Feb. 23, 1960 E. V. SUNDT 2,926,227

OVERLOAD CIRCUIT BREAKER

Filed March 15, 1957

Fig. 1

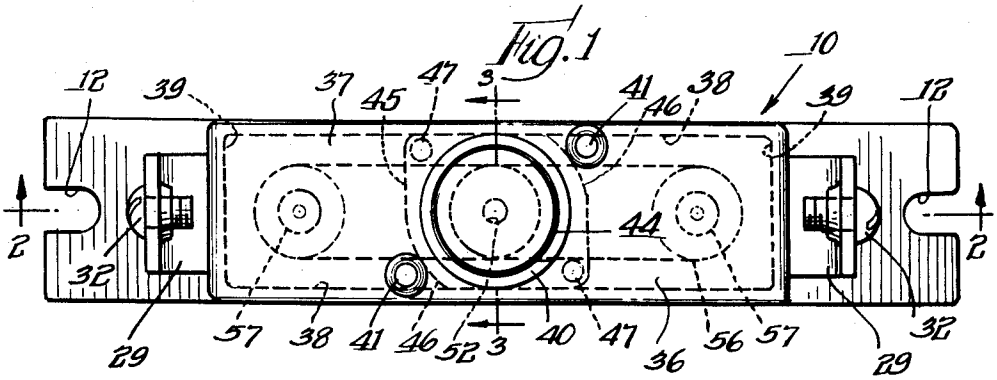


Fig. 2.

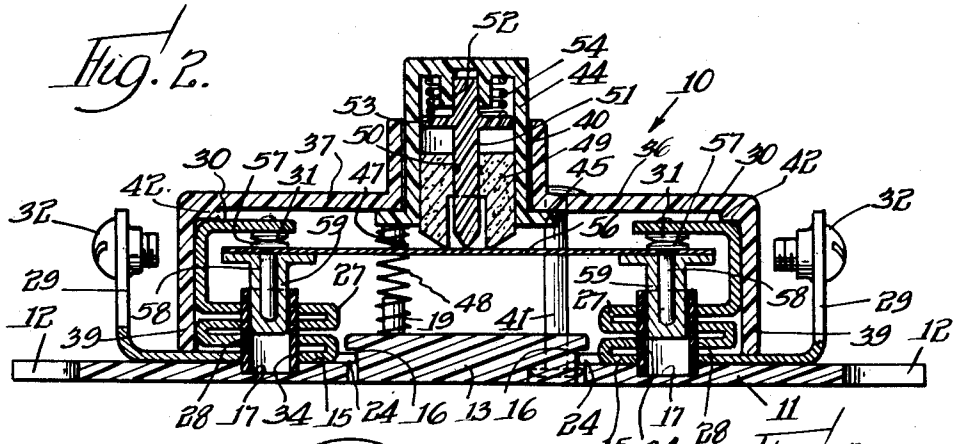


Fig. 3.

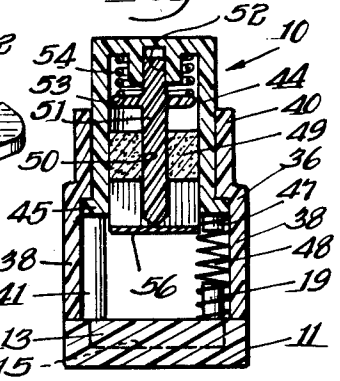


Fig. 4.

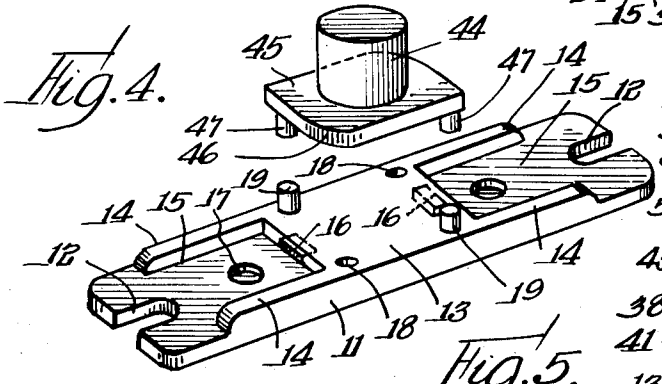


Fig. 5.

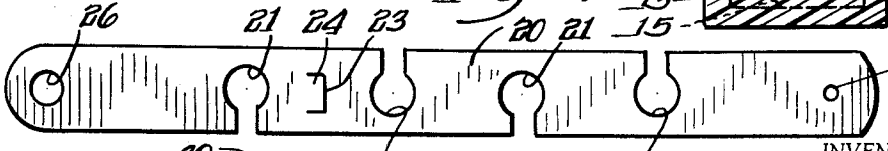
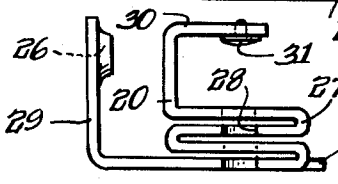


Fig. 6.



INVENTOR.

Edward V. Sundt

BY

Wallenstein & Spangenberg

attys.

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2,926,227

OVERLOAD CIRCUIT BREAKER

Edward V. Sundt, Wilmette, Ill.

Application March 15, 1957, Serial No. 646,445

14 Claims. (Cl. 200—88)

The principal object of this invention is to provide an improved overload circuit breaker for protecting an electric circuit against current overload conditions therein, wherein the circuit breaker opens the electric circuit only after a time interval where sustained low current overload conditions occur and wherein the circuit breaker immediately opens the electric circuit where sudden high current overload conditions occur.

In circuit breakers of the thermal bimetal snap action type, substantial time lag characteristics are obtainable for sustained low overload conditions since the bimetallic element must heat to the point where stress energies are built up sufficiently to make the element snap the breaker open. However, on severe overload conditions, the bimetallic type circuit breakers can burn up before this snap is able to take place. The circuit breaker of this invention, which is also of the thermal type, has the desirable time lag characteristics of the bimetallic snap action type, but since it is not of the type requiring snapping of the thermal element to open the breaker, it may operate more quickly and burning up of the circuit breaker due to severe overload conditions is substantially prevented.

Circuit breakers of the magnetic type have the disadvantage of tripping open on short peak overloads and, where provision for time lag is incorporated therein, considerable cost is added thereto. In the circuit breaker of this invention, a rapid magnetic opening of the circuit breaker is provided upon a short circuit, a sudden high current overload condition, and yet time delay is provided for opening the circuit breaker under sustained low current overload conditions. Thus, the circuit breaker of this invention incorporates the favorable characteristics found in thermal bimetal types and magnetic types of circuit breakers, but eliminates the unfavorable characteristics thereof.

Briefly, the overload circuit breaker of this invention for protecting an electric circuit against current overload conditions includes high current coil means, circuit controlling contact means and an armature connected in series in the electric circuit to be protected. The armature actuates the contact means, and has a resistance to current flow so as to be heated by the passage of current therethrough, and has high magnetic permeability below and a low magnetic permeability above a predetermined Curie point temperature. A permanent magnet is magnetically coupled to the armature and acts upon the armature in a direction to hold the contact means closed when the temperature of the armature is below the Curie point temperature. Spring means act upon the armature in a direction to uncouple the armature from the magnet and open the contact means when the temperature of the armature rises to substantially the Curie point temperature due to a sustained low current overload condition in the electric circuit to be protected for opening the circuit. The time lag here provided is determined by the time required to heat the armature to substantially the Curie point temperature and when this occurs the

circuit breaker automatically opens without the necessity for building up stresses in the armature as is required in the case of bimetallic snap acting elements. Burning up of the circuit breaker on severe current overload conditions is greatly minimized if not absolutely prevented.

To protect absolutely the circuit breaker against short circuit conditions, i.e., sudden high current overload conditions, core means having high magnetic permeability are also carried by the armature and are associated with the series connected high current coil means for moving the armature in said opposite direction to uncouple the armature from the magnet and open the contact means when the current flow in the coil means exceeds a predetermined value due to a sudden high current overload condition in the electric circuit to be protected for opening said circuit. Thus, rapid magnetic opening of the circuit breaker is provided upon the occurrence of short circuit conidtions while time delay opening is provided for sustained low current overload conditions, this being simply and inexpensively accomplished and without danger of burning up of the circuit breaker.

The circuit breaker of this invention also includes means for manually resetting the circuit breaker after it has opened the electric circuit. This is accomplished by manually moving the permanent magnet to magnetically recouple the armature to the magnet after the armature has been moved by the spring means or the high current coil means to open the contact means. In this way the contact means may be reclosed and the circuit breaker reset. The circuit breaker is at all times trip free, even during the manual resetting thereof, so that circuit protection is at all times afforded.

Further objects of this invention reside in the details of construction of the circuit breaker and in the cooperative relationships between the component parts thereof.

Other objects and advantages of this invention will become apparent to those skilled in the art upon reference to the accompanying specification, claims and drawing, in which:

Fig. 1 is a top plan view of the overload circuit breaker of this invention;

Fig. 2 is a vertical sectional view taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view taken substantially along the line 3—3 of Fig. 1;

Fig. 4 is an exploded perspective view of the base and carrier in their related positions;

Fig. 5 is a plan view of a terminal strip which is utilized for forming a coil and supporting a contact;

Fig. 6 illustrates the coil and contact support when the terminal strip of Fig. 5 is folded upon itself.

Referring first to Figs. 1 to 4, the overload circuit breaker of this invention is generally designated at **10**. It includes a base **11** formed of electrical insulating material such as Bakelite or the like. The base **11** is provided at its ends with slots **12** which are utilized for purposes of mounting the overload circuit breaker. The base **11** is centrally provided with a raised portion **13** from which extend ribs **14** forming cavities **15** on each side of the raised portion **13**. The raised portion **13** adjacent each cavity **15** is provided with a notch **16**, and the floors of the cavities **15** are each provided with a hole **17**. The raised portion **13** is provided with a pair of diagonally arranged holes **18**, and a pair of diagonally arranged bosses **19**.

A terminal strip is designated at **20** in Fig. 5 and this terminal strip may be formed from any suitable electrically conductive metal such as brass or the like. This terminal strip **20** is provided with a pair of notches **21** which open on one side edge of the strip, and a pair of notches **22** which open on the other side edge thereof.

As shown, these notches are preferably of keyhole configuration. Between two of the notches 21 and 22, the strip 20 is provided with a U-shaped slit 23 to form a tongue 24. One end of the terminal strip 20 is provided with a hole 25, and the other end is provided with a tapped hole 26. The terminal strip 20 is folded upon itself as indicated in Fig. 6, with the notches 21 and 22 in alignment. This folding forms a high current coil 27 having a central hole 28 formed by the notches 21 and 22. In the folding operation, the tongue 24 is also formed. The end of the terminal strip is bent upwardly at 29 to form an ear for making electrical connection by means of a screw 32 received in the tapped hole 26. The other end of the terminal strip 20 is bent as indicated at 30 to form a contact support for carrying a stationary contact 31, which is secured in the hole 25.

Two of these coil and contact support members are preferably utilized in the overload circuit breaker and they are arranged in the cavities 15 of the base 11. When they are so arranged, they are held in position by the ribs 14 on the base and by the tongues 24 extending into the slots 16. The central holes 28 in the coils 27 overlie the holes 17 in the cavities 15, and the stationary contacts 31 preferably overlie the holes 28 in the coils 27. An insulating sleeve 34, which may be formed from Flaminol insulating sleeving material, is inserted in the hole 28 of each coil 27 for core insulating purposes. These sleeves 34 also extend into the holes 17 in the cavities 15 further to assist in maintaining the coils 27 in proper position on the base 11.

The overload circuit breaker of this invention also includes a cover 36 having a top wall 37, side walls 38, which engage the central raised portion 13 and the ribs 14 of the base, and end walls 39 which extend downwardly between the ribs 14 and which engage the terminal strips to hold the same securely in place. The cover is secured to the base by means of a pair of rivets 41 extending through holes in the top wall 37 of the cover and through the holes 18 in the base. The top wall 37 of the cover is also centrally provided with an upwardly extending sleeve 40. The corners of the cover, where the top wall and the end walls meet, are provided with projections 42 which engage the contact supporting extensions 30 further to assist in rigidly holding the folded terminal strips in place. The cover 36 may be made of any suitable electrical insulating material such as Bakelite or the like.

Slidably mounted in the sleeve 40 of the cover 36 is a carrier 44 having a cylindrical portion, a closed top, and an outwardly extending flange 45, the flange 45 being arranged within the cover and the closed top of the carrier extending outwardly from the sleeve 40 of the cover to form a push button. The flange 45 of the carrier has two of its corners rounded off, as indicated at 46, so as to clear the rivets 41, and has two of its other corners provided with downwardly extending bosses 47. The carrier may be formed from any suitable electrical insulating material such as Bakelite or the like. The carrier is spring urged to its upper position where the flange 45 engages the top wall 37 of the cover by means of a pair of springs 48 extending between the pair of bosses 19 on the base, and the pair of bosses 47 on the carrier. The carrier may be moved downwardly against the action of these springs 48 by manually pressing on the closed top thereof in the manner of pressing a push button.

The carrier 44 internally carries a permanent magnet 49 having a pair of downwardly extending poles and the magnet may be an Alnico or the like magnet. The magnet 49 is provided with a vertically extending central hole 50 in which is slidably mounted a pin 51 made of electrical insulating material such as glass filed Plaskon or the like. This pin 51 is also slidably mounted in a sleeve portion 52 on the carrier 44. The pin 51 is provided with a flange 53, and a spring 54 is interposed between this flange and the closed top of the carrier for

resiliently urging the pin 51 downwardly with respect to the carrier 44 and the magnet 49 carried thereby.

Located within the cover 36 is an electrically conductive armature 56 which has a resistance to current flow so as to be heated by the passage of current therethrough and which has high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature. This armature is preferably formed from a ferrous nickel alloy having a Curie point temperature of substantially 350 degrees Fahrenheit. The ends of the armature 56 carry movable contacts 57 and soft iron magnet rivets 58, the contacts and rivets being suitably secured to the armature as by welding or the like. The rivets 58 carry cores 59 formed from Armco iron or the like, these cores 59 extending into the insulating core sleeves 28.

The armature 56 is adapted to be raised and lowered, and it is held in its raised position by the permanent magnet 49 with the movable contacts 57 engaging the stationary contacts 31. When the overload circuit breaker is connected into the circuit to be protected by means of the screws 32, a series circuit is completed through the coils 27, the stationary contacts 31, the movable contacts 57, and the armature 56. Under normal load conditions, the armature 56 is held raised by the permanent magnet 49 with the movable contacts engaging the stationary contacts and the armature, having a resistance to current flow, is heated by the current flow therethrough in accordance with the amount of the current flow. If there is a sustained overload condition in the circuit, the armature 56 will heat up to substantially the Curie point temperature, whereupon the magnetic permeability of the armature quickly and materially reduces. When this occurs, the spring 54 operates the pin 51 for forcibly moving the armtaure 56 away from the permanent magnet 49, and to separate the movable contacts 57 from the stationary contacts 31. As a result, the circuit to be protected is opened upon the occurrence of these sustained low overload conditions. Under low overload condtiions, the armature 56 loses its magnetic permeability at approximately 135 percent of the calibrated rating of the circuit breaker, and when this overload condition occurs, the armature 56 is quickly pushed off of the permanent magnet 49 by the pin 51, and is held in the circuit opening position by the spring actuated pin 51.

In order to manually reset the circuit breaker, the carrier 44 is pushed downwardly against the action of the springs 48, to move the magnet 49 into engagement with the lowered armature 56. In so doing, the spring 54 is compressed, and the pin 51 retracted. If, when this is done, the armature 56 has cooled below the Curie point temperature so as to obtain high magnetic permeability, the armature is then magnetically recoupled to the magnet 49. Wehn the carrier is released, the springs 48 raise the same, and the magnet 49 moves the armature 56 upwardly to cause the movable contacts 57 to re-engage the stationary contacts 31. It is thus seen that, in the manual resetting of the overload circuit breaker, trip free action is obtained during the resetting operation, for if overload conditions should occur, the armtaure would immediately be moved by the spring 54 to the open position.

Due to the fact that the coils 27 formed by the terminal strips 20 are extremely high current coils, there is no substantial action by these coils upon the cores 59 carried by the armature during low overload conditions. If, however, there should be a sudden high overload condition, such as caused by a short circuit or the like, a large current flow would pass through the coils 27, which would immediately operate to pull the cores 59 downwardly and pull the armature 56 away from the permanent magnet 49, thereby separating the movable contacts 57 from the stationary contacts 31 to open the circuit. In other words, the magnetic field produced by the coils 27 is substantially negligible in normal operation with a current of 30 or 60 amperes. Under a short circuit, how-

ever, this current value may increase to 1,000 or 2,000 amperes in a few milliseconds, and the ampere turns thus provided by the high current coils 27 snap the circuit breaker open before any damage can occur to the circuit breaker or associated equipment. The circuit breaker may be manually reset, following opening by a sudden high overload condition, in the same way as it is reset following operation due to sustained low overload conditions, trip free resetting being obtained in both instances.

While for purposes of illustration, one form of this invention has been disclosed, other forms thereof may become apparent to those skilled in the art upon reference to this disclosure and, therefore, this invention is to be limited only by the scope of the appended claims.

I claim as my invention:

1. A manually resettable overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, stationary contact means for connection into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, movable contact means carried by the armature and adapted to engage the stationary contact means for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a permanent magnet acting upon the armature in a direction to hold the movable contact means in engagement with the stationary contact means when the temperature of the armature is below the Curie point temperature, and spring means acting upon the armature in the opposite direction to disengage the movable contact means from the stationary contact means when the temperature of the armature rises to substantially the Curie point temperature due to a current overload condition in the electric circuit to be protected for opening said circuit, and a manually operated resiliently urged mounting means for the permanent magnet for normally maintaining the magnet in one position magnetically to maintain the armature in a position to hold the movable contact means in engagement with the stationary contact means, and for manually moving the magnet to another position to magnetically couple the armature to the magnet after the armaure has been magnetically uncoupled from the magnet and moved by the spring means to a position where the movable contact means is disengaged from the stationary contact means for the purpose of manually resetting the circuit breaker.

2. A manually resettable overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a pair of spaced apart stationary contacts for series connection into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, a pair of movable contacts carried by the armature and adapted to engage the pair of stationary contacts for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a permanent magnet acting upon the armature between the movable contacts in a direction to hold the movable contacts in engagement with the stationary contacts when the temperature of the armature is below the Curie point temperature, and spring means acting upon the armature between the movable contacts in the opposite direction to disengage the movable contacts from the stationary contacts when the temperature of the armature rises to substantially the Curie point temperature due to a current overload condition in the electric circuit to be protected for opening said circuit, and a manually operated resiliently urged mounting means for the permanent magnet for normally maintaining the magnet in one position magnetically to maintain the armature in a position to hold the pair of movable contacts in engagement with the pair of stationary contacts, and for manually moving the magnet to another position to magnetically couple the armature to the magnet after the armature has been magnetically uncoupled from the magnet and moved by the spring means to a position where the pair of movable contacts is disengaged from the pair of stationary contacts for the purpose of manually resetting the circuit breaker.

3. A manually resettable overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, stationary contact means for connection into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, movable contact means carried by the armature and adapted to engage the stationary contact means for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a manually operated carrier mounted for movement between two positions, first spring means for moving the carrier to one of the positions and allowing manual movement of the carrier to the other position, a permanent magnet carried by the carrier and acting upon the armature in a direction to hold the movable contact means in engagement with the stationary contact means when the carrier is in said one position and the temperature of the armature is below the Curie point temperature, second spring means acting upon the armature in the opposite direction to move the armature and disengage the movable contact means from the stationary contact means when the temperature of the armature rises to substantially the Curie point temperature due to a current overload condition in the electric circuit to be protected for opening said circuit, said carrier being manually movable to said other position against the action of said first spring means to magnetically recouple the armature to the magnet after the armature has been moved by the second spring means and the armature has cooled below the Curie point temperature, and said first spring means moving the carrier to said one position to move the magnetically recoupled armature and hence to engage the movable contact means with the stationary contact means for resetting the circuit breaker.

4. A manually resettable overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a pair of spaced apart stationary contacts for series connection into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, a pair of movable contacts carried by the armature and adapted to engage the pair of stationary contacts for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a manually operated carrier mounted for movement between two positions, first spring means for moving the carrier to one of the positions and allowing manual movement of the carrier to the other position, a permanent magnet carried by the carrier and acting upon the armature between the movable contacts in a direction to hold the pair of movable contacts when the carrier is in said one position and the temperature of the armature is below the Curie point temperature, second spring means acting upon the armature between the movable contacts in the opposite direction to move the armature and disengage the pair of movable contacts from the pair of stationary contacts when the tempera-

ture of the armature rises to substantially the Curie point temperature due to a current overload condition in the electric circuit to be protected for opening said circuit, said carrier being manually movable to said other position against the action of said first spring means to magnetically recouple the armature to the magnet after the armature has been moved by the second spring means and the armature has cooled below the Curie point temperature, and said first spring means moving the carrier to said one position to move the magnetically recoupled armature and hence to engage the pair of stationary contacts for resetting the circuit breaker.

5. A manually resettable overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, stationary contact means for connecting into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, movable contact means carried by the armature and adapted to engage the stationary contact means for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a manually operated carrier mounted for movement between two positions, spring means for moving the carrier to one of the positions and allowing manual movement of the carrier to the other position, a permanent magnet having a hole therein and carried by the carrier and acting upon the armature in a direction to hold the movable contact means in engagement with the stationary contact means when the carrier is in said one position and the temperature of the armature is below the Curie point temperature, a pin extending through the hole in the magnet and engaging the armature, a spring interposed between the pin and the carrier and acting upon the pin for moving the armature in the opposite direction to disengage the movable contact means from the stationary contact means when the temperature of the armature rises to substantially the Curie point temperature due to a current overload condition in the electric circuit to be protected for opening said circuit, said carrier being manually movable to said other position against the action of the spring means to magnetically recouple the armature to the magnet after the armature has been moved by the spring and pin and the armature has cooled below the Curie point temperature, and said spring means moving the carrier to said one position to move the magnetically recoupled armature and hence to engage the movable contact means with the stationary contact means for resetting the circuit breaker.

6. A manually resettable overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a pair of spaced apart stationary contacts for series connection into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, a pair of movable contacts carried by the armature and adapted to engage the pair of stationary contacts for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a manually operated carrier mounted for movement between two positions, spring means for moving the carrier to one of the positions and allowing manual movement of the carrier to the other position, a permanent magnet having a hole therein and carrier by the carrier and acting upon the armature between the movable contacts in a direction to hold the pair of movable contacts in engagement with the pair of stationary contacts when the carrier is in said one position and the temperature of the armature is below the Curie point temperature, a pin extending through the hole in the magnet and engaging the armature between the movable contacts, a spring interposed between the pin and the carrier and acting upon the pin for moving the armature in the opposite direction to disengage the pair of movable contacts from the pair of stationary contacts when the temperature of the armature rises to substantially the Curie point temperature due to a current overload condition in the electric circuit to be protected for opening said circuit, said carrier being manually movable to said other position against the action of the spring means to magnetically recouple the armature to the magnet after the armature has been moved by the spring and pin and the armature has cooled below the Curie point temperature, and said spring means moving the carrier to said one position to move the magnetically recoupled armature and hence to engage the pair of movable contacts with the pair of stationary contacts for resetting the circuit breaker.

7. An overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a terminal strip for connection into the electric circuit to be protected and having a plurality of oppositely arranged notches therein and being folded upon itself with the notches in alignment and forming a coil with a central opening and having a contact supporting extension, stationary contact means carried by the contact supporting extension of the terminal strip, an electrically conductive armature, movable contact means carried by the armature and adapted to engage the stationary contact means for connecting the armature in series with the electric circuit to be protected, means acting upon the armature in a direction to hold the movable contact means in engagement with the stationary contact means, and a core having high magnetic permeability carried by the armature and extending into the central opening of the coil for moving the armature in the opposite direction to disengage the movable contact means from the stationary contact means when the current flow in the coil exceeds a predetermined value due to a current overload condition in the electric circuit to be protected for opening the circuit.

8. An overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a pair of terminal strips for connection into the electric circuit to be protected and each having a plurality of oppositely arranged notches therein and being folded upon itself with the notches in alignment and forming a coil with a central opening and having a contact supporting extension, a pair of stationary contacts carried, respectively, by the contact supporting extensions of the terminal strips, an electrically conductive armature, a pair of movable contacts carried by the armature and adapted to engage the pair of stationary contacts for connecting the armature in series with the electric circuit to be protected, means acting upon the armature in a direction to hold the pair of movable contacts in engagement with the pair of stationary contacts, and a pair of cores having high magnetic permeability carried by the armature and extending into the central openings of the pair of coils for moving the armature in the opposite direction to disengage the pair of movable contacts from the pair of stationary contacts when the current flow in the coils exceeds a predetermined value due to a current overload condition in the electric circuit to be protected for opening the circuit.

9. An overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, stationary contact means for connection into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, movable contact means carried by the armature and adapted to

engage the stationary contact means for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a permanent magnet acting upon the armature in a direction to hold the movable contact means in engagement with the stationary contact means when the temperature of the armature is below the Curie point temperature, and spring means acting upon the armature in the opposite direction to disengage the movable contact means from the stationary contact means when the temperature of the armature rises to substantially the Curie point temperature due to a sustained low current overload condition in the electric circuit to be protected for opening said circuit, coil means connected in series with the stationary contact means, and core means having high magnetic permeability carried by the armature and extending into the coil means for moving the armature in said opposite direction to uncouple the armature from the permanent magnet and disengage the movable contact means from the stationary contact means when the current flow in the coil means exceeds a predetermined value due to a sudden high current overload condition in the electric circuit to be protected for opening said circuit.

10. An overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a pair of spaced apart stationary contacts for series connection into the electric circuit to be protected, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, a pair of movable contacts carried by the armature and adapted to engage the pair of stationary contacts for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a permanent magnet acting upon the armature between the movable contacts in a direction to hold the movable contacts in engagement with the stationary contacts when the temperature of the armature is below the Curie point temperature, and spring means acting upon the armature between the movable contacts in the opposite direction to disengage the movable contacts from the stationary contacts when the temperature of the armature rises to substantially the Curie point temperature due to a sustained low current overload condition in the electric circuit to be protected for opening said circuit, a pair of coils connected in series with the pair of stationary contacts, and a pair of cores having high magnetic permeability carried by the armature and extending into the pair of coils for moving the armature in said opposite direction to uncouple the armature from the permanent magnet and disengage the movable contacts from the stationary contacts when the current flow in the pair of coils exceeds a predetermined value due to a sudden high current overload condition in the electric circuit to be protected for opening said circuit.

11. An overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a terminal strip for connection into the electric circuit to be protected and having a plurality of oppositely arranged notches therein and being folded upon itself with the notches in alignment and forming a coil with a central opening and having a contact supporting extension, stationary contact means carried by the contact supporting extension of the terminal strip, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, movable contact means carried by the armature and adapted to engage the stationary contact means for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a permanent magnet acting upon the armature in a direction to hold the movable contact means in engagement with the stationary contact means when the temperature of the armature is below the Curie point temperature, and spring means acting upon the armature in the opposite direction to disengage the movable contact means from the stationary contact means when the temperature of the armature rises to substantially the Curie point temperature due to a sustained low current overload condition in the electric circuit to be protected for opening said circuit, and a core having high magnetic permeability carried by the armature and extending into the central opening of the coil for moving the armature in the opposite direction to disengage the movable contact means from the stationary contact means when the current flow in the coil exceeds a predetermined value due to a sudden high current overload condition in the electric circuit to be protected for opening said circuit.

12. An overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, a pair of terminal strips for connection into the electric circuit to be protected and each having a plurality of oppositely arranged notches therein and being folded upon itself with the notches in alignment and forming a coil with a central opening and having a contact supporting extension, a pair of stationary contacts carried respectively by the contact supporting extensions of the terminal strips, an electrically conductive armature having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, a pair of movable contacts carried by the armature and adapted to engage the pair of stationary contacts for connecting the armature in series with the electric circuit to be protected to heat the armature in accordance with the current flow in said electric circuit, a permanent magnet acting upon the armature between the movable contacts in a direction to hold the movable contacts in engagement with the stationary contacts when the temperature of the armature is below the Curie point temperature, and spring means acting upon the armature between the movable contacts in the opposite direction to disengage the movable contacts from the stationary contacts when the temperature of the armature rises to substantially the Curie point temperature due to a sustained low current overload condition in the electric circuit to be protected for opening said circuit, and a pair of cores having high magnetic permeability carried by the armature and extending into the central openings of the pair of coils for moving the armature in the opposite direction to disengage the pair of movable contacts from the pair of stationary contacts when the current flow in the coils exceeds a predetermined value due to a sudden high current overload condition in the electric circuit to be protected for opening the circuit.

13. An overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, high current coil means, contact means and an armature connected in series in the electric circuit to be protected, said armature actuating the contact means and having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, a permanent magnet magnetically coupled to the armature and acting upon the armature in a direction to hold the contact means closed when the temperature of the armature is below the Curie point temperature, spring means acting upon the armature in a direction to uncouple the armature and open the contact means when the temperature of the armature rises to substantially the Curie point temperasure due to a sustained low current overload condition in the electric circuit to be protected for opening said

circuit, and core means having high magnetic permeability carried by the armature and associated with the coil means for moving the armature in said opposite direction to uncouple the armature from the permanent magnet and open the contact means when the current flow in the coil means exceeds a predetermined value due to a sudden high current overload condition in the electric circuit to be protected for opening said circuit.

14. A manually resettable overload circuit breaker for protecting an electric circuit against current overload conditions therein comprising, high current coil means, contact means and an armature connected in series in the electric circuit to be protected, said armature actuating the contact means and having resistance to current flow so as to be heated by current flow therethrough and high magnetic permeability below and low magnetic permeability above a predetermined Curie point temperature, a permanent magnet magnetically coupled to the armature and acting upon the armature in a direction to hold the contact means closed when the temperature of the armature is below the Curie point temperature, spring means acting upon the armature in a direction to uncouple the armature and open the contact means when the temperature of the armature rises to substantially the Curie point temperature due to a sustained low current overload condition in the electric circuit to be protected for opening said circuit, and core means having high

magnetic permeability carried by the armature and associated with the coil means for moving the armature in said opposite direction to uncouple the armature from the permanent magnet and open the contact means when the current flow in the coil means exceeds a predetermined value due to a sudden high current overload condition in the electric circuit to be protected for opening said circuit, and means for manually moving the permanent magnet to magnetically recouple the armature to the magnet after the armature has been moved by the spring means or the coil means to open the contact means for the purpose of reclosing the contact means and resetting the circuit breaker.

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