Feb. 8, 1949. S. MILLER 2,461,338

FUSE-PLUG TYPE CIRCUIT BREAKER

Filed Sept. 7, 1944 2 Sheets-Sheet 1

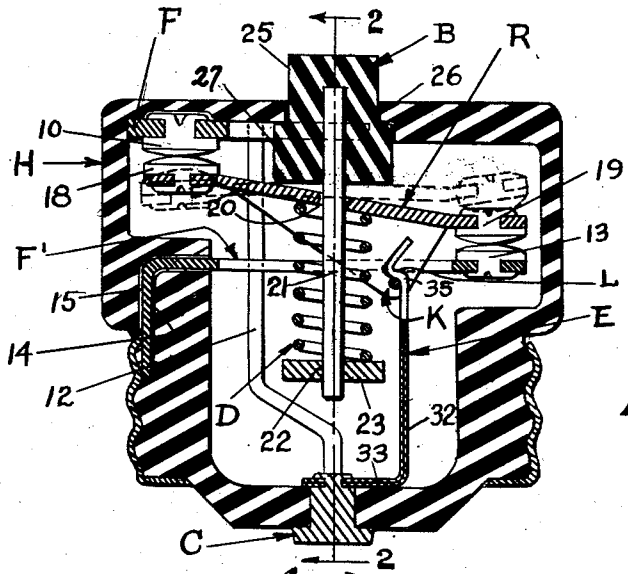


Fig. 1

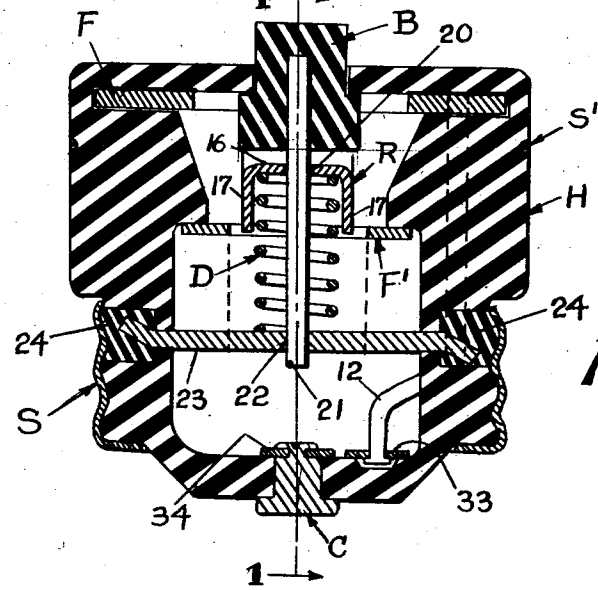


Fig. 2

INVENTOR.
SWIFT MILLER
BY William F Buckley

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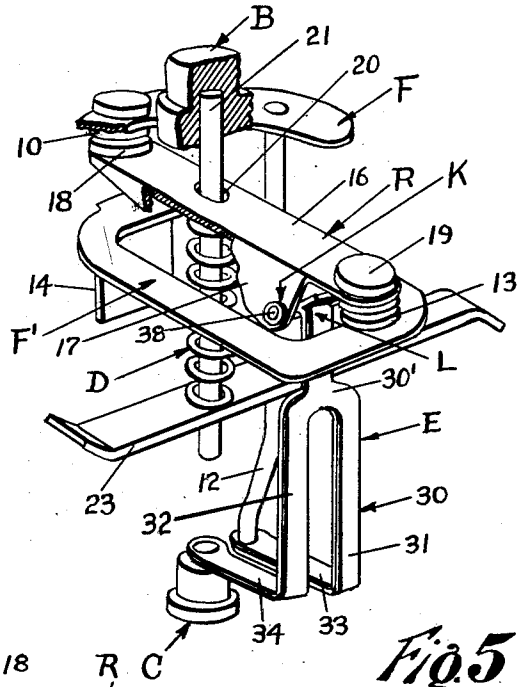


Fig. 3

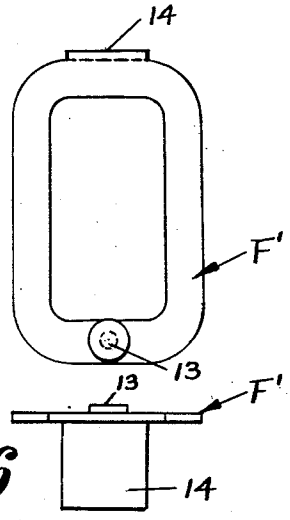


Fig. 5

Fig. 6

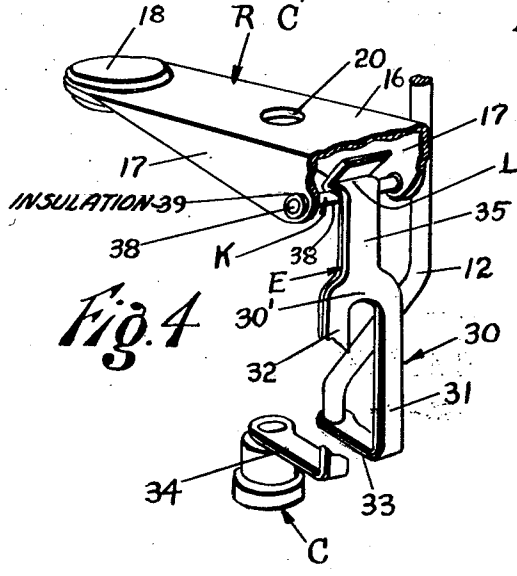


Fig. 4

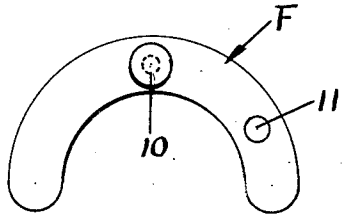


Fig. 7

INVENTOR.
SWIFT MILLER
BY William F. Buckley

Patented Feb. 8, 1949

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UNITED STATES PATENT OFFICE

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FUSE-PLUG TYPE CIRCUIT BREAKER

Swift Miller, Milwaukee, Wis.; Edith Mayhew Miller, executrix of said Swift Miller, deceased, assignor by decree of distribution to Edith Mayhew Miller

Application September 7, 1944, Serial No. 553,037

11 Claims. (Cl. 200—116)

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This invention relates to an improvement in fuse-plug type circuit breakers designed and adapted to be used in the ordinary fuse box to take the place of the usual plug-type fuse. The circuit breaker embodying the present invention, unlike the usual plug-type fuse, will not burn out or be destroyed when subjected to overload or short circuit, but will simply break the circuit. It may be manually reset to close the circuit when normal conditions are resumed.

An object of the present invention is to provide a fuse-plug type circuit breaker of this character which is simple, compact and closely organized in construction, highly efficient in operation, easily reset and easy and comparatively inexpensive to manufacture.

One of the outstanding features of the invention resides in the novel and special manner of constructing and organizing the switching or circuit making and breaking arrangement which is provided within the housing or casing of the plug and which controls the flow of current from the screw shell contact of the plug to the center contact thereof.

Generally speaking, two fixed contacts are provided within the housing or casing, one connected to the screw shell contact and the other connected to the center contact. These fixed contacts are spaced laterally and axially from each other. Interposed between them is a bridging contact arm with contact portions at its ends engageable with and disengageable from the fixed contacts. The intermediate portion of the bridging contact floats or rocks on a spring which provides a source of force for moving the bridging contact. A bi-metallic element is provided and is in series with the contacts when the circuit breaker is closed. The bi-metallic element is provided with a hook-like formation serving as a latch and as a fulcrum and cooperating in performing both of its functions with a keeper provided on the bridging contact arm. Also combined with the bridging contact arm is a push button, the push button, in the construction illustrated, coacting with the opposite side of the arm from that engaged by the spring. Under normal conditions the hook-like formation of the bi-metallic element engages the keeper of the bridging contact arm so that the spring rocks the arm in such a way as to bring the contact portions of the arm into contacting engagement with the fixed contacts, and as long as normal conditions prevail the spring holds the contacts engaged. In the event of overload or short circuit, the bi-metallic element warps so as to disengage

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the hook-like formation from the keeper, whereupon the effect of the spring upon the contact arm is reversed in that the contact arm is first rocked about one of the fixed contacts as a fulcrum and thereafter engages the inner end of the push button so that both contact portions of the arm are disengaged from the fixed contacts. The circuit breaker may be closed or reset simply by pressing in on the push button. Inward movement of the push button first shifts the contact arm bodily to bring the keeper into latching engagement with the hook-like formation of the bi-metallic element. Upon release of pressure upon the push button the spring rocks the arm about the hook-like formation as a fulcrum, thereby establishing contact between both contact portions of the arm and the fixed contacts.

Another object of the invention is to provide simple though highly efficient, safe and reliable means for connecting the screw shell and center contacts to their respective fixed contacts.

These objects of the invention and other ancillary advantages are attained by the mechanism, construction, and arrangement illustrated in the accompanying drawings forming part hereof, in which:

Fig. 1 is a view in vertical cross section taken on line 1—1 of Fig. 2 and illustrating a fuse-plug type circuit breaker embodying the invention, parts being shown in elevation for the sake of illustration;

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

Fig. 3 is a fragmentary perspective view showing the operating parts of the circuit breaker, the housing or casing being removed and parts being broken away and shown in section for the sake of illustration;

Fig. 4 is a fragmentary perspective view illustrating a portion of the floating or rocking contact arm, the bi-metallic element, its latching formation and cooperable keeper pin, and also a portion of the connective or conducting rod establishing an electrical connection between one leg of the bi-metallic element and one of the fixed contacts;

Fig. 5 is a detailed view in top plan illustrating the flexible fixed contact;

Fig. 6 is a view thereof in end elevation; and

Fig. 7 is a view in bottom plan of the other fixed contact.

By referring to the drawings it will be seen that a fuse-plug type circuit breaker embodying the present invention comprises generally a housing or casing H of insulating material such as porce-

lain, plastic, glass, rubber composition or the like. Combined with the housing H is a screw shell contact S adapted to be screwed into the usual socket. A center contact C is provided at the center of the inner end of the plug. Within the housing H fixed contacts F and F' are provided, the contact F being connected, in the manner hereinafter to be described, to the center contact C, and the contact F' being electrically connected to the screw shell contact S. The contacts F and F' are spaced transversely and axially from each other as illustrated in the drawings.

Interposed between the contacts F and F' is a rockable or floatable bridging contact R having contact portions at its ends engageable with and disengageable from the fixed contacts F and F'. The rockable or floatable bridging contact R is subject to the joint control of a bi-metallic element E, a push button B and a spring D. The spring D provides the principle source of force for moving the bridging contact arm R and for holding the bridging contact arm R in closed or open position, although when the device is reset the force of the spring D is overcome by the pressure exerted on the bridging contact arm R by the push button D.

The bi-metallic element E is provided at its free end with a hook-like formation designated at L and constituting a combined latch and fulcrum. This combined latch and fulcrum is combined with a keeper K, usually in the form of a pin mechanically attached to and electrically insulated from the bridging contact arm R.

The housing H may be constructed in various ways. Usually it is preferable to constitute it of two similar half sections, the meeting faces of the sections having interfitting key and keyway formations, and the sections being held together in the assembly by the screw shell contact S and a snap ring S'. However, the particular housing construction is per se no part of the present invention. It may be constructed in any suitable way consistent with the assembly of the parts therein with rigidity, ruggedness, strength and the requisite insulating properties.

The fixed contact F is in the form of an arcuate metallic strip shown in detail in Fig. 7 which is positioned against the inside of the outer end of the housing and accommodated in a suitable recess provided therefor. It is provided with a contact button 10 which faces inwardly (see Fig. 1) and with a hole 11 to adapt it for attachment to a conductive rod 12.

The flexible fixed contact F' is of sheet metal stamping in the form of an open rectangular frame having a contact button 13 at one end and an attaching and connecting tab 14 at its other end. The tab 14 is integral with and at right angles to the rectangular frame of the fixed contact F' and in the assembly the tab 14 extends through a recess 15 in the housing H down to the screw shell contact S with which it is mechanically and electrically interconnected (see Fig. 1).

The rockable or floatable bridging contact R may also be conveniently constituted of a sheet metal stamping of inverted channel-like construction, the contact R having a flat body portion 16 and integral downwardly extending and tapered side flanges 17. The ends of the body portion 16 of the contact R project beyond the flanges 17 and have contact portions in the form of contact buttons designated at 18 and 19, suitably secured thereto (see Figs. 1 and 3).

Centrally, the body portion of the contact R is provided with a hole or opening 20. The underside of the central portion of the body 16 of the contact R rests or floats on the top of the spring D. The push button B overlies the opening 20 of the body 16 of the contact R and the stem or guide rod 21, with which the push button is equipped, extends through the hole 20, down through the spring D and through a guide opening 22 provided in a cross bar 23, the oppositely bent ends of which are mounted on the housing H and are insulated from the screw shell contact S by insulating plugs 24 (see Fig. 2).

The push button B is of headed or flanged construction. The body portion 25 of the push button slidably interfits with a guide opening 26 provided therefor in the top of the housing H. The flanged or headed lower end 27 of the push button limits the outward movement of the button and is also engageable with the top of the central portion of the body 16 of the contact R. The hole 20 in the body portion 16 of the contact R has a diameter greater than the outside diameter of the guide stem 21 of the push button to allow the bridging contact R to rock, relative to the guide stem.

The bi-metallic element E has an inverted U-shaped body portion 30 including parallel legs 31 and 32 connected at their upper ends by the connecting portion 30'. The lower end of the legs 31 and 32 have extensions 33 and 34 bent at right angles thereto, the extension 33 being mechanically and electrically connected to the lower end of the connecting rod 12 and the extension 34 being similarly connected to the center contact C.

Integral with the connecting portion 33 of the bi-metallic element is a shank-like extension 35 provided at its upper end with a hook-like formation formed by reversely bending the upper end and thereby providing an effective combined latch and fulcrum structure previously designated generally at L. The keeper K is usually in the form of a pin 38 which has its ends supported in openings provided therefor in the flanges 17 of the contact R, the ends, however, being electrically insulated from the contact R by interposing suitably insulating washers and bushings 39 between the ends of the pin 38 and the openings in the flanges 17.

With the construction described, under normal conditions of operation the parts of the circuit breaker are positioned as shown in Fig. 1. In such position the combined latch and fulcrum L engages the keeper K and holds the bridging contact R in the position shown wherein its contacts 18 and 19 are pressed firmly into electrical contact with the contacts 10 and 13. In such position of the parts and with the casing H screwed into a socket of the fuse box, current will flow from center contact C through extension 34, leg 32, connecting portion 30', leg 31 and its extension 33 to conducting rod 12. The current then flows through the fixed contact F, engaged contact buttons 10 and 18 to the bridging contact R and from the contact R through engaged contact buttons 19 and 13 to relatively fixed contact F'. The tab 14 conducts the current from the contact F' to the screw shell contact S.

In the event of overload or short circuit the bi-metallic element E will warp, swinging the latch L to the right as viewed in Fig. 1, and disengaging it from the keeper K. The spring D immediately functions to rock the contact R about the contacts 10 and 18 as a fulcrum until the center portion of the body 16 of the contact R engages the underside of the headed end of the

push button B, whereupon the contact R is further rocked to the position shown in dotted lines in Fig. 1.

In this position the center portion of the body 16 of the contact R is pressed against the underside of the headed end of the push button B and both of its contacts 18 and 19 are disengaged and spaced from the contacts 10 and 13 respectively. This, of course, breaks the circuit. To insure an adequate air gap between contact button 10 and 18 in the open position of the circuit breaker, the end of the contact R carrying the contact button 18, may be inwardly bent or deflected as shown to advantage in Fig. 1.

To reset the circuit breaker and reestablish the circuit the push button 25 is pressed inwardly. This moves the contact R bodily inwardly against the action of the spring D until the keeper pin 38 rides down the sloping surface of the latch L and snaps into latching engagement with the latching shoulder of the latch L. Upon release of pressure on the push button B the spring D functions to reversely rock the contact R about pin 38 of the keeper K and the latching shoulder of latch L as a fulcrum, thereby again bringing the contacts 18 and 19 into firm electrical contact with their cooperable fixed contact buttons 10 and 13.

While it is advantageous to constitute the fixed contacts and the rockable contact arm of sheet metal stampings, obviously they may be fabricated or fashioned in various other ways. Likewise it is not essential that the contact F' be flexible, although this is desirable for smooth and reliable resetting. The contact F' may be rigid and the inherent resiliency of the rockable bridging contact arm or portions thereof relied upon for the desired spring or give for reengagement of the latch and keeper upon resetting. Also the combined latch and fulcrum structure of the bi-metallic element may be fashioned in various ways.

The essential features of the invention reside in the provision of a rockable bridging contact arm having suitable contacts or contact portions engageable with and disengageable from the fixed contacts, and in the novel way in which the rockable bridging contact arm is organized with the spring and its push button together with the special manner in which the combined latch and fulcrum of the bi-metallic element coacts with the keeper of the arm and the way in which their action is coordinated with the action of the arm, spring, and fixed contacts as hereinabove described and as hereinafter claimed.

Most of the mechanical difficulties encountered in the design of a satisfactory fuse-plug type circuit breaker are due to the necessity of its having what is known as the "trip free" feature. This means that it must be possible to reset the device with a short circuit on the line without danger of burning up the device. It is therefore necessary to latch it without completing the circuit. In this device the latch is engaged by pushing in the button, but the circuit is not completed until the pressure is removed from the push button.

In general, while I have shown and described one construction in which the invention may be advantageously embodied, it is to be understood that the construction shown has been selected merely for the purpose of illustration or example, and that various changes in the size, shape, and arrangement of the parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

What I claim is:

1. A circuit breaker comprising spaced fixed contacts, a rockable bridging contact arm having contact portions engageable with and disengageable from said fixed contacts, said fixed contacts being disposed at opposite sides of said arm, a spring cooperable with said contact arm, means responsive to the thermal effect of current conditions in the circuit and having latching engagement with an intermediate portion of the arm to hold its contact portions engaged with the fixed contacts under the bias of the spring when normal current conditions obtain in the circuit and automatically release the arm to allow it to be rocked to circuit breaking position under the drive of the spring upon the occurrence of an overload current in the circuit breaker, and means for resetting the circuit breaker to circuit making position.

2. A fuse plug-type circuit breaker comprising a casing, screw shell and center contacts carried by the casing, fixed contacts supported within the casing and connected to said screw shell and center contacts respectively, a spring in said casing, a rockable bridging contact arm having contact portions engageable with and disengageable from said fixed contacts to make and break the circuit, said contact arm being floatably engaged with said spring for bodily or rocking movement in opposite directions, means responsive to the thermal effect of an overload current in the circuit breaker to provide for rocking of the bridging contact arm to circuit breaking position under the drive of said spring, and a push button cooperable with the bridging contact arm for resetting the circuit breaker.

3. A circuit breaker comprising spaced fixed contacts, a rockable bridging contact arm having contact portions engageable with and disengageable from said fixed contacts, said fixed contacts being disposed at opposite sides of said arm, a spring cooperable with the arm for driving and biasing the same, a bi-metallic element having a hook-like formation engageable with an intermediate portion of the arm to latch the same in circuit closing position when normal current conditions obtain in the circuit and also serving as a fulcrum about which the arm rocks when the circuit breaker is reset, and a push button for resetting the arm.

4. A fuse plug-type circuit breaker comprising a casing, screw shell and center contacts carried by the casing, fixed contacts supported within the casing and connected to said screw shell and center contacts respectively, a spring in said casing, a rockable bridging contact arm having contact portions engageable with and disengageable from said fixed contacts to make and break the circuit, said contact arm being floatably engaged with said spring for bodily or rocking movement in opposite directions, a bi-metallic element having a combined latch and fulcrum thereon cooperable with the arm to latch the same in circuit closing position when normal current conditions obtain in the circuit and also serving as a fulcrum about which the arm rocks when the circuit breaker is reset, and manually operable means for resetting the circuit breakers.

5. A fuse type circuit breaker comprising a casing, screw shell and center contacts carried by the casing, oppositely facing fixed contacts supported within the casing and spaced from each other, both transversely and axially, said fixed contacts being connected to the screw shell and

center contacts respectively, a rockable bridging contact arm disposed between the fixed contacts and having contact portions cooperable therewith, a spring cooperable with the arm and providing a source of power to move the same, a push button also cooperable with the arm, a bi-metallic element having a hook-like formation cooperable with the arm and co-functioning with the spring to hold the circuit breaker closed under normal conditions and also serving as a fulcrum for the arm to provide for rocking of the arm to engage said contacts when the circuit breaker is reset, the spring also acting, when the bi-metallic element warps, and disengages its hook-like formation from the arm first to rock one of the contact portions of the bridging contact arm about its fixed contact and then press an intermediate portion of the bridging contact arm against the inner end of the push button thereby holding both contact portions of the bridging contact arm spaced from their fixed contacts.

6. A fuse plug type circuit breaker comprising a casing, screw shell and center contacts carried by the casing, a fixed contact connected to the center contact of the casing, a relatively fixed but flexibly mounted contact connected to the screw shell contact of the casing, a rockable bridging contact arm having contact portions engageable with and disengageable from the fixed contact and the relatively fixed contact respectively, a keeper structure formed on the arm, a bi-metallic element connected in series with the contacts in the closed position of the circuit breaker and having a latching element cooperable with the keeper structure, a compression spring having one end engaging a fixed abutment and having its other end pressing against the central portion of the arm, a push button slidably mounted on the casing and engageable with the arm on the opposite side of the central portion thereof from that engaged by the spring, the spring functioning when the latch of the bi-metallic element is engaged with the keeper to maintain the contacts engaged and also operating, when the bi-metallic element warps and disengages the keeper, to rock one of the bridging contacts against its fixed contact and thereafter press the arm against the inner end of the push button to hold both bridging contacts spaced from their fixed contacts.

7. A fuse plug type circuit breaker comprising a casing, screw shell and center contacts carried by the casing, a fixed contact connected to the center contact of the casing, a relatively fixed but flexibly mounted contact connected to the screw shell contact of the casing, a rockable bridging contact arm having contact portions engageable with and disengageable from the fixed contact and the relatively fixed contact respectively, a keeper structure formed on the arm, a bi-metallic element connected in series with the contacts in the closed position of the circuit breaker and having a latching element cooperable with the keeper structure, a compression spring having one end engaging a fixed abutment and having its other end pressing against the central portion of the arm, a push button slidably mounted on the casing and engageable with the arm on the opposite side of the central portion thereof from that engaged by the spring, the spring functioning when the latch of the bi-metallic element is engaged with the keeper to maintain the contacts engaged and also operating, when the bi-metallic element warps and disengages the keeper, to rock one of the bridging contacts against its fixed contact and thereafter press the arm against the inner end of the push button to hold both bridging contacts spaced from their fixed contacts, said push button, when pressed inwardly, engaging the central portion of the arm and moving it bodily until the keeper engages the latch of the bi-metallic element, whereupon the pressure on the push button being released, the spring functions to rock the arm to bring the bridging contacts into engagement with its fixed contacts.

8. An electric circuit breaker of the class described, comprising a casing of insulating material, a push button suitably mounted for vertical movement in the said casing, two metallic contacts fixedly mounted in the casing, a metallic contact arm movably positioned between the said stationary contacts, a spring normally urging the movable contact toward one of the fixed contacts and away from the other, a bi-metallic strip having a hook or latch at its free end to engage the moving contact arm at one side of the spring and when engaged, performing the function of a pivot, causing the spring to bias the contact arm until it comes to rest in a relatively diagonal position with its two ends bearing against the two fixed contacts respectively.

9. A fuse plug-type circuit breaker comprising a casing, screw shell and center contacts carried by the casing, fixed contacts supported within the casing and connected to said screw shell and center contacts respectively, a spring in said casing, a rockable bridging contact arm of inverted channel formation including a body portion and side flanges and having contacts at the ends of the body portion engageable with and disengageable from said fixed contacts to make and break the circuit, the center of the body portion of the contact arm being floatably engaged with said spring for bodily or rocking movement in opposite directions, a bi-metallic element having a hook formation providing a combined latch and fulcrum, a keeper pin carried by and electrically insulated from the side flanges of the contact arm and cooperable with the hook formation of the bi-metallic element to latch the contact arm in circuit closing position when normal current conditions obtain in the circuit, and also serving as a fulcrum about which the arm rocks when the circuit breaker is reset, a push button slidably mounted on the casing and engageable with the body portion of the contact arm on the opposite side thereof from that engaged by the spring, and acting, when pressed inwardly, to move the contact arm bodily until the keeper pin engages the hook formation of the bi-metallic element whereupon when the pressure on the push button is released the spring functions to rock the contact arm about the hook formation of the bi-metallic element as a fulcrum to bring the contacts of the contact arm into engagement with the fixed contacts.

10. A fuse plug-type circuit breaker comprising a casing, screw shell and center contacts carried by the casing, fixed contacts supported within the casing, a spring in said casing, a rockable bridging contact having contact portions engageable with and disengageable from said fixed contacts, said contact arm being floatably engaged with the spring for bodily or rocking movement in opposite directions, a bi-metallic element of substantially inverted U-shaped form having spaced legs and an integral connecting portion between the legs at one end thereof, the other ends of the legs having lateral extensions, a shank integral with the connecting portion and provided with a

combined latch and fulcrum formation, a keeper structure on the contact arm with which said combined latch and fulcrum formation coacts, one of the extensions of the bi-metallic element being electrically interconnected with the center contact, a connecting rod between the other extension and one of the fixed contacts, and an electrical connection between the other fixed contact and the screw shell contact.

11. A circuit breaker comprising spaced contacts, a bridging contact arm having contact portions engageable with and disengageable from said first named contacts respectively to thereby make and break the circuit, latch mechanism releasably engageable with said arm, manually actuated means operable on said arm to effect engagement thereof with said latch mechanism, a spring operable independently of said manually actuated means to urge said arm into circuit closing position when said arm is engaged with said latch mechanism and into circuit breaking position when said latch mechanism is disengaged from said arm, and means responsive to the thermal effect of current conditions in the circuit for releasing said latch mechanism to thereby break the circuit irrespective of the position of said manually actuated means.

SWIFT MILLER.

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