April 2, 1957 R. E. LOCHER 2,787,682

CIRCUIT BREAKER

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FIG. 1.

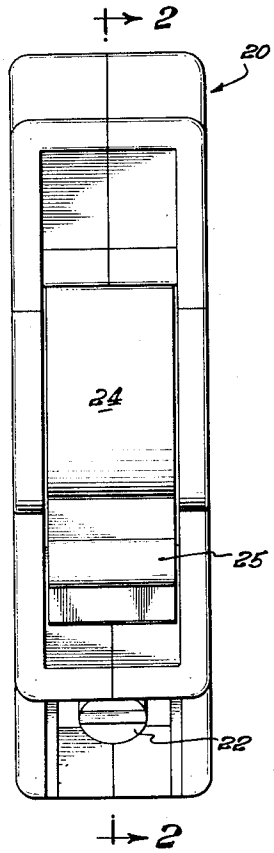


FIG. 7.

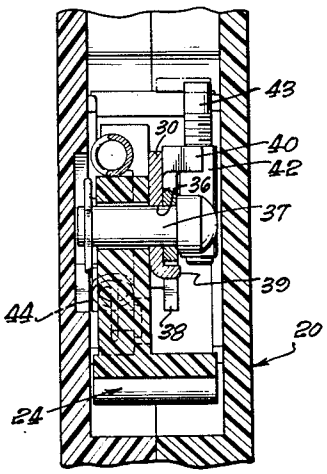
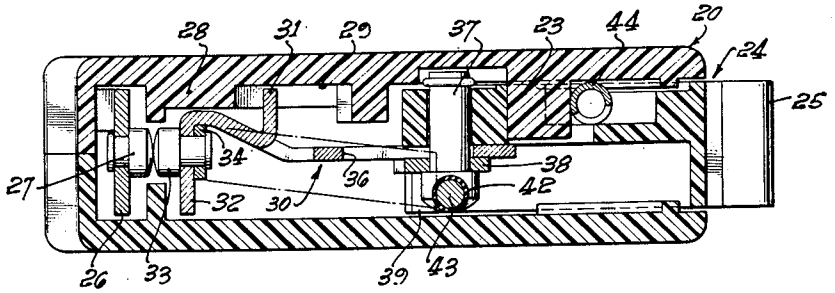


FIG. 6.



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FIG. 2.

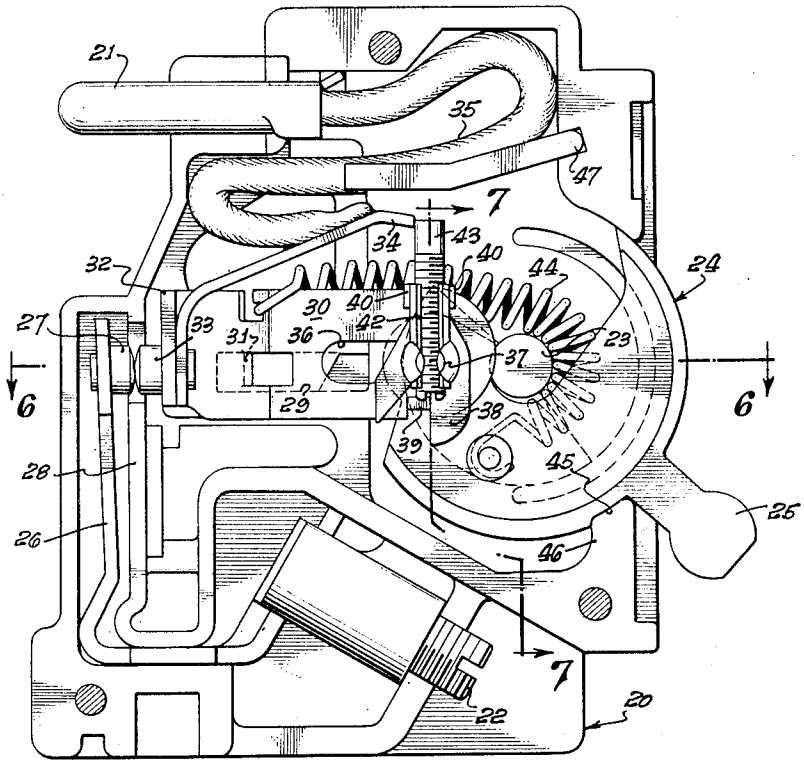
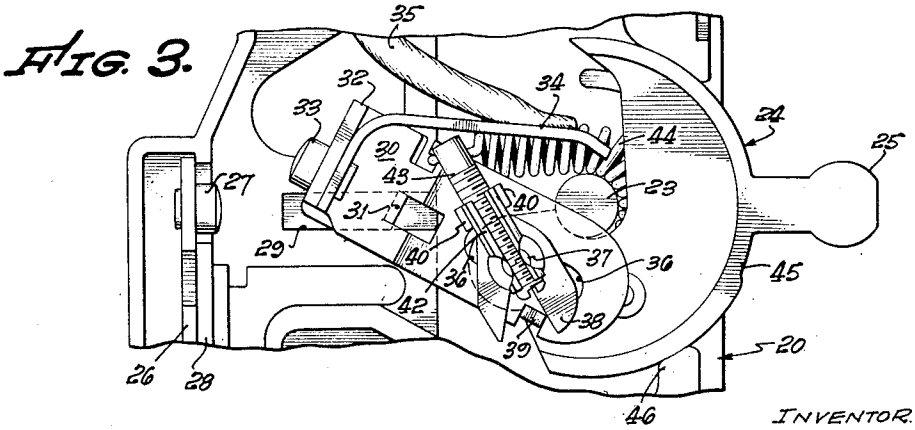


FIG. 3.



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CIRCUIT BREAKER

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FIG. 4.

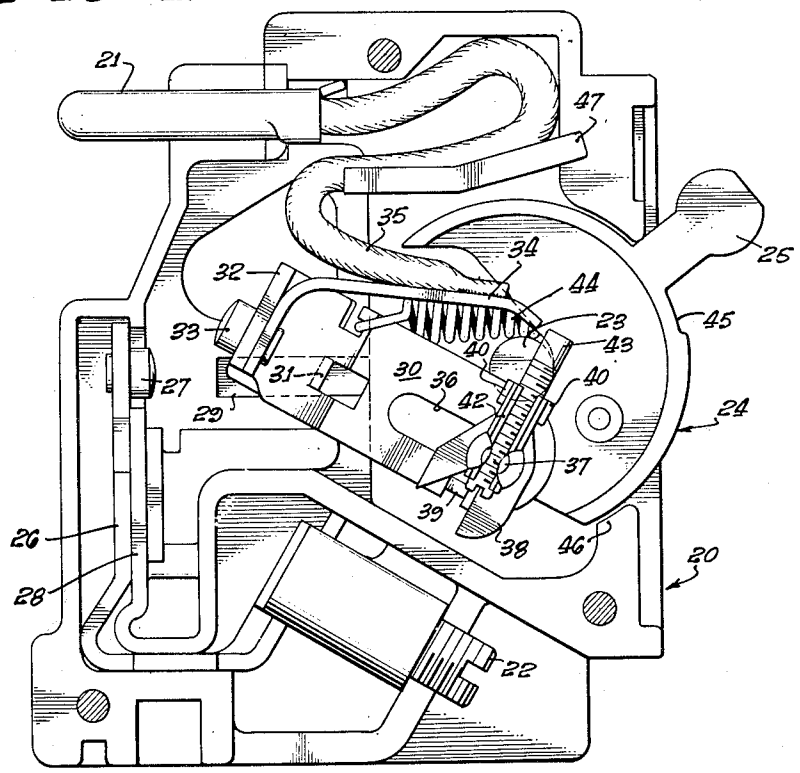
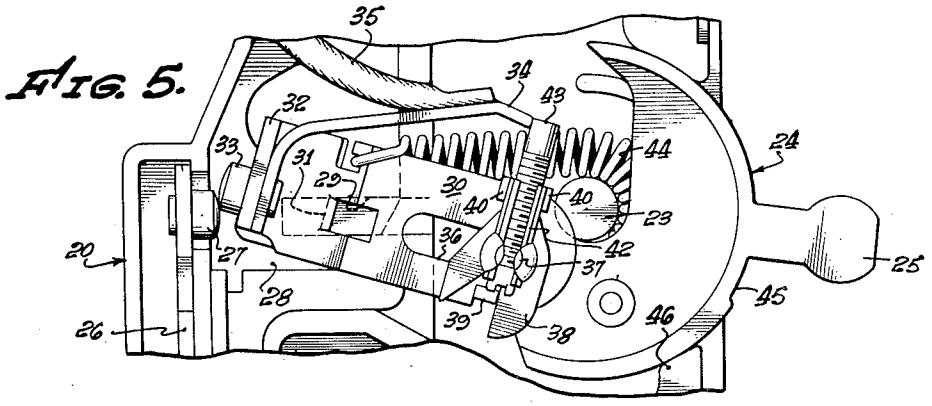


FIG. 5.



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CIRCUIT BREAKER

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FIG. 8.

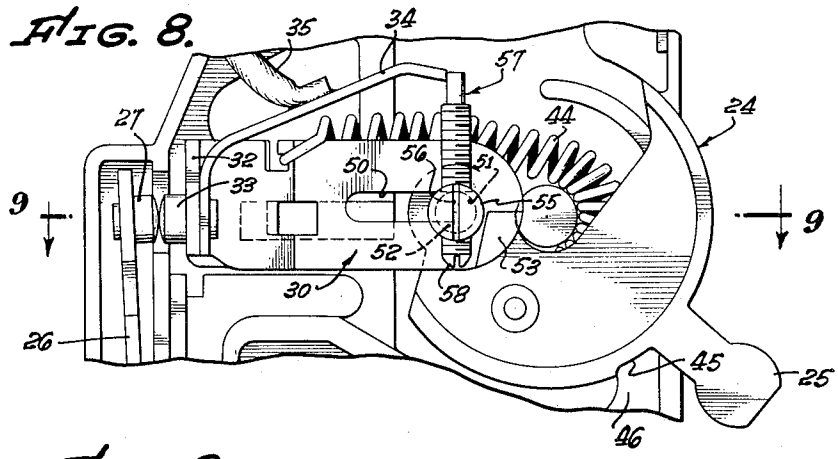


FIG. 9.

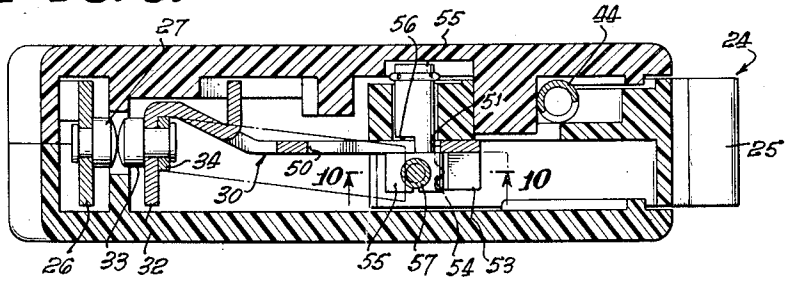


FIG. 10.

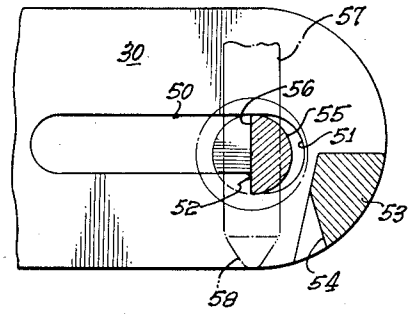
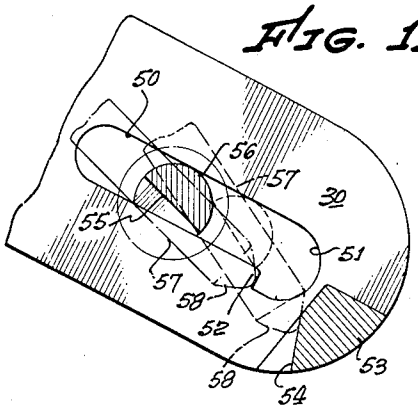


FIG. 11.



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United States Patent Office 2,787,682 Patented Apr. 2, 1957

2,787,682

CIRCUIT BREAKER

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Application March 8, 1954, Serial No. 414,624

7 Claims. (Cl. 200—116)

This invention relates to an electric switch and more particularly to an electric switch of the automatic circuit-breaker type, which may be defined as a device through which an electric current is passed and which opens the circuit automatically to interrupt the circuit whenever predetermined conditions occur in the circuit. The invention also relates to an automatic circuit breaker which is capable of manual operation to interrupt the circuit.

The invention further relates to a device by which the circuit is interrupted whenever the current in the circuit increases to a predetermined or overload value so that it becomes desirable to open the circuit.

The invention also relates to an overload circuit breaker or interrupter which includes a thermostatic element which, when heated above a predetermined temperature by the passage of an excessive amount of electrical current therethrough, expands to release an engagement and interrupt the electrical circuit through the circuit breaker.

It is an object of this invention to provide an improved electrical switch of the class described in which manual means are provided for closing the switch and opening the switch, the manual means being inoperative to maintain the switch closed when the thermostatic element is heated to a predetermined overload state.

Another object of the invention is to provide a circuit breaker in which a relatively large amount of pressure holds the contacts in engagement, while only a small amount of pressure is exerted on the thermostatic element.

A further object of the invention is to provide a circuit breaker in which the electrical contacts move into engagement through a wiping action which assures a good electrical contact.

The invention also has for its objects to provide means in an electric switch of the class described that are positive in operation, convenient in use, easily installed in working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawings merely show and the following description merely describe a preferred embodiment and certain modifications of the present invention, which are given by way of illustration or example only.

In the drawings, like reference characters designate similar parts in the several views, in which:

Fig. 1 is a front elevational view of my circuit breaker;

Fig. 2 is a sectional view of the same taken on line 2—2 of Fig. 1;

Fig. 3 is a broken sectional view similar to Fig. 2, showing my circuit breaker opening when an overload occurs;

Fig. 4 is a sectional view similar to Fig. 2, showing the contacts open;

Fig. 5 is a similar broken sectional view showing the contacts being closed;

Fig. 6 is a sectional view taken on line 6—6 of Fig. 2;

Fig. 7 is a sectional view taken on line 7—7 of Fig. 2;

Fig. 8 is a sectional view similar to Fig. 2 of a modified circuit breaker of the invention;

Fig. 9 is a sectional view taken at line 9—9 of Fig. 8;

Fig. 10 is a broken sectional view taken at line 10—10 of Fig. 9; and

Fig. 11 is a similar sectional view showing the operation of the latch device illustrated.

A preferred embodiment which has been selected to illustrate my invention comprises a case or outer housing 20, which is formed of a suitable electrically non-conducting material such as molded plastic. Extending outwardly from the housing 20 is a line terminal 21 and on the opposite side of said housing 20 is a load terminal 22. Continuity of the circuit between the terminals 21 and 22 is maintained through the circuit breaker and is interrupted when the circuit breaker is opened automatically or manually.

Mounted within the housing 20 and shown as integral therewith is a shaft 23. A semicircular manual control member 24 has a thumb lever portion 25 which extends outwardly from the housing 20. The manual control member 24 is provided adjacent its center with a cam surface which is adapted to contact and travel around the shaft 23.

Extending from the terminal 22 within the housing 20 is an electrically conducting contact arm 26, which is bent to form a leaf spring. The contact arm 26 has a circular fixed contact 27 attached to the end thereof. Mounted on the inside of the housing 20 adjacent the fixed contact 27 is an integral guide member 28.

The guide member 28 is provided with a slot 29. A carrier arm 30, which is preferably formed of metal, has a right angle lip 31, which travels within the slot 29. The carrier arm 30 is provided at one end with a right-angle portion 32, on one side of which is mounted a second contact 33, which will be referred to as the movable contact 33, because it is movable within the housing 20. Attached to the other side of the right-angle portion 32 and adapted to receive electrical current from the movable contact 33 is a bimetallic electrically conducting thermostatic element 34. The thermostatic element 34 is physically and electrically connected at one end to the right-angle portion 32 and is electrically connected at another point thereon to a flexible cable 35, which is in turn electrically connected to the terminal 21.

When the fixed contact 27 and the movable contact 33 engage, an electrical circuit is completed and current flows from the terminal 22 through the contacts 27 and 33, through the thermostatic element 34 and through the cable 35 to the other terminal 21.

The carrier arm 30 is provided with an opening 36. An actuator is rotatably mounted on the manual control member 24 by means of a pivot post 37 passing through the opening 36. Mounted on the pivot post 37 is a latch 38, which is positioned directly adjacent the carrier arm 30. The latch 38 has a U-shaped slit in the bottom thereof. The carrier arm 30 is provided with a right-angle extension 39, which extends within the U-shaped slit in the latch 38 to provide engagement between the latch 38 and the carrier arm 30. The top of the latch 38 is provided with a pair of transverse arms 40. The end of the pivot post 37 is provided with an opening. An insulating member 42 is positioned within the opening and the arms 40 of the latch 38 and extends therebetween.

Mounted within and extending through the insulating member 42 is a screw threaded rod 43. The rod 43 has a smooth head portion which extends to terminate at a point directly adjacent the end of the thermostatic element 34. The bottom of the rod 43 is provided with a slit which is adapted to accommodate the blade of a

small screw driver. The insulating member 42 isolates the rod 43 electrically from the carrier arm 30. A coil spring 44 has one end attached to the carrier arm 30 adjacent the downwardly extending lip 31 and its opposite end attached to the manual control member 24 so that it coils around the shaft 23. The coil spring 44 biases the carrier arm 30 away from the contact arm 26 and thus biases the movable contact 33 away from engagement with the fixed contact 27.

The rounded outer surface of the manual control member 24 is provided with a small notch 45, which is positioned directly adjacent the thumb lever portion 25. When the circuit breaker is in its first static condition, the notch 45 engages a projection 46, which is formed by an integral portion of the housing 20. These elements are held in engagement by pressure from the contact arm 26, to prevent counter-rotation of the manual control member 24 by the coil spring 44.

The relationship and cooperation of the elements will be more fully understood from their interaction when the circuit breaker is in use. Referring first to Fig. 2, this shows the circuit breaker in its closed contact condition. The contacts 27 and 33 are engaged and current flows between the terminals 22 and 21 through the thermostatic element 34. The carrier arm 30 extends in a line with the contacts 27 and 33. The rod 43 extends in a direction substantially perpendicular to the carrier arm 30. The portion of the manual control member 24 adjacent the thumb lever portion 25 bears against the inside of the housing 20.

The thermostatic element 34 is provided adjacent its free end with a slightly bent portion. When the circuit breaker is in closed contact condition, the end surface of the thermostatic element contacts the side of the smooth end of the rod 43. When the amount of electrical current flowing through the thermostatic element 34 becomes excessive, the bent portion thereof tends to straighten out and flex away from the rod 43, due to the difference in the coefficient of the expansion of the two metals which comprise the thermostatic element 34. When the flexible movement of the end of the thermostatic element 34 becomes sufficient, the end of the thermostatic element 34 moves sufficiently to become disengaged from the rod 43.

A permanent magnet 47 is mounted in the casing 20 adjacent the terminal 21 in a position which is directly adjacent the thermostatic element 34 when the contacts 27 and 33 are engaged. The purpose of the magnet 47 is to aid the movement of the thermostatic element 34 away from the end of the rod 34.

When this occurs, the circuit breaker leaves the static state described above and enters a dynamic state wherein the following movements take place. The coil spring 44 exerts pressure on the carrier arm 30 to pull it in a direction away from the contact arm 26, to break the engagement between the contacts 27 and 33. The coil spring 44 exerts simultaneous counterclockwise pressure on the manual control member 24, causing it to move away from engagement with the projection 46 and into engagement with the shaft 23. This movement frees the manual control member 24 so that it can be easily and quickly rotated by the coil spring 44. The rotation of the manual control member causes the rod 43 to pivot toward the fixed contact 27. The carrier arm 30 is moved by the rotation of the manual control member 24 until its lip 31 reaches the end of the slot 29. The rod 43 is brought back into position by the latch 38 and the extension 39 of the carrier arm 30. The rod 43 moves past the free end of the thermostatic element 34 and remains in a position adjacent the free end thereof.

The circuit breaker can be converted back to closed contact condition by reverse movement of the thumb lever portion 25 of the manual control member 24. When such movement takes place, the manual control member 24 moves in a clockwise direction. The pivot post 37 moves in a direction toward the fixed contact 27. The smooth end of the rod 43 engages the end of the thermostatic element 34, while the latch 38 engages the extension 39 of the carrier arm 30. This moves the carrier arm 30 and the attached thermostatic element 34 toward the fixed contact 27. The lip 31 of the carrier arm 30 travels in the slot 29 of the guide member 28, to guide the movement.

This movement continues until the bottom of the movable contact 33 comes into engagement with the top of the fixed contact 27. At this time, the movement of the pivot post 37 becomes more upward than lateral, causing the movable contact 33 to move into complete engagement with the fixed contact 27 by a downward wiping action which assures a good contact. The carrier arm 30 becomes wedged between the pivot post 37 and the fixed contact 27. The resilience of the contact arm 26 provides firm pressure for holding the contacts 27 and 33 in engagement with each other and for holding carrier arm 30 against accidental displacement.

It should be noted that the pressure provided by the contact arm 26, which is bent to form a leaf spring, also helps to break the engagement between the contacts 27 and 33 when an overload occurs. The further pressure from the coil spring 44 moves the carrier arm 30 to the farthest possible distance away from the contact arm 26, to complete the full separation of the contacts 27 and 33.

The modified construction shown in Figs. 8, 9, 10 and 11 of the drawings differs from that shown in the initial figures primarily in the manner in which the pivot post 37 is constructed so as to avoid the use of the latch 38 and the extension 39, discussed in conjunction with the initial figures. As shown most clearly in Figs. 8 to 11 of the drawings, the carrier arm 30 is provided with an opening 50 which is provided adjacent to the control member 24 with a hooked extremity 51 having a notch-like lip 52 projecting from the opening 50 away from the side of the plate positioned adjacent to the spring 44. Mounted upon the carrier arm 30 adjacent to this lip 52, but removed from the opening 50 in the general direction of the control member 24, is a cam lever guide 53 containing a V-shaped internal notch 54, as is best shown in Figs. 9, 10 and 11.

Carried upon the control member 24 in the same location as the pivot post 37 was carried upon this member in the initial construction described in this specification, is a pivot post 55 which is provided with an internal notch 56 which is adapted to slide in the opening 50 and which is adapted to be held by the lip 52 as illustrated in Fig. 10 of the drawing. On the lower extremity of this pivot post 55, there is positioned a threaded rod 57 having a pointed extremity 58 located so that during the travel of this rod 57 this extremity engages the notch 54 within the cam lever guide 53, turning this rod 57 to such a position as to make it locked within the lip 52, as illustrated in Fig. 10 of the drawings. The method of turning is in and of itself shown in Fig. 11 of the drawings by the various phantom views in this figure.

The operation of the modified construction shown in Figs. 8 through 11 is essentially the same as described above in conjunction with other figures of the drawings with the difference that instead of the extension 39 engaging the latch 38 so as to adjust the position of the rod 43 mounted upon the pivot post 37, the pointed end 58 engages the cam lever guide 53 so as to turn this pivot post 55 in order to place the threaded rod 57 in an operative position, as previously indicated.

A number of modifications may be made within the scope of this disclosure by those skilled in the art. As an example of such modification, current can be made to flow not only through the thermostatic element 34 directly to the contact 33, but, if the appropriate elements are made of a conductive material, can flow through this thermostatic element 34 both to the rod 43, the pivot post 37, and thence to the carrier arm 30 and the contact 33,

in addition to flowing directly to this contact 33. One very important advantage of the instant invention relates to the fact that a self-cleaning action is obtained which wipes off any oxides or other undesirable material on the contacts employed as the device described is operated so as to close these contacts.

I claim as my invention:

1. A circuit breaker comprising: a casing having a pair of terminals; a contact arm disposed within said casing, said contact arm being in the form of a leaf spring and having a contact thereon, said contact being in conductive relation with one of said terminals; a carrier arm having a contact thereon, said carrier arm being adapted to move toward said contact arm to engage said contacts; guide means disposed within said casing to guide the movement of said carrier arm; a manual control member rotatably disposed in said casing; a coil spring attached to said carrier arm and said manual control member to bias said carrier arm away from said contact arm; a pivot post rotatably mounted on said manual control member; a pivot member attached to said post and extending on opposite sides thereof, said pivot post extending through an opening in said carrier arm, said pivot member being adapted to engage said carrier arm on one side of said pivot post; and a bimetallic thermostatic element secured at one end to said carrier arm and in conductive relation with the contact thereon, another portion of said thermostatic element being in conductive relation with the other of said terminals, said thermostatic element having a tip portion adapted to engage an electrically insulated portion of said pivot member on the opposite side of said pivot post, said manual control member being adapted to move said carrier arm to engage said contacts, said tip portion of said thermostatic element being adapted, when overheated, to flex away from said pivot member and become disengaged therefrom, permitting said manual control member to be rotated and said carrier arm to be moved away from said contact arm to disengage said contacts, said manual control member being adapted upon rotation in the opposite direction to move said contacts back into engagement.

2. A circuit breaker comprising: a casing having a pair of terminals; a substantially fixed contact disposed within said casing and electrically connected to one of said terminals; a carrier arm of conductive material having a contact thereon, said carrier arm and contact being adapted to be moved toward and engage said fixed contact; a manual control member adapted to rotate in said casing; a spring attached to said carrier arm and said manual control member to bias said carrier arm contact away from said fixed contact; a pivot post rotatably mounted on said manual control member; a pivot member attached to said post and extending on opposite sides thereof, said pivot post extending through an opening in said carrier arm, one end of said pivot member engaging said carrier arm; and a bimetallic thermostatic element secured at one end to said carrier arm and in conductive relation therewith, another portion of said thermostatic element being in conductive relation with the other of said terminals, said thermostatic element having a tip portion adapted to engage the other end of said pivot member, said other end of said pivot member being electrically insulated from said carrier arm, said manual control member being adapted, when said thermostatic element and pivot member are so engaged, to move said carrier arm and engage said contacts, said tip portion of said thermostatic element being adapted when overheated to flex away from said pivot member and become disengaged therefrom, permitting said manual control member to be rotated and said carrier arm moved away from said contact arm by the resilient action of said spring to disengage said contacts, said manual control member being adapted upon rotation in the opposite direction to move said contacts back into engagement.

3. A circuit breaker as defined in claim 2, in which said manual control member has a notch, said notch being adapted to engage a portion of said casing when said contacts are engaged, the engagement between said notch and casing preventing the rotation of said manual control member until release thereof.

4. A circuit breaker comprising: a casing having a pair of terminals; a substantially fixed contact disposed within said casing; a carrier arm of conductive material having a contact thereon, said carrier arm and contact being adapted to be moved toward said fixed contact to engage said contacts; a manual control member rotatably disposed in said casing; a spring attached to said carrier arm and said manual control member to bias said carrier arm contact away from said fixed contact; a pivot post rotatably mounted on said manual control member; a pivot member attached to said post and extending on opposite sides thereof, said pivot post extending through an opening in said carrier arm, one end of said pivot member engaging said carrier arm; and a bimetallic thermostatic element attached to said carrier arm and adapted to receive electrical current when said contacts are engaged, said thermostatic element having a tip portion adapted to engage the other end of said pivot member, said manual control member being adapted to move said carrier arm and engage said contacts, said tip portion of said thermostatic element being adapted when overheated by the flow of electrical current to flex away from said pivot member and become disengaged therefrom, permitting said manual control member to be rotated and said carrier arm moved away from said contact arm by the resilient action of said spring to disengage said contacts, said manual control member being adapted upon manual rotation in the opposite direction to move said contacts back into engagement.

5. A circuit breaker comprising: a casing; a substantially fixed contact disposed within said casing; a carrier arm of conductive material having a contact thereon, said carrier arm and contact adapted to be moved toward said fixed contact to engage said contacts; a manual control member rotatably disposed in said casing; a spring attached to said carrier arm and said manual control member to bias said carrier arm contact away from said fixed contact; a pivot post rotatably mounted on said manual control member; a pivot member attached to said post and extending on opposite sides thereof, said pivot post extending through an opening in said carrier arm, one end of said pivot member engaging said carrier arm; and a bimetallic thermostatic element attached to said carrier arm and adapted to receive electrical current when said contacts are engaged, said thermostatic element having a tip portion adapted to engage the other end of said pivot member, said manual control member being adapted to move said carrier arm and engage said contacts, said tip portion of said thermostatic element being adapted when overheated by the flow of electrical current to flex away from said pivot member and become disengaged therefrom to disengage said contacts.

6. A circuit breaker comprising: a casing; a substantially fixed contact disposed within said casing; a carrier arm of conductive material having a contact thereon; a manual control member rotatably disposed in said casing; a spring attached to said carrier arm and said manual control member to continuously bias said carrier arm contact away from said fixed contact; a pivot post rotatably mounted on said manual control member; a pivot member attached to said post, said pivot member slidingly engaging said carrier arm; and a bimetallic thermostatic element attached to said carrier arm and adapted to receive electrical current when said contacts are engaged, said thermostatic element having a tip portion adapted to engage said pivot member, said manual control member being adapted to move said carrier arm and slidingly engage said contacts, said tip portion of said thermostatic element being adapted when overheated by the flow of electrical current therethrough to flex away

from said pivot member and become disengaged therefrom to disengage said contacts.

7. In an automatic circuit breaker, the combination of: a case; a substantially stationary contact mounted in said case; a movable contact member having a contact slidably engageable with and disengageable from said stationary contact; a manually operable handle pivotally mounted to said case, said handle having notch means engageable with an extension of said case when in the circuit closed position, and being movable radially in relation to said pivotal mounting to engage said case extension the engagement of said notch means with said extension holding said handle in said circuit closed position; an actuator pivotally mounted on said handle and operatively connected to said movable contact member; a current responsive latch mounted to said movable contact member; and spring means urging said notch means into engagement with said case extension and urging said

actuator into contact with said latch when said circuit breaker is in the closed position.

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