June 29, 1937. S. S. GRADY 2,085,018

CIRCUIT BREAKER

Original Filed March 21, 1928 2 Sheets-Sheet 1

Fig. 1

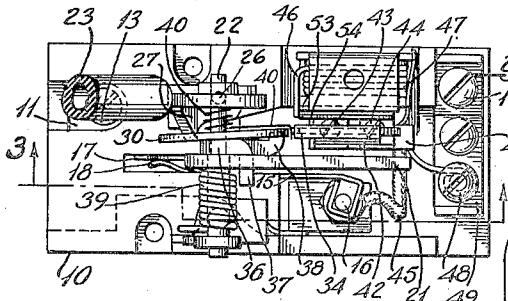


Fig. 2

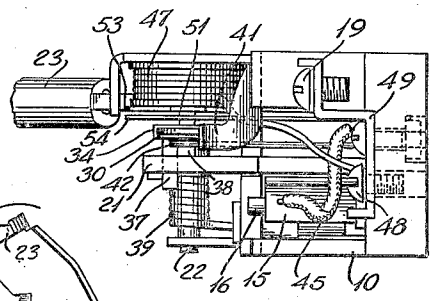


Fig. 6

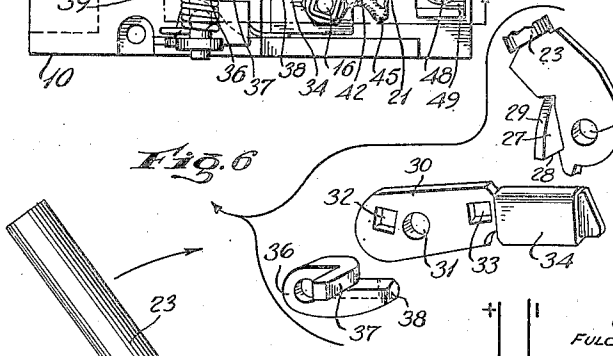


Fig. 7

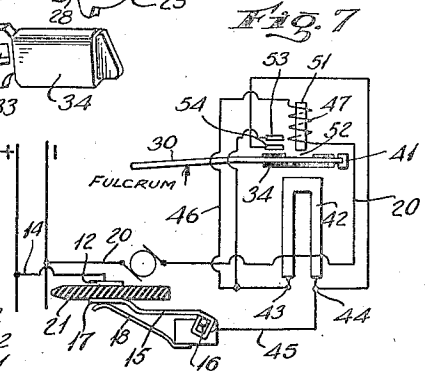


Fig. 3

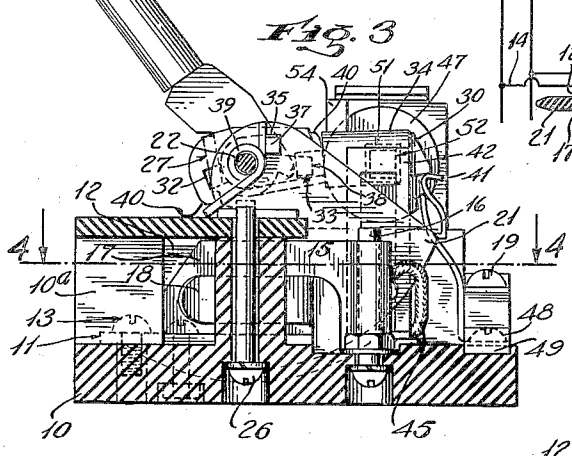


Fig. 5

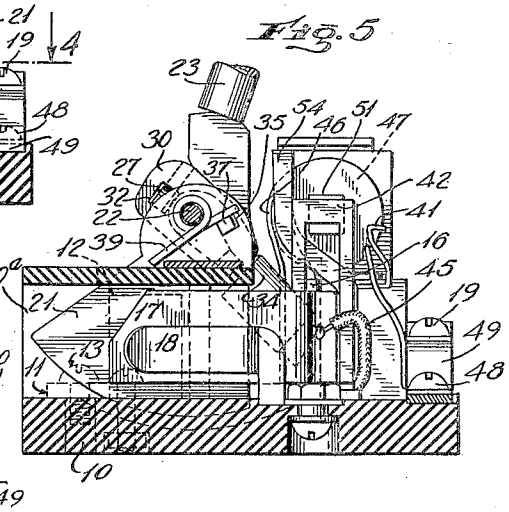
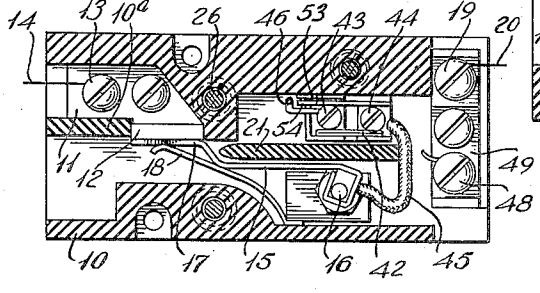


Fig. 4



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June 29, 1937. S. S. GRADY 2,085,018

CIRCUIT BREAKER

Original Filed March 21, 1928 2 Sheets-Sheet 2

Fig. 8

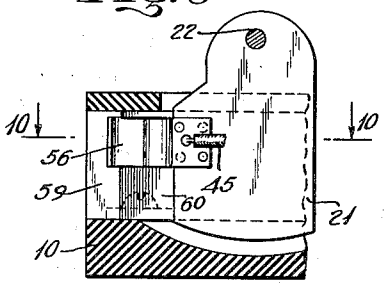


Fig. 9

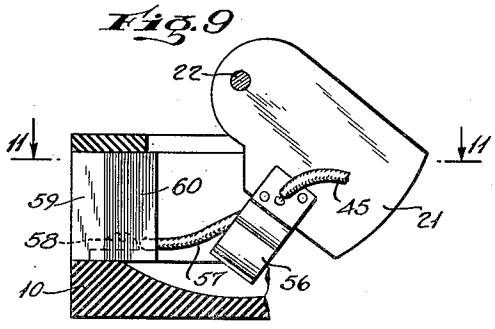


Fig. 10

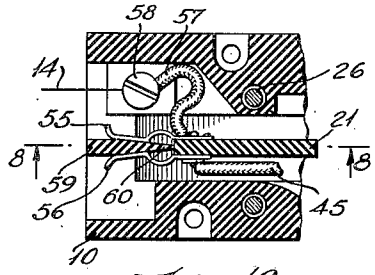


Fig. 11

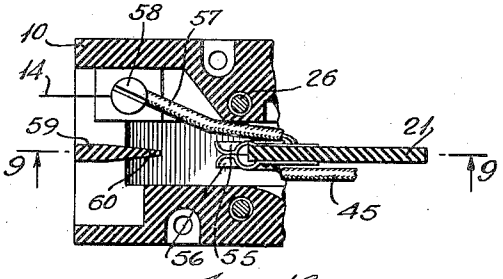


Fig. 12

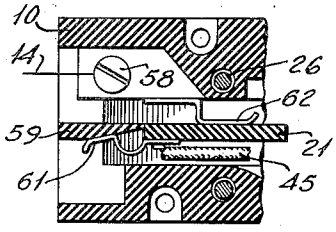


Fig. 13

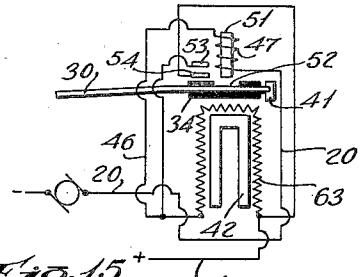


Fig. 14

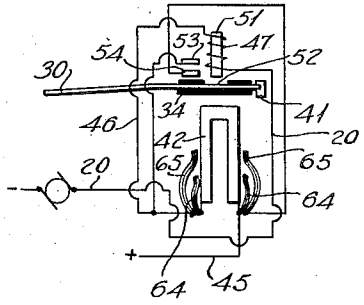
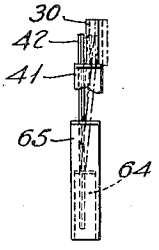


Fig. 15



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2,085,018

CIRCUIT BREAKER

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Original application March 21, 1928, Serial No. 263,414, now Patent No. 1,909,174. Divided and this application May 15, 1933, Serial No. 671,193. Renewed September 4, 1936

5 Claims. (Cl. 200—116)

This invention relates to switches for breaking electric circuits, and aims to improve the construction and operation of such switches.

An object of the invention is the provision of a structure arranged so that the switch can be operated manually to break the circuit, and in case of a light overload the overload breaks the circuit by thermostatic means, while in case of a heavy overload the overload breaks the circuit by magnetic means.

A particular feature of novelty resides in the arrangement of a pair of contacts operated by electro-magnetic means responsive to heavy overloads in the circuit to short-circuit the thermostat and prevent burning out of the thermostat when heavy overloads pass through the circuit.

Other objects and advantages will become apparent as the description proceeds.

While a preferred form of the invention has been disclosed for purposes of illustration, it should be understood that various changes may be made in the structure without departing from the spirit and scope of the invention as hereinafter set forth and claimed.

In the drawings:

Fig. 1 is a plan view of the circuit breaker.

Fig. 2 is an end elevation looking from the right side of Fig. 1.

Fig. 3 is a section on line 3—3 of Fig. 1.

Fig. 4 is a section on line 4—4 of Fig. 3.

Fig. 5 is a section corresponding to Fig. 3 but showing the parts in a different position.

Fig. 6 is an exploded view showing details of the operating mechanism.

Fig. 7 is a diagram showing the wiring arrangements.

Fig. 8 is a detail view of a modification.

Fig. 9 shows the parts of Figure 8 in another position.

Fig. 10 is a section on line 10—10 of Figure 8.

Fig. 11 is a section on line 11—11 of Figure 9.

Fig. 12 is a view similar to Figure 10 but showing a further modification.

Fig. 13 is a diagram of a modified system of wiring.

Fig. 14 is a diagram showing a method of thermostat control.

Fig. 15 is a diagram showing parts of Figure 14.

Referring to the drawings more particularly, the device comprises a body 10, formed of porcelain or other insulating material. A terminal conductor 11 has a contact arm 12 extending through an opening in a partition carried by the body, and a binding post 13 serves to attach the wire 14 to the conductor 11. A second contact arm 15 is loosely pivoted at 16 and has a flat face 17 normally biased toward the contact arm 12 by the spring 18. The contact arm 15 is electrically connected with the binding post 19 from which the wire 20 leads to an appliance utilizing the current. When contacts 12 and 17 are in engagement, current is flowing to the appliance, and the invention includes means for breaking the circuit by separating the contacts 12 and 17.

This structure includes a sector shaped interposer 21 formed of fiber or other suitable insulating material, which is swingingly mounted on a shaft 22 supported from the body by suitable brackets. When the circuit is closed the interposer is held in the position of Figs. 3 and 4, and after the mechanism has been operated to interrupt the circuit the interposer occupies a position between the contacts 12 and 17, as illustrated in Figs. 5 and 7.

The operating mechanism includes a handle member 23, the lower end of which is formed with an aperture 24 by which it is pivoted on shaft 22, and the part extending below the shaft is formed with a notch 25 which cooperates with upper end of a bolt 26 (Fig. 3) to limit the movement of the handle. The handle member carries a detent 27 which projects toward the interposer and has a straight lower side 28 and a curved outer side 29.

Another element of the operating mechanism is the latch arm 30, shown in Fig. 6, which is formed with an aperture 31 by which it is pivoted on shaft 22 between the interposer and the handle 23 in a manner permitting free lateral movement of the arm. Openings 32 and 33 are formed through the arm for purposes that will shortly appear, and the free end of the arm is surrounded by insulation 34.

The interposer 21 has an aperture 35 formed therethrough, and a coupler 36, which is pivoted on shaft 22 between the interposer and the latch arm, has one branch 37 extending into the aperture 35 of the interposer, and another branch 38 extending into the aperture 33 of the latch arm 30. A coil spring 39 is wound around shaft 22 and has one of its ends engaging the body 10, while its other end contacts with the end of branch 37 and tends to bias the interposer toward the position of Fig. 5. A second coil spring 40 surrounds the shaft 22 and engages the upper side of the latch arm 30 to press it downward, the spring 39 alone and at least with the spring 40 provides an urging force of sufficient tension to overcome the lag or reluctance of emergency cur-

rents to insure the actuation of the interposer into circuit breaking position whenever the latch arm 30 is tripped.

A spring catch 41 holds the latch arm in raised position, and the invention provides several distinct ways of moving the free end of the latch arm upwardly (looking at Fig. 1) to disengage it from the catch, as will now be explained.

When the parts are in the position of Fig. 3 the detent 27 is engaged in the aperture 32, as will be clear from Figs. 1 and 3. If at any time it is desired to break the circuit manually, the handle 23 is moved toward the right, as indicated by the arrow in Fig. 3. During this movement the detent 27 rides upwardly out of the opening 32, and in doing so the curved edge 29 presses the left end of latch arm 30 downwardly (Fig. 1) thereby swinging the latch arm about the fulcrum indicated in Fig. 7 and thereby causing the free end of the latch arm to ride upwardly disengaging the branch 38 of the coupler from the aperture 33 of the latch arm and causing the latch arm to move and off the catch 41. As soon as the coupler arm is disengaged from the latch arm the spring 39 snaps the interposer between the contacts 12 and 17 to the position of Figs. 5 and 7. During this separating movement the contact 17, due to its loose pivotal mounting, remains parallel to the contact 12, and the interposer wipes the entire face of each contact. When in the position of Fig. 5, the interposer 21 covers entirely the opening in the partition 10^a through which the contact 12 projects and snugly engages the partition 10^a so that the gap between the two contacts will be effectually obstructed by the partition 10^a and the interposer 21, and the spark can under no circumstances pass from one contact to the other.

When the circuit is to be again closed, the circuit breaker is reset by moving the handle 23 back toward the position of Fig. 3. During this movement the lower face 28 of the detent 27 reengages the aperture 32 to move the latch arm until its aperture 33 receives the branch 38 of the coupler 36 thereby in turn to return the interposer 21 into circuit making position and until its nose latches over the catch 41 again.

The invention also includes electrically operated means for tripping the latch arm 30 and breaking the circuit. For this purpose there is provided a U-shaped thermostatic element 42 which has its legs secured to the body 10 by binding posts 43 and 44, and which projects upwardly between the interposer and the latch arm 30 (see Fig. 2). The binding post 44 is connected with the contact arm 17 by the wire 45, and the wire 46 runs from the binding post 43, forms the magnet coil 47, and then connects with the binding post 48 carried by the conductor 49. The binding post 19 secures the wire 20, which, as stated previously, leads to the appliance utilizing the current.

The subject matter of this application constitutes a division of application for patent, Serial No. 263,414 filed March 21, 1928, now issued as Patent No. 1,909,174.

The current normally passes through the thermostat 42, and whenever there is a light overload, the thermostat becomes heated, and due to its structure the upper end bends upwardly (Fig. 1) and disengages the latch arm 30 from the coupler 36, causing operation of the interposer as before described.

The structure of the thermostat is such that it can stand severe overloads for only a short time, and arrangement is therefore made for automatically cutting-out the thermostat and operating the circuit breaker by magnetic means whenever a heavy overload occurs.

This is accomplished through the electromagnet formed by the coil 47. The laminated core 51 of the electromagnet lies opposite a gap 52 in the insulation 34 on latch arm 30 when the parts are in the set position of Figs. 1 and 3. The normal current of the circuit passes through the electromagnet without causing it to function, and similarly a light overload such as causes the thermostat 42 to bend is not strong enough to cause operation of the latch arm 30 by the electromagnet. But when a severe over-load passes through the circuit the electro-magnet is powerfully energized and attracts the latch arm, permitting the spring 39 to move the interposer as before explained. The thermostat 42 can stand the heavy overload for a short time, but it would be burned out if the heavy current passed through it for the full interval during which the mechanism is operating to break the circuit.

In order to prevent this result arrangement is made to short-circuit the thermostat by the first surge of the overload that puts the electro-magnet into operation. For this purpose a pair of contacts 53 and 54 are provided. These contacts are attached to binding posts 43 and 44 respectively, and extend up to a point where they will be in the path of the latch arm 30 as it moves under the influence of the electro-magnet. With this arrangement the energization of the electromagnet moves the latch arm to close the contacts 53 and 54, thereby short-circuiting the thermostat, and simultaneously initiates the operation of the circuit breaking mechanism.

Various alternative arrangements of the contacts may be used, as will be clear from Figs. 8 to 12 inclusive. In the modification shown in Figs. 8 to 11 the contacts 55 and 56 are mounted directly on opposite sides of the swinging member 21. The contact 55 is connected by the flexible pig-tail 57 with the binding post 58, from whence leads the conductor 14, while the conductor 45, heretofore described, is attached to the contact 56. The contacts 55 and 56 are of spring material and are formed with flat faces adapted for mutual surface engagement beyond the edge of the member 21, as shown in Fig. 11, and the outer edges of the contacts are flared to form a V-shaped notch. A stationary separator 59 is of insulating material and is stationarily mounted on the base in direct alinement with the member 21. The forward edge of the separator is pointed as at 60 to facilitate entrance of the separator into the V-shaped notch to separate the contacts as the member 21 moves from the closed-circuit position of Figs. 9 and 11 to the open-circuit position of Figs. 8 and 10.

In the modification of Fig. 12 the contact 61 is similar to the contact 56, just described, and is mounted on the movable member 21, while the contact 62 is stationary. In this case the parts are so designed that the movement of member 21 carries the contact 61 from the open position of Fig. 12 to a closed position in which the contact 61 engages contact 62.

Fig. 13 illustrates a modified system of wiring in which the current does not pass directly through the thermostat 42, but passes through a coil 63 arranged so that it is insulated from the thermostat but is in a position to heat the thermostat.

In Figs. 14 and 15 an arrangement is shown

for compensating for the differences in temperature due to summer weather so that the thermostat will operate to break the circuit under a certain definite amount of overload at either ordinary temperatures or the elevated temperatures of summer weather. Since the raised summer temperatures will have some heating effect on the thermostat, provision is made to proportionately reduce the heating effect of the electrical current. This is done by arranging a pair of auxiliary thermostatic elements 64 in position so that under a certain increase in temperature they will engage the sides of the main thermostat 42. The auxiliary thermostats are in the electrical circuit, so that when they engage the main thermostat part of the current is diverted through them and less current passes through the lower legs of the main thermostat. This operates to reduce the heating effect of the current on the main thermostat. A second pair of auxiliary thermostats 65 may be arranged to cut in after another definite rise in atmospheric temperature, and in a similar way as many auxiliary thermostats are desired may be used, the thermostats being arranged to cut in at any desired steps of rise in atmospheric temperature.

I claim:

1. A control comprising a main thermostatic member capable of bending under raised temperatures, an electric circuit adapted to heat the thermostatic member, and auxiliary thermostatic means operatively associated to short circuit part of said main thermostatic member thereby to reduce the heating effect of the electric circuit on the main thermostatic member under conditions of raised atmospheric temperature.

2. A circuit breaker comprising a pair of contacts resiliently maintained in engagement with one another, an interposer adapted to flex said contacts from engagement with one another and to extend between the contacts to interrupt the circuit, means for positively actuating the interposer into interrupting position, a latch for holding the interposer in inoperative position, an operating means to release the latch in response to an overload in the circuit, a handle for resetting said interposer into operative position, and connecting means for connecting said handle to said interposer in inoperative position to position said handle to reset said interposer.

3. A circuit breaker comprising a fixed plane contact face having an extended plane area, a second contact face having an extended plane area, means for normally maintaining said second contact face in engagement with said plane contact face, a pivotally mounted separating insulation member having parallel extended plane areas moving parallel to the plane areas of said contact faces to effectively wipe such contact faces during operation at a point extensively removed from the peripheral edges of said separating member, and an operating means to cause actuation of the separating member about its axis vertical to its parallel extended plane areas in response to an overload in the circuit.

4. A control comprising a main U-shaped thermostatic member capable of bending under raised temperatures, an electric circuit adapted to heat the thermostatic member connected to the terminals of said U-shaped member, and auxiliary thermostatic fingers connected to said circuit adjacent to the free ends of said terminals and adapted to engage the legs of said thermostatic member spaced from its terminals to short circuit the lower parts of said legs and thereby reduce the heating effect of the electric circuit on the main thermostatic member under conditions of raised atmospheric temperatures, said fingers being capable of bending under raised atmospheric temperatures so as to engage the legs of said thermostatic member.

5. A control comprising a main U-shaped thermostatic member capable of bending under raised temperatures, an electric circuit adapted to heat the thermostatic member connected to the terminals of said U-shaped member, and a plurality of pairs of auxiliary thermostatic fingers connected to said circuit adjacent to the free ends of said terminals and adapted to engage the legs of said thermostatic member spaced from its terminals to short circuit the lower parts of said legs and thereby reduce the heating effect of the electric circuit on the main thermostatic member under conditions of raised atmospheric temperatures, said fingers being capable of bending under raised atmospheric temperatures so as to engage the legs of said thermostatic member, the pairs of fingers being spaced at varying distances from the terminals of said thermostatic member whereby the heat producing effect may be varied according to various atmospheric temperatures.

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