Aug. 6, 1940. J. SACHS 2,210,260

AUTOMATIC CIRCUIT BREAKER

Filed Feb. 27, 1939

Fig. 1

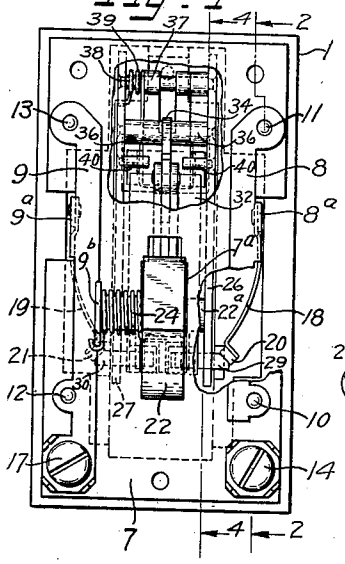


Fig. 2

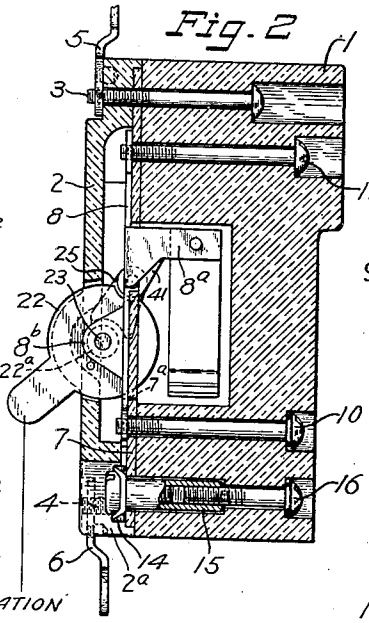


Fig. 3

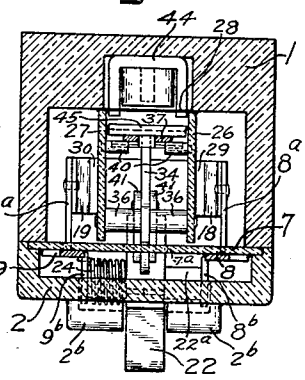


Fig. 7

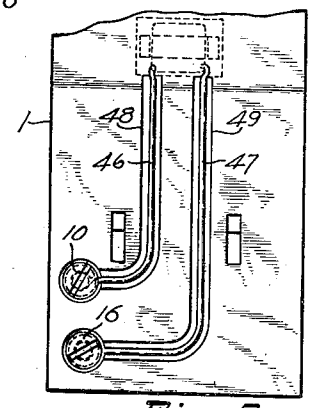


Fig. 4

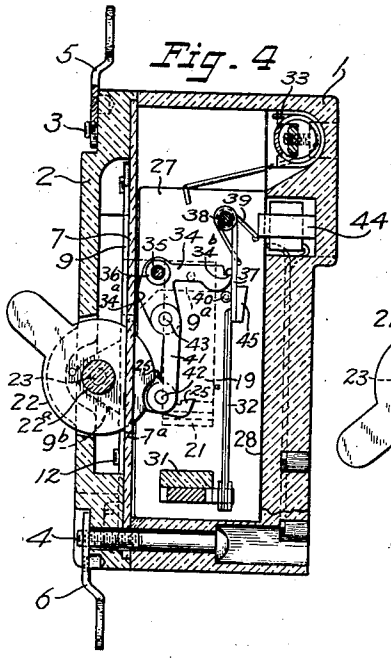


Fig. 5

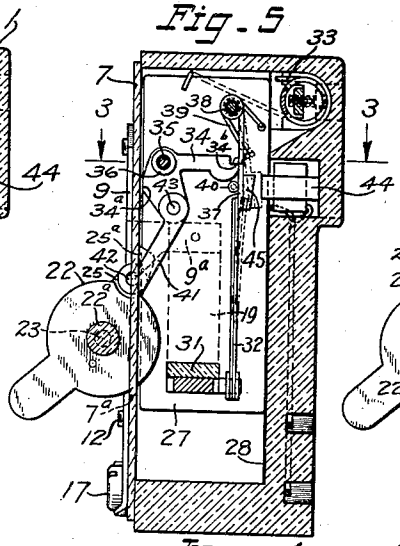
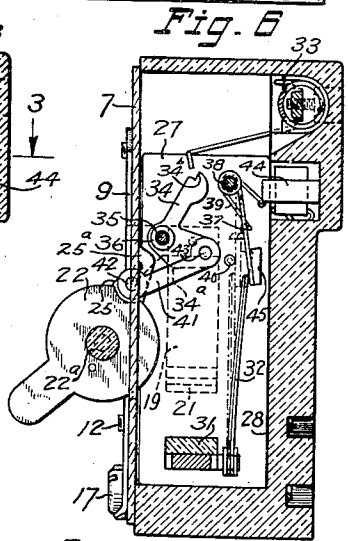


Fig. 6



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UNITED STATES PATENT OFFICE

2,210,260

AUTOMATIC CIRCUIT BREAKER

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

Application February 27, 1939, Serial No. 258,698

11 Claims. (Cl. 200—88)

This invention relates to a circuit breaker of the type set forth in my reissued Patent No. 20,018 and in my Patents Nos. 1,812,843, 2,020,333 and 2,094,063 all entitled Automatic circuit breaker.

Each of the circuit breakers disclosed in the before-mentioned patents includes a bodily movable bi-metallic element or strip which serves in and of itself as a latch to normally hold the movable contact member in closed-circuit position, the movable contact member being ordinarily connected by means of the said latch with a manually operable actuator so that the said actuator can move the contact member for ordinary switching purposes. The bi-metallic latch is so arranged that it is heated upon the attainment of excess current conditions in the circuit so that it is deflected in such a way as to be released or disengaged, the contact member thereupon being permitted to move automatically to open-circuit position independently of the actuator.

One of the objects of the present invention is to provide a circuit breaker of the general type disclosed in the said patents, but so constructed that the bodily movable bi-metallic strip is entirely relieved of any mechanical stresses resulting from the holding or the moving of the movable contact member. This object is attained by providing a mechanical latch for effecting the moving and the holding of the contact member, the said latch being functionally independent of the movable bi-metallic element or strip but associated therewith in such a way that the said strip upon being heated and deflected causes the latch to be released so as to thus permit the contact member to automatically move to open-circuit position.

Another object of the invention is to provide in association with the independent mechanical latch before referred to, a means entirely independent of the bodily movable bi-metallic strip for also moving the latch to cause the release thereof. This separate means may be a magnet connected in the circuit so as to operate upon attainment of excess current conditions. When a bi-metallic strip and a magnet are both provided, they may be so designed that the bi-metallic strip will be slowly heated and deflected as the result of a long continued overload and that the magnet will be instantaneously energized upon a heavy overload such as a short circuit. It will be understood that in accordance with the present invention, the movable bi-metallic latch and the magnet act independently of each other upon the separate mechanical latch, this construction being distinctly different from that shown in my aforesaid Reissued Patent No. 20,018 wherein there is provided a magnet which acts to cause or at least augment the deflection of the bi-metallic strip.

In the accompanying drawing I have shown the embodiment of the invention which I now deem preferable, 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 sectional view taken along the line 2—2 of Fig. 1. In this view the front cover is included.

Fig. 3 is a transverse horizontal sectional view taken along the line 3—3 of Fig. 5.

Fig. 4 is a vertical sectional view taken along the line 4—4 of Fig. 1, this view also showing the front cover of the circuit breaker which is in section along the central vertical plane thereof. In this view the operating parts are shown in open-circuit positions.

Fig. 5 is a view similar to the Fig. 4 but omitting the front cover and showing the operating parts in closed-circuit positions.

Fig. 6 is a view similar to Fig. 5 but showing the operating parts in the positions which they assume when automatic opening takes place with the handle or operating member held in its closed-circuit position.

Fig. 7 is a fragmentary rear view showing the wiring connections for the magnet.

Referring to the drawing, 1 represents as an entirety the main insulating base or casing for the circuit breaker and 2 represents the front insulating cover. These parts are connected by suitable means, such as screws 3 and 4 and together they constitute an enclosure. The screws 3 and 4 engage metal brackets 5 and 6 by means of which the entire circuit breaker can be mounted in a wall box or other suitable casing.

The main base or casing 1 has an opening or recess at the front and is closed or substantially closed at the rear. A front guide plate 7 is provided which substantially closes the front opening in the casing 1. Resting upon the guide plate 7 are two conducting members 8 and 9 which are similar in construction except that they are

right and left. The members 8 and 9 are held in place by means of screws 10, 11 and 12, 13 which extend forward through the casing 1 and through holes in the plate 7. The screws thus serve not only to hold the members 8 and 9 but also to hold the plate 7.

The member 8 is somewhat shorter than the member 9, and immediately below the said member 8, but insulated therefrom, is a wire terminal 14, held by a threaded tube 15 and a screw 16. The member 9 is provided with a corresponding wire terminal 17 at the lower end thereof. The cover 2 is provided with notches 2^a at the lower corners to provide space for the terminals 14 and 17.

The members 8 and 9 are provided with rearward extending portions 8^a and 9^a which are positioned in suitably formed notches in the sides of the plate 7. Carried by and electrically connected with the said portions 8^a and 9^a are resilient conducting elements 18 and 19 which carry contacts 20 and 21. The said contacts 20 and 21 are stationary except for such movement as is provided by the resiliency of their supports 18 and 19 and they will be hereinafter referred to as stationary contacts.

The members 8 and 9 are provided with forward projecting ears 8^b and 9^b which serve to support a pivotally mounted handle 22. The handle is provided with hubs 22^a having axially positioned pintles 23 seated in bearing apertures in the said ears 8^b and 9^b. The cover 2 has forward projecting portions 2^b, 2^b which enclose the hubs. A coil spring 24 surrounds one of the handle hubs and serves to bias the handle in the clockwise direction. A portion of the handle 22 projects rearward through a slot 7^a in the plate 7. The handle is preferably formed of insulating material and it carries a metallic piece 25 adapted to be connected with operating links to be hereinafter described.

The contact carrying member of the circuit breaker is rectilinearly movable within the hollow interior of the casing 1, the said member being guided at the front and held in place by means of the before-mentioned guide plate 7. The said contact-carrying member preferably comprises two insulating plates 26 and 27 which are spaced apart transversely. The two plates 26 and 27 are adapted to engage at the front directly with the guide plate 7. At the rear there is preferably provided an auxiliary guide plate 28 seated in the bottom of the main recess in the casing 1.

Two laterally projecting movable contacts 29 and 30 are carried by the contact member at the sides thereof, these contacts projecting laterally from the respective side plates 26 and 27 and being adapted to be engaged with and disengaged from the respective stationary contacts 20 and 21. The said contacts 29 and 30 are in the form of metallic plates which project inward through slots in the respective side plates 26 and 27. Extending transversely between the two side plates and associated with the contacts is an insulating bar 31.

The two movable contacts 29 and 30 are electrically connected with each other, this electrical connection being through a bodily movable bimetallic U-shaped thermostatic strip 32, mechanically and electrically connected directly with the two contacts.

From the foregoing description it will be apparent that the contact member is movable rectilinearly as guided by the plates 7 and 28, and that in so moving it serves to bring the movable contacts 29 and 30 into or out of engagement with the respective stationary contacts 20 and 21 to make or break the circuit. When the contact member is in the upper contact engaging position as shown in Figs. 2 and 5, electrical connection is established between the conducting members 8 and 9; and when the contact member is in the lower position as shown in Figs. 4 and 6 the circuit is broken at two places, that is between the contacts 20 and 29 and between the contacts 21 and 30.

A suitable spring means is provided for biasing the contact member in the downward or circuit-opening direction. Preferably and as shown there is provided a torsional coil spring 33 positioned in a suitable auxiliary recess near the rear of the casing 1.

For actuating the contact member for normal switching purposes, or to effect closing of the circuit after automatic opening thereof, I provide a member 34 which I shall term an actuating member or actuator. The actuator is pivoted to the contact member for movement about a transverse axis in fixed relationship thereto. The actuating member 34 is of bell crank form and consists of a metallic plate pivotally mounted on a pin 35 extending transversely between the two side plates 26 and 27. Spacing bushings 36, 36 hold the actuator in central position. A shoulder 34^a on the actuator 34 is adapted to engage the plate 7 and to thus limit relative movement of the actuator in the clockwise direction. The actuator is provided with a tooth 34^b which is normally engaged by a wear piece carried by a latch 37 pivoted on a pin 38 extending transversely between the side plates 26 and 27. A spring 39 biases the latch for clockwise movement and such movement is limited by stop pins 40, 40. The latch is immediately adjacent the bi-metallic strip 32, so that upon rearward deflection of the strip the latch is correspondingly moved. With the parts in the relative positions shown in Fig. 5, the actuator and the contact member are positively connected by the latch 37 so as to move in unison.

The handle or operating member 22 serves as the means for manually operating the actuator 34. The metallic piece 25 on the handle member 22 is connected with the actuator 34 by means of two similar links 41, 41, the links being pivoted to the handle at 42 and to the actuator at 43.

When the parts are in the relative positions shown in Fig. 5 the links 41 cooperate with the handle 22 to form a toggle which locks the parts in position with the movable contacts 29 and 30 pressed into firm engagement with the stationary contacts 20 and 21. Continued movement of the handle in the counter-clockwise direction is prevented by the engagement of an extension 25^a on the metallic piece 25 with the front guide plate 7 as shown in Fig. 5. The pivotal axis at 42 is at the left of a straight line connecting the pivotal axes at 23 and 43, and thus the handle member 22 and the links 41 serve to resist the tendency of the contact member to move downward under the influence of the spring 33 and of gravity. The spring 33 is sufficiently powerful to enable the said toggle action to hold the handle or operating member 22 in its lower or closed-circuit position, the toggle action resisting the tendency of the spring 24 to move the said member in the clockwise direction to its open-circuit position.

The above described toggle action can be released by pressing the handle upward, the parts then moving under the action of the springs 33 and 24 to the open-circuit position shown in Fig.

4. The movable contacts 29 and 30 are thus disengaged from the stationary contacts 20 and 21 and the circuit is broken in two separate places. By moving the handle toward the downward position the several parts can be restored to their respective closed-circuit positions, as shown in Fig. 5, and the circuit can be thus re-established.

As before explained, the bi-metallic strip 3 is electrically connected between the movable contacts 29 and 30. It is adapted to be deflected rearward upon the passage of excess current therethrough, with the result that the latch 37 is moved rearward so as to be disengaged from the tooth 34b of the actuator 34. Such disengagement permits the actuator 34 to turn slightly relatively to the contact member in the counter-clockwise direction. This slight movement changes the relation of the toggle links 41 and 22 and reduces the pressure which had theretofore served to hold the links 41 and the handle member 22 in their effective toggle relationship. This change in relationship and reduction in pressure permits the handle member 22 to move in the clockwise direction so as to render the toggle ineffective. Thus both the contact member and the handle are freed and both of them move to their open-circuit positions under the influence of their respective springs. It will be understood that normally the contact member and the handle move substantially simultaneously with the result that the latch and the actuator may never be substantially separated from each other. When the parts reach their full open-circuit position as shown in Fig. 4 the latch and the actuator are in position to fully re-engage as soon as the thermostatic strip is sufficiently cooled.

The circuit-opening movement of the contact member is not in any way dependent on the circuit-opening movement of the handle member and will, in fact, occur even though the handle member be held in its closed-circuit position, as shown in Fig. 6. The rearward deflection of the thermostatic strip 32 releases the latch and permits the actuator 34 to turn in the counter-clockwise direction as already stated, even though the handle is held, thus releasing the contact member from the control of the handle member 22 and of the links 41. The contact member moves downward to the position shown in Fig. 6, the actuator 34 and the links 41 assuming the relative positions shown in that figure. If the handle 22, after having been held as described, be now released, it will move under the influence of the spring 24 to its open-circuit position as shown in Fig. 4, thus bringing the actuator 34 into its normal position with respect to the contact member so that the tooth 34b is automatically engaged by the latch 37.

It will be observed that with the described construction, the bi-metallic strip 32 is entirely free from any stresses resulting from the holding or moving of the contact member. All such stresses are carried solely by the mechanical latch 37 and the bi-metallic strip serves merely as a means for moving the latch.

It may be desirable, and sometimes preferable, to provide a means additional to the bi-metallic strip 32 for also moving the latch 37 to effect release thereof to thereby effect opening of the circuit. While I do not necessarily limit myself as concerns the character of this additional means, I prefer for this purpose, and have shown, a magnet 44. This magnet is located in a suitable recess in the rear wall of the base 1 and is adjacent the closed-circuit position of the latch 37 as clearly shown in Fig. 5. The latch 37 is provided with an armature 45 for cooperation with the magnet, the armature being drawn rearward when the magnet is energized, thus moving the latch rearward and effecting its release from the actuator 34. The circuit is then opened in the manner already described.

The magnet 44 may be electrically connected in any suitable way, but preferably it is connected in the main circuit of the breaker and in series with the contacts and with the bi-metallic strip 32. As shown, particularly in Fig. 7, wires 46 and 47 connect the magnet respectively with the screws 10 and 16, these wires being positioned in suitable grooves 48 and 49 formed in the rear wall of the base 1.

Preferably the electrical characteristics of the bi-metallic strip 32 and of the magnet 44 are such that a low overload which will not energize the magnet sufficiently to release the latch will, if continued, cause the gradual heating and deflection of the strip 32 so as to eventually release the latch 37 in the manner already described. However, in the event of a heavy overload or short circuit, the magnet 44 will be instantaneously energized thus immediately releasing the latch without the delay which would be involved in the heating and deflection of the bi-metallic strip 32.

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 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, and means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to hold the contact member in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position.

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 thermostatic bi-metallic strip supported upon and bodily movable with the contact member, the said strip being connected in the circuit so as to be heated and deflected upon the attainment of an abnormal current condition in the circuit, and means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to hold the contact member in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position.

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 thermostatic bi-metallic strip supported upon and bodily movable with the contact member and arranged to be heated upon the attainment of an abnormal

current condition in the circuit and thus deflected, and means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to hold the contact member in closed-circuit position, the said latch being directly engaged by the strip and being automatically moved thereby upon deflection thereof so as to thus permit the contact member to automatically move to open-circuit position.

4. In an automobile 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 actuating member movable under manual control, 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, and means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to connect the contact member with the actuating member so that the latter may move the former and hold it in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position free from the control of the actuating member.

5. In an automatic circuit breaker, the combination of a stationary contact, a rectilinearly 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 actuating member rectilinearly movable under manual control, a thermostatic bi-metallic strip supported upon and bodily movable with the contact member and extending approximately in the direction of rectilinear movement, the said strip being arranged to be heated and deflected upon the attainment of an abnormal current condition in the circuit, and means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to connect the contact member with the actuating member so that the latter may move the former and hold it in closed-circuit position, the said latch upon deflection of the strip being automatically moved transversely of the aforesaid direction of rectilinear movement and thus released so as to thus permit the contact member to automatically move to open-circuit position free from the control of the actuating member.

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 actuating member supported upon and bodily movable with the contact member and also movable relatively thereto, manually operable means for moving the actuating member, 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, and means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to connect the contact member with the actuating member to prevent movement of the latter relatively to the former and thus enable the actuating member to move the contact member and hold it in closed-circuit position, the said latch being automatically released upon deflection of the strip and thus permitting the contact member to automatically move to open-circuit position free from the control of the actuating member.

7. In an automobile 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 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, means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to hold the contact member in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position, and means additional to the bi-metallic strip and acting independently thereof for releasing the latch.

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, 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, means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to hold the contact member in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position, and a magnet connected in the circuit and serving upon the attainment of excess current conditions in the circuit to move and release the latch entirely independently of the bi-metallic strip.

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, 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, means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to hold the contact member in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position, and a magnet connected in the circuit and serving upon the attainment of excess current conditions in the circuit to move and release the latch entirely independently of the bi-metallic strip, the said magnet being station-

ary and located adjacent the closed-circuit position of the latch.

10. 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 actuating member movable under manual control, 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, means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to connect the contact member with the actuating member so that the latter may move the former and hold it in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position free from the control of the actuating member, and means additional to the bi-metallic strip and acting independently thereof for releasing the latch.

11. 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 actuating member movable under manual control, 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, means including a releasable latch bodily movable with the contact member and normally serving independently of the bi-metallic strip to connect the contact member with the actuating member so that the latter may move the former and hold it in closed-circuit position, the said latch being automatically released upon deflection of the strip so as to thus permit the contact member to automatically move to open-circuit position free from the control of the actuating member, and a magnet connected in the circuit and serving upon the attainment of excess current conditions, in the circuit to move and release the latch entirely independently of the bi-metallic strip.

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