Dec. 5, 1939. J. SACHS 2,182,773

AUTOMATIC CIRCUIT BREAKER

Filed Feb. 27, 1939

Fig. 1

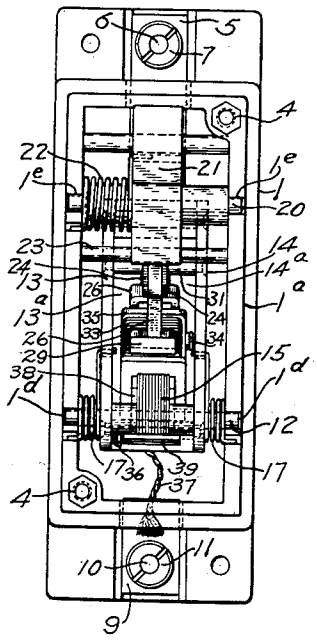


Fig. 2

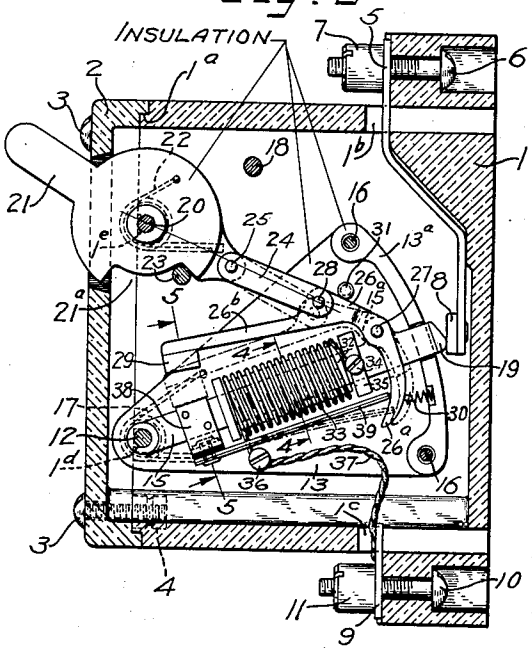


Fig. 3

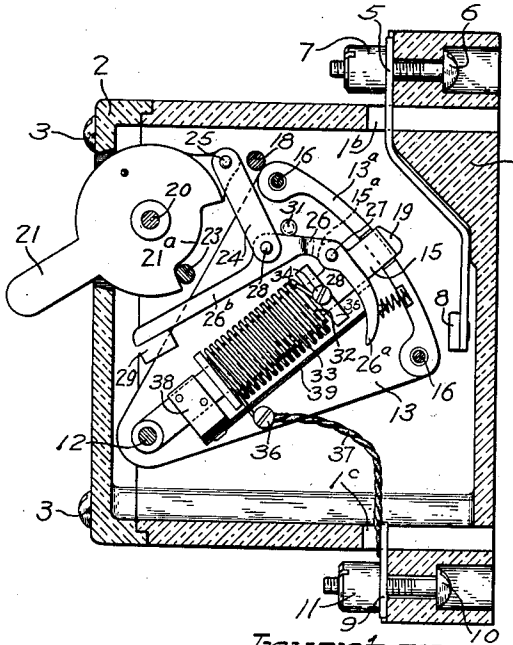


Fig. 4

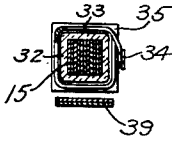
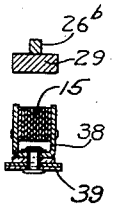


Fig. 5



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AUTOMATIC CIRCUIT BREAKER

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6 Claims. (Cl. 200—88)

This invention relates to a circuit breaker of the general type disclosed in my Patent No. 1,812,846 entitled Automatic circuit breaker. In a circuit breaker of this type, there is a movable contact member and also a movable operating member which is mechanically connected with the contact member to control it, the said mechanical connection normally serving when the operating member is in closed-circuit position to hold the contact member in closed-circuit position. The movable contact member carries a bodily movable electro-responsive means which serves upon the attainment of excess current conditions in the circuit to act upon the mechanical connection in such a way as to release the contact member and to permit it to move automatically to open-circuit position.

In accordance with one phase of the present invention, the bodily movable electro-responsive means comprises a thermostatic bi-metallic strip and also a magnet, each adapted independently of the other to act upon the mechanical connection to effect the release of the contact member.

In accordance with another phase of the invention, there is provided an electro-responsive circuit breaker releasing means which comprises a magnet and a bi-metallic strip which are both movable and are so related to each other that the coil of the magnet is closely adjacent the bi-metallic strip and serves as a heating element to cause the heating and deflection of the strip. As concerns this phase of the invention, I do not necessarily limit myself to an electro-responsive means which is bodily movable with the movable contact member.

In the accompanying drawing I have shown one suitable embodiment of the invention, but it will be understood 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 central sectional view of the circuit breaker, the front cover being included. The movable parts are in closed-circuit positions.

Fig. 3 is a view similar to Fig. 2 but showing the movable parts in open-circuit positions.

Fig. 4 is a fragmentary 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.

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 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 a suitable ledge at the top of the support 1 is a conducting member 5 held in place by a screw 6. A nut 7 on the screw 6 cooperates with the conductor 5 to constitute a wire terminal. The conductor 5 extends downward and inward through an opening 1^b in the top wall of the support 1 and carries a stationary electrical contact 8.

Carried by a suitable ledge at the bottom of the support 1 is a conductor 9 held in place by a screw 10. A nut 11 on the screw 10 cooperates with the conductor 9 to constitute a wire terminal. The conductor 9 extends upward into an opening 1^c in the bottom wall of the support 1.

The side walls of the support 1 are provided at the front with similar opposite notches 1^d, 1^d which receive a transverse pivot pin 12. The cover 2 holds the pivot pin 12 in place in the said notches. Pivotally mounted on the pin 12 is a movable contact member which comprises two insulating side plates 13 and 14 and which also comprises a laminated core piece 15 positioned mid-way between the side plates. The two side plates and the core piece are held in properly spaced relationship with each other and with the sides of the support by means of suitable bushings on the pin 12.

The two side plates 13 and 14 are generally triangular in shape and at their edge opposite the pivot pin are provided respectively with a flange 13^a extending toward the right and a flange 14^a extending toward the left. These flanges engage each other at the central plane of the circuit breaker and they are provided with registering notches through which the outer end of the core piece 15 projects as clearly shown in Figs. 2 and 3. The two side plates are connected to each other by means of screws or rivets 16, 16. Two springs 17, 17 surrounded the bushings at the outer sides of the side plates 13 and 14 and are connected with the housing walls with the side plates so as to bias the entire conducting member for movement in the counter-clockwise or cir-

cuit-opening position. Movement of the conducting member in the counter-clockwise direction is limited by a stop pin 18 which extends transversely between the side walls of the support 1.

Connected with the outer end of the core piece 15, by brazing or otherwise, is a movable contact 19 which is adapted to engage and disengage the stationary contact 8 as the conducting member is moved in one direction or the other about the pivot pin 12.

The side walls of the support 1 are also provided at the front with notches 1e, 1e similar to the before-mentioned notches 1d, 1d. These notches receive a pivot pin 20 which is held in place by the cover 2. Mounted on the pivot pin 20 is a handle or operating member 21, this being held in central position by means of suitable bushings. The handle projects through a suitable opening in the front cover 2. A spring 22 serves to bias the handle for movement in the counter-clockwise or circuit-opening direction. Movement of the operating member in both directions is limited by a transverse stop pin 23 which extends between the side walls of the support 1 and which engages with the ends of a notch 21a.

The operating member 21 is mechanically connected with the contact member so that the former can move and control the latter and as shown in the drawing the mechanical connection is of such character that it holds the contact member in closed-circuit position whenever the operating member is in closed-circuit position. This mechanical connection may vary as to its details of construction but I prefer to provide a link such as 24 pivotally connected with the operating member at 25. As shown the link 24 comprises two similar link elements spaced apart at opposite sides of the operating member. The link 24 is adapted to cooperate with the operating member to constitute a toggle which is in overset or locked position when the operating member is in closed-circuit position. The other end of the link 24, instead of being directly pivoted to the contact member, is indirectly connected therewith by means of an abutment member 26 which is movable relatively to the contact member so as to be adapted to shift the position of the link 24 and break the toggle, as will be hereinafter more fully explained. The abutment member 26 is pivoted at 27 to an ear 15a projecting upward from the core piece 15, and the link 24 is pivoted to the abutment member at 28. Below the pivotal connection 27 the abutment member is relatively wide and is provided with an opening through which the core piece extends, and it terminates in a cam-shaped tail portion 26a. The portion 26b of the abutment member 26 above and to the left of the pivotal connection at 27, is much narrower so as to fit between the two elements of the link 24. The portion 26b at or near the forward end thereof carries a magnetic armature 29. A spring 30 biases the abutment member for movement in the clockwise direction, such movement being limited by a stop pin 31 which extends transversely between the side plates of the contact member.

Surrounding the core piece 15 is an insulating shell 32 on which is wound a high resistance conducting wire 33 which forms a magnet coil. The wire 33 is connected at its right hand and to a screw 34 which is threaded into a metallic washer 35 carried by the core piece 15. The other end of the wire 33 extends to a connecting screw 36 on one of the side plates of the contact member and is there electrically connected with one end of a flexible conductor 37, the other end of the flexible conductor being connected by soldering or otherwise with the conductor 9. It will be observed that when the parts are in the positions shown in Fig. 2, an electrical circuit is established from the terminal 7 and the conductor 5 through the contacts 8 and 19 to the core piece 15 and the magnet coil 33. From the magnet coil the circuit extends to the screw 36 and through the flexible conductor 37 to the conductor 9 and the wire terminal 11. When the magnet is sufficiently energized it draws the armature 29 downward thus moving the abutment member in the counter-clockwise direction.

Connected with the core piece 15 by means of rivets or otherwise is a U-shaped clip 38 which carries a bi-metallic strip 39. This strip extends rearward parallelly with the core piece and in close proximity to the wire 33 which constitutes the coil of the magnet. The upper right hand end of the bi-metallic strip 39 engages the cam surface on the tail portion 26a on the abutment member. Preferably the bi-metallic strip is insulated from the U-shaped clip 38 which carries it so as to prevent the passage of current through the strip.

With the parts in the positions shown in Fig. 2 the circuit is closed, the conducting member being held in its closed-circuit position by the link 24 and the handle member 21 which cooperate to form a toggle. It will be observed that the pivotal axis at 25 is slightly below a straight line connecting the axes at 20 and 28. The spring 30 holds the abutment member in its upper position in engagement with the stop 31.

Upon the attainment of a low overload condition in the circuit, the high resistance wire 33 becomes heated and the heat thereof is gradually transmitted to the bi-metallic strip 39 which deflects downward to the position shown by dot-and-dash lines in Fig. 2. The downward deflection of the strip 39 has a camming effect on the tail portion 26a of the abutment member moving the abutment member in the counter-clockwise direction to, or at least toward, the position shown by dot-and-dash lines in Fig. 2. This movement of the abutment member moves the pivotal axis 28 downward sufficiently to break the toggle relationship between the link 24 and the handle 21, and as soon as this toggle relationship is broken the handle 21 and also the conducting member are moved to their open-circuit positions by the springs 22 and 17, 17.

In the event of a sudden or heavy overload such as a short circuit, the magnet acts to instantaneously move the armature 29 downward to the position shown by dot-and-dash lines in Fig. 2, thus causing the opening of the circuit breaker in exactly the same manner as previously described. It will be observed that this magnetic action takes place without the delay which would be involved in the deflection of the strip 39 as the result of heat transmitted from the coil 33.

When the movable parts are in their open-circuit positions as shown in Fig. 3, they can be restored to closed-circuit position by moving the handle 21 upward or in the clockwise direction. Initially the abutment member 26 may be moved downward compressing the spring 30, but as the parts approach the closed-circuit position as shown in Fig. 2, the spring 30 will act to return the abutment member to its normal relative position as shown.

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, an operating member movable under manual control, means mechanically connecting the contact member with the operating member to enable the former to control the latter and normally serving when the operating member is in closed-circuit position to hold the contact member in closed-circuit position, a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and arranged to be heated and deflected upon the attainment of an abnormal current condition in the circuit, the said strip upon deflection acting upon the said mechanical connection to release the contact member for automatic circuit-opening movement, and a magnet supported upon and bodily movable with the contact member and arranged to be energized upon the attainment of abnormal current conditions in the circuit, the said magnet upon energization acting upon the said mechanical connection independently of the bi-metallic strip to release the contact member for automatic circuit-opening movement.

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 pivoted operating member movable under manual control, a link pivotally connected with the contact member and with the operating member and cooperating with the latter to form a toggle which serves when the operating member is in closed-circuit position to hold the contact member in closed-circuit position, a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and arranged to be heated and deflected upon the attainment of an abnormal current condition in the circuit, the said strip upon deflection acting to break the said toggle and thereby release the contact member for automatic circuit-opening movement, and a magnet supported upon and bodily movable with the contact member and arranged to be energized upon the attainment of abnormal current conditions in the circuit, the said magnet upon energizattion acting to break the said toggle and thereby release the contact member for automatic circuit-opening movement.

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 pivoted operating member movable under manual control, an abutment member pivotally connected with the contact member, a link pivotally connected with the abutment member and with the operating member and cooperating with the latter to form a toggle which normally serves when the operating member is in closed-circuit position to hold the contact member in closed-circuit position, a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and arranged to be heated and deflected upon the attainment of an abnormal current condition in the circuit, the said strip upon deflection moving the abutment member to break the said toggle and thereby release the contact member for automatic circuit-opening movement, and a magnet supported upon and bodily movable with the contact member and arranged to be energized upon the attainment of abnormal current conditions in the circuit, the said magnet upon energization moving the abutment member to break the said toggle and thereby release the contact member for automatic circuit-opening movement.

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 pivoted operating member movable under manual control, an abutment member pivotally connected with the contact member, the said abutment member having a tail portion at one side of its pivotal connection with the contact member and having an armature portion at the other side of its said pivotal connection, a link pivotally connected with the abutment member and with the operating member and cooperating with the latter to form a toggle which normally serves when the operating member is in closed-circuit position to hold the contact member in closed-circuit position, a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and arranged to be heated and deflected upon the attainment of an abnormal current condition in the circuit, the said strip upon deflection engaging the tail portion of the abutment member to shift the pivotal axis of the link and thereby break the said toggle and release the contact member for automatic circuit-opening movement, and a magnet supported upon and bodily movable with the contact member and arranged to be energized upon the attainment of abnormal current conditions in the circuit, the said magnet upon energization acting upon the armature portion of the abutment member to shift the pivotal axis of the link and thereby break the said toggle and release the contact member for automatic circuit-opening movement.

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 operating member movable under manual control, means mechanically connecting the contact member with the operating member to enable the former to control the latter and normally serving when the operating member is in closed-circuit position to hold the contact member in closed-circuit position, a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and serving when heated and deflected to act upon the said mechanical connection so as to release the contact member for automatic circuit-opening movement, and a magnet supported upon and bodily movable with the contact member and arranged to be energized upon the attainment of abnormal current conditions in the circuit and serving upon energization to act upon the said mechanical connection so as to release the contact member for automatic circuit-opening movement, the coil of the magnet being closely adjacent the bi-metallic strip and serving as a heating element to cause the heating and deflection of the said strip.

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, a pivoted operating member movable under manual control, a link pivotally connected with the contact member and with the operating member and cooperating with the latter to form a toggle which serves when the operating member is in closed-circuit position to hold the contact member in closed-circuit position, a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and serving when heated and deflected to break the said toggle and thereby release the contact member for automatic circuit-opening movement, and a magnet supported upon and bodily movable with the contact member and arranged to be energized upon the attainment of abnormal current conditions in the circuit and serving upon energization to break the said toggle and thereby release the contact member for automatic circuit-opening movement, the coil of the magnet being closely adjacent the bi-metallic strip and serving as a heating element to cause the heating and deflection of the said strip.

JOSEPH SACHS.