Oct. 5, 1937. J. SACHS 2,094,963

AUTOMATIC CIRCUIT BREAKER

Original Filed Nov. 8, 1934 2 Sheets-Sheet 1

Fig. 1

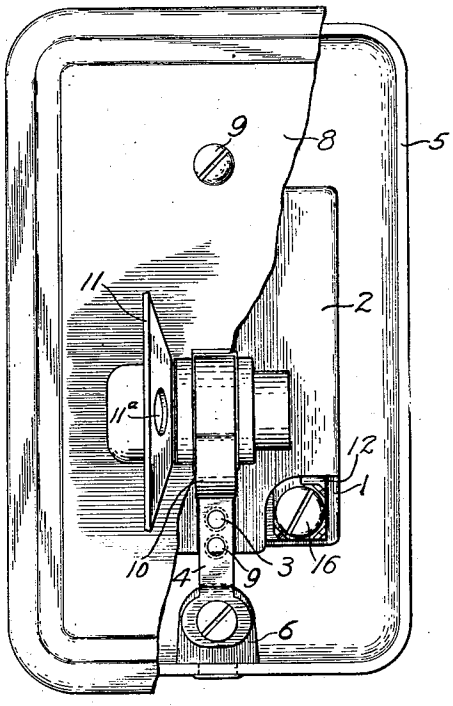



Fig. 2

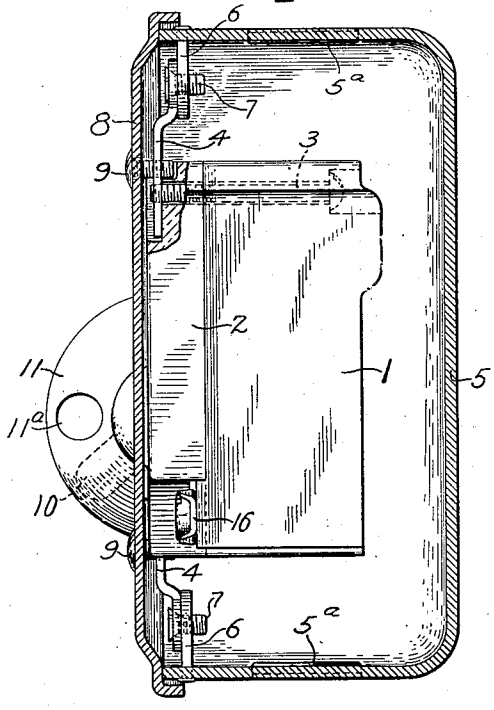



Fig. 3

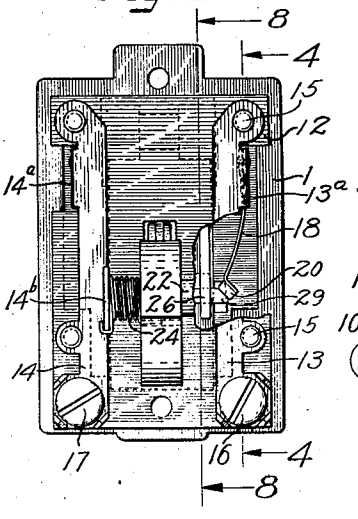



Fig. 4

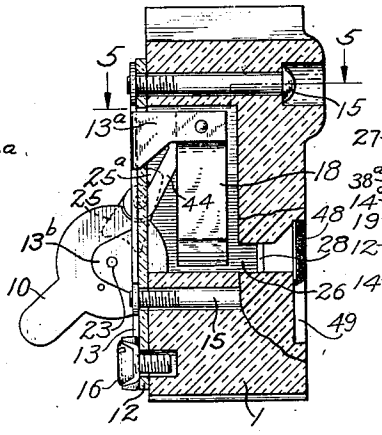
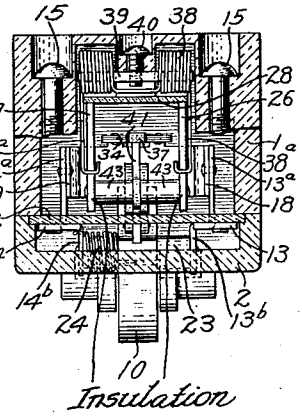



Fig. 5




Insulation

Inventor
Joseph Sachs
By S. Jay Teller
Attorney

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Fig. 6

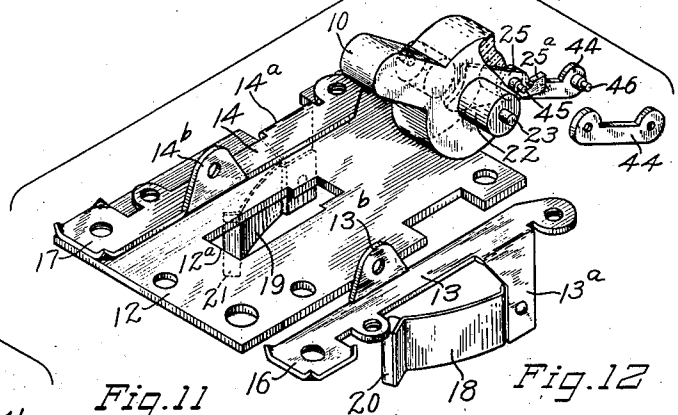


Fig. 7

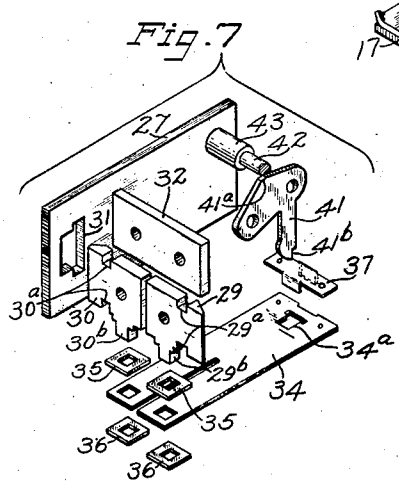


Fig. 11

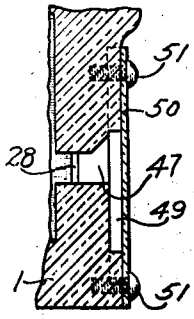


Fig. 12

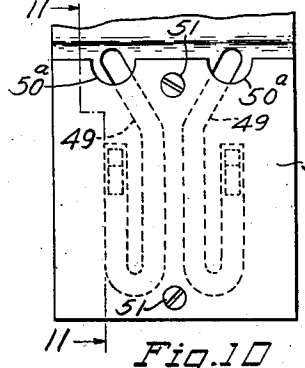


Fig. 8

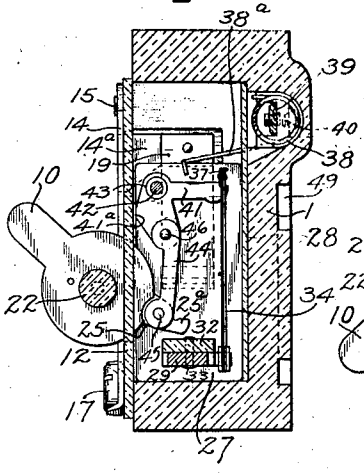


Fig. 9

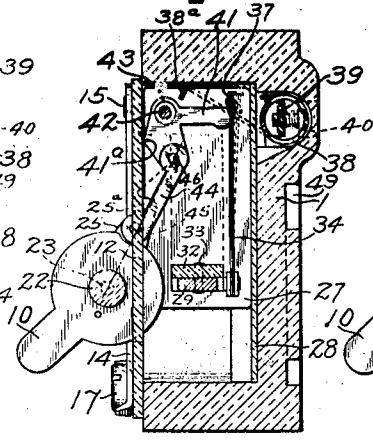
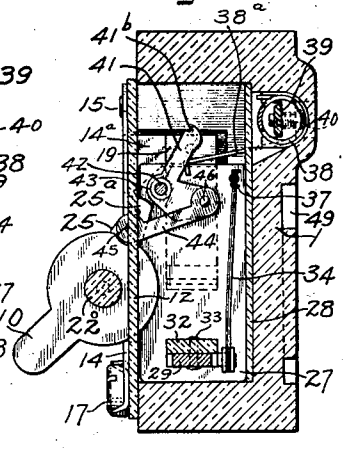


Fig. 10



Inventor
Joseph Sachs
By S. Jay Teller
Attorney

Patented Oct. 5, 1937

2,094,963

# UNITED STATES PATENT OFFICE

2,094,963

## AUTOMATIC CIRCUIT BREAKER

Joseph Sachs, West Hartford, Conn.

Application November 8, 1934, Serial No. 752,154
Renewed September 24, 1936

30 Claims. (Cl. 200—116)

This invention relates particularly to an automatic circuit breaker of the type set forth in my Patents Nos. 1,811,970, 1,812,842, 1,812,843 and 1,812,846 all dated June 30, 1931 and in my Patent No. 2,020,333 dated November 12, 1935.

In my last said patent I have disclosed a circuit breaker having a pivotally movable contact carrying member and having an actuator pivoted directly upon the contact carrying member so as to be bodily movable therewith; an electro-responsive means such as a bi-metallic thermostatic strip is secured to the contact carrying member and engages directly with the actuator to prevent movement thereof relatively to the contact member; and an operating means is connected with the actuator and serves to move it and to thus move the contact member to open and close the circuit. Upon the attainment of abnormal current conditions in the circuit the electro-responsive means releases the actuator, thus permitting it to move relatively to the contact member and thus permitting the contact member to automatically move to open-circuit position.

For some purposes it is preferable to make use of a rectilinearly movable contact carrying member instead of a pivotally movable member. The rectilinearly movable member ordinarily requires less space, can be more readily assembled with or disassembled from the other circuit breaker parts, and provides a better toggling action for locking in closed-circuit position. The principal object of the present invention is to provide a circuit breaker of the type set forth having a rectilinearly movable contact carrying member and at the same time having many of the advantages incident to the circuit breaker set forth in my last said patent.

In the accompanying drawings I have shown the embodiment of the invention which I now deem preferable, but it will be understood that the drawings are intended for illustrative purposes only and are 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 drawings:

Fig. 1 is a front view of a circuit breaker embodying the invention, the said circuit breaker being enclosed in a metallic box the front cover of which is partly broken away.

Fig. 2 is a side view of the circuit breaker, the enclosing box being shown in vertical section.

Fig. 3 is a front view of the circuit breaker with the front cover thereof removed.

Fig. 4 is a vertical sectional view taken along the line 4—4 of Fig. 3.

Fig. 5 is a horizontal sectional view taken along the line 5—5 of Fig. 4.

Fig. 6 is a detail view showing separately the front guide plate of the circuit breaker and various other parts directly associated therewith.

Fig. 7 is a detail view showing separately the several parts of the contact carrying member.

Fig. 8 is a vertical sectional view taken along the lines 8—8 of Fig. 3, but showing the parts in open-circuit position.

Fig. 9 is a view similar to Fig. 8 but showing the parts in closed-circuit positions.

Fig. 10 is a view similar to Fig. 9 showing the handle held in closed-circuit position and showing the contact member in open-circuit position.

Fig. 11 is a fragmentary sectional view similar to Fig. 4 and showing an alternative embodiment of the invention, this view being taken along the line 11—11 of Fig. 12.

Fig. 12 is a fragmentary rear view of the construction shown in Fig. 11.

Referring to the drawings, 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, 3, and together they constitute an enclosure. As shown, the front ends of the screws 3, 3 are engaged with brackets 4, 4 which may serve as a means for supporting the circuit breaker. The circuit breaker is shown mounted in a box 5 having supporting ears 6, 6 therein. The brackets 4, 4 engage the ears 6, 6 and are connected thereto by means of screws 7, 7. The front cover 8 of the box may be held in place by means of screws 9, 9 entering threaded holes in the brackets 4, 4. It will be understood that the box 5 is provided with the usual openings or knockouts, such as $5^a$, $5^a$, permitting circuit wires to extend into the box for connecting the circuit breaker.

The circuit breaker is provided with a horizontally pivoted handle or operating member 10 which projects through a suitable slot in the front cover 8. As shown, the cover is provided with metallic guards 11 placed at opposite sides of the handle. The guards have holes $11^a$ for receiving a seal or lock to hold the handle in a predetermined position.

Fig. 3 shows the circuit breaker with the front insulating cover 2 thereof removed. The main casing 1 has an opening or recess at the front and is closed or substantially closed at the rear. A

front guide plate 12 is provided which substantially closes the front of the recess in the casing 1. Resting upon the guide plate 12 are two conducting members 13 and 14 which are identical in construction except that they are right and left. Each of the members 13 and 14 is held in place by means of screws 15, 15 which extend forward through the casing 1 and through holes in the plate 12. The screws 15, 15 thus serve not only to hold the members 13 and 14 but also to hold the plate 12.

The members 13 and 14 are provided with wire terminals 16 and 17 which are shown as being at the lower ends thereof. The members 13 and 14 are provided with rearward extending portions 13a and 14a which are positioned in suitably formed notches in the sides of the plate 12. Carried by and electrically connected with the said portions 13a and 14a 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 13 and 14 are provided with forward projecting ears 13b and 14b which serve to support the before mentioned pivotally mounted handle 10. The handle is provided with hubs 22 having axially positioned pintles 23 seated in bearing apertures in the said ears 13b and 14b. 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 10 projects rearward through a slot 12a in the plate 12. 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 recess in the casing 1, the said member being guided at the front and held in place by means of the before mentioned guide plate 12. 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 12. 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 31 in the respective side plates 26 and 27. Each contact 29 and 30 is provided with opposite notches 29a and 30a and the narrower notched portion of the contact fits the narrower portion of the corresponding slot 31. Extending transversely between the two side plates is an insulating bar 32, the ends of which project into the wider portions of the slots 31 so as to hold the contacts in place. The inner ends of the contacts engage the bar 32 at the left hand side thereof as viewed in Fig. 7 and are held in place by means of rivets 33, 33. It will be observed that with the described construction the insulating bar 32 serves not only to hold the contacts 29 and 30 in place but also serves to hold the two side plates 26 and 27 in proper spaced relationship.

The two movable contacts 29 and 30 are electrically connected with each other, this electrical connection preferably being through an electro-responsive means which is carried by and is bodily movable with the contact member. By preference and as shown, this electro-responsive means is a bi-metallic thermostatic strip 34, mechanically and electrically connected directly with the two contacts. The contacts are provided with integral rearward extensions 29b, 30b which extend through corresponding apertures in the strip. Washers 35, 35 and 36, 36 may be provided and the rearward ends of the projections 29b, 30b may be upset or riveted over so as to hold the washers and the bi-metallic strip in place. The bi-metallic strip 34 is adapted to serve as a latch as will be presently explained, and in order that it may more effectively so serve it is provided with an opening at 34a and carries a wear piece 37 which is riveted in place and which is formed with two rearward extensions, one of which extends through the opening 34a.

From the foregoing description it will be apparent that the contact member is movable rectilinearly as guided by the plates 12 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 Fig. 4 electrical connection is established between the terminals 16 and 17; and when the contact member is in the lower position as shown in Fig. 8 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 tortional coil spring 38 positioned in a suitable auxiliary recess near the rear of the casing 1. At the ends of the spring are two integral arms 38a, 38a which extend forward and bear directly against the upper ends of the plates 26 and 27. For holding the spring 38 in place in the recess there is provided a cross bar 39 which is secured in place by a screw 40. It will be observed that the main body of the spring 38 is behind the plate 28, the two arms 38a, 38a projecting forward at the sides of the plate.

For actuating the contact member for normal switching purposes, or to effect closing of the circuit after automatic opening thereof, I provide a member which I shall term an actuating member or actuator. This member is normally engaged by the thermostatic strip or latch 34, and the actuator is so positioned and connected that a portion of the stress of actuation is transmitted directly from the actuator to the contact member independently of the thermostatic latch. The actuator is shown at 41, and it is pivoted to the contact member for movement about a transverse axis in fixed relationship thereto. As illustrated and as preferred, the actuating member 41 is a link of bell crank form and it consists of a metallic plate pivotally mounted on a pin 42 extending transversely between the two side plates 26 and 27. Spacing bushings 43, 43 hold the actuator in central position. A shoulder 41a on the actuator 41 is adapted to engage the plate 12 and to thus limit relative movement of the actuator in the clock-wise direction. The actuator is provided with a tooth 41b which, at normal temperatures, is engaged by the wear piece 37 on

the thermostatic latch **34**. With the parts in the relative positions shown in Fig. 8, the actuator and the contact member are positively connected to move in unison.

The handle or operating member **10** serves as the means for manually operating the actuator **41**. The metallic piece **25** on the handle member **10** is connected with the actuator **41** by means of two similar links **44**, **44**, the links being pivoted to the handle at **45** and to the actuator at **46**.

When the parts are in the relative positions shown in Fig. 9 the links **44** cooperate with the handle **10** 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 **25a** on the metallic piece **25** with the front guide plate **12** as shown in Fig. 9. The pivotal axis at **45** is at the left of a straight line connecting the pivotal axes at **23** and **46**, and thus the handle member **10** and the links **44** serve to resist the tendency of the contact member to move downward under the influence of the spring **38** and of gravity. The spring **38** is sufficiently powerful to enable the said toggle action to hold the handle or operating member **10** 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 **38** and **24** to the open-circuit position shown in Fig. 8. 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. 9, and the circuit can be thus re-established.

It will be evident that the force required for moving and holding the contact member is transmitted through the links **44** to the actuator **41** and from the actuator to the contact member. The normal connection between the actuator and the contact member is partly through the pivot pin at **42** and partly through the thermostatic latch **34**. By reason of the fact that the actuator **41** engages directly with the contact member through the pivot pin **42**, the stress transmitted through the latch **34** is much less than it otherwise would be. The tendency of the links **44** in closing the circuit is to relatively rotate the actuator in the counter-clockwise direction, but such rotation is resisted by the thermostatic latch **34**. The said latch **34** acts at a distance from the axis **42** which is considerably greater than the distance at which the links **44** act, and the result is that the stress transmitted through the latch **34** is considerably less than that transmitted through the links **44**.

As before explained, the bi-metallic strip **34** 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 wear piece **37** is disengaged from the tooth **41b** of the actuator **41**. Such disengagement permits the actuator **41** to turn slightly relatively to the contact member in the counter-clockwise direction. This slight movement changes the relation of the toggle links **44** and **10** and reduces the pressure which had theretofore served to hold the links **44** and the handle member **10** in their effective toggle relationship. This change in relationship and reduction in pressure permits the handle member **10** 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 actually completely disengaged from each other. When the parts reach their full open-circuit position as shown in Fig. 8 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. 10. The rearward deflection of the thermostatic strip **34** permits the actuator **41** 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 **10** and of the links **44**. The contact member moves downward to the position shown in Fig. 10, the actuator **41** and the links **44** assuming the relative positions shown in that figure. If the handle **10**, 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. 8, thus bringing the actuator **41** into its normal position with respect to the contact member so that the tooth **41b** is automatically engaged by the latch **34**.

It will be observed that the contact member together with the actuator and the bi-metallic thermostatic latch carried by the said contact member constitute a movable self-contained unit. The movement of this self-contained unit is guided and controlled by the two guide plates **12** and **28**, but inasmuch as the actuator is carried directly by the side plates of the contact member any looseness at the guide plates will in no way affect the accuracy or the operating characteristics of the circuit breaker. As already explained, the actuator **41** is pivoted to the contact member at **42**, and the actuator and the bi-metallic latch **34** normally remain in fixed relationship with each other and with the contact member, there being no relative movement at the bearing **42** except upon automatic opening of the circuit breaker and even then the movement is normally very slight.

Preferably, as shown in Figs. 3, 9, 11 and 12, I provide in the rear wall of the casing **1** immediately behind the engaged positions of the contacts **20**, **29** and **21**, **30** two holes **47**, **47**. Registering holes are provided in the plate **28**. The holes **47** are useful for inspection purposes during the assembly and testing of the circuit breaker. By looking through the holes it is possible to observe whether the movable contacts **29** and **30** properly engage the stationary contacts **20** and **21**. After assembly and inspection are complete the holes **47** may be closed by means of sealing wax or other suitable material as indicated at **48**.

Preferably, though not necessarily, grooves **49**, **49** are provided in the rear face of the casing **1**, these grooves communicating at one end with the openings **47**, **47**. When the circuit breaker is in-

tended to be used under conditions which are not severe, the holes are closed by sealing wax or otherwise, as already described, and the grooves **49, 49** have no function. However, when the circuit breaker is to be used for more severe service, the holes **47, 47** are not closed and a plate **50** of insulating material is secured in place on the rear face of the casing **1**, as for instance by means of screws **51, 51**. The plate **50** is provided with holes or notches **50a, 50a** registering with the grooves **49, 49** near the ends thereof. When the holes **47, 47** are left open and when the plate **50** is provided, a tortuous passageway is provided for arc-formed gases which are permitted to escape but which, on account of the length of the passage, are sufficiently cooled before escaping.

What I claim is:

1. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, means normally serving to hold the contact member in its closed-circuit position, and a thermostatic bi-metallic element additional to the said holding means and bodily movable in unison with the said contact member, the said element serving upon a predetermined temperature change to cause the said holding means to release the contact member and permit automatic rectilinear movement thereof to its open-circuit position.

2. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, means normally serving to hold the contact member in its closed-circuit position, and an electro-responsive means additional to the said holding means and comprising an element inherently responsive to abnormal current conditions in the circuit, the said element being bodily movable rectilinearly in unison with the said contact member and serving upon the passage of excess current to cause the said holding means to release the contact member and permit automatic rectilinear movement thereof to its open-circuit position.

3. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, a movable operating member, means controlled by the operating member for effecting movements of the contact member, the said means normally serving to hold the contact member in its closed-circuit position, and an electro-responsive means additional to the said movement effecting means and comprising an element inherently responsive to abnormal current conditions in the circuit, the said element being bodily movable rectilinearly in unison with the said contact member and serving upon the passage of excess current to cause the said movement effecting means to release the contact member and permit automatic rectilinear movement thereof to its open-circuit position.

4. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, a pair of toggle links adapted when in their operative relationship to hold the contact member in its closed-circuit position, and an electro-responsive means comprising an element inherently responsive to abnormal current conditions in the circuit, the said element being bodily movable rectilinearly in unison with the said contact member and serving upon the passage of excess current to change the relationship of the toggle links so as to release the contact member and permit automatic rectilinear movement thereof to its open-circuit position.

5. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, a pair of toggle links adapted when in their operative relationship to hold the contact member in its closed-circuit position, and a bi-metallic element electrically connected in the circuit and bodily movable rectilinearly in unison with the said contact member, the said element serving upon the passage of excess current to change the relationship of the toggle links so as to release the contact member and permit automatic rectilinear movement thereof to its open-circuit position.

6. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, means normally serving to hold the contact member in its closed-circuit position, and a thermostatic bi-metallic element additional to the said holding means and bodily movable rectilinearly in unison with the said contact member and in parallelism with its own plane, the said element serving upon the passage of excess current through the circuit to cause the said holding means to release the contact member and permit automatic rectilinear movement thereof to its open-circuit position.

7. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, a pair of toggle links of which one has a pivotal connection with the contact member, the said links when in their operative relationship serving to hold the contact member in its closed-circuit position, and a thermostatic element bodily movable rectilinearly in unison with the said contact member and serving upon the passage of excess current through the circuit to bodily move the pivotal connection between the contact member and the corresponding toggle link so as to change the relationship of the links and thereby release the contact member and permit automatic rectilinear movement thereof to its open-circuit position.

8. In an automatic circuit breaker, the combination of a contact member guided for rectilinear movement and biased toward its open-circuit position, a movable operating member, means controlled by the operating member for effecting movements of the contact member, the said means being releasable independently of the operating member and normally serving to hold the contact member in its closed-circuit position, and an electro-responsive means additional to the said movement effecting means and comprising an element inherently responsive to abnormal current conditions in the circuit, the said element being bodily movable rectilinearly in unison with the said contact member and serving upon the passage of excess current to cause the said movement effecting means to release the contact member independently of the operating member and permit automatic rectilinear movement thereof to its open-circuit position.

9. An automatic circuit breaker comprising in combination, a pivoted operating member, a contact member guided for rectilinear movement and biased independently of the operating member toward its open-circuit position, a link pivotally connected with the operating member and the contact member and serving upon pivotal move-

ment of the former to move the latter rectilinearly for ordinary switching purposes, the said operating member and the said link being adapted to act as toggle links to hold the contact member in closed-circuit position, and an electro-responsive means comprising an element inherently responsive to abnormal current conditions in the circuit, the said element being bodily movable rectilinearly in unison with the said contact member and serving upon the passage of excess current to change the position of the links with respect to the operating member so as to break the toggle and release the contact member and permit automatic rectilinear movement thereof to its open-circuit position independently of the operating member.

10. An automatic circuit breaker comprising in combination, a pivoted operating member biased for movement toward its open-circuit position, a contact member guided for rectilinear movement and biased independently of the operating member toward its open-circuit position, a link pivotally connected with the operating member and the contact member and serving upon pivotal movement of the former to move the latter rectilinearly for ordinary switching purposes, the said operating member when in closed-circuit position and the said link being adapted to act as toggle links to hold the contact member in its closed-circuit position, and an electro-responsive device connected in the circuit and bodily movable rectilinearly in unison with the said contact member, the said device serving upon the passage of excess current to change the relationship of the link with respect to the operating member so as to break the toggle and release both the operating member and the contact member and permit independent automatic movements of both of them to their respective open-circuit positions.

11. An automatic circuit breaker comprising in combination, a pivoted operating member, a contact member guided for rectilinear movement and biased independently of the operating member toward its open-circuit position, a link pivotally connected with the operating member and the contact member and serving upon pivotal movement of the former to move the latter rectilinearly for ordinary switching purposes, the said operating member and the said link being adapted to act as toggle links to hold the contact member in closed-circuit position, and a current-carrying bi-metallic element carried by and bodily movable with the said contact member and deflectable upon the passage of excess current to change the position of the link with respect to the operating member so as to break the toggle and release the contact member and permit automatic rectilinear movement thereof to its open-circuit position independently of the operating member.

12. The combination in an automatic circuit breaker, of a stationary electric contact, a movable contact member guided for rectilinear movement and including an electric contact adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, an electro-responsively controlled latch on the contact member adapted to be automatically moved from its normal relationship to the said member upon the attainment of abnormal current conditions in the circuit, a handle pivotally movable about a fixed axis, and an actuating means operated by the handle and serving to move the contact member toward and hold it in its contact engaging position, the said actuating means having an engagement with the latch adapted to be released upon automatic movement of the latter as aforesaid and the said means also having movable engagement directly with the rectilinearly movable contact member so that the force transmitted through the latch is less than the total force required for moving and holding the contact member.

13. The combination in an automatic circuit breaker, of a stationary electric contact, a rectilinearly movable contact member including an electric contact adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, an electro-responsively controlled latch carried by and bodily movable with the contact member and adapted to be automatically moved out of its normal relationship with the said member upon the attainment of abnormal current conditions in the circuit, an actuator bodily movable with the contact member and permanently connected therewith for movement relative thereto, the said actuator normally having an engagement with the latch adapted to be released upon automatic movement of the latter as aforesaid, and means for operating the said actuator to enable it to normally effect rectilinear movement of the contact member to and from its contact engaging position.

14. The combination in an automatic circuit breaker of a stationary electric contact, a rectilinearly movable contact member including an electric contact adapted to engage and disengage the stationary contact, the said member being biased in the contact disengaging direction, an actuator bodily movable with the contact member and also movable relatively thereto, an electro-responsively controlled latch attached to the contact member and projecting from the point of attachment approximately in the contact disengaging direction, the said latch at its projecing end normally engaging the actuator to prevent relative movement thereof and the said latch upon the attainment of abnormal current conditions in the circuit disengaging the actuator to permit relative movement thereof and to thereby permit automatic contact disengaging movement of the contact member, a handle pivotally movable about a fixed axis, and means connecting the handle with the actuator enabling the said handle to normally move the actuator and the contact member rectilinearly.

15. The combination in an automatic circuit breaker, of two stationary electric contacts, a rectilinearly movable contact member including two electric contacts adapted to engage and disengage the respective stationary contacts, the said member being biased in the contact disengaging direction, a bi-metallic thermostatic current-carrying latch on the contact member and electrically connected between the two movable contacts, the said latch being adapted to be automatically moved out of its normal relationship with the said contact member upon the attainment of abnormal current conditions in the circuit, an actuator carried by and bodily movable with the contact member and also pivotally movable relatively to the said contact member, the said actuator normally having an engagement with the latch adapted to be released upon automatic movement of the latter as aforesaid, and means for operating the said actuator to enable it to normally effect rectilinear movement of the contact member to and from its contact engaging position.

16. The combination in an automatic circuit breaker, of two opposite stationary electric contacts, a rectilinearly movable contact member including two opposite electric contacts adapted to engage and disengage the respective stationary contacts, the said member being biased in the contact disengaging direction, a U-shaped bi-metallic thermostatic current-carrying latch on the contact member and electrically connected between the two opposite movable contacts, the said latch being adapted to be automatically moved out of its normal relationship with the said contact member upon the attainment of abnormal current conditions in the circuit, an actuator carried by and bodily movable with the contact member, and also pivotally movable relatively to the said contact member, the said actuator normally having an engagement with the latch adapted to be released upon automatic movement of the latter as aforesaid, and means for operating the said actuator to enable it to normally effect rectilinear movement of the contact member to and from its contact engaging position.

17. The combination in an automatic circuit breaker, of two stationary electric contacts, a movable contact member including two transversely spaced insulating side plates and also including two separate electric contacts carried by the side plates adapted to respectively engage and disengage the stationary contacts, the said side plates having bearing surfaces whereby the contact member is guided for rectilinear movement, a bi-metallic thermostatic current-carrying latch on the contact member and electrically connected between the two movable contacts, the said latch being adapted to be automatically moved from its normal relationship to the said contact member upon the attainment of abnormal current conditions in the circuit, an actuator positioned between the two side plates and pivotally supported thereon and normally having an engagement with the latch adapted to be released upon automatic movement of the latter as aforesaid, and means for operating the said actuator to enable it to normally effect rectilinear movement of the contact member to and from its contact engaging position.

18. An automatic circuit breaker comprising in combination, a rectilinearly movable contact member biased in the circuit-opening direction, an operating member pivoted for movement about a fixed axis, two pivotally connected links pivoted respectively to the pivoted operating member and to the rectilinearly movable contact member and serving as an operative connection between them, an electro-responsively controlled means normally serving to prevent pivotal movement of one of the links relatively to the contact member and serving upon the attainment of abnormal current conditions in the circuit to permit such pivotal movement, and means enabling the other link and the operating member to serve as a releasable toggle normally holding the contact member in closed-circuit position.

19. An automatic circuit breaker comprising in combination, a rectilinearly movable contact member biased in the circuit-opening direction, an actuator pivoted to the contact member for relative movement about a movable axis but normally held against such relative movement, operating means including toggle links connected with the actuator and when in their effective positions serving to hold the said actuator and contact member in their closed-circuit positions, the said links being biased toward their ineffective positions but being normally held in their effective positions as the result of pressure resulting from the said bias of the contact member, and an electro-responsively controlled means normally serving to prevent the said pivotal movement of the actuator and serving upon the attainment of abnormal current conditions in the circuit to permit such pivotal movement, the said pivotal movement of the actuator serving to permit automatic rectilinear circuit-opening movement of the contact member and also serving to simultaneously release the pressure on the toggle links and thus permit them to automatically move to their open-circuit positions.

20. In an automatic circuit breaker, the combination of a casing having a recess open at the front, a plate at the front of the casing substantially closing the recess, a stationary contact within the casing recess, a movable contact member within the casing recess including a contact adapted to engage and disengage the stationary contact, means for biasing the contact member in the contact disengaging direction, a pivoted handle at the front of the plate, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, and a thermostatic bi-metallic element carried by the contact member in substantially parallelism with the front plate and normally connected in the circuit, the said element being deflectable upon the passage of excess current therethrough to thereby render the said mechanical connection ineffective and thus permit the contact member to automatically move to its open-circuit position independently of the handle.

21. In an automatic circuit breaker, the combination of a casing having a recess open at the front, a guide plate at the front of the casing substantially closing the recess, a stationary contact within the casing recess, a rectilinearly movable contact member within the casing recess guided at the front by the said guide plate and including a contact adapted to engage and disengage the stationary contact, means for biasing the contact member in the contact disengaging direction, a pivoted handle at the front of the guide plate, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, and an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to automatically move rectilinearly to its open-circuit position independently of the handle.

22. In an automatic circuit breaker, the combination of a casing having a recess open at the front, a guide plate at the front of the casing substantially closing the recess, two stationary contacts spaced apart transversely within the casing recess, a rectilinearly movable contact member within the casing recess guided at the front by the said guide plate and including two contacts at the sides adapted to engage and disengage the stationary contacts, means for biasing the contact member in the contact disengaging direction, a pivoted handle at the front of the guide plate, a bodily movable bi-metallic element electrically connected between the movable contacts and constituting at least a part of a normally operable mechanical connection between the handle and the contact member, the said bi-metallic element serving upon the attainment of an abnormal current condition therein to render the said mechani-

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cal connection ineffective and to thus permit the contact member to automatically move rectilinearly to its open-circuit position independently of the handle.

23. In an automatic circuit breaker, the combination of a casing having a recess open at the front, an insulating guide plate at the front of the casing and substantially closing the recess, two conductors at the front of the guide plate spaced apart transversely and having rearward extensions, two stationary contacts carried by the rearward extensions and positioned behind the guide plate, a rectilinearly movable contact member within the casing recess guided at the front by the said guide plate and including two electrically connected contacts at the sides adapted to engage and disengage the stationary contacts, means for biasing the said contact member in the contact disengaging direction, a pivoted handle at the front of the guide plate, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, and an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to automatically move rectilinearly to its open-circuit position independently of the handle.

24. In an automatic circuit breaker, the combination of a casing having a recess open at the front, an insulating guide plate at the front of the casing and substantially closing the recess, two conductors at the front of the guide plate spaced apart transversely and having rearward extensions, a handle at the front pivotally mounted directly on the said front conductors and having a portion extending rearward through a slot in the guide plate, two stationary contacts carried by the rearward extensions and positioned behind the guide plate, a rectilinearly movable contact member within the casing recess guided at the front by the said guide plate and including two electrically connected contacts at the sides adapted to engage and disengage the stationary contacts, means for biasing the said contact member in the contact disengaging direction, a normally operable mechanical connection between the handle and the contact member, enabling the former to move the latter, and an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to automatically move rectilinearly to its open-circuit position independently of the handle.

25. In an automatic circuit breaker, the combination of a casing having a recess open at the front, an insulating guide plate at the front of the casing and substantially closing the recess, a stationary contact within the casing recess, a rectilinearly movable contact member within the casing recess guided at the front by the said guide plate and including a contact adapted to engage and disengages the stationary contact, means for biasing the contact member in the contact disengaging direction, a pivoted handle at the front of the guide plate, a stop carried by the handle and adapted to engage the inner face of the guide plate to limit the handle movement, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, and an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to automatically move rectilinearly to its open-circuit position independently of the handle.

26. In an automatic circuit breaker, the combination of a casing having a recess open at the front, an insulating guide plate at the front of the casing and substantially closing the recess, a stationary contact within the casing recess, a rectilinearly movable contact member within the casing recess guided at the front by the said guide plate and including a contact adapted to engage and disengage the stationary contact, means for biasing the contact member in the contact disengaging direction, an actuator pivoted to the contact member and bodily movable therewith, a bi-metallic current-carrying releasable latch normally holding the actuator against pivotal movement in one direction relatively to the contact member and serving upon the attainment of abnormal current conditions in the circuit to release the actuator and permit it to move in the last said direction, a stop on the actuator directly engaging the front guide plate to limit pivotal movement in the opposite direction, and means engaging the actuator to normally move the contact member to open or close the circuit.

27. An automatic circuit breaker comprising in combination, a casing having a recess open at the front, a stationary contact within the casing recess, a rectilinearly movable contact member within the casing recess including a contact adapted to engage and disengage the said stationary contact, a movable handle, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to move rectilinearly to its open-circuit position independently of the handle, and a coil torsional spring carried by the casing and having an integral arm in contact with the contact member, the said spring serving to bias the contact member for movement in the circuit-opening direction.

28. An automatic circuit breaker comprising in combination, a casing having a main recess open at the front and an auxiliary recess at the rear of the main recess, a stationary contact within the main casing recess, a rectilinearly movable contact member within the main casing recess including a contact adapted to engage and disengage the said stationary contact, a movable handle, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to move rectilinearly to its open-circuit position independently of the handle, a coil torsional spring in the auxiliary recess in the casing and having an integral arm in contact with the contact member, the said spring serving to bias the contact member for movement in the circuit-opening direction, and a cross bar in the auxiliary recess within the coil of the spring for holding the spring in place.

29. An automatic circuit breaker comprising in combination, a casing having a recess open at the

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front, two stationary contacts spaced apart transversely within the casing recess, a contact member within the casing recess rectilinearly movable between the stationary contacts and including two insulating side plates spaced apart transversely and electrically connected contacts carried by the side plates and adapted to engage and disengage the said stationary contacts, a movable handle, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to move rectilinearly to its open-circuit position independently of the handle, and a coil torsional spring carried by the casing near the rear thereof and having at its ends two integral arms in contact with the respective side plates of the contact member, the said spring serving to bias the contact member for movement in the circuit opening direction.

30. An automatic circuit breaker comprising in combination, a casing having a main recess open at the front and an auxiliary recess at the rear of the main recess, two stationary contacts spaced apart transversely within the main casing recess, a contact member within the main casing recess rectilinearly movable between the stationary contacts and including two electrically connected contacts at the sides adapted to engage and disengage the said stationary contacts, a movable handle, a normally operable mechanical connection between the handle and the contact member enabling the former to move the latter, an electro-responsive element arranged to be energized upon the attainment of an abnormal current condition in the circuit so as to render the said mechanical connection ineffective and to thus permit the contact member to move rectilinearly to its open-circuit position independently of the handle, a coil torsional spring in the auxiliary recess in the casing and having an integral arm in contact with the contact member, the said spring serving to bias the contact member for movement in the circuit-opening direction, and a plate at the rear of the main recess covering the auxiliary recess and serving as a guide for the movable contact member.

JOSEPH SACHS.

## DISCLAIMER

2,094,963.—*Joseph Sachs*, West Hartford, Conn. AUTOMATIC CIRCUIT BREAKER. Patent dated October 5, 1937. Disclaimer filed April 12, 1943, by the assignee, *Colt's Patent Fire Arms Manufacturing Company*.

Hereby enters this disclaimer of claim 14 in said patent.

[*Official Gazette May 4, 1943.*]