April 10, 1951 F. N. SCHWEND ET AL 2,548,825

CIRCUIT BREAKER

Filed March 26, 1949

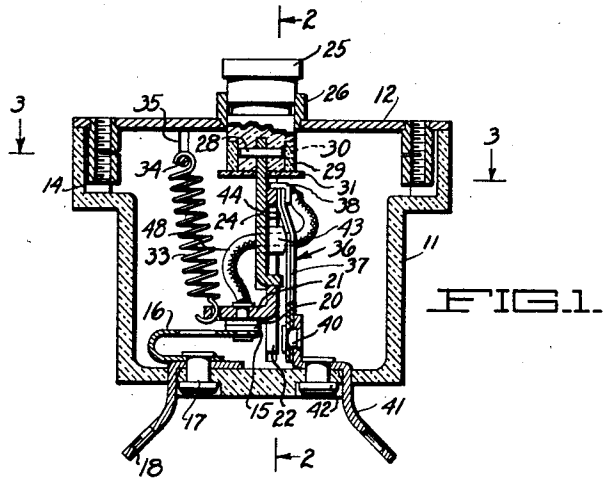


FIG. 1.

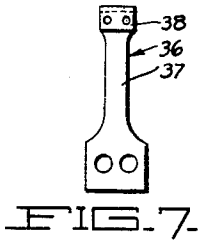
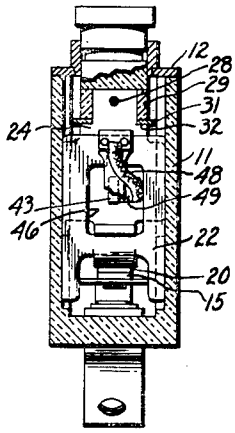


FIG. 7.

FIG. 2.



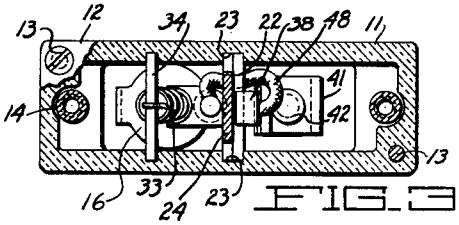


FIG. 3.

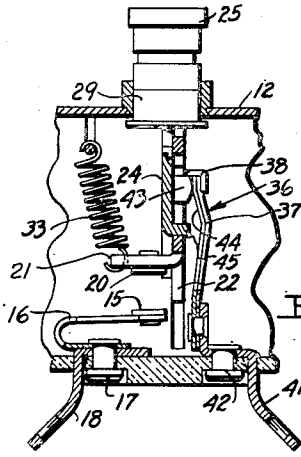


FIG. 4.

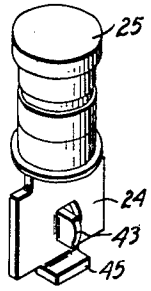


FIG. 5.

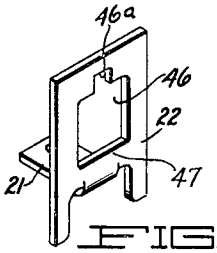


FIG. 6.

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Patented Apr. 10, 1951 2,548,825

UNITED STATES PATENT OFFICE

2,548,825

CIRCUIT BREAKER

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Application March 26, 1949, Serial No. 83,546

6 Claims. (Cl. 200—116)

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This invention relates to circuit breakers and has particular reference to combined manually operable and automatic overload circuit breakers.

The principal object of the present invention is to provide an improved manually and thermostatically operable circuit breaker which is of simple construction and which will fit in limited space.

Another object of the invention is to provide a circuit breaker which will open with a snap action when released either manually or automatically.

Another object is to provide a simple circuit breaker which is of rugged and long wearing construction and devoid of delicate parts.

Another object is to provide a circuit breaker of the above type which is easy to assemble.

A further object is to provide a circuit breaker of the above type which will function under extreme jarring and vibration conditions such as found in aircraft installations.

A still further object is to provide a circuit breaker of the above type having a minimum number of springs and of such construction that the mechanism can be at least manually operated in case of spring breakage.

The manner in which the above and other objects of the invention are accomplished will be readily understood on reference to the following specification when read in conjunction with the accompanying drawing, wherein:

Fig. 1 is a longitudinal sectional view through a circuit breaker embodying the present invention and showing the same in "closed" condition.

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

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

Fig. 4 is a sectional view similar to that of Fig. 1 but with parts broken away and showing the circuit breaker in an "open" condition.

Figs. 5 and 6 are perspective views of certain of the parts comprising the circuit breaker.

Fig. 7 is an end elevation view of the switch latch.

Referring to the drawings, the circuit breaker comprises a one piece casing 11 of insulating material, such as molded phenolic plastic. A metal cap piece 12 is removably attached to the open end of the casing by a pair of screws 13 (Fig. 3) thus forming a complete enclosure for the operating parts. A pair of threaded sockets 14 are integrally attached to the cap piece 12 to receive suitable mounting screws (not shown) whereby to permit the circuit breaker to be

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mounted on an instrument panel or the like with the outer surface of the cap piece 12 flush with the panel.

A switch contact 15 is fixed to one end of a flexible U-shaped contact carrier 16 constructed of spring brass or similar metal. The other end of the carrier is held in contact with an electric terminal 18, extending through the base of the casing, by a rivet 17. The latter extends through the base of the casing 11 to hold the terminal 18 and carrier 16 in permanent location in the casing and in connection with each other.

A second switch contact 20 is carried above the contact 15 by a lug 21 extending from a vertical contact slide 22 (see also Fig. 6) mounted for vertical movement in a guideway or groove 23 formed in the inner opposing side walls of the casing. The grooves 23 are wide enough to also slidably support a second actuating slide 24 (see also Fig. 5) slidable in contact with but relative to the slide 22.

The slide 24 is attached to a knob 25, preferably of insulating material, the latter extending outside of the cap piece 12 and slidable in a closely fitting sleeve 26 attached to the cap piece to prevent the entrance of dust, sand, etc., into the interior of the circuit breaker.

For the purpose of removably attaching the slide 24 to the knob 25, the upper end of the slide is fitted in a laterally extending slot in the lower end of the knob 25 and is retained therein by a pin 28. A sleeve 29 is fitted over the lower end of the knob to cover the pin and is provided with a hole 30 which may be aligned with the pin 28 to permit insertion of the latter. After installation of the pin 28, the sleeve is rotated to move the hole 30 out of registry with the pin.

A washer 31 of insulating material is retained in place over a shoulder 32 (Fig. 2) on the slide 24 by the bottom surface of the knob 25 to insure complete insulation between the slide and the cap piece 12.

The slide 22 is biased in an upward direction by a tension spring 33 extending between the lug 21 and a pin 34. The latter extends across the casing and rests in the bottoms of slots 35 formed in the side walls of the casing. However, when the switch is in its closed condition illustrated in Figs. 1 and 2, wherein the contacts 15 and 20 are in contacting relationship, the slide 22 is normally retained in its lower illustrated position by a latch, generally indicated at 36. The latch is formed of a thermo-responsive, bi-metallic strip 37 of any suitable known combination of metals having suitably attached at its upper end

a latch tip or piece 38 arranged to engage the upper edge of the slide 22. The lower end of the bi-metallic strip 37 is rigidly attached by one or more rivets 40 to a second terminal 41, extending through the base of the casing 11 and rigidly attached thereto by a rivet 42. In lieu of the latching tip 38, the upper end of the strip 37 could equally well be bent over at right angles to form, in itself, the latching tip.

The bi-metallic strip 37 is so arranged that under normal temperature conditions, i. e., under normal current conditions, it will remain in its position shown in Fig. 1 whereby to latch the slide 22 in its lower (closed) position.

The actuating slide 24 has a camming lug 43 struck outwardly therefrom into a position passing through a rectangular opening 46 in the slide 22 and normally contacting an inclined section 44 of the strip 37. Also, a second lug 45 is bent outward from the slide 24 to also extend through the opening 46 in the slide 22. The latter lug normally rests on the lower edge 47 of the opening 46.

From the foregoing it will be seen that the actuating slide 24 forms the means for manually causing opening and closing the contacts 15 and 20. When it is desired to open the contacts, the knob 25 is withdrawn from its position shown in Fig. 1, causing the camming lug 43 to move along the inclined edge 44 of the strip 37, camming the same outwardly until the latch tip 38 releases the slide 22, whereupon the spring 33 will move the latter slide upwardly with a snap action to break the contacts. This snap action will reduce to a minimum any existent arcing tendencies. The circuit breaker elements will then assume the open condition shown in Fig. 4 and the spring 33 will become effective to move the slides 22 and 24 to their full upper positions in the event the knob 25 is not then manually withdrawn to its full extent.

Normally, the camming lug 43 does not engage the upper edge 46*a* of the opening 46 in the slide 22. However, in the event that the spring 33 should break or the slides bind in any way to prevent operation of the spring during opening of the switch, the knob 25 may be manually withdrawn to its fullest extent, and in doing so, the lug 43 will engage the edge 46*a* of slide 22, thereby retracting the same to open position.

When it is desired to close the switch, the knob 25 is pressed inward to its position shown in Fig. 1, and in doing so, the lug 45 will press against the edge 47 of slide 22 to depress the latter. As the camming lug 43 moves along the inclined edge 44 of the strip 37, the latter will recede toward its normal latching position and will then ride along the surface of the slide 22 until the upper edge of the latter passes below the latching tip 38, whereupon the latter will latch and hold the same in closed position.

A flexible conductor 48 is soldered or otherwise electrically connected at its upper end to the latching tip 38 and is passed through an opening 49 formed by the formation of the camming lug 43. The opposite end of the conductor is electrically connected to the lug 21 of the slide 22, thereby completing the circuit, when the switch is closed, from the terminal 41, through the strip 37, conductor 48, contacts 15 and 20, and spring carrier 16 to the terminal 18.

When the circuit in which the switch is connected becomes overloaded, the bi-metal strip 37 will become heated and will warp outwardly (to the right in Fig. 1) in the customary manner,

releasing the slide 22, in substantially the same manner, as the latter is manually released. The spring 33 will then become effective to carry both slides 22 and 24 upwardly to their positions of Fig. 4.

It will be noted that the circuit breaker construction permits the contacts to be manually held closed even though an overload condition exists, i. e., even though the strip 37 is warped outwardly due to excessive heating. Such feature is of considerable importance in aircraft and the like installations, for the sake of safety, in order to operate certain electrically operated elements even though the circuit therefor becomes overloaded.

The contact carrier 16 is preferably so arranged that it will yield a slight amount when the slide 22 is moved to its circuit closing position of Fig. 1. This action not only effects an even and sufficient spring pressure against the contacts 15 and 20 when in closed condition but also enables a slight wiping or sliding action of one contact relative to the other upon opening and closing the same to clean them of any corrosion or oxidation so as to insure adequate electrical connections.

One of the principal features of the switch of the present invention is its ease of assembly. In assembling the parts, the terminal assemblies, i. e., 16, 18, 36 and 41 are riveted to the base of the casing 11 by rivets 17 and 42, respectively. The knob 25 is inserted in the sleeve 26 and then attached to the slide 24. Thereafter, the slides 22 and 24 are slid into place along grooves 23. The spring 33 is positioned in place and the pin 34 carrying the upper end of the spring 33 is placed in the slots 35. The cap piece 12 is thereafter secured in place on the casing 11 by the screws 13. The circuit breaker may be equally easily disassembled for inspection or replacement of parts.

The circuit breaker may be adapted to wide ranges of current capacities merely by substituting bi-metallic strips of different load ratings for the strip 37.

Although the bi-metallic strip 37 is disclosed as being operable directly by current passing therethrough, it is apparent, of course, that the combined bi-metallic strip and latch may be operated indirectly by attaching the upper end of the flexible conductor 48 to a suitable conductor wrapped around the lower half of the strip 37 and connected in circuit with the terminal 41. In any event, however, no biasing spring or element is needed for the latch of the present construction, thereby resulting in a reliable and sensitive circuit breaker mechanism.

Further, the spring 33 could be omitted, if it were not necessary to obtain a snap action in breaking the contacts 15 and 20, in view of the fact that the lost motion connection effective between the slides 22 and 24 permits of manual retraction of the former slide 22.

Having thus described the invention, what we desire to secure by United States Letters Patent is:

1. In a circuit breaker, a casing, a first contact, spring means on said casing supporting said contact, a contact carrier having a second contact thereon adapted to engage said first contact, means on said casing supporting said carrier for movement from a contact engaging position to a contact disengaging position, a spring biasing said contact carrier toward contact disengaging position, a latch comprising a thermo-responsive ele-

ment, means on said casing fixedly supporting said latch at one end thereof, said latch being engageable at the free end thereof with said contact carrier whereby to hold said contact carrier in contact engaging position; a manually operable actuating member, said actuating member being operable upon movement thereof in one direction to move said contact carrier to contact engaging position, a cam element on said member operable upon movement of the latter in the opposite direction to deflect said free end of said latch to release said contact carrier, an electric terminal electrically connected to said first contact, a second electric terminal, and means comprising said thermo-responsive element for electrically connecting said second terminal to said second contact, said thermo-responsive element being effective to deflect said free end of said latch to release said contact carrier upon passage of a predetermined current therethrough.

2. In a circuit breaker, a casing, a first contact, spring means on said casing supporting said contact, a contact slide carrying a second contact thereon adapted to engage said first contact, a second manually operable actuating slide, means supporting said slides for relative lengthwise movement, spring means biasing said contact slide toward contact disengaging position, a thermo-responsive latch engageable at one end thereof with said contact carrier whereby to hold the same in contact engaging position, means on said casing fixedly supporting said latch at the opposite end thereof, said slides having interengaging portions whereby said actuating slide is effective upon movement thereof in one direction to move said contact slide to contact engaging position, and a cam on said actuating slide operable upon movement thereof in the opposite direction to deflect said latch at said first mentioned end thereof to release said contact slide.

3. In a circuit breaker, a casing having a base and opposed side walls extending therefrom, a first contact, yieldable means supporting said contact, a contact slide moveable lengthwise in guideways in said side walls, said contact slide carrying a second contact adapted to engage said first contact, a second manually operable actuating slide moveable lengthwise in said guideways and relative to said contact slide, spring means biasing said contact slide toward contact disengaging position, a bi-metallic element having a latching tip at one end thereof, means fixedly supporting said element at the opposite end thereof, said latching tip being arranged to normally latch said contact slide in contact engaging position, said slides having inter-engaging portions effective to move said contact slide to contact engaging position upon movement of said actuating slide in one direction, a cam on said actuating slide effective to cam said element to latch releasing position during movement of said actuating slide in the opposite direction, an electric terminal electrically connected to said first contact, a second electric terminal, and means comprising said bi-metallic element for electrically connecting said second terminal to said second contact, said bi-metallic element being effective to move to latch releasing position upon passage of a predetermined current therethrough.

4. In a circuit breaker, a casing having a base and opposed side walls extending therefrom, a first contact, means on said casing supporting said contact, each of said walls having a slot therein, said slots being aligned to form guide

ways, a contact slide movable lengthwise in said guide ways, a second contact carried by said contact slide and adapted to engage the first contact, a second manually operable actuating slide movable lengthwise in said guide ways and relative to said contact slide, said actuating slide being operable upon movement thereof in one direction to move said contact carrier to contact engaging position, an arm extending outwardly from said contact slide, a spring operatively connected to said arm for biasing said contact slide toward contact disengaging position, a thermo-responsive latch for holding said contact slide in contact engaging position, and means on said actuating slide operable upon movement of the latter in the opposite direction to release said latch.

5. In a circuit breaker, a casing having a base and opposed side walls extending therefrom, a first contact, means on said casing supporting said contact, a contact slide movable lengthwise in guide ways in said side walls, said contact slide carrying a second contact adapted to engage said first contact, a second manually operable actuating slide movable lengthwise in said guide ways and relative to said contact slide, spring means biasing said contact slide toward contact disengaging position, a bi-metallic element having a latching tip at one end thereof, means on said casing supporting said element at the opposite end thereof, said latching tip being arranged to normally latch said contact slide in contact engaging position, said slides having interengaging portions effective to move said contact slide to contact engaging position upon movement of said actuating slide in one direction, means on said actuating slide effective to move said bi-metallic element to latch releasing position upon movement of said actuating slide in the opposite direction, an electric terminal electrically connected to said first contact, a second electric terminal, and means comprising said bi-metallic element for electrically connecting said second terminal to said second contact, said bi-metallic element being effective to move to latch releasing position upon passage of a predetermined current therethrough.

6. In a circuit breaker, a casing having a base and opposed side walls extending therefrom, a first contact, means on said casing supporting said contact, a contact slide movable lengthwise in guide ways in said side walls, said contact slide carrying a second contact adapted to engage said first contact, a second manually operable actuating slide movable lengthwise in said guide ways and relative to said contact slide, spring means biasing said contact slide toward contact disengaging position, a bi-metallic element having a latching tip at one end thereof, means on said casing supporting said element at the opposite end thereof, said latching tip being arranged to normally latch said contact slide in contact engaging position, said slides having inter-engaging portions effective to move said contact slide to contact engaging position upon movement of said actuating slide in one direction, means on said actuating slide to move said bi-metallic element to latch releasing position during movement of said actuating slide in the opposite direction, means on said actuating slide effective to move said contact slide to contact disengaging position during movement of said actuating slide in said opposite direction upon failure of said spring means to do so, an electric terminal electrically connected to said first contact, a second electric

terminal, and means comprising said bi-metallic element for electrically connecting said second terminal to said second contact, said bi-metallic element being effective to move to latch releasing position upon passage of a predetermined current therethrough.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,156,760	Jackson	May 2, 1939
2,418,537	Wood	Apr. 8, 1947
2,458,807	Tucker	Jan. 11, 1949
2,476,648	Zeller	July 19, 1949
2,485,736	Ingwersen	Oct. 25, 1949