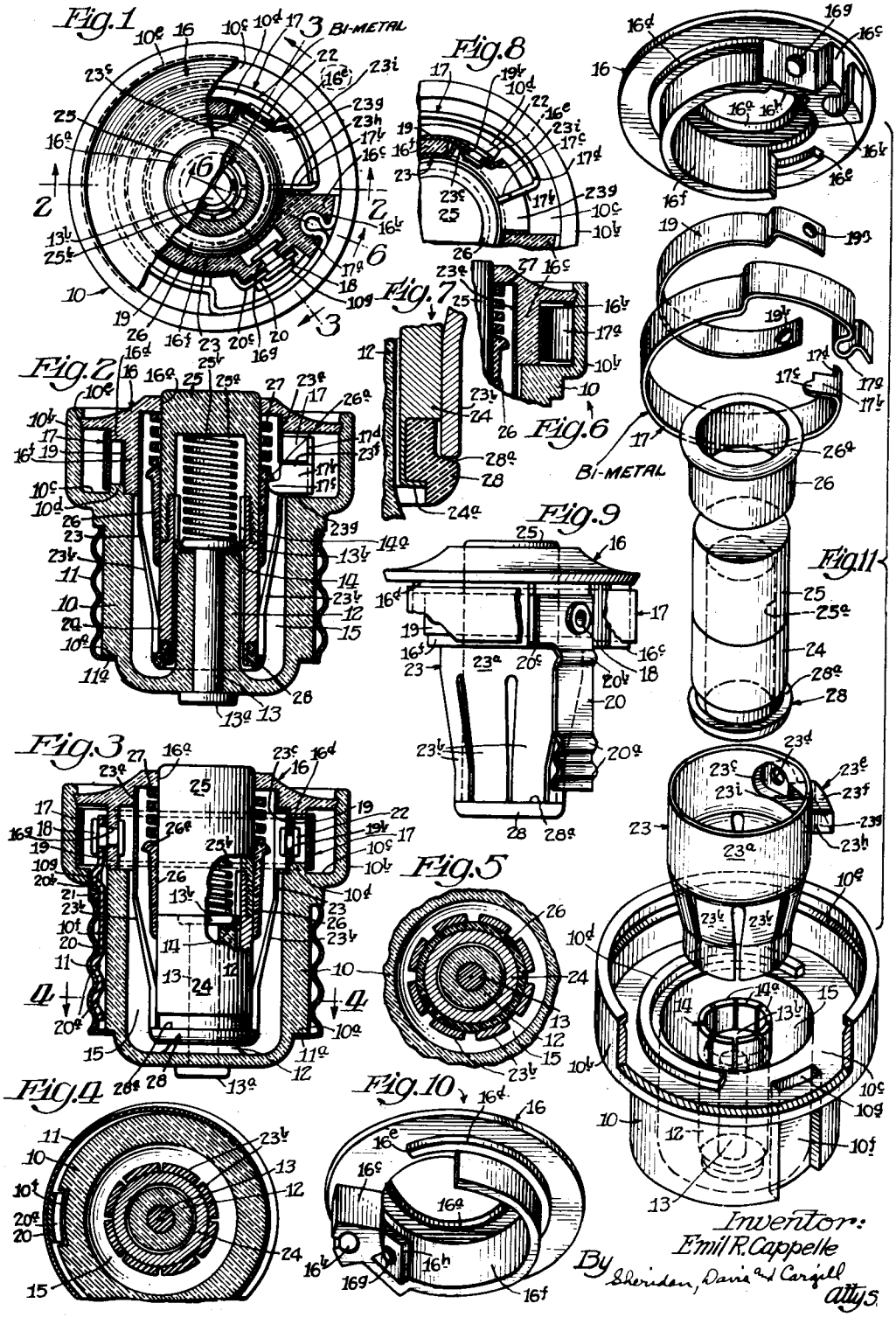
May 20, 1941. E. R. CAPPELLE 2,242,232

CIRCUIT BREAKER

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CIRCUIT BREAKER

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Fig. 12

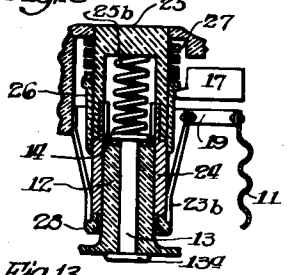


Fig. 13

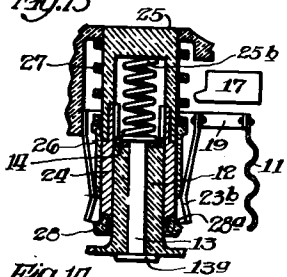


Fig. 14

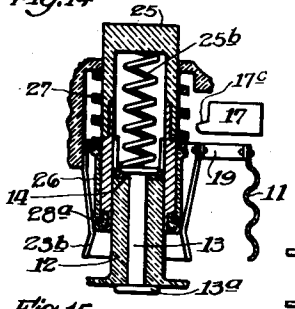


Fig. 15

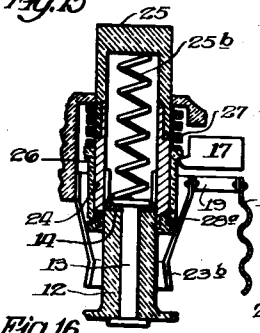


Fig. 16

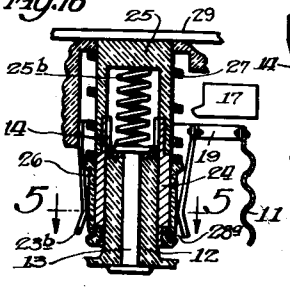


Fig. 17

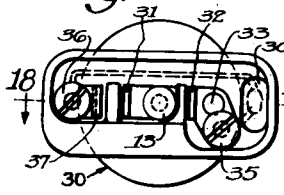


Fig. 18

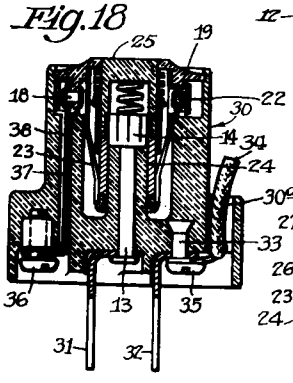


Fig. 19

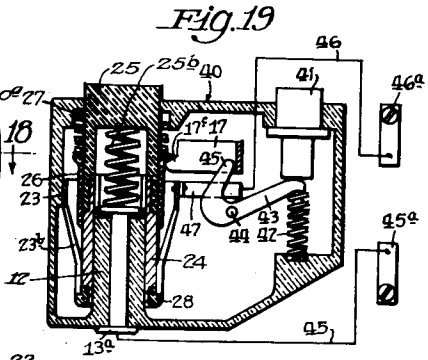


Fig. 20

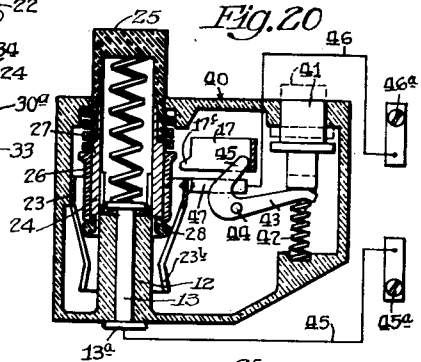


Fig. 22

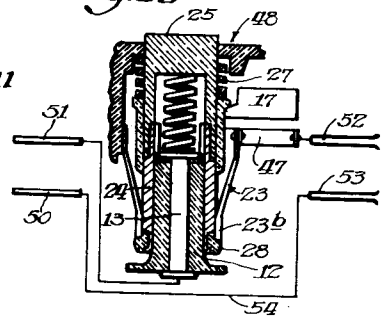


Fig. 21

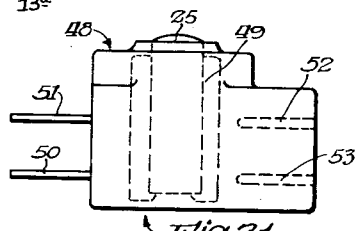


Fig. 24

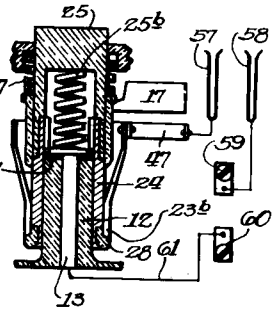


Fig. 23

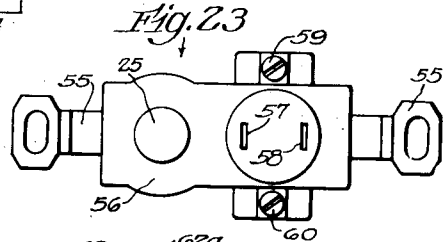
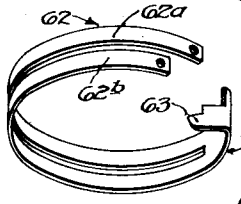


Fig. 25



bi-metal

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Patented May 20, 1941

2,242,232

UNITED STATES PATENT OFFICE

2,242,232

CIRCUIT BREAKER

Emil R. Cappelle, Chicago, Ill.

Application November 1, 1937, Serial No. 172,080

19 Claims. (Cl. 200—116)

This invention relates to improvements in circuit breakers.

One object of the invention is to provide an improved thermostatically responsive circuit breaker of simple and economical construction.

Another object of the invention is to provide a circuit breaker of simple, compact, economical construction which may be operated repeatedly by overloaded circuits or by current flow above a predetermined amperage and repeatedly reset without renewal of its parts.

A further object of the invention is to provide a circuit breaker provided with a manually resetting device comprising a member which moves from normal position to indicate an open circuit but which member, if its movement to indicating position is obstructed by any means or is manually held in normal position, will not prevent the circuit opening mechanism of the device from opening the circuit upon recurrence or continuance of circuit overload.

An additional object of the invention is to provide a circuit breaker having switch or contact mechanism housed within a casing which preferably is tamper-proof and through an opening in which casing operates a manually operable member for resetting the switch to closed position but which switch may open automatically independently of the operability of said member.

Another object of the invention is to provide a circuit breaker having a pair of cooperating concentric contact elements which provide a relatively large contact area and which can be separated to break a circuit by means of an intermediate insulating member which snuffs the arc which tends to form between the members upon the breaking of the circuit.

An additional object of the invention is to provide a circuit breaker mechanism which has no wires or like flexible connections which require soldering or welding to other parts and which mechanism is adapted for incorporation in switches, outlet receptacles or other relatively low cost electrical devices.

In the drawings, certain embodiments of the invention are disclosed for the purpose of illustration, wherein:

Fig. 1 is a broken top plan view of a circuit breaker embodying the present improvements and of a type adapted to be screwed into a threaded socket;

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

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1;

Fig. 4 is a horizontal section taken on line 4—4 of Fig. 3;

Fig. 5 is a section taken on line 5—5 of Fig. 16;

Fig. 6 is a broken sectional view taken on line 6—6 of Fig. 1;

Fig. 7 is an enlarged broken sectional view of a lower portion of the contact members in the relation shown in Fig. 2;

Fig. 8 is a broken top plan view corresponding to Fig. 1 but with a heat responsive member shown in a position which effects the breaking of the circuit;

Fig. 9 is a broken view of the cap or cover of the device shown in Figs. 1 and 2 in detached relation and showing also the parts which are mounted on or carried by said cap;

Fig. 10 is a perspective view of the lower side of the cap;

Fig. 11 is a distended or exploded view of the parts of the circuit breaker;

Fig. 12 is a broken vertical sectional view, partially diagrammatic, showing the relation of the operating parts of the circuit breaker while the same are in circuit closing relation;

Fig. 13 shows the parts at the instant they reach circuit breaking relation;

Fig. 14 is a similar view illustrating a position of the parts succeeding the position shown in Fig. 13 during movement of the operative parts to circuit opening position;

Fig. 15 is a similar view showing the parts after having completed their movement from circuit closing to circuit opening position;

Fig. 16 is a similar view showing the device in circuit opening relation where a button or resetting device is obstructed and retained in the position which normally indicates a closed circuit;

Fig. 17 is a bottom plan view of a terminal plug in which the present invention is embodied for protecting the lighting or heating or power device receiving current through the plug;

Fig. 18 is a sectional view taken on line 18—18 of Fig. 17;

Fig. 19 is a vertical sectional view of a structure embodying the present improvements and means which cooperate with the improved circuit breaker for converting the same into a manually operable switch;

Fig. 20 is a view similar to Fig. 19 but illustrating the device in circuit opening position;

Fig. 21 is an elevation of a conductor con-

nector embodying the present improvements and into which a conventional receptacle plug may be inserted for supplying current to an electrical device;

Fig. 22 is a sectional view of the device shown in Fig. 21 and illustrating the circuit thereof diagrammatically;

Fig. 23 is a plan view of a wall plug receptacle having a circuit breaker embodying the present invention incorporated therein;

Fig. 24 is a sectional view through the device shown in Fig. 23 and illustrating the circuit thereof diagrammatically; and

Fig. 25 is a perspective view of a modified thermostatic element adapted for use in structures embodying the present improvements.

The circuit breaker shown in Figs. 1 to 16, inclusive, is of a type adapted to be screwed into a conventional fuse outlet for protecting a circuit against predetermined overloads. The device comprises an outer casing **10** of suitable material such as porcelain, "Bakelite," or the like, on the exterior of which, as shown in Fig. 2, is a screw terminal **11**, a lower end **11***a* of which engages beneath a shoulder **10***a* of the casing. The manner in which the screw terminal **11** is retained in position on the casing **10** will be described later. The interior of the casing **10** is provided with an integral upstanding tubular boss or post **12** through which extends the other terminal **13** having a contact head **13***a* at its lower end. The upper end of the member **13** is also provided with a head **13***b* which seats within a cup-like conducting brush member **14**, the vertical walls of which are slotted as shown in Fig. 11 to provide resilient fingers **14***a*. The head **13***b* holds the conducting member **14** in position on the upper end of the post **12**. Surrounding the post is an annular space **15**. The upper end of the casing **10** is of somewhat enlarged diameter and comprises a cylindrical wall **10***b*. This construction provides a shoulder **10***c* which is provided with a semi-circular rib **10***d* spaced outwardly from the inner edge of the shoulder as shown in Fig. 11.

The inner surface of the wall **10***b* may be provided, as shown, with an annular notch **10***e* into which may be snapped or pressed an edge of a closure or cap member indicated generally by the numeral **16**. The cap is provided with a central passage **16***a* and at its lower surface is shaped for attachment thereto of a thermostatic member and in one embodiment of the invention, a heating element. The thermostatic member is shown in perspective in Fig. 11 and is indicated generally by the numeral **17**. The member is generally of open ring-like form and adjacent one end is provided with a loop formation **17***a* which is arranged to seat within an opening **16***b* formed in an integral lower extension **16***c*. The width of the member **17** and its shape are such that it extends around and may contact with an integral rib **16***d* which terminates at **16***e* adjacent the extension **16***c*. In assembling the member **17** in position, the loop formation **17***a* is merely pressed downwardly into the passage **16***b*, the fit being substantially tight and the portions adjacent the loop contacting adjacent surfaces of the member **16***c* to anchor the looped end against movement.

Extending downwardly from the rib formation **16***d* is an integral wall **16***f* which is offset inwardly from the outer periphery of the rib **16***d* but is concentric therewith. The wall adjacent the member **16***c* is provided with an opening **16***g* for receiving a rivet or like fastening means **18**, by means of which a heating element **19** is attached in position on the cap. The heating element **19** is shown in perspective in Fig. 11 and, as will be seen, lies adjacent the outer surface of the wall **16***f*, the rivet **18** passing through the opening **19***a*.

When the parts are in assembled relation, it will be seen that the thermostatic element **17** abuts the outer vertical edge of the rib **16***d* at its upper edge and at its lower edge abuts the rib **10***d* of the casing. The heating element **19** is therefore disposed inwardly of the thermostatic element which preferably is of the bimetallic type whereby emitted heat will be concentrated upon the inner metal of the thermostat for causing rapid expansion thereof and a somewhat radial movement of the free end **17***b* which extends inwardly over the annular passage **15** of the casing as shown in Fig. 2. It will be noted that the inwardly directed end **17***b* is disposed between the block-like formation **16***c* and the end **16***e* of the rib **16***d*.

The inner wall of the depending flange **16***f* of the cap member is provided with a vertical recess or slot **16***h* depending from the outer face of which is a connector strip **20** having threads **20***a* adjacent its lower end of the same pitch as the threads of the shell **11**, the rivet head being accommodated by the slot **16***h*. The strip **20** in the assembled device is secured to the heating element **19** by the rivet **18** and passes through a vertical opening **10***g* of the member **10** which communicates with a slot **10***f* formed in the exterior wall of the body of the casing. When the member **20** has been passed through the opening **10***g* into the slot **10***f* as shown in Fig. 3, a transverse rib **20***b* thereof closes the opening **10***g* to prevent entrance of dust and foreign matter into the interior of the circuit breaker. In attaching the shell **11**, its threads mesh with the threads **20***a* whereby the shell is held in position thereon although solder **21** is employed for preventing rotation of the shell with respect to the casing after assemblage. An extension **20***c* of member **20** rests on the wall **10***c* of the casing **10** and prevents imposition of excessive strain on the rivet **18** as the shell is secured into position. The other end of the heating element **19** is provided with an opening **19***b* for receiving a rivet **22** or the like, by means of which the element is electrically connected to a contact indicated generally by the numeral **23** which, in the embodiment of the invention illustrated, constitutes one of two cooperating switch members by means of which a circuit is opened or closed. The contact **23** is formed of conducting material having an upper cylindrical portion **23***a* and a lower tapered portion which is slotted longitudinally to provide flexible contact fingers **23***b*. The cylindrical portion of the contact is provided with an outwardly formed portion **23***c* through an opening **23***d* in which the rivet **22** extends and holds one end of the element **19** in firm electrical contact with the contact **23**. The upper portion **23***a* of the contact is also provided with a horizontal box-like formation **23***e* having upper and lower walls **23***f* and **23***g* between which the inwardly directed movable end of thermostat **17** projects. The end **17***b* of the thermostat is slidable horizontally between the wall **23***f* and **23***g* which restricts tilting or twisting movement of the thermostat on a horizontal axis. When the contact **23** is in assembled relation, it seats against the inner wall of

the depending flange or wall 16f of the cap and extends downwardly into the annular passage 15 of the casing. The wall 23g rests upon the horizontal wall 10c of the casing, as shown in Figs. 2 and 3, while an end wall 23h of the box-like formation 23e abuts a vertical wall of the member 16c of the cap, while an opposite wall 23i abuts the end 16e of rib 16d as shown in Figs. 1 and 8 which prevents rotation of the contact with reference to the cap 16.

Slidable axially with respect to the post 12 but spaced therefrom is a second contact member 24 which is of conducting material and of tubular form and adapted to reciprocate with reference to the contact 14 and to be guided thereby. The external diameter of the contact 24 is such as to provide suitable electrical contact with the lower ends of the flexible contact fingers 23b when the circuit breaker is in circuit closing position as shown in Fig. 2. The internal diameter of the contact 24 is such that it makes suitable electric contact with the flexible fingers 14a of the cup member 14 as shown in Fig. 2. This contact between the members 14 and 24 is maintained whether the member 24 is in circuit opening or circuit closing position with reference to contact 23.

The upper end of contact 24 is shown of reduced diameter and threaded for convenient attachment to the lower threaded end of a resetting member 25 shown in the form of an insulating button. The member 25 is centrally recessed as at 25a, within which recess is located a spring 25b which seats at its lower end within the cup member 14 and at its upper end normally exerts pressure against the member 25 to move it upwardly. The button 25 is slidable through the opening or passage 16a in the cap 16. The exterior diameter of the button 25 is shown as being the same as that of the contact 24, the two members forming, when assembled as shown in Fig. 2, a unitary member around which is disposed a cylindrical insulating spreader member 26 which is movable in a direction to engage the flexible arms 23b to spread them or distend them radially to force them out of contact with the contact member 24 for opening the circuit through the circuit breaker.

The upper end of the member 26 is provided with a flange 26a between which and the cap 16 is located a spring 27 which tends to force the member 26 downwardly to wedge or spread the fingers 23b outwardly or radially as above mentioned. The lower end of the contact 24 is reduced in diameter (see Fig. 7) for receiving an annular member 28 of insulating material having a ledge or shoulder 28a adapted to seat under the ends of the arms 23b to retain the member 24 in circuit closing position. The member 28 is shown attached to the member 24 by means of a flange 24a.

It will be seen that when the spring 27 forces the member 26 downwardly, the arms 23b will be forced radially outwardly from the shoulder 28a whereupon the spring 25b will force the button 25 and the contact member 24 upwardly. Figs. 12 to 15, inclusive, are progress views illustrating the operation of the circuit breaker as described. Fig. 12 shows it in circuit closing position, i. e., with the arms 23b in contact with the member 24 and with the member 26 in its upper normal position. Fig. 13 shows the member 26 being forced downwardly by the spring 27 and spreading the arms 23b outwardly from the ledge 28a. Fig. 14 shows the parts partially moved upwardly under the action of the spring 23b which is of greater strength than the spring 27 so that as the ledge 28a engages the lower end of the member 26, the latter is also carried upwardly against the action of the spring 27 and thereby compressing the latter. Fig. 15 shows the mechanism in final circuit breaking position.

For the purpose of retaining the member 26 normally in the position shown in Figs. 2 and 12, suitable means are provided which are actuatable to releasing position by the thermostat 17. In the embodiment of the invention shown, such holding and releasing is in the form of a catch member 17c which is shown as integral with the thermostat and carried by the free inwardly directed end 17b thereof. This end 17b extends through the box-like formation 23e of the contact 23 and is slidable upon the lower wall 23g thereof which spaces the lower edge of the thermostat 17 from the wall 10 and renders it freely movable under the expanding action of the heat generated by the heating element 19. This end of the thermostat is reduced in the vertical dimension, forming a shoulder 17d which abuts the upper wall 23f for limiting inward movement of the end 17b. The walls 23f and 23g prevent tilting or twisting of the thermostat 17 upon a horizontal axis under the thrust of the spring 27.

When the device above described has been screwed into a socket, current through the breaker flows through terminal 13, conducting member 14, contact 24 to the cooperating contact 23. From this contact it flows through the heating element 19 and thence through the conductor strip 20 to the shell 11.

The thermostat is so calibrated that it moves the catch 17c out of engagement with the cooperating rib or flange 26a when subjected to the heat generated by current of predetermined amperage flowing through the heating element 19. For example, when the circuit breaker is in the form shown in Figs. 1 to 11 and is intended to be used as a substitute for a conventional screw screw type fuse, the calibration of the thermostat with reference to the heating element is such that the heat generated by a normal current load will be insufficient to cause the thermostat to move the catch 17c out of supporting relation with the flange 26a and will hold the mechanism in the positions shown in Fig. 2. Upon a predetermined current overload, however, or a short circuit, the thermostat will move the catch 17c out of supporting position with reference to the member 26a whereupon the spring 27 will force the member 26 downwardly which spreads the arms 23b and opens the circuit. The spring 25b then forces the button 25 and the contact 24 upwardly to the position shown in Fig. 15. The button thus indicates that the circuit in which a particular circuit breaker is installed has been opened. When the cause of the overload or the short circuit has been determined and corrected, the button 25 is pressed inwardly from the position shown in Fig. 15 to the position shown in Figs. 2 or 12. During the inward movement of the button, the insulating member 26 spreads the fingers 23b apart until the ledge 28a is beneath the lower ends of the fingers whereupon the latter snap back into circuit closing contact with the member 24, thus providing a quick make of the circuit. During such downward movement of the button 25, the catch member 17c will engage the flange 26a and retain the member 26 in the upper position. Should the button 25 be pressed inwardly before

the cause of the circuit overload or the cause of a short circuit is remedied, the arms 23b will snap into contact with the contact 24 as described and reestablish the circuit but due to the heavy surge of current through the device, the thermostat will again release the catch or trip member 17c whereupon the spring 27 will force the member 26 downwardly to again open the circuit. This may happen before ones fingers are removed from the bottom 25.

Fig. 16 shows the member 26 moved to circuit opening position but with the button held in the position which normally indicates a closed circuit. As stated, it may be held in such a position by one's finger in attempting to close a circuit before remedying the cause of the short or circuit overload. In said figure, however, an object 29 is shown in position holding the button inwardly. This object may be any thing which inadvertently restrains outward movement of the button under the action of the spring 25b. It will therefore be seen that the mechanism described protects a circuit from dangerous overloads and normally indicates that the circuit has been opened but that the circuit may be opened independently of the indicating means which, in the present embodiment, is the resetting button 25.

The foregoing description of the invention has dealt with an embodiment of the invention in a circuit breaker of the screw base type but it will be obvious that the invention may be embodied in other forms of devices for protecting electrical apparatus or equipment or wiring systems from excessive current loads. In Figs. 17 and 18, for example, the invention is shown as being embodied in a receptacle plug indicated generally by the numeral 30. The circuit breaking mechanism of the plug 30 is the same as described above and will not be redescribed but its parts are indicated by corresponding reference characters. In Fig. 18, the prongs or plug-in terminals 31 and 32 of the plug are shown attached to the latter for convenience in attaching a lamp, flat iron or other utensil to a conventional wall outlet receptacle. The terminal 31 is shown attached to the member 13 while the terminal 32 is attached to the base of the plug by a rivet 33. An electric cord 34 from the receptacle passes through a passage 30a of the plug, one wire of which is attached as by a screw 35 to the terminal 32 while the other wire is attached by a screw 36 to a conductor 37 which extends through an opening 38 into contact with the rivet 18. When the terminals 31 and 32 have been inserted in an outlet receptacle, current may flow through terminal 31, conductor 13 to the cup 14, thence to the circuit breaker contact 24 and to the cooperating contact 23 which is connected to one end of the heating element 19 by rivet 22. The opposite end of the heating element is connected by rivet 18 to the conductor strip 37 and thence the current flows through one of the conductor wires to the utensil and back through the other wire to the terminal 32.

Figs. 19 and 20 diagrammatically disclose the circuit breaker in conjunction with mechanism which enables the circuit breaker to be used as a switch for opening the circuit while not interfering with its functioning in breaking a circuit automatically upon predetermined overload. In these figures, the circuit breaker mechanism is mounted in a casing 40 in which is also mounted a suitable actuating mechanism for mechanically displacing the thermostat member 17 from its usual position for releasing the spreader member 26 for operation by a spring 27. The manually operating mechanism mentioned may comprise a push button 41 which is held normally in position as shown in Fig. 19 by a spring 42. When it is desired to open the circuit, the button is pressed downwardly, the button operating a bell crank lever 43 which is pivoted at 44 to a portion of the casing 40. The upper arm 45 of the lever engages the inner surface of the thermostatic member 17 adjacent its free end and swings the catch member 17c outwardly to release the member 26 whereupon the circuit is opened by the breaker mechanism in the same manner as it is opened when the thermostat moves under the action of heat generated by current above a predetermined amperage. To close the circuit with such an arrangement, the push button 25 is pressed downwardly until the member 28 is engaged by the lower ends of the flexible contact arms 23b of member 23 as above described. Fig. 20 illustrates the device in circuit opening position. The circuit of this embodiment of the invention is shown diagrammatically in the figgures. One conductor 45 is connected to the terminal 13a while the other conductor 46 is connected to the contact member 23 as by means of a heating element 47 shown diagrammatically, but which may correspond structurally with the element 19 of the preceding figures. Numerals 45a, 46a indicate diagrammatically conventional binding posts or terminals to which are connected conductors for supplying current to a currrent consuming device to be controlled by the combined switch and circuit breaker.

Figs. 21 and 22 show the circuit breaker embodied in an electric outlet receptacle which is in the form of a plug and which may be plugged into a conventional wall outlet. This device is indicated generally by the numeral 48 and comprises a suitable insulating casing 49 in which the circuit breaker is located as shown in Fig. 22 but illustrated by dotted lines in Fig. 21. Terminals 50 and 51 are adapted to be plugged into a wall outlet receptacle while socket members 52 and 53 are adapted to receive terminals of a conventional receptacle plug which is connected with a conductor of any electric appliance. The circuit of the device shown is similar to that described above in connection with Figs. 19 and 20. When the device 48 is plugged into a wall receptacle, current may flow from terminal 50, to conductor 54 and to terminal receptacle 53, thence through a plug inserted in the outlet receptacles 52 and 53 through the connected appliance and back through terminal 52 to the heating element 47 to contact 23. From contact 23 it flows to contact 24 through the circuit breaker, as above described, to the terminal 51.

The form of the invention shown in Figs. 23 and 24 is similar to that shown in Figs. 21 and 22 except that in Figs. 23 and 24, the circuit breaker is shown embodied in a wall outlet of the type usually mounted in outlet boxes by means of a transverse strip or strips 55. In this form of the invention, an insulating casing 56 carries the receptacle terminals 57 and 58, the former of which is connected to a heating element 47 and the other of which is connected to a terminal post 59. The terminal 13 of the circuit breaker is connected to a second terminal post 60 by a conductor 61. The current supply lines are, of course, connected to the posts 59 and 60 to supply current to the electric appliance whose plug is inserted in the members 57 and 58, the current flowing through the circuit breaker as above

described so that in the event of a short or an overload, the circuit will be broken.

Fig. 25 is a perspective of a modified form of thermostatic member which, when used, eliminates the necessity of the heating element 19. As shown, the thermostatic element indicated generally by numeral 62 is provided at its movable end with a catch member 63 which may correspond in construction and function with the catch member 17c of the above described embodiments of the invention. The element is slotted from its opposite or fixed end throughout substantially its entire length. This construction provides two legs 62a and 62b which are connected in the circuit of the circuit breaker so that the current flows through both legs of the heating element. Upon overload, the heat generated causes a rapid movement of the free end of the element to move the catch 63 out of position wherein it supports the spreader member 26, the thermostatic metal being of the light resistance type.

The construction of the circuit breaker in its various forms as above described is such that it can be manufactured and assembled at relatively low cost.

It will be noted that in assembling the device only the terminal 13 and brush or conductor cup 14 are initially installed in the casing 10. All the other operating parts of the device are assembled in the cap 16. The heating element 19 is attached by rivet 22 to the contact 23 and rivet 18 inserted in its opening with the head inward and the projection portion partially expanded to retain it in position or it may be molded in such position. Button 25 and contact 24 then are secured together and passed through spring 27 and spreader member 26. The button is then passed through the opening of the cap to fully compress the spring 27 and is held in that position. The contact 23 is placed in position in the cap. The projecting end of rivet 18 is passed through the opening in the other end of the heating element and the conductor strip 20 placed in position on the rivet which is then riveted over. The loop 17a of the thermostat 17 is then pressed into the receiving recess 16b and the free end passed through the box-like portion 23e to dispose the catch 23c in engaging position with the flange 26a of the spreader. Upon release of the button 25, the parts are held in the assembled position shown in Fig. 9. The cap assembly is then inserted in the casing, a spring 25b having been placed in the conductor brush or cap member 14. During the insertion of the cap assembly, the conductor strip 20 passes through the slot 10e which locates or guides the parts of the assembly into their proper positions with reference to the casing 10. The cap is then depressed against the spring 25b until the edge of the cap snaps into the groove 10e. It thus is not necessary to make any soldered or screw connections in the relatively small space available within the casing, the screw shell 11 being screwed into position and secured to the strip 20 by solder 21 to prevent relative rotation of the shell. The coaction of the threads of the shell with the threads 20a of the strip not only makes a close electrical contact but draws the assembly down upon the wall 10c of the casing.

The improved circuit breaker which can be reset repeatedly eliminates the expense and annoyance incident to the replacement of blown fuses. Since the device can be reset to circuit closing position merely by pressing in the indicator button 25, there is no necessity for removing the device from its socket after initial installation. The displacement of the button to the outward position shown in Fig. 15, upon opening a circuit by the device, facilitates the ready determination of the circuit in which a short has occurred or in which an overload was imposed. The arrangement whereby the member 26 can be actuated to open the circuit independently of the outward movement of the button is a desirable safety feature which prevents damage to wiring or electrical equipment should an attempt be made to close the circuit before correcting the cause of the circuit overload.

The response of the thermostat to the heat of an overloaded circuit is rapid due in part to the fact that the heating element 19 is in the form of a flat ribbon substantially co-extensive with and of the same area as the movable portions of the thermostat and arranged substantially concentrically with respect thereto. The space between the heating element and thermostat is practically sealed by the relation of those members to the ribs 10d and 16d when the device is in normal or circuit closing relation and since the metallic strip of the thermostat having the greater coefficient of expansion is disposed inwardly, the heat generated by an overload will cause quick response by the thermostat in releasing the device to circuit opening position, the releasing action being supplemented by suitable inclinations of the contacting portions of the catch 17c and the flange 26a. As the thermostat moves out of contact with the ribs 16d of the cap and rib 10d of the casing, the heat is dissipated by radiation from the thermostat to the cooler air in the annular chamber into which the thermostat moves and therefore quickly returns to the normal position in which it engages the flange 26a when the button 25 is again depressed to close the circuit.

It will be observed also that the construction is such as to quickly make and break the circuit. When the button is pressed downwardly to circuit closing position, the ends of the fingers 23b snap past the member 28 and thus effect a quick make of the circuit, the member 28 being a rounded lower edge which wedges the fingers outwardly during the downward stroke of the contact 24. When the circuit is broken by the automatic operation of the device upon the descent of the member 26, the circuit is broken rapidly and since member 26 is of insulating material, it tends to quench arcing which may take place between the contacts 23 and 24 since, as shown in Figs. 13 and 14, it is moved into a position interposed between the contacting areas of said contacts. The movement of the member 26 into arc-quenching position is extremely rapid since it continues to move downwardly after releasing the arms 23b from the ledge 28a as the contact 24 starts upwardly under the action of the spring 25b. During the final portion of the upward movement of member 26 and button 25, the spring 27 acts as a buffer and cushions the thrust of spring 25b. The downward movement of the member 26 under action of the spring 27 is arrested upon engagement of the member with the ledge 28a, in which position of the member 26, the lower portion of contact 24 is effectively insulated from the contact 23 in addition to being spaced therefrom.

While I have shown and described certain embodiments and adaptations of the present improvements for the purpose of illustration, it will

be apparent that various changes in construction and arrangement of parts may be resorted to without departing from the spirit of the invention.

I claim:

1. A circuit breaker comprising a pair of separable circuit closing contacts arranged concentrically one of said contacts being spring actuatable in an axial direction and the other comprising a plurality of flexible fingers adapted to engage the periphery of the first contact to close a circuit therethrough, an annular insulating member movable in a direction axially of said contacts from an inoperative position to a position between the contacts to move the ends of said fingers radially to release the spring actuatable contact and to open a circuit through the same, means for normally retaining said member in the inoperative position, and a thermostatic member responsive to current overloads for effecting the release of said member from said retaining means.

2. A circuit breaker comprising a pair of concentric contacts, one of said contacts being radially resilient and arranged for separating movement with respect to the other, said other contact being axially movable, a spring actuated insulating member movable between said contacts upon overload of the circuit for separating the same and releasing said axially movable contact, means for retaining said member in inoperative position, and a thermostatic member responsive to overload of the circuit for effecting the release of said member.

3. A circuit breaker comprising a casing, a pair of circuit closing contacts therein one of said contacts comprising radially movable fingers and the other being axially movable, thermostatically controlled spring actuated mechanism therein for effecting radial movement of said fingers and separation of said contacts upon circuit overload, and a spring actuated resetting member secured to said axially movable contact arranged to move outwardly of said casing upon the separation of said contacts and to shift said movable contact axially.

4. A circuit breaker comprising a casing, a pair of circuit closing contacts in said casing, a spring actuated member, one of said contacts being carried by said member, the second contact being arranged to engage said first contact for closing a circuit and to retain said member in operative position against the action of the actuating spring thereof, a second spring actuated member arranged to move said second contact to release said first member, means for retaining said second member in inoperative position, and a thermostatic member arranged to release said retaining means upon circuit overload whereby said first movable member can move said first contact out of circuit closing position.

5. A circuit breaker comprising a pair of relatively movable circuit closing contacts, a spring actuated member for moving one of said contacts to break the circuit, a second spring actuated member for moving the other contact out of normal circuit closing position and simultaneously restoring said first mentioned member to its normal position against the action of the spring thereof, and thermostatically controlled means for releasing said first mentioned member from said normal position upon an overload of the circuit.

6. A circuit breaker comprising a pair of circuit closing contacts, a thermostat responsive to circuit overloads, and means controlled by said thermostat for separating said contacts upon an overload of the circuit, said means comprising a pair of spring actuated members one of which is restrained against spring movement by said thermostat and the other is restrained by one of said contacts, the arrangement being such that upon overload of the circuit said thermostat-controlled means is released by said thermostat and effects separation of the contacts and release of the other spring actuated member and the latter restores said means to original position and moves the other contact out of circuit closing position with respect to said first contact.

7. A circuit breaker comprising a pair of relatively movable circuit closing contacts, a thermostat responsive to circuit overloads, and means controlled by said thermostat for effecting the separation of said contacts upon an overload of the circuit, said means comprising a spring actuated member carrying one of said contacts and arranged to be retained against spring movement by the other of said contacts, a second spring actuated member adapted for retention against spring movement by said thermostat during normal current loads and for release upon a circuit overload and adapted to move said second contact to release said first member for spring movement thereof to move said first contact out of circuit closing position, the spring of said first member being capable of returning said second member to original position against the action of the spring thereof.

8. A circuit breaker comprising a casing, a plunger thereon spring actuated outwardly of said casing, a contact carried by said plunger, a second movable contact arranged to retain said plunger in position against the action of the spring thereof and engage said first contact for closing a circuit, a spring actuated member arranged for moving said second contact away from said first contact for releasing said plunger, and a thermostatic member provided with means for retaining said spring actuated member in position against the action of the spring thereof during a normal circuit load and to release said member upon an overload to effect the separation of the contacts to break the circuit and initiate the movement of said plunger outwardly of the casing.

9. A circuit breaker comprising a casing, a plunger therein spring actuated outwardly of said casing, a contact carried by said plunger, a movable contact in said casing arranged to engage said first contact to close a circuit and retain said plunger in position against the action of the spring thereof during a normal circuit load, a thermostatic member responsive to circuit overloads, and a spring actuated member arranged to be retained by said thermostat in spring retracted position during normal circuit loads and to be released upon circuit overload whereby the spring thereof moves said member in a direction to engage said second contact and moves the same away from said first contact to open the circuit and effect the release of said plunger for movement by the spring thereof outwardly of the casing, said plunger having means for engaging said member for returning the same to spring retracted position against the action of the spring thereof.

10. A circuit breaker comprising a casing, a pair of circuit closing contacts therein, a thermostatic member responsive to circuit overloads, and a pair of spring actuatable members in said

casing, one arranged for retention in spring retracted position by one of said contacts and the other by means controlled by said thermostat, the arrangement being such that upon a circuit overload the latter spring actuatable member is released for movement by the spring thereof in a direction to effect release of the other member and separation of the contacts to open the circuit and said latter member effects the return of the first member to spring retracted position.

11. A circuit breaker comprising a pair of circuit terminals, a pair of circuit closing contacts each electrically connected with one of said terminals, spring actuated insulating means for separating the contacts to open a circuit through said terminals, a thermostatic member responsive to current overload, a catch for retaining said spring actuated means in position against the action of the spring thereof during normal circuit loads, said catch being movable by said thermostatic member to release said spring actuated means upon circuit overloads whereby said means can effect the separation of said contacts to open the circuit, and means for moving one of said contacts in an axial direction upon separation of said contacts, said movable contact during the movement thereof by said last mentioned means being arranged to engage said insulating means and restore the same to original position for re-engagement with said catch.

12. A circuit breaker comprising a pair of cooperating concentric circuit closing contacts having annular contacting areas and inter-engaging means, the outer of said contacts being radially distensible, an annular member having means for moving the same in an axial direction intermediate said contacts to effect radial separation thereof for releasing the contacts and breaking the circuit through the same, and means responsive to a predetermined flow of current through said contacts for retaining said annular member in inoperative position during current flow below a predetermined amperage and for releasing said member upon flow of current above said predetermined amperage.

13. A circuit breaker comprising a pair of concentric contacts, the inner of said contacts being spring actuatable in an axial direction from circuit closing position, the outer of said contacts being radially distensible and arranged normally for engaging said inner contact to retain the same in circuit closing position, an annular spring-actuated intermediate member slidable axially between said contacts for effecting radial distension of said outer contact to open the circuit and release said inner contact for spring actuation from circuit closing position, a catch member normally retaining said intermediate member in inoperative position against spring actuation, and means responsive to predetermined circuit overload for effecting the release of said intermediate member.

14. A circuit breaker comprising a casing, a pair of circuit closing contacts therein having portions arranged for interengagement for retaining the same in circuit closing position during predetermined circuit loads, one of said contacts being spring actuatable from normal circuit closing position and provided with a resetting member movable outwardly of the casing, a spring actuated member slidable intermediate said contacts for opening a circuit through the same and effecting the disengagement of said first contact for spring actuation of said resetting member outwardly of the casing, catch means normally retaining said intermediate member against spring actuation, and means responsive to predetermined circuit overload for releasing said catch means.

15. A circuit breaker comprising a casing, a pair of relatively movable contacts therein having coacting annular engaging portions for releasably retaining the same in circuit closing relation, one of said members being spring actutable from normal circuit closing position and comprising an indicating member, and a spring actuatable thermostatically controlled annular contact-separating member arranged for telescopic movement along said movable contact to effect separation of said contacts to break a circuit through the same upon predetermined circuit overload and to disengage said contacts for spring actuation of said movable contact and said indicating member from normal position.

16. A circuit breaker comprising a pair of contacts having coacting portions for releasably retaining the same normally in circuit closing relation, one of said contacts being movable from normal position, a spring tending to move said movable contact from said position, a spring actuatable contact-releasing member for effecting the release of said contacts for movement of said movable contact from circuit closing position, catch means for retaining said releasing member normally in inoperative position against the action of the spring thereof, and means responsive to a circuit overload for actuating said catch means for freeing said contact-releasing member.

17. A circuit breaker comprising a casing provided with an apertured cover and a pair of terminals, one of said terminals comprising a threaded shell, a pair of circuit controlling contacts in said casing, one of said contacts having a radially distensible annular portion for normally engaging the other contact to close the circuit therethrough and to retain the contacts in circuit closing relation, said other contact being movable axially of said first contact, an indicating member secured to said second contact and movable within said aperture, a spring tending to move said member outwardly through said aperture and said second contact from normal circuit closing position, a heating element in said casing electrically connected with said terminals, a thermostatic element adjacent said heating element and movable in response to a predetermined heating effect of said element, a spring actuatable annular insulating member movable between said contacts to distend said annular portion of said first mentioned contact to open the circuit therethrough and release said second contact, and a catch member controlled by said thermostatic element and arranged to retain said insulating member in inoperative position during normal circuit loads and to release said member upon overload for actuation by the spring thereof.

18. A circuit breaker comprising a pair of circuit closing contacts, one of said contacts being spring actuatable from a position wherein it is adapted to close a circuit through the other contact, catch means for retaining said contacts normally in circuit closing relation, a manually operable resetting member carried by said movable contact for restoring said contact to normal position, a catch member, a thermostat arranged to move said catch member to and from operative position, and a spring operable member adapted to be retained in inoperative position by said catch member during normal circuit loads

through said contacts and arranged to be released by said catch member upon circuit overload to effect release of said movable contact by said catch means for breaking the circuit and to prevent closure of the circuit by means of the resetting member prior to the movement of said catch member to operative position.

19. A circuit breaker comprising a pair of interengageable contacts, one of said contacts being spring actuatable from a normal position wherein it is adapted to close the circuit through the other contact, a manually operable resetting member carried by said movable contact for restoring the latter to original position, and a thermostatically controlled spring actuatable member arranged to separate the contacts to break the circuit independently of the movability of said resetting member by said movable contact.

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