A convenient and frequent use of the invention is in connection with a manually operated circuit closer, normally governing the circuit to open and close the same, as desired, but allowing the circuit breaker to act under abnormal conditions, independently of the actuation of the handle of the manually operated switch.

A frequent use of such a device is to thus manually and automatically control the current to electric translating devices, and in such cases, it is convenient, though not essential, to arrange the circuit connections to pass through the manually operated switch and circuit breaker in series.

I consider it advantageous to so connect the circuit breaker and switch mechanism that the operation of the switch may close the circuit breaker, and reset the latch after it has been opened, and thereafter allow the manually operated switch to govern the circuit through an indefinite number of makes and breaks, causing opening and closing of the circuit until an abnormal condition occurs. Such a general arrangement is illustrated in my copending application filed Sept. 18, 1922, Serial No. 588,755.

An object of this invention is to provide a simple and effective arrangement of the operating connection between switch operating mechanism and the electroresponsive circuit closer. Further objects include compactness of the elements comprising the circuit closer, cheapness of manufacture, certainty of operation, while having no parts subject to excess wear or likely to get out of order.

In the drawings, I have shown an arrangement of a rotary snap switch of well known design, associated with the circuit breaker construction governed by latch mechanism controlled by a solenoid in turn, controlled by a current responsive member, normally carrying current and adapted upon an overload to render active a shunt through the solenoid, thereby tripping the circuit breaker, and I have so connected the snap switch member with the circuit breaker elements that subsequent turning may reset the snap switch.

One of the objects of the present invention is to provide a simple arrangement of latching mechanism whereby if the abnormal circuit condition, that is for example, the overload still exists, the circuit breaker can not be reset until the current is normal.

Another specific object is to so arrange the circuit connections through the solenoid with relation to the circuit breaker that the current through the circuit breaker is never more than momentary, that is, it can not pass through the solenoid longer than a period just sufficient to cause it to operate to open the circuit breaker. This allows the use of a small, and therefore cheap, solenoid having light windings.

In the drawings, Fig. 1 is in the nature of a side elevation of the manually operated snap switch and electro-responsive switch mounted on the same base, the housing for each being shown in section; Fig. 2 is a substantially axial section through the rotary snap switch and corresponding parts of the electroresponsive circuit breaker; Fig. 3 is a sectional detail showing the arrangement of the solenoid actuating the tripping mechanism; Fig. 4 is a sectional plan of the electro-responsive circuit breaker mechanism showing its housing in section; Fig. 5 is a similar view showing the parts of the circuit breaker in open circuit position; Fig. 6 is a sectional plan of the snap switch showing its housing in section; Fig. 7 is a sectional plan showing the step by step mechanism of the snap switch; Fig. 8 is a sectional detail taken substantially on the line 8—8 of Fig. 4, showing the thermostatic electric conductor in its closed position; Fig. 9 is a similar view showing the open position thereof. On Fig. 4 is shown a broken line indicating the plane of the section of Fig. 2; the plane of the section through the solenoid is indicated by the line 3—3 of Fig. 4.

A suitable base for the mounting of the parts consists of a block 1, preferably rigid with a plate 2, somewhat larger in diameter, while the block 1 forms a bearing for the shaft 5 having the usual hand knob 3 for a snap switch as shown. As is customary in switches of this type, the shaft 5 is provided with a projection or cam 6 allowing a relative movement, and a rotatable stop washer 7 adapted to engage projections 8 on a plate 9. This is shown particularly in Fig. 7, these parts appearing in section in Fig. 2. On this shaft 5 is provided the usual sleeve 10 embraced by the spring 11, engaging one of the notches in the flange 12, while the other end engages the carrier 13 for the switch blades 14, adapted in one position to bridge between contacts 15 and 16, and in another position, brought about by a quarter turn of the knob, to stand away from the contacts, that is, at right angles to the position in Fig. 6. The shaft 5 is shown as projecting through the block 1 and plate 2 and as carrying rigidly on its end a two part cam 20, adapted to engage a projection 21 formed rigid on a circuit breaker blade 22, shown as pivoted at 23 and adapted in one position, as shown in Fig. 4, to engage a contact 25.

In order to make clear the function of the several parts, the path of the current may be traced through both switches as follows: The current may pass, say from one of the lead wires 26 to the terminal 15 as shown in Fig. 2 and thence through the switch blades 14 to the terminal 16, through a wire 28 to the pivot 23, then through the pivoted blade 22, contact 25, and thence through a thermostatic bar designated 30, to a contact strip 32; and thence to the other lead wire 26.

The thermostatic bar 30 preferably is made up of two strips of metal secured together and adapted when carrying an excessive current to become heated consequent upon the resistance offered, the heat causing the bar which is rigid at one end, as shown in Figs. 8 and 9, to raise its contact from the member 32, thus interrupting the normal flow of the current, by opening the normal circuit. This shunts the current as will now be described, through a solenoid governing a latch for the switch blade 22.

The circuit breaker blade 22 is urged to open by any suitable yielding means such as a spring 35, shown as attached at one end to the blade and at the other to a pin or post, or the like 36 which may be rigid with the plate 2. In the position shown in Fig. 4, this blade is held in engagement with the contact 25 by a latch member consisting of a bar 40, pivoted at 41 and having a projecting shoulder adapted to engage the end of the blade or bar 22. The end of the bar 40 embraces a reduced portion of a pin 45 attached to the solenoid core as shown particularly in Fig. 3. This reduced portion provides a shoulder on the core pin at either side of the bar 40.

The solenoid may comprise the usual coils indicated at 46 in the form of a spool mounted upon supports 48 carried on the plate 2, the core being surrounded by a sleeve 49 in which the solenoid may slide. The core pin 45 is preferably of nonmagnetic material while the core 50 is of suitable iron. The pin forms a reduced extension projecting through an opening in one end of the support, thus providing a space for a spring 52, normally urging the core to the right. The coil is shown as connected in parallel with the thermostatic bar 30 by wires designated 55 leading to the contacts 25 and 32 so that when the thermostatic bar is electrically disconnected the solenoid forms a shunt, bridging this break in the circuit with the result that the heavy portion of the core 50 tends to center itself within the core 46. The first part of the movement being idle until the inner shoulder engages the bar 40 after the core has attained some momentum, whereby the bar 40 is forcibly and certainly disengaged from the circuit breaker blade 22. The thermostatic bar 30 is of such proportions that, when it is closed, the major portion of the current through the circuit-breaker-switch blade 22 passes through the thermostatic bar, and very little current passes through the solenoid 46. However, when the thermostatic bar, which shunts the solenoid 46, moves out of engagement with the contact 32, all of the current through the circuit breaker passes through the solenoid coil and causes it to trip the circuit breaker to open position.

Since the solenoid coil is carrying all of the current passing through the blade 22 at the time the circuit therethrough is being interrupted, the solenoid serves as a choke coil and limits the current to a predetermined value, thus preventing an excessive current under overload or short-circuit conditions that would be destructive to the circuit-breaker-switch blade 22 and the contact 25. If now the switch handle 3 be operated, the first quarter turn will simply open the snap switch, the next quarter turn will cause one of the projections of the cam to act on a projection 21 and swing the blade 22 into contact with the blade 25. If the overload condition still remains, the bar 30 will, of course, promptly respond by breaking the circuit, causing the solenoid to again act and disengage the latch, whereby it will be seen that it is impossible to manually hold the circuit closed through both of the circuit breaker elements namely, through the snap switch and the latch retained blade 22. On the other hand, under normal conditions in the circuit, the latch controlled circuit breaker may be readily manually set by simply

operating the handle of the snap switch and once set and latched, the projections of the cam 20 may freely pass the projection of the circuit breaker blade 22, throughout an indefinite number of makes and breaks of the snap switch, until an overload condition occurs.

This device has been found to be very simple and effective in operation and may be cheaply manufactured and easily accomplishes the objects set forth. It may be suitably encased. As shown, the snap switch has the usual casing designated 60 while the latch controlled circuit breaker on the other side of the base may be covered by a suitable casing 62. Convenient means of securing these casings may consist of a plurality of ears 63, registering with bosses 64 of the plate 2 provided with openings to receive suitable bolts or like securing devices.

I am aware of various maximum current load automatic cutout devices combined with service switch constructions and particularly the disclosures of the patent to Perkins #287,321 of October 23, 1883, and the disclosure of an automatic opening and closing device having a magnetically actuated detent in the Drake Patent #569,960 of October 20th, 1896.

My present effort has been to co-ordinate the mechanisms of a magnetically controlled circuit breaker and a snap switch of modern construction in compact manner whereby the snap switch may be operable in the usual manner and the operating means therefor may function only to close the circuit breaker without influencing the functioning of the current breaker opening means in the event of a prevailing overload condition in the circuit controlled by the device.

I claim:—

1. An electric circuit controlling device comprising separable contacts, means for closing the contacts, latching mechanism for holding the contacts closed, a solenoid and core for releasing said latch, a manually operable rotary member for actuating the closing means, a separate switch actuated by said manually operable member through successive makes and breaks independently of said contacts and a normally closed bimetallic thermostatic switch connected in series with said first named contacts and the contacts of the last named switch.

2. An electric circuit controlling device comprising a circuit breaker tending to open, a latch for holding it closed, a solenoid connected with the latch, a manually operated switch, means for connecting it to the circuit breaker, whereby movement of said switch may close the circuit breaker and become disconnected while the circuit breaker remains closed, electric connections through the solenoid whereby it may be responsive to abnormal circuit conditions to release the latch and a normally closed bimetallic thermostatic switch connected in series with the contacts of the circuit breaker and switch and bridging the connections of the solenoid.

3. The combination with a circuit breaker, of yielding means tending to open it, a latch for holding it closed, an electro-responsive control device for releasing the latch, a manually operated switch having mechanical means for closing the circuit breaker and placing it under the control of the latch, electrical connections through the circuit breaker and manually operated switch for connecting the contacts thereof in series, a normally closed bimetallic thermo-responsive bar normally carrying the current and adapted to open the circuit under abnormal conditions, and thereby cause the full current of the circuit to pass through the control device.

4. The combination with a circuit breaker, of yielding means tending to open it, a latch for holding it closed, an electro-responsive control device for releasing the latch, a manually operated switch having mechanical means for closing the circuit breaker and placing it under the control of the latch, electrical connections through the circuit breaker and manually operated switch for connecting the contacts thereof in series, a bimetallic thermo-responsive bar normally carrying the current and adapted to open the circuit under abnormal circuit conditions, and shunt connections around said bar through the control device to render it active momentarily when said bar is in open position.

5. The combination with a circuit breaker, an electro-responsive means causing it to open and to manually operated switch in series with the circuit breaker and adapted to be mechanically but temporarily connected to the circuit breaker for closing it simultaneously with the closing of the switch, said electro-responsive means including a self-closing circuit breaking device adapted to normally carry the current but to open the circuit under abnormal conditions and a magnetic device having electric connections shunting around the self closing breaking device to cause the magnetic device to operate when the circuit through the self closing circuit breaking device is open.

6. The combination with a circuit breaker, an electro-responsive means causing it to be opened and a manually operated switch in series with the circuit breaker and adapted to be temporarily mechanically connected to the circuit breaker for closing it and to be disconnected therefrom during the normal operation of the switch, said electro-responsive means including a bimetallic thermo-resistance bar adapted to normally carry the current but to open the circuit under abnormal conditions, and a magnetic solenoid hav-

ing electric connections shunting around the bar.

7. In a device of the character described, the combination of a hand operated revolving snap switch, a circuit breaker switch in series therewith and adapted to be closed by a revolving movement of a manually operated member of the snap switch and having electro-responsive means for opening it automatically, and a normally closed self-closing circuit breaker governing the circuit and responsive to overload to open the circuit and thereby cause the electro-responsive means to open the circuit breaker.

8. An electric circuit controlling device comprising manually separable contacts and other automatically separable contacts, a manually operable member for closing both sets of contacts, means connecting all of said contacts in series, a latching mechanism for holding the automatically separable contacts closed, a magnetic device for tripping the latching mechanism, said magnetic device being normally electrically connected in multiple relative to the means connecting the contacts in series, and a thermostatic switch connected in series with said contacts, bridging the connections for the magnetic device, whereby the highly magnetic device will be in series with the contacts when the thermostatically operated switch is open.

9. In a device of the character described, the combinataion of a base member, a snap switch mechanism supported on one side thereof, a circuit breaking device mounted on the opposite side of the base member, an operating member extending through the base, and means mounted on the operating member for closing and opening the snap switch and for closing the circuit breaker.

10. In a device of the character described, the combination of a snap switch mechanism, a base formed of insulating material supporting the snap switch mechanism on one side thereof, a separable pair of contacts comprising a circuit breaker mounted on the opposite side of the base and in series with the switch mechanism, an operating member extending through the base, means mounted on the operating member for actuating the snap switch mechanism for closing the contacts of the circuit breaker, a latch mechanism mounted on the base adjacent the separable contacts of the circuit breaker for maintaining them in closed relation, a magnetic device for tripping the latch mechanism, a self-closing circuit breaking device connected in series with said contacts and a shunt connection for the magnetic device bridged by the self-closing device.

11. In a device of the character described, the combination of a snap switch mechanism mounted upon a base formed of insulating material, a circuit breaker having the contacts thereof connected in series with contacts of the snap switch mechanism, the circuit breaker being mounted on the opposite side of the base, an operating member in the form of a revoluble stem extending through the base for closing and opening the snap switch contacts and for closing the contacts in the circuit breaker, a magnetically released detent mechanism for latching the circuit breaker contacts in closed position including a solenoid, and a bimetallic thermostatically actuated circuit breaking device connected in series with the contacts and bridging a shunt connection for the solenoid, said operating member carrying means for closing the separable contacts of the circuit breaker consequent to operating movement thereof.

12. In a device of the character described, the combination of a snap switch mechanism, a supporting base therefor formed of insulating material, an operating member having a resilient connection with the movable contacts of the snap switch mechanism, said connection being in the form of a spring whereby the spring may be tensioned to actuate the contacts, a circuit breaker mounted on the opposite side of the base, means actuated by the operating member and extending through the base for closing the circuit breaker contacts during the spring tensioning movement of the operating member, and automatically actuated detent mechanism for normally maintaining the circuit breaker contacts closed.

13. An electric circuit controlling device comprising manually separable contacts and other automatically separable contacts, a manually operable member for closing both sets of contacts, means connecting all of said contacts in series, a latching mechanism for holding the automatically separable contacts closed, a magnetic device for tripping the latching mechanism, said magnetic device being normally electrically connected in multiple relative to the means connecting the contacts in series, and a self-closing and opening circuit breaking device normally closed and connected in series with said contacts, bridging the shunt connection for the magnetic device.

14. In a device of the character described, the combination of a snap switch mechanism, a base member supporting the snap switch mechanism on one side thereof, a circuit breaking device mounted on the opposite side of the base member, an operating member extending through the base and arranged to operate the snap switch, and a cam mounted on the operating member for closing the circuit breaker contacts.

15. In a device of the character described, the combination of a snap switch mechanism, a base formed of insulating material supporting the snap switch mechanism, a separable pair of contacts comprising a circuit breaker mounted on the opposite side of the

base, an operating member for the snap switch extending through the base, a spring mounted on the operating member for actuating the snap switch mechanism, a cam carried by the operating member for closing the contacts of the circuit breaker, a latch mechanism mounted on the base adjacent the separable contacts of the circuit breaker for maintaining them in closed relation, a magnetic device for tripping the latch mechanism, electrically conductive means connecting the snap switch mechanism contacts and the contacts of the circuit breaker in series, and a bimetallic thermostatic bar comprising a part of the circuit and forming a self-closing circuit breaking device bridging a shunt connection for the magnetic device.

16. The combination with a circuit breaker having a trip coil in series therewith, of a thermal-responsive resetting device in series with the circuit breaker and normally shunting the trip coil and responsive to variations in the current through the circuit breaker to open the shunt circuit under predetermined current conditions.

17. The combination with a circuit breaker having a current-responsive and inductively current-limiting trip means in series with the circuit breaker, of a current-responsive resetting device in series with the circuit breaker and normally shunting the trip means and responsive to variations in the current through the circuit breaker to open the shunt circuit under predetermined current conditions.

In testimony whereof, I hereunto affix my signature.

JOEL R. COOK.