Aug. 6, 1940. J. SACHS 2,210,259

AUTOMATIC CIRCUIT BREAKER

Filed Feb. 27, 1939

Fig. 1

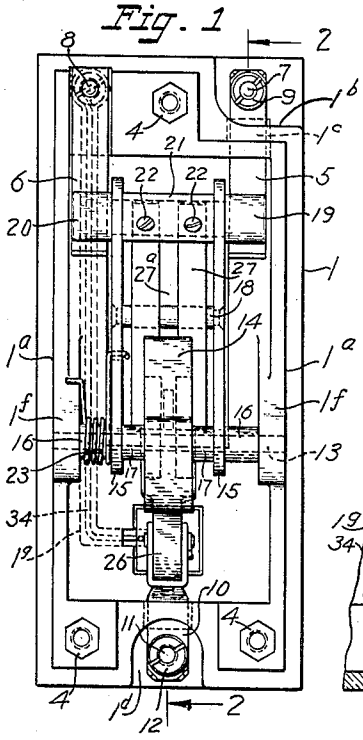


Fig. 2

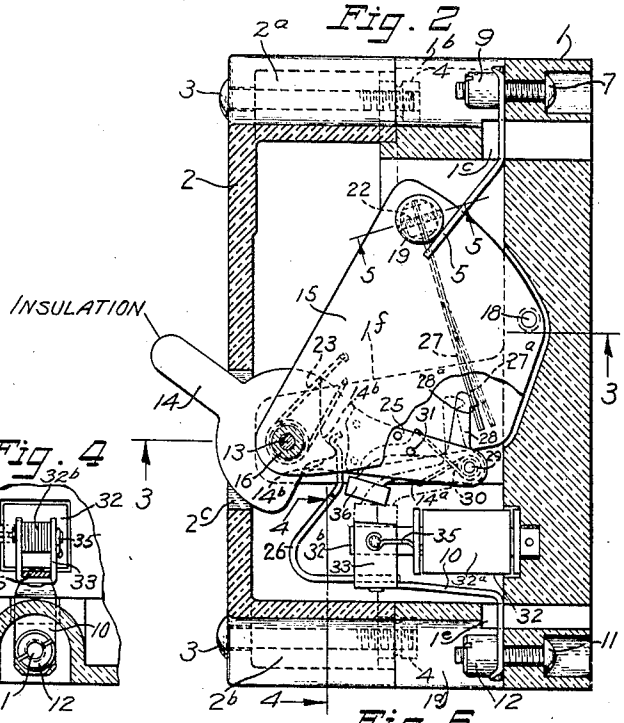


Fig. 4

Fig. 3

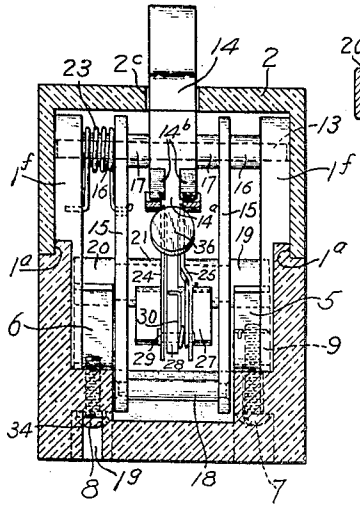


Fig. 5

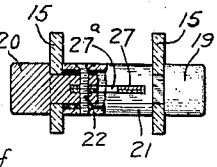
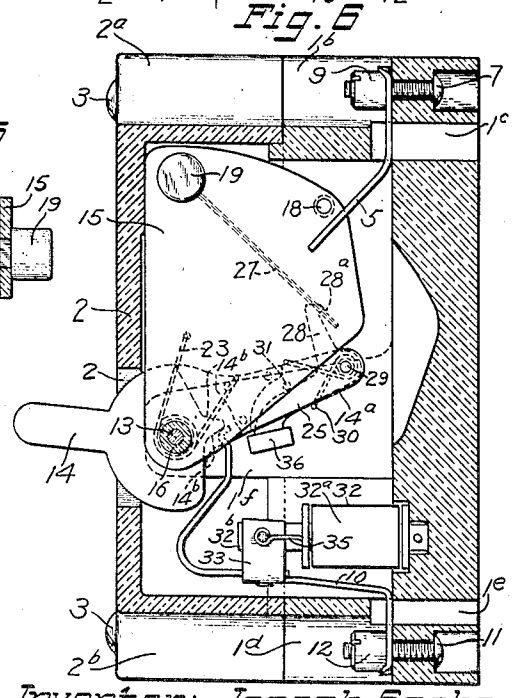


Fig. 6



Inventor: Joseph Sachs

By S. Jay Teller

Attorney

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AUTOMATIC CIRCUIT BREAKER

Joseph Sachs, West Hartford, Conn., assignor to Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., a corporation of Connecticut

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9 Claims. (Cl. 200—88)

This invention relates to a circuit breaker of the general type disclosed in my reissued Patent No. 20,018 and in my Patent No. 1,811,970, each entitled Automatic circuit breaker. The general object of the present invention is to provide a circuit breaker of the type disclosed having an electro-responsive device arranged to act as a latch normally engaging a relatively movable retainer to hold the circuit closed and having another electro-responsive device arranged to move the retainer independently of the latch and thereby effect disengagement without any unlatching movement of the said latch. In accordance with the invention either the electro-responsive device which serves as a latch or the relatively movable retainer, or both, are bodily movable with the movable contact of the circuit breaker. Preferably there is a manually operable actuator, and in this case the electro-responsive device which serves as a latch and the relatively movable retainer are bodily movable with the actuator and with the movable contact of the circuit breaker, thus serving to transmit stress from one to the other.

The invention is not necessarily limited with respect to the character of the two electro-responsive devices, but as shown one of the devices is a bodily movable bi-metallic latch normally engaged by a retaining element and adapted upon deflection to disengage the retaining element to permit automatic opening of the circuit. The other electro-responsive device is shown as being a stationary magnet which upon energization serves to move the retaining element out of engagement with the bi-metallic latch to thereby permit automatic opening of the circuit.

As to mechanical details and arrangement of parts, the invention can be embodied in various ways and one suitable embodiment is disclosed in the accompanying drawing. It will be understood, however, that the drawing is intended for illustrative purposes only and is not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

Fig. 1 is a front view of a circuit breaker embodying the invention, the front cover being omitted.

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1, the front cover being included. The movable parts are in closed-circuit positions.

Fig. 3 is a transverse horizontal sectional view taken along the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary vertical sectional view taken along the line 4—4 of Fig. 2.

Fig. 5 is a fragmentary sectional view taken along the line 5—5 of Fig. 2.

Fig. 6 is a view similar to Fig. 2 but showing the movable parts in open-circuit positions instead of closed-circuit positions.

In the construction as shown in the drawing, there is provided a combined support and enclosure consisting of a main rear support 1 and a front cover 2, these parts being formed to provide a chamber within which most of the circuit breaker mechanism is contained. The parts 1 and 2 are preferably formed of insulating material. The cover 2 is held in place by means of screws 3, 3 which are threaded into metallic inserts 4, 4 molded in place in the support 1. The support 1 is peripherally rabbeted at 1^a to receive the cover.

Carried by the rear support 1 are two similar conducting members 5 and 6 which constitute the stationary contacts of the circuit breaker, these being held in place respectively by screws 7 and 8 which project forward from the rear of the support. One of these screws, as for instance the screw 7, is longer than the other and is provided with a nut 9 which cooperates with the end portion of the conductor to form a wire terminal. The support 1 is recessed at 1^b so as to permit access to the wire terminal at 9 and the cover 2 is similarly recessed at 2^a. The conductor 5 extends from the recess 1^b into the interior of the enclosure through an opening at 1^c, and the conductor 6 is entirely within the enclosure.

At the opposite end of the support 1 is a conductor 10 held in place by a screw 11 which is similar to the screw 8 and which is similarly provided with a nut 12 cooperating with the conductor 10 to form a wire terminal. The support and the cover are recessed at 1^d and 2^b to permit access to the wire terminal at 12. The conductor 10 extends from the recess 1^d into the interior of the enclosure through an opening 1^e.

Projecting forward from the support 1, near the sides thereof and preferably formed integrally therewith, are two bracket portions 1^f, 1^f so located as to be normally enclosed within the cover 2. A pivot pin 13 extends transversely between these two bracket portions and pivotally supports an operating member or handle 14 and a contact member which consists in part of transversely spaced insulating side plates 15, 15. The operating member 14 projects forward through an opening 2^c in the front cover, and the said operating member and also the plates 15, 15 are held

in spaced relationship by means of bushings 16, 16 and 17, 17 on the pin 13.

The two side plates 15, 15 of the contact member are connected by a tie rod 18 and they are also connected by means of the movable contact structure which is shown in detail in Fig. 5. There are two movable contacts 19 and 20 adapted to engage respectively with the stationary contacts 5 and 6. Each of the contacts 19 and 20 is cylindrical in form and has a smaller shank portion which may be square or otherwise non-circular so as to project inward through a similarly shaped opening in the corresponding side plate 15. An insulating tube 21 fits over the inner shank portions of the contacts 19 and 20 and is held by screws 22, 22. A spring 23 serves to bias the contact member in the counter-clockwise or circuit-opening direction.

The handle or operating member 14 is preferably formed of insulating material and it has a rearward projecting portion 14^a to which are riveted two spaced metallic plates 24 and 25 which will be herein referred to collectively as constituting an actuator. At its sides the operating member 14 is provided with two rearward projections 14^b, 14^b which are engaged by a bifurcated spring 26. This spring is shown as carried by the conducting element 10 but the exact manner of mounting is immaterial. The bifurcations of the spring 26 act upon the projections 14^b, 14^b to hold the operating member in the closed-circuit position as shown in Fig. 2 or in the open-circuit position as shown in Fig. 6. It will be understood that the handle or operating member 14 is resiliently held and that it may be moved downward or upward, the projections 14^b, 14^b being forced past the spring 26.

Associated with the movable contact member is a relatively movable retaining device or retainer and also two separate electro-responsive devices. The term "relatively movable" as applied to the retaining device, refers merely to a movement such as a pivotal movement for unlatching purposes. There may be considerable variation as to the characters of the electro-responsive devices and as to their relationship with each other and with the retainer, but one of the said devices normally serves as a latch which engages the retainer to transmit stress from the actuator to the contact member and thereby hold the contact member in closed-circuit position, the said device upon electro-responsive action being moved to disengage the retainer so as to permit automatic circuit-opening movement of the contact member. The other device upon electro-responsive action serves to move the retainer independently of the electro-responsive latch to disengage the retainer from the latch without any unlatching movement of the latter, thus permitting automatic circuit-opening movement of the contact member. Either the electro-responsive latch or the retainer or both are bodily movable with the contact member. When there is an actuator, as is here shown, the retainer and at least one of the electro-responsive devices move bodily with both the actuator and the contact member and normally serve to mechanically connect them so that the former can move the latter. The two electro-responsive devices preferably have different operating characteristics, and as shown one of them is an electro-thermal device such as a bi-metallic element and the other is an electro-magnetic device.

As shown, one electro-responsive device is a U-shaped bi-metallic element or latch 27 electrically connected in series between the two movable contacts 19 and 20. The before-mentioned tube 21 is slotted to receive the end portions of the legs of the U-shaped latch and the shank portions of the contacts are also slotted to receive the said end portions which are held by the before-mentioned screws 22, 22. Inasmuch as the bi-metallic latch 27 is electrically connected between the contacts, it will be heated and deflected in accordance with the current in the circuit and in the event of the attainment of excess current conditions it will be deflected rearward as indicated by dotted lines in Fig. 2.

For cooperation with the electro-responsive bi-metallic latch 27, there is provided a retaining element or device 28 which is mounted between the side plates 24 and 25 of the actuator, being carried by a transverse pivot pin 29. The retaining device or retainer has an abutment portion 28^a which projects into a suitable opening 27^a in the bi-metallic latch 27. A spring 30 biases the retaining element for movement in the clockwise direction thus tending to hold it in the position shown by full lines in Fig. 2, in which position it is normally engaged with the latch. Movement of the retaining element is limited by a suitable stop which may be in the form of a transverse pin 31 extending between the two plates 24 and 25.

The other electro-responsive device is a magnet 32 which is preferably stationary. The magnet has a coil 32^a and a core 32^b, the latter being connected with the conductor 10 by means of a U-shaped clip 33. The coil 32^a of the magnet is electrically connected with the stationary contact 6 by means of a wire 34 which is positioned in a groove 1^g in the rear of the support 1 and which is connected at its upper end by means of the screw 8 which holds the contact in place. The magnet coil is also connected at 35 with the before-mentioned clip 33 which is in turn electrically connected with the conductor 10. Thus when the parts are in closed-circuit position the electrical circuit extends from the terminal 9 through the contacts 5 and 19, the bi-metallic latch 27 and the contacts 6 and 20, and thence through the wire 34 and the magnet coil 32^a to the conductor 10 and the terminal 12.

The retaining element 28 is provided with an armature 36 which upon energization of the magnet is moved from the position shown in full lines in Fig. 2 to the position shown in dotted lines in Fig. 2. It will be observed that this movement of the retaining element under the influence of the magnet serves to disengage the retaining element from the bi-metallic latch, the said latch remaining in its normal position.

For ordinary switching purposes the contact member can be moved by the handle or operating member either to its closed-circuit position as shown in Fig. 2 or to its open-circuit position as shown in Fig. 6, the operating member being held in one or the other of the said positions by means of the spring 26.

With the circuit closed, a continued small overload will cause the bi-metallic latch 27 to be heated and to be deflected to the position shown by dotted lines in Fig. 2. This disengages the latch from the retainer and permits the contact member to move automatically to open-circuit position entirely independently of the operating member and the actuator. After the contact member has moved to its open-circuit position as shown in Fig. 6, the handle or operating member can be moved to open-circuit position as shown in the same figure, relatching being ef-

fected as soon as the bi-metallic latch has cooled sufficiently to return to its normal position.

In the event of a severe or heavy overload such as a short circuit, the magnet 32 acts instantaneously to move the retainer 28 from the position shown by full lines in Fig. 2 to the position shown by dotted lines in the same figure, thus disengaging the latch 27 without the delay which would be involved in the heating and deflecting of the latch as a result of the overload current. This permits the contact member to move as before to its open-circuit position entirely independently of the operating member and the actuator.

What I claim is:

1. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, a relatively movable retaining device, an electro-responsive device normally engaging the retaining device and transmitting stress so as to hold the contact member in closed-circuit position, at least one of the said devices being bodily movable with the contact member and the said electro-responsive device upon electro-responsive action being moved to disengage the retaining device so as to permit automatic circuit-opening movement of the contact member, and another electro-responsive device serving upon electro-responsive action to move the retaining device independently of the first said electro-responsive device to disengage the retaining device therefrom so as to permit automatic circuit-opening movement of the contact member.

2. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, a relatively and bodily movable retainer, and two separate electro-responsive devices associated with the retainer and operable respectively electro-thermally and electro-magnetically, one of the said devices normally engaging the retainer to transmit stress so as to hold the contact member in closed-circuit position but upon electro-responsive action being moved to disengage the retainer so as to permit automatic circuit-opening movement of the contact member, and the other of the said devices upon electro-responsive action moving the retainer independently of the first said device to disengage the retainer therefrom so as to permit automatic circuit-opening movement of the contact member.

3. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, a bi-metallic latch deflectible in response to excess current conditions in the circuit, a relatively movable retainer normally engaged by the latch to enable the latter to transmit stress so as to hold the contact member in closed-circuit position, the said retainer being disengaged by the latch upon deflection thereof so as to permit automatic circuit-opening movement of the contact member, and means for moving the retainer independently of the latch to disengage the former from the latter to permit automatic circuit-opening movement of the contact member.

4. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, a bi-metallic latch deflectible in response to excess current conditions in the circuit, a relatively movable retainer normally engaged by the latch to enable the latter to transmit stress so as to hold the contact member in closed-circuit position, the said retainer being disengaged by the latch upon deflection thereof so as to permit automatic circuit-opening movement of the contact member, and a magnet connected in the circuit for moving the retainer independently of the latch to disengage the former from the latter to permit automatic circuit-opening movement of the contact member.

5. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, an actuator movable under manual control, a relatively and bodily movable retainer, and two separate electro-responsive devices associated with the retainer, one of the said devices normally engaging the retainer to transmit stress between the actuator and the contact member so as to thereby hold the contact member in fixed relationship with the actuator and thus enable the latter to move the former but the said device upon electro-responsive action being moved to disengage the retainer so as to permit automatic circuit-opening movement of the contact member independently of the actuator, and the other of the said devices upon electro-responsive action moving the retainer independently of the first said device to disengage the retainer therefrom so as to permit automatic circuit-opening movement of the contact member independently of the actuator.

6. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, an actuator movable under manual control, a relatively and bodily movable retainer, and two separate electro-responsive devices associated with the retainer and operable respectively electro-thermally and electro-magnetically, one of the said devices normally engaging the retainer to transmit stress between the actuator and the contact member so as to thereby hold the contact member in fixed relationship with the actuator and thus enable the latter to move the former but the said device upon electro-responsive action being moved to disengage the retainer so as to permit automatic circuit-opening movement of the contact member independently of the actuator and the other of the said devices upon electro-responsive action moving the retainer independently of the first said device to disengage the retainer therefrom so as to permit automatic circuit-opening movement of the contact member independently of the actuator.

7. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward

its open-circuit position, an actuator movable under manual control, a bi-metallic latch deflectible in response to excess current conditions in the circuit, and a relatively and bodily movable retainer with which the latch is normally engaged, the said bi-metallic latch and the said retainer being bodily movable with the actuator and the contact member and normally serving to mechanically connect them to enable the former to move the latter and the said latch upon deflection disengaging the retainer to thereby permit automatic circuit-opening movement of the contact member independently of the actuator and the said retainer being independently movable relatively to the latch to disengage it and thereby permit automatic circuit-opening movement of the contact member independently of the actuator.

8. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, an actuator movable under manual control, a bi-metallic latch deflectible in response to excess current conditions in the circuit, a relatively and bodily movable retainer with which the latch is normally engaged, the said bi-metallic latch and the said retainer being bodily movable with the actuator and the contact member and normally serving to mechanically connect them to enable the former to move the latter and the said latch upon deflection disengaging the retainer to thereby permit automatic circuit-opening movement of the contact member independently of the actuator, and a magnet connected in the circuit for independently moving the retainer relatively to the latch to disengage it and thereby permit automatic circuit-opening movement of the contact member independently of the actuator.

9. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position, an actuator movable under manual control, a bi-metallic latch deflectible in response to excess current conditions in the circuit, a relatively and bodily movable retainer with which the latch is normally engaged, the said bi-metallic latch and the said retainer being bodily movable with the actuator and the contact member and normally serving to mechanically connect them to enable the former to move the latter and the said latch upon deflection disengaging the retainer to thereby permit automatic circuit-opening movement of the contact member independently of the actuator, and a stationary magnet connected in the circuit and positioned adjacent the closed-circuit position of the retainer, the said magnet upon energization serving to independently move the retainer relatively to the latch to disengage it and thereby permit automatic circuit-opening movement of the contact member independently of the actuator.

JOSEPH SACHS.