

Aug. 18, 1931.

J. SACHS

1,819,005

AUTOMATIC CIRCUIT BREAKER

Original Filed May 21, 1928

2 Sheets-Sheet 1

Fig. 1

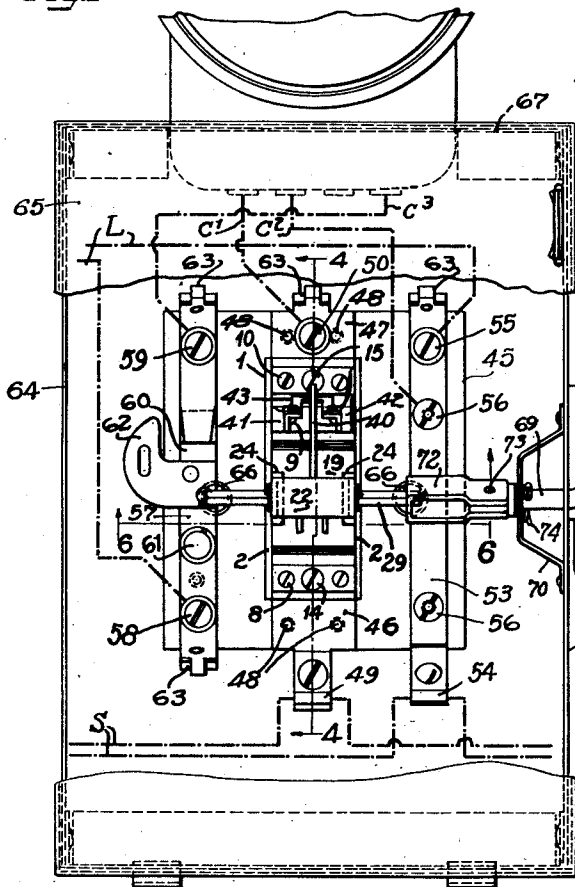
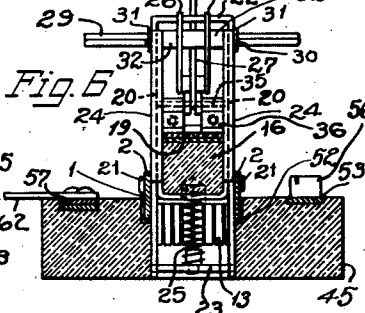
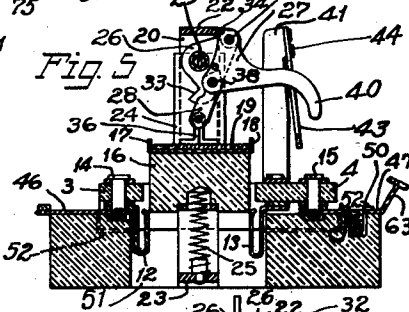
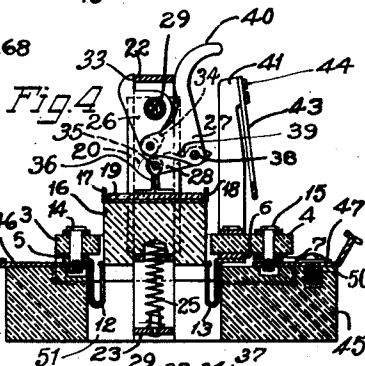
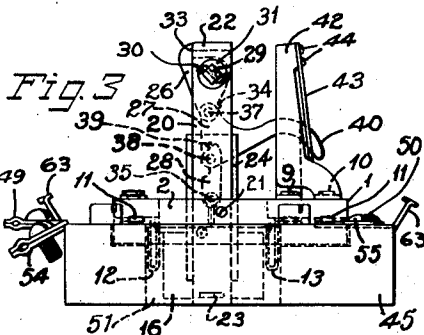
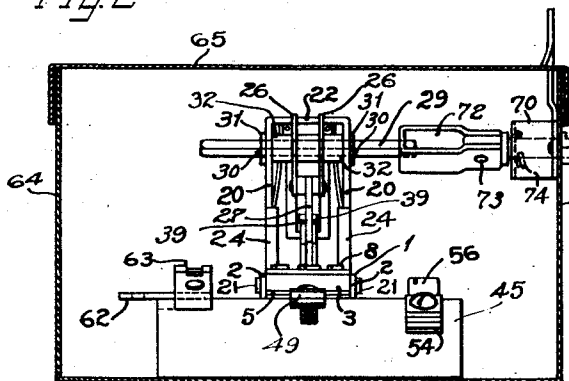


Fig. 2



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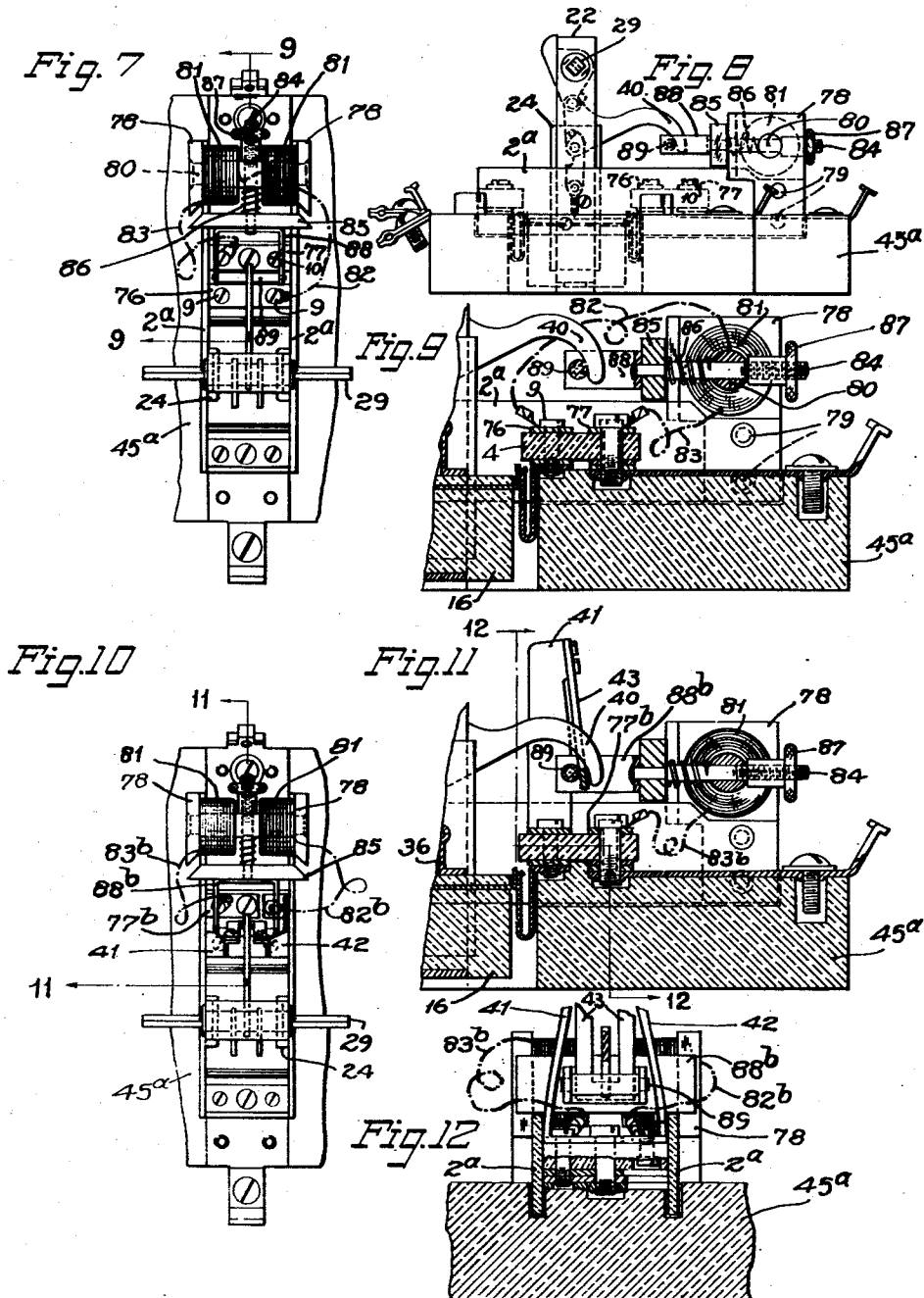
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AUTOMATIC CIRCUIT BREAKER

Original Filed May 21, 1928 2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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AUTOMATIC CIRCUIT BREAKER

Application filed May 21, 1928, Serial No. 279,391. Renewed May 21, 1931.

The invention relates particularly to a circuit breaker which is adapted to be small and compact and capable of being manufactured at low cost, so as to be adapted for use with small motors and household appliances and in service entrance installations where it may take the place of the usual service switch and fuses. The circuit breaker, particularly when used in service entrance installations, may take the place of the usual service switch and fuses, and it affords the householder an opportunity of restoring the service himself after it has been interrupted by an overload without the necessity for the troublesome replacement of fuses.

One of the objects of the invention is to provide a circuit breaker of the type described having various improved details of construction and operation, particularly an improved arrangement of operating links, an improved arrangement of circuit making and breaking contacts and an improved arrangement of electro-responsive releasing means.

A further object of the invention is to provide a novel circuit breaker of the type described in the form of a compact simple unit which includes both thermal and magnetic releasing means and which is provided with connections permitting it to be readily secured to or removed from a main supporting base or panel.

Another object of the invention is to provide a novel circuit breaker of the type described having the parts arranged to form a simple compact detachably mountable unit and having a handle supported separately from the unit and detachably connected therewith.

Other objects of the invention will be apparent from the following specification and claims.

A circuit breaker embodying the present invention is in some respects similar to that disclosed and claimed in my copending application for automatic circuit breakers, Serial No. 271,819, filed April 21, 1928.

In the accompanying drawings I have shown three embodiments of the invention but it will be understood that the drawings

are intended for illustrative purposes only and are not to be relied upon as limiting or defining 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 shown as enclosed in a cabinet adapted to be protectively associated with an electric meter.

Fig. 2 is a bottom view of the circuit breaker shown in Fig. 1, the enclosing cabinet being shown in section.

Fig. 3 is a side view of the circuit breaker shown separately from the enclosing cabinet. In this view the parts are shown in the normal or circuit closing positions.

Fig. 4 is a vertical sectional view taken along the line 4—4 of Fig. 1, this view showing the parts in the positions to which they are moved when the circuit is broken automatically.

Fig. 5 is a view similar to Fig. 4 but showing the parts in the positions to which they are moved when the circuit is broken manually.

Fig. 6 is a horizontal sectional view taken along the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary front view similar to Fig. 1 but showing an alternate embodiment of the invention.

Fig. 8 is a side view similar to Fig. 3 but showing the same embodiment of the invention as Fig. 7.

Fig. 9 is an enlarged fragmentary vertical sectional view taken along the line 9—9 of Fig. 7.

Fig. 10 is a fragmentary front view similar to Fig. 7 but showing still another embodiment of the invention.

Fig. 11 is an enlarged fragmentary sectional view taken along the line 11—11 of Fig. 10.

Fig. 12 is a fragmentary sectional view taken along the line 12—12 of Fig. 11.

The circuit breaker may, if preferred, constitute a separate unit adapted to be combined or associated with other electrical parts and it will be so described.

Referring to the drawings, 1 represents as an entirety the body portion of the circuit breaker unit. The body portion 1 as illustrated comprises two side plates 2, 2 and two transverse members 3 and 4 all formed of insulating material. In addition the body comprises three transverse metallic members 5, 6 and 7. In order that the various parts may be held together I have shown screws 8, 9 and 10 extending through the members 3 and 4 into the respective members 5, 6 and 7, and I have shown the said members 5, 6 and 7 as provided with integral extensions 11, 11 which extend through openings in the side plates 2, 2 and are riveted over. It will be observed that with the body member constructed as illustrated there is provided a central opening therein bounded at the sides by the plates 2, 2 and at the ends by the insulating members 3 and 4.

Mounted on the body portion of the unit are stationary contacts 12 and 13. As shown these contacts are U-shaped and are located respectively at the bottom and top of the aforesaid central opening in the body. The contact 12 engages the transverse member 5 being held in place by the screws 8, 8, and the contact 13 engages the transverse member 6 being held in place by the screws 9, 9. The transverse member 5 together with the contact 12 constitutes one connector for the mounting of the circuit breaker unit on a base or panel board, and the transverse member 7 constitutes another similar connector. Associated with the said connectors are screws 14 and 15 by which the said connector may be held in engagement with companion connectors on the base or panel board. The said connectors serve for establishing both mechanical and electrical connections.

I provide a rectilinearly movable insulating contact member 16 which is movable forward and rearward and which carries connected contacts 17 and 18 engageable and disengageable respectively with the stationary contacts 12 and 13. As shown the two contacts 17 and 18 are formed by turning outward the edges of a single transverse conducting plate engaging the front face of the contact member 16. This conducting plate is held in place by an insulating plate 19.

For purposes to be described I preferably provide two parallel forward projecting supporting and guiding elements or arms 20, 20 on the body, these engaging the respective side plates 2, 2 and being held in place by means of screws 21, 21. Preferably the two elements 20, 20 are formed as parts of a single integral yoke having a transverse connecting portion 22 as shown. The said elements 20, 20 are preferably extended rearward beyond the side plates 2, 2 and are connected by means of a transverse member 23.

The contact member 16 is guided by means of the aforesaid supporting and guiding ele-

ments or arms 20, 20. In order that it may be so guided there is provided a U-shaped yoke 24 which embraces the member 16 and which engages the inner faces of the said arms 20, 20. The edges of the legs of the yoke are flanged outward as shown so as to slidably engage the edges of the arms 20, 20. It will be understood that the contact member 16 and the insulating plate 19 are notched or grooved at opposite edges as indicated in Fig. 1 to receive the legs of the yoke 24. By means of this construction the contact member 16 and also the contacts 17 and 18 thereon are guided for rectilinear movement forward and backward. A spring 25 is interposed between the member 16 and the before-mentioned transverse member 23, this spring tending to move the contact member and the contacts thereon forward to the circuit breaking position as shown in Figs. 4 and 5.

For normally holding the contact member and the contacts thereon in their rearward circuit making positions I provide a triple toggle linkage comprising three links 26, 27 and 28. The front link or actuating member 26 is movable about a fixed axis and as shown it is connected with an operating shaft 29 which extends transversely and which is mounted in bearing apertures in the two supporting members 20, 20. The link 26 is shown as comprising two spaced parts, these parts being operatively connected with the shaft 29 for movement therewith. Preferably and as shown the shaft 29 is square and the parts of the link 26 are provided with square openings to receive the shaft. The shaft is held against longitudinal movement by means of pins 30, 30 preferably engaging washers 31, 31. The parts of the link 26 are held in proper spaced relationship by means of bushings 32, 32 on the shaft. The link 26 is formed with shoulders 33 and 34 for limiting the movement thereof. The rear link 28 is pivotally connected at its rear end with the contact member 16, a pivotal connection being provided at 35 by means of clips 36. The pin 35 may extend through the clips into holes in the legs of the yoke 24. The link 28 preferably comprises two parts spaced apart as shown.

The intermediate link 27 is located between the parts of the links 26 and 28. It is connected with the front link 26 by means of a pivotal connection at 37 and it is connected with the rear link 28 by means of a pivotal connection at 38. Relative movement between the links 27 and 28 is limited by means of a pin 39 on the link 27 engaging a shoulder on the link 28.

With the three links in normal positions as shown in Fig. 3 the axes of the pivotal connections 37 and 38 are out of line with the axes at 29 and 35. Movement of the linkage toward the left as shown is limited by means of the shoulder 33 and the pin 39.

In order that the inner toggle may be broken to permit the contact member to be moved outward by the spring 25 to break the circuit one of the two links constituting the rear toggle, preferably the link 27, is provided with an extension 40. For moving the extension 40 to break the rear toggle I provide an electro-responsive means forming a part of the unit. As illustrated in Figs. 1 to 6 the electro-responsive means comprises a bi-metallic thermal strip but the invention is not so limited. As shown there are two forward extending supporting arms 41 and 42, the arm 41 being provided with a transverse extension engaged by the screws 9, 9 and the arm 42 being provided with a transverse extension engaged by the screws 10, 10. A U-shaped electro-responsive thermal strip 43 is arranged with its legs extending forward and respectively connected with the two supporting arms 41 and 42 by means of screws 44, 44. It will be apparent that the arm 41 is in electrical connection with the contact 13, that the arm 42 is in electrical connection with the transverse member or connector 7, and that therefore, with the parts in circuit closing position as illustrated in Fig. 3 an electrical connection is established from the transverse member or connector 5 through the contacts and through the thermal strip to the transverse member or connector 7.

The strip 43 is adapted to be deflected by reason of the heating action of excess current therein in accordance with the well known action of such bi-metallic strips. The link extension 40 projects between the legs of the U-shaped strip and engages the transverse portion thereof at its outer side. The parts are so constructed and adjusted that when the bi-metallic strip 42 is deflected outward by reason of excess current the link extension 40 is moved sufficiently to break the rear toggle and to permit the parts to be moved by the spring 25 to the positions shown in Fig. 4. It will be obvious that by turning the shaft 29 in the counter-clockwise direction the link 26 may be turned to break the forward toggle and permit the parts to be moved by the spring 25 to the positions shown in Fig. 5. Movement of the link 26 is limited by the shoulder 34. By turning the shaft 29 in the opposite direction the parts may be restored to the positions shown in Fig. 3. Thus the device may be operated for making or breaking the circuit manually without disturbing the inner toggle.

After the device has been operated automatically to open the circuit, the parts being in the positions shown in Fig. 4, the circuit may be closed by first moving the shaft 29 in the counter-clockwise direction so as to straighten out the rear toggle and bring the parts to the relative positions shown in Fig. 5. Then by turning the shaft 29 in the clockwise direction the parts may be moved to cir-

cuit closing position as shown in Fig. 3. If the excess current conditions should still prevail the circuit will be again opened automatically exactly as already described.

The circuit breaker unit which I have described may be used in association with any desired parts and I do not limit myself to any one use thereof. However, in order that one application of the invention may be clearly understood I have shown the said unit combined with other parts to form a house entrance installation adapted to be directly associated with an electric meter. I do not herein broadly claim the use of an electric circuit breaker mechanism as a part of a meter service installation, this being set forth and claimed in my patent for electric service installation No. 1,696,150 dated December 18, 1928.

I have shown the circuit breaker unit as mounted on a base 45 of insulating material. The said base is provided with conducting plates 46 and 47 which are held in place by means of screws 48, 48 extending forward from the rear of the base. The plates 46 and 47 serve as connectors and the circuit breaker unit proper is held in place by means of the said screws 14 and 15 which enter threaded holes in the said plates. Thus the connectors of the circuit breaker are detachably engaged with the connectors of the main base or support. The said plates 46 and 47 are further provided respectively with terminals such as the clamp 49 and the screw 50 for engagement with electric conductor wires. The base 45 is provided with an opening 51 between the connector plates 46 and 47, which opening is adapted to receive parts of the circuit breaker unit as shown. The base is also provided with grooves 52, 52 for receiving the side plates 2, 2 of the circuit breaker unit.

In order that complete provision may be made for the connection and use of an electric meter I provide on the base 45 in addition to the circuit breaker unit a neutral conductor or strap 53 provided with wire terminals 54 and 55 and if desired with additional terminals 56, 56. A test switch 57 is interposed between wire terminals 58 and 59. The details of the test switch 57 may be varied but I have shown a switch comprising a blade 60 pivoted at 61 and adapted to be swung laterally by means of an insulating handle 62. In order to facilitate the testing of the meter suitable contacts adapted for the attachment of instrument leads and bypass connections are provided at 63, 63.

One arrangement of electrical connection which may be used is shown by dot-and-dash lines in Fig. 1. The service wires S are connected respectively with the terminals 49 and 54. Meter connections C¹ and C² extend respectively from the terminal 50 and one of the terminals 56 to the meter, and another meter connection C³ extends from the meter

to the terminal 59. The load wires L are connected with the terminals 55 and 58.

From the foregoing description it will be apparent that the circuit breaker unit is interposed between an incoming service wire and the meter and thus serves to protect not only the customer's load circuit but also the meter in case of any excess current conditions. The circuit from the meter extends through the test switch 57 and this switch may therefore be utilized to disconnect the meter from the load wires for testing in accordance with well understood practice. Prior to the opening of the switch 57 a suitable by-pass may be connected to the proper terminals 63, 63 in order that the customer's circuit may not be interrupted.

The base 45 and the parts carried thereby may be enclosed in a protecting cabinet such as the cabinet 64. This cabinet is or may be of substantially standard construction being rectangular in form and having an openable front cover 65 adapted to be sealed in closed position to protect the interior parts. The base is secured to the rear wall of the cabinet by means of screws at 66, 66. Preferably the upper end wall 67 of the cabinet is provided with a suitable opening through which the terminal chamber portion of the meter may project as shown so as to entirely enclose the connections between the meter and the service appliance within the cabinet.

A suitable means is provided for manually operating the shaft 29 of the circuit breaker unit and in accordance with one phase of the invention I preferably provide an operating handle which is mounted independently of the circuit breaker unit and which is detachably connectible therewith. The details of the construction and independent mounting of the operating means or handle may be varied but as shown I provide a handle 68 which is on the exterior of the cabinet and which is connected with a spindle 69 extending through one side wall of the cabinet into the interior thereof. As shown a bearing bracket 70 is riveted or otherwise secured to the right hand side wall 71 of the cabinet and the said bracket and the said side wall are formed with aligned bearing apertures for the spindle 69. Connected with the spindle 69 at the inner end thereof is a yoke 72 having a square aperture at its inner end adapted to receive the right hand end of the shaft 29. Preferably to facilitate the engagement of the shaft 29 with the yoke 72 the said yoke is pivotally connected with the spindle for movement about a transverse pivotal axis at 73. Longitudinal movement of the spindle in the inward direction is limited by means of a cotter pin 74. Carried by the side wall 71 is a stop 75 for limiting the movement of the handle 68.

From the foregoing description it will be apparent that the handle 68 is accessible when the cover 65 is closed to render the parts inside of the cabinet entirely inaccessible. By turning the handle 68 the customer can operate the circuit breaker as before described to open or close the circuit any time as desired. However, the circuit breaker construction is such that the operator cannot interfere with the automatic opening thereof, the said automatic opening taking place independently of the handle 68.

As already stated the circuit breaker unit is detachably mounted on the base being held in place by means of the screws 14 and 15. The shaft 29 is detachably engaged with the yoke 72 forming a part of the manual operating means. It is therefore obvious that the entire circuit breaker unit can be easily removed for inspection, repair or replacement without disturbing any of the wiring connections or any of the other parts of the installation.

In Figs. 7 to 9 I have shown an embodiment of the invention which is similar to that shown in Figs. 1 to 6 but which differs therefrom primarily in that magnetic means instead of thermal means are provided for automatically operating the circuit breaker to open the circuit. The supporting arms 41 and 42 are omitted and also the thermal strip 43 carried thereby. In lieu thereof transverse members 76 and 77 are provided on the transverse insulating member 4, the said members 76 and 77 being held respectively by the screws 9, 9 and 10, 10.

The side plates 2^a, 2^a are similar to the side plates 2, 2 but are made longer at the top. Connected with the side plates 2^a, 2^a are iron cheek pieces 78, 78 these being held in place by means of rivets 79, 79. Connected between the cheek pieces 78, 78 is a transverse magnet core 80, the said core being connected with the cheek pieces by riveting as shown. Surrounding the core 80 are two magnet coils 81, 81, these being spaced apart as shown and being connected in series with each other. The two magnet coils are connected in series between the two transverse plates 76 and 77, conductors 82 and 83 being diagrammatically indicated for this purpose.

The core 80 is provided with a transverse hole therethrough and a rod 84 is slidably mounted in the said hole. At the lower end of the rod 84 is mounted an armature 85, a spring 86 being provided on the rod for normally pressing the armature downward. For adjustably limiting the downward movement of the armature there is provided a nut 87 on the threaded upper end of the rod 84. It will be noted that the armature engages or approximately engages the top edges of the side plates 2^a, 2^a being thus held from turning about the axis of the rod 84.

Secured to the armature 85 is a U-shaped

yoke 88 which carries at its lower end a transverse insulating bar 89. The bar 89 is positioned at the lower or inner side of the link extension 40, being substantially in engagement therewith when the parts are in normal position as shown in Figs. 8 and 9.

The circuit breaker unit as shown in Figs. 7 to 9 may be suitably mounted, as for instance upon a base such as the base 45^a, this base being similar to the base 45 except that it is modified to accommodate the longer unit, particularly the side plates 2^a, 2^a thereof. With the unit mounted on the base 45^a the circuit extends in series through the contacts of the unit and through the coils of the magnet thereof. The construction is such that when the current exceeds a definite predetermined amount the magnet is energized sufficiently to move the armature 85 upward, thus drawing the transverse bar 89 against the link extension 40 and breaking the rear toggle to automatically open the circuit as already fully described. The operation of the circuit breaker unit and in fact of the entire installation is or may be otherwise exactly the same as that already described and repetition is unnecessary.

In Figs. 10 to 12 I have shown another embodiment of the invention wherein both thermal and magnetic means are provided for automatically operating the circuit breaker unit to open the circuit. I do not herein broadly claim a circuit breaker adapted to operate by the combined or alternative electro-thermal and electro-magnetic effects of the current as this subject matter is set forth and claimed in my copending application, Serial No. 303,544 filed September 1, 1928 (now Patent No. 1,736,372 patented November 19, 1929) as a division of my prior application Serial No. 578,125 filed July 28, 1922, this latter application having resulted in Patent No. 1,696,150 dated December 18, 1928.

As shown in Figs. 10 to 12 the thermal strip 43 and the two supporting arms 41 and 42 therefor are identical with those shown in Figs. 1 to 6 with the single exception that a transverse bar 77^b is provided which is electrically separate from the supporting arm 42. The construction and mounting of the magnet is or may be identical with that already described in connection with Figs. 7 and 9 with the single exception that the yoke 88^b may be slightly longer than the yoke 88 in order to permit the transverse insulating bar 89 to be positioned at the inside of or below the bi-metallic strip 43 as clearly shown in Fig. 11. The magnet is electrically connected between the supporting arm 42 and the plate 77^b, conductors 82^b and 83^b being diagrammatically indicated for this purpose.

In view of the description of the operation as already given in connection with Figs. 1 to 6 and in connection with Figs. 7 to 8 it is

believed that the operation of the construction shown in Figs. 10 to 12 will be clear. The link extension 40 may be moved either by the thermal strip 43 or by the magnet. The parts are so constructed and adjusted in relation to each other that a moderate overload will cause the bi-metallic strip 43 to deflect and effect the opening of the circuit as described, the magnet not being sufficiently energized to be effective. However, in the case of excessive overload such as might be caused by a short circuit the magnet will be instantly energized thus mechanically moving the strip 43 to thereby move the link extension 40 and thus open the circuit. In the case of an excessive overload the magnet would act more quickly than the bi-metallic strip and thus the circuit would be interrupted more quickly than it would by the normal action of the bi-metallic strip.

What I claim is:

1. An automatic circuit breaker comprising in combination, an insulating support, two stationary spaced arms extending from the support, two stationary spaced electric contacts carried by the support, a contact member guided in a fixed rectilinear path determined by the said arms and carrying two connected electric contacts adapted to respectively engage and disengage the two stationary contacts, a spring tending to move the contact member to circuit breaking position, a manually operable actuating member pivotally mounted on the arms, and a bodily movable electro-responsively releasable mechanical connection between the actuating member and the contact member enabling the former to effect the movement of the latter to open or close the circuit, the said mechanical connection being automatically released upon the passage of excess current to release the contact member from the actuating member and thus permit the said contact member to automatically move to its open-circuit position independently of the actuating member.

2. An automatic circuit breaker comprising in combination, an insulating support, two stationary spaced arms extending forward from the support, two stationary spaced electric contacts carried by the support, a movable contact member guided by the said arms for movement in a fixed rectilinear path and carrying two connected electric contacts adapted respectively to engage and disengage the two stationary contacts, a spring tending to move the contact member forward to circuit breaking position, a triple toggle linkage normally serving to hold the contact member in its rearward circuit making position and having the front link thereof pivoted to the said arms and having the rear link thereof pivoted to the contact member, electro-responsive means in circuit with the contacts and serving upon the passage of excess current to break the rear toggle and permit the

contact member to be moved forward by the spring to disengage the contacts and thus break the circuit at two points, and an operating means adapted for moving the front toggle link in one direction to break the front toggle and permit the contact member to be moved by the spring as aforesaid and adapted for moving the said front link in the other direction to thereby move the contact member rearward to circuit closing position.

3. An automatic circuit breaker comprising in combination, a body, a stationary electric contact on the body, a movable contact member carrying a contact engageable and disengageable with the first said contact, a spring tending to move the contact member forward to circuit breaking position, two forward extending supporting arms spaced apart on the body and one of them electrically connected with the stationary contact, a U-shaped electro-responsive thermal strip having the legs thereof extending forward and respectively connected with the said supporting arms, a triple toggle linkage normally serving to hold the contact member in its rearward circuit making position and having the front link thereof movable about a fixed axis and having the rear link thereof pivoted to the contact member, a lateral extension on one of the toggle links projecting between the legs of the U-shaped strip and engaging the transverse portion thereof at the outer side, the said extension being moved by the thermal strip upon the passage of excess current and serving to break the rear toggle and permit the contact member to be moved forward by the spring to separate the contacts and thus break the circuit, and an operating means adapted for moving the front toggle link in one direction to break the front toggle and permit the contact member to be moved by the spring as aforesaid and adapted for moving the said front link in the other direction to thereby move the contact member rearward to circuit closing position.

4. An automatic circuit breaker comprising in combination, a stationary electric contact, a movable electric contact member carrying a contact engageable and disengageable with the first said contact, a spring tending to move the contact member forward to circuit breaking position, a triple toggle linkage normally serving to hold the contact member in its rearward circuit making position and having the front link thereof movable about a fixed axis and having the rear link thereof pivoted to the contact member, an electro-responsive thermal strip and a magnetically controlled means both in the circuit and either or both serving upon the passage of excess current to break the rear toggle and permit the contact member to be moved outward by the spring to separate the contacts and thus break the circuit, and an operating means adapted for moving the front toggle

link in one direction to break the front toggle and permit the contact member to be moved by the spring as aforesaid and adapted for moving the said front link in the other direction to thereby move the contact member rearward to circuit closing position.

5. The combination of an insulating base, two spaced connectors on the front of the base, and a manually and automatically operable circuit breaker unit having connectors detachably engageable respectively with the said connectors on the base, the said unit comprising stationary and movable contacts, manually controllable means for operating the movable contact to make or break the circuit, and means including an electro-responsive thermal strip and a magnet both electrically connected between the two said connectors of the unit and each operative upon the passage of excess current to cause the automatic circuit breaking movement of the movable contact independently of the manually controllable means.

6. An automatic circuit breaker comprising in combination, a body having two parallel spaced side plates, a movable actuating member carried by the body, a contact member located at least in part between the said side plates and biased for movement relatively to the actuating member toward its open-circuit position, a stationary electric contact carried by the body, a movable electric contact carried by the contact member and movable therewith into and out of engagement with the stationary contact so as to close and open the circuit, a releasable mechanical connection means between the said contact member and the said actuating member to enable the latter to operate the former, a bi-metallic strip serving upon the passage therethrough of excess current to automatically release the mechanical connection to permit automatic movement of the contact member to its open-circuit position, and magnetically controlled means carried by and extending between the side plates and engaging the said strip to mechanically move it and thereby release the mechanical connection upon the passage of excess current.

In testimony whereof I have hereunto set my hand this 18th day of May, 1928.

JOSEPH SACHS.

DISCLAIMER

1,819,005.—*Joseph Sachs*, West Hartford, Conn. AUTOMATIC CIRCUIT BREAKER.
Patent dated August 18, 1931. Disclaimer filed July 11, 1933, by the patentee.
Hereby enters this disclaimer as follows:
He hereby disclaims claim 1.
[*Official Gazette August 8, 1933.*]