March 20, 1945. J. D. BOLESKY 2,371,672

CIRCUIT BREAKER

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FIG. 1.

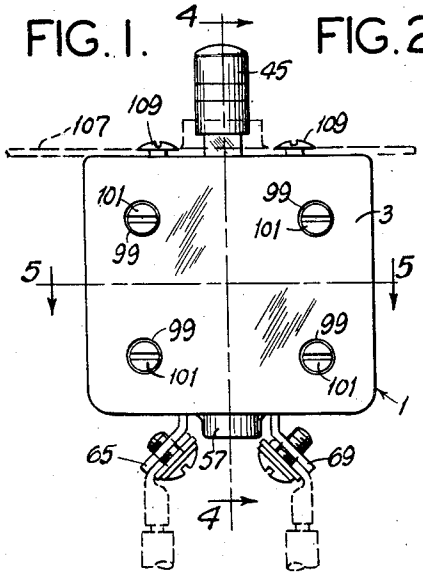


FIG. 2.

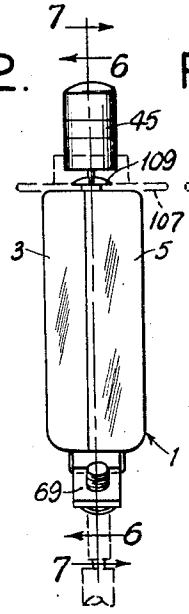


FIG. 3.

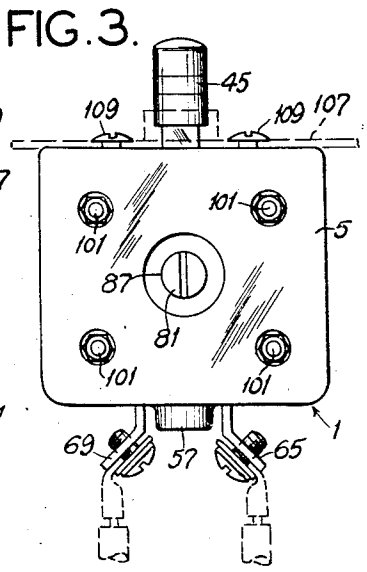


FIG. 4.

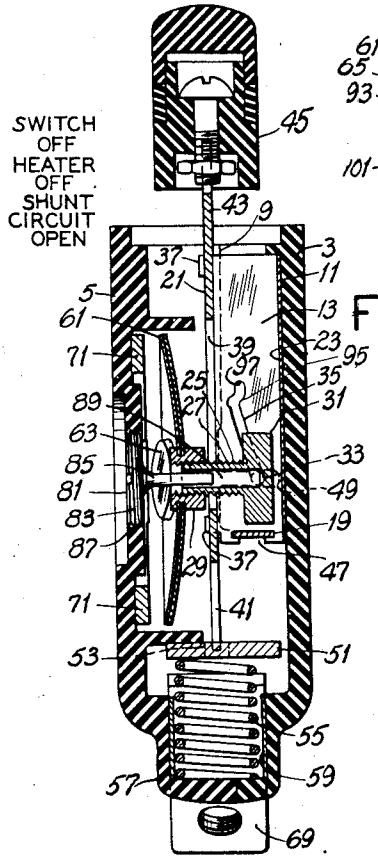


FIG. 5.

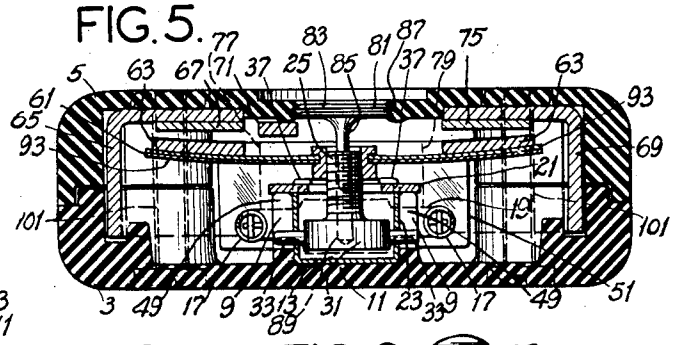


FIG. 12.

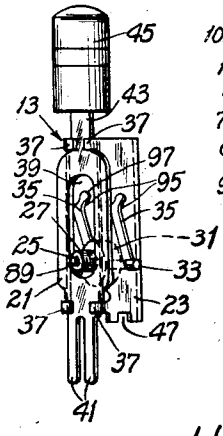
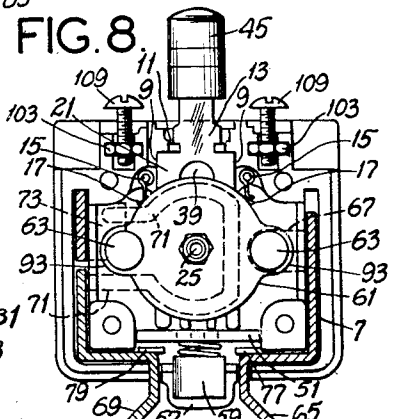


FIG. 8.



John D. Bolesky,
Inventor.
Haynes and Koenig,
Attorneys.

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CIRCUIT BREAKER

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FIG. 6.

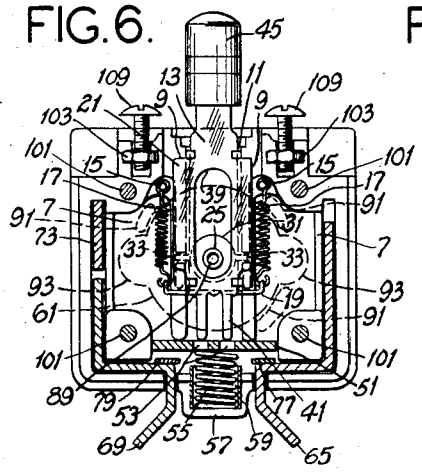


FIG. 7.

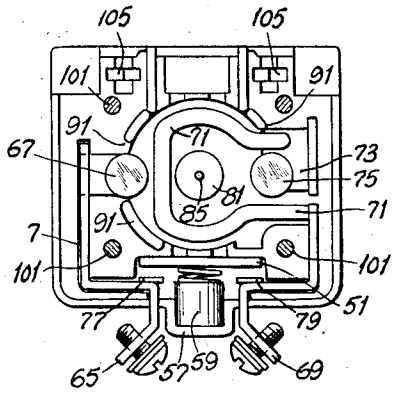


FIG. 9.

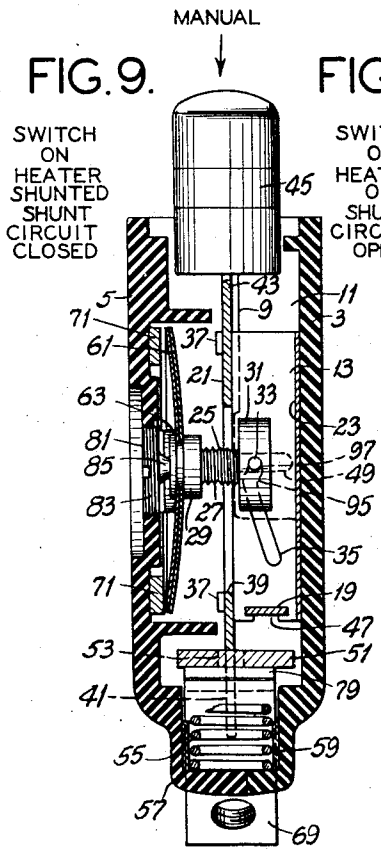


FIG. 10.

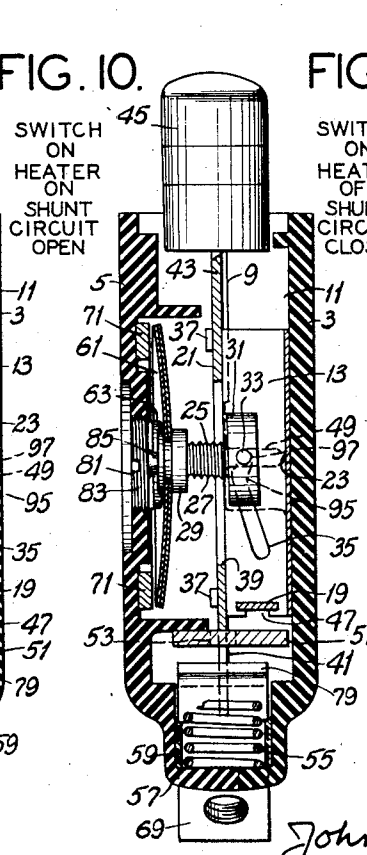
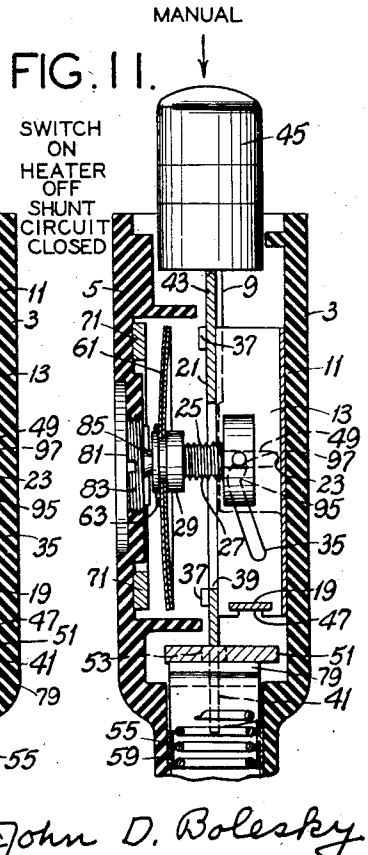


FIG. 11.



John D. Bolesky,
Inventor.
Haynes and Koenig,
Attorneys.

Patented Mar. 20, 1945 2,371,672

UNITED STATES PATENT OFFICE

2,371,672

CIRCUIT BREAKER

John D. Bolesky, Attleboro, Mass., assignor to Metals & Controls Corporation, Attleboro, Mass., a corporation of Massachusetts

Application July 8, 1942, Serial No. 450,143

13 Claims. (Cl. 200—116)

This invention relates to electric circuit breakers, and more particularly to circuit breakers which automatically trip out on overload in the electrical circuit, and which are manually reset to close the circuit again.

The invention is an improvement over that shown in my United States patent application, Serial No. 408,917, filed August 30, 1941, now Patent No. 2,345,451, March 28, 1944, for Switch.

Among the various objects of the invention may be noted the provision of a thermostatic circuit breaker which is positive in its action and not readily jarred into premature tripping; the provision of a device of the class described which has more positive and reliable switch-opening movement greater than that provided for by thermostatic movement per se; the provision of an arrangement of the thermal element such that during its actuation frictional drag is minimized and the uniformity of operation therefore improved; the provision of means for shunting out the thermal element if desired by the same control handle which is used to reset the breaker and without interfering with free movement of the thermal element; and the provision of a circuit breaker of the class described which is compact, foolproof and simple in its operation and economical to manufacture. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is illustrated one of various possible embodiments of the invention,

Fig. 1 is a top plan of the device;

Fig. 2 is a right end elevation of Fig. 1;

Fig. 3 is a bottom plan view of Fig. 1;

Fig. 4 is a section, on an enlarged scale, on the line 4—4 in Fig. 1;

Fig. 5 is a section, on an enlarged scale, on the line 5—5 in Fig. 1;

Fig. 6 is a section, on the line 6—6 in Fig. 2 with the thermal element dotted;

Fig. 7 is a section, on the line 7—7 in Fig. 2;

Fig. 8 is a section similar to Fig. 6 but with the thermal element shown in full and the heater dotted;

Fig. 9 is a view similar to Fig. 4 but showing the device in another position;

Fig. 10 is a view similar to Figs. 4 and 9 but with the device in a different position;

Fig. 11 is a view similar to Figs. 4, 9 and 10 but showing the device in still another position; and,

Fig. 12 is an isometric view of the operating handle mechanism.

Similar numbers indicate corresponding parts throughout the several views of the drawings.

Circuit breakers are of many different types. The present invention is concerned with thermal-type circuit breakers which utilize a thermal element both to open the circuit and to release associated mechanism. Circuit breakers, in general, utilize either creep-acting thermal elements alone, or such creep-acting elements in conjunction with other apparatus to render the device snap-acting. Such structures have disadvantages for many purposes.

If such a circuit breaker is operating under conditions near its tripping point, the contact pressure exerted by the thermal element, or its position in relation to the detent which it may be controlling, may be so critical that a slight jar will often prematurely trip it. Also, in some types of thermal circuit breakers the thermal element is so arranged that during its actuation, it drags against other parts with considerable friction, which results in non-uniformity of operation.

According to the present invention a circuit breaker is provided which is positive in its action, is not readily jarred into premature tripping, can be easily adjusted, opens the electrical contacts in a minimum of time, and with ample opening to interrupt the arcs encountered in the circuit for which the circuit breaker is designed, and which is so arranged in relationship of its parts that the thermal element presents no hindering friction against any moving part.

The thermal element employed is an inherently snap-acting thermostatic member, plate or disc. Up to the point of tripping, this snap-acting element does not move, and hence maintains a positive latching action in conjunction with the detent which it releases, and hence is not readily jarred from its detent position. In addition, when the snap-acting element does snap, it clears the moving parts completely and the device is therefore free of the disadvantages encountered where the friction above referred to is present. Also, the pressure exerted by other moving parts in the circuit breaker has but little effect upon the calibration of the circuit breaker of the present invention.

In some types of circuit breakers it is necessary to incorporate what is called a shorting or shunting bar so that in an emergency the circuit may be closed to give a temporary control over the circuit in spite of the fact that the circuit is under overload conditions. In certain of these circuit breakers the manner in which this is accomplished is to cause the thermal element itself to act as a shunt bar. This may give trouble since the overload conditions are then apt to overheat

and change the calibration of the thermal element and hence of the circuit breaker. In this invention the shunt bar is used in such a way that it completely shunts out the thermal element and little, if any, current passes through the thermal element when the shorting bar is used. In addition, this actuation of the shorting bar, while being accomplished by the same control handle which is used to reset the breaker, is so arranged as to have no restraining effect on the thermal element, which is at all times free to move.

Referring now to the drawings, numeral 1 indicates a frame or base made of an electrical insulating material such as a molded synthetic resin of the "Bakelite" type. The base 1 is constructed of two parts 3 and 5. Molded into this base are grooved abutments, etc. illustrated generally at 7 (Fig. 6) tending to hold the various parts in alignment. Extending from the base are upright partitions 9 which form a channel 11 in which the boat or cam member 13 rides. Pegs 15 are inserted firmly and immovably in the base and serve as anchors for ends of the springs 17. The other ends of the springs 17 are respectively attached to the stirrup 19.

The construction of the slidable boat 13 is illustrated particularly by Fig. 12. The boat is, as indicated, of two main portions, the slide 21 and the frame 23. These are formed of thin sheet metal with sufficient rigidity to keep their shape. In addition to these two main parts there is a third part, the disc post indicated generally at 25. This post 25 is formed of steel or some other such metal. It has a threaded hub 27 which threads into the disc hub 29 (see Fig. 4), and a circular base portion 31. Two pins 33 project from diametrically opposite points on the circular portion 31 and are slidably engaged in the cam slots 35 of the frame 23. Bent-over ears 37 on the frame 23 serve to slidably hold the slide 21 to the frame 23, thus providing for a relative sliding between the frame 23 and slide 21. This motion is in a lengthwise direction. The slide 21 is provided with an elongated center opening 39, through which the threaded hub 27 of the disc post 25 is allowed to extend freely when the boat is assembled.

Slide 21 is also supplied with projecting ends 41, the purpose of which will subsequently be described. The other end of slide 21 is provided with a projection 43 to which the knob 45 is attached. The knob may be held on by any of the customary means. The frame 23 has at one end notches 47 which serve to be engaged by the stirrup 19, and thus guide the stirrup in position on the frame 23, the stirrup being kept in position against the frame 23 by the springs 17.

Fig. 6 shows the boat mounted in the base 1. It will be observed that the stirrup 19 is engaging the end of the frame 23 in notches 47 so that when the knob 45 is pressed to slide the boat inward, the springs 17 provide a return bias.

The projecting pins 33 of the disc post 25 extend beyond the sides of the frame 23, and fit slidably into vertical notches 49 which are molded into the upright partitions 9. Thus, when the boat 13 is pushed along the base, the disc carrier post 25 cannot move along with it, but must move up and down in a direction perpendicular to the base, as viewed in Fig. 1. This up-and-down movement is caused by engagement of the pins 33 in the cam slots 35 in the sides of the frame 23.

Referring now to Fig. 8, there is shown a shunting or shorting bar 51, which is made of conducting contact material such as, for example, silver or silver alloys or any other proper electrical conducting material. Bar 51 has two holes 53 therein, which holes receive the extensions 41 of the slide 21 to guide the shorting bar. The shunt bar 51 is shown mounted in position on the base with the extensions 41 passing through the holes 53 (see Figs. 6 and 9). A spring 55 rests in a properly provided groove 57 molded in the base 1. A metallic tube 59 serves to guide the spring and provide a mounting for it. Spring 55 is of such length as to keep the shorting bar 51 pressed away from the end of the base and toward the center of the base in a non-contact-making position.

Referring again to Figs. 4 and 8, a snap-acting bimetallic disc 61 is shown threadably mounted by means of hub 29 on the post 25. The hub 29 is provided with the proper abutments and shoulders in the usual way so that disc 61 is relatively free to rotate thereon. Thus by turning the disc hub 29 on the threaded hub 27, the position of disc 61 is changed relative to the base 5. By this means temperature adjustment of the disc is made. Contacts 63 are electrically welded on disc 61, or otherwise mounted and electrically connected to the disc 61.

Referring now to Fig. 7, the terminal and stationary contact assembly is shown with the internal heater. These are as follows: One terminal 65, comprising a strip of conducting metal of the proper thickness and size to fit in the grooves 7 molded in the base, is shown pressed into position. This terminal has a contact 67 on its side facing the central portion of the circuit breaker positioned to engage one of the disc contacts 63. The other terminal 69 is likewise mounted on the base, and to it is attached at one end a heater 71. The other end of heater 71 is attached to a third metal support 73 which likewise engages the molded grooves in the base 1. Support 73 is not in electrical contact with terminal 69, except through the heater 71. Support 73 carries on its inner surface a contact 75 which is adapted to engage the other contact 63 on the bimetallic disc 61. In addition to these contacts, terminal 65 carries on it an additional stationary contact 77 adapted to be engaged by one end of the shunt bar 51, and terminal 69 carries a stationary contact 79 which is adapted to be engaged by the other end of the shunt bar 51.

It is to be understood that the heater element 71 may be omitted in this case where the current is great enough that the heating caused by its passage through the disc 61 alone is great enough to cause the thermostatic action of the disc. In general, the switches with lower current ratings require the heater because a point is reached where mechanical operation of a cross section of the disc cannot be reduced to a small enough section to bring about the heating required in view of the current available. It is in such cases that the auxiliary heater is used because its cross section is independent of any mechanical strength requirements. Its cross section may be made whatever is necessary to bring about the heating desired.

Referring to Fig. 5, there is shown a post button 81 having a threaded portion 83 and a projecting stem 85. This post button screws into the base portion 5 (see also Fig. 3), which has a hole 87 threaded for that purpose. Projecting stem 85 slidably fits into the hole 89 which is provided centrally in the disc post 25. This stem portion 85 and the notches 49 serve as the bearings on

which the post 25 rides up and down when the boat 13 moves back and forth in the base. It will be observed that a molded portion (see Fig. 6) serves to engage the extending ears 93 of the disc 61, and thus maintain the respective contacts in alignment.

It will be observed that as the boat 13 moves along the base in its channel 11, the disc post 25 rides up and down in a direction perpendicular to the plane of motion of the boat 13. As the disc post 25 does this, it carries up and down with it the snap-acting bimetallic disc 61. Thus the contacts 63 are brought into engagement with the stationary terminal contacts as the boat 13 slides along the base against the tension of the springs 17, and vice versa. The operation of these motions is such that when the boat is moved by means of the knob 45 along the base, the pins 33 are forced by the cam slots 35 in an upward direction (as Figs. 6 and 8 are drawn) so as to bring the disc and its mating circuit-closing contacts into engagement with the stationary contacts 67 and 75. When the disc contacts 63 reach the stationary contacts 67 and 75 the motion of the perimeter of the disc is stopped, but further motion of the slide forces the center of the disc still farther upward, thus putting pressure on the cold disc which is resisted by the spring characteristic of the disc itself. When the boat is pushed further along, the pins 33 ride up over the curved detent parts 95 of the cam slots 35. To make the pins ride up over the detent parts 95 against the pressure of cold disc 61, an additional force is required. Consequently when the pins drop down behind the detent parts 95, the spring pressure of disc 61 serves to hold the boat in position against the tension of springs 17, as long as the pressure is maintained against the pins by the cold disc 61. The ends 97 of the slots 35 back of each detent part 95 are preferably thus a little longer than actually required, to make sure that the pins 33 will drop down.

Assuming that the parts are in this position, we will see that there is an electrical circuit through the terminal 65, contact 67, the corresponding contact 63 of the disc, disc 61, the other disc contact 63, the stationary contact 75, heater 71 and terminal 69.

The overload tripping operation of the device on overload conditions is as follows:

When the device is subjected to the overload current which it is designed to interrupt, the heater 71 heats up as does the disc 61 (since it is subjected to the current also). After a predetermined given interval of time, the heat generated is sufficient to cause the disc to snap to its other (hot) position of concavity. This motion of the disc in its snap opens the contacts and also serves to release the pressure of the pins 33 against the detent 95, and the biasing springs 17 are now free to pull the boat 13 back into its original position. This motion of the boat 13 causes the cam slots 35 to draw the hot disc 61 away from the stationary contacts 67 and 75. It will be observed that if the knob and boat are held in the circuit-closing position, the motion of the disc snaps the contacts 63 away from contacts 67 and 75, thus opening the circuit. The automatic movement of the disc caused by the boat 13 and its cam action is large compared to the motion obtained from the thermal movement of the disc alone and gives the breaker additional circuit-interrupting capacity. In addition, this movement caused by the cam action is sufficiently large so that when the disc cools and snaps back to its original cold position, the contacts 63 do not make contact with the stationary contacts 67 and 75 mounted on terminals 65 and 69. Thus, with the disc in its cold position, and until reset, the circuit is maintained in an open position.

It will accordingly be observed that the opening of the circuit is caused by a combination of the motion of the disc and the motion of the boat. Also, that the motion of the disc alone is sufficient to open the circuit, and the device is thus trip-free of the handle when the latter is in its normal circuit-closed position. That is, pushing in the handle while the disc is snapped to hot position will not re-close the circuit through the disc.

The purpose and operation of the shorting bar is as follows:

It sometimes happens that in an emergency it is necessary to prevent the circuit breaker from interrupting the circuit, or else to quickly re-close the circuit if the circuit breaker has opened it. To this end the shunting bar 51 is provided. By referring to Fig. 12, it will be seen that the slide 21 can move relative to the frame 23. Consequently inward pressure on the knob 45 will cause the slide 21 to slide in a little further. This further sliding action results in the end of the slide 21 striking the shunt bar 51 as shown in Figs. 9 and 11, and forcing the bar 51 into engagement with the stationary contact 77 and 79. Consequently this further forward motion of the slide 21 will enable the circuit to be closed, regardless of the position of the disc (see Figs. 9 and 11; Fig. 9 illustrates the condition where the disc is in its cold position and Fig. 11 where the disc is in its hot position).

From the above it will be understood that this further forward motion of the slide 21 will enable the circuit to be closed, regardless of the position of the disc, and likewise that this in no way interferes with the operation of the disc. It will be observed that the shunting bar 51 effectively shunts out the heater 71 and the disc 61, so that neither is injured by the overload current. When the pressure on knob 45 is relieved, the spring 55 forces the shorting bar away from the contacts 77 and 79, thus opening the shunting circuit.

An important factor of this construction is that by allowing relative movement between the slide 21 and the frame 23, the spring 55 can be made fairly light and still be strong enough to force the slide 21 back, and hence open the shunt bar circuit. It has been found that if the disc 61 is in its cold circuit-closed position there is considerable pressure exerted against the frame 23. If frame 23 and slide 21 were all of one piece, the whole of said piece would have to be moved inward to close the shorting bar. The friction caused by the disc pressure against the frame 23 and the frame against the base would be sufficient to hold the shorting bar closed, even if the knob 45 were released, unless a very strong spring 55 were used. As a practical matter, it is found that the spring 55 would have to be so strong as to make it difficult, if not impossible, to fit it into the small space required by efficient design of a circuit breaker of this type. Also, the use of such a strong spring would make it very difficult to close the shorting bar. By the present construction a light spring is allowed to work against the freely-moving slide 21 to open the shorting bar. Also, the lost-motion between prongs 41 and bar 51 avoids a large initial deflection in the spring 55 such as would be nec-

essary if the bar 51 partook of the full stroke of 21. This is further conducive to a short spring.

From the above it is clear that the present circuit breaker is the type which utilizes a thermal means to initiate the mechanical motion, said mechanical motion further moving the thermal element. The motion of the thermal element per se will serve to open the circuit with a snap action. This quick opening tends to minimize burning of the contacts by arcing. Also, the disc when in its hot position exerts no pressure against the boat, and hence the boat is free to be moved back by springs 17. The use of a snap-acting thermal element thus minimizes friction, since such an element occupies either its hot or cold position, any intervening position being of extremely short duration.

Referring to Figs. 1 and 3, through the holes 99 are passed rivets or bolts 101, which serve to hold the two halves of the base together. Referring again to Figs. 6 and 7, just before the two halves of the base are put together, nuts 103 are inserted in properly shaped hexagonal recesses 105 in each half of the base, so that when the two halves are put together nuts 103 are held so that they cannot turn. Then the frame 107 which serves to mount the breaker on the proper panel is held firmly to the base by means of screws 109 which engage the nuts 103.

To adjust the circuit breaker to the proper rating, the button 81 is unscrewed, thus giving access to the disc hub 27. This is turned (thus changing the temperature adjustment of the disc) until the disc snaps at the correct interval of time, with the calibrating current flowing through it. A drop of solder is then placed on the hub to solder it to post 25, and thus to prevent it from further turning and getting out of adjustment.

While the thermostatic member 61 is, according to the present example, inherently stressed to be concave toward the first contacts 75 and 77 when cold, and vice versa, it is clear that this relationship of conditions could be reversed without changing the inventive principles. In other words the second contacts 63 could be carried from the first contacts upon cooling, the two conditions of stability of the thermostatic member being reversed as regards temperature.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A circuit breaker comprising a frame part carrying an overload contact, a snap-acting thermostatic disc carrying a mating contact for the overload contact, a carrier for said disc and movable for actuation toward and away from said overload contact, the disc having a cold position concave toward the contact and a hot position concave away from the contact, a follower on the carrier, a cam movable with respect to the frame and cooperating with the follower and shaped so that upon one movement it drives the disc toward the overload contact a distance to bring together the disc contact and the overload contact and to tension said disc, the cam and the tensioned disc cooperating to hold the tensioned disc in position, means biasing the cam in the reverse direction tending to release the follower and draw it in a direction to move the disc away from the overload contact, biasing action automatically occurring when the tension is removed from the disc by snapping of the disc to its hot position.

2. A circuit breaker comprising a frame part carrying an overload contact and a shunting contact, a snap-acting thermostatic disc carrying a mating contact for the overload contact, a carrier for said disc and movable for actuation toward and away from said overload contact, the disc having a cold position concave toward the contact and a hot position concave away from the contact, a follower on the carrier, a cam cooperating with the follower and shaped so that upon one movement it drives the disc toward the overload contact a distance to bring together the disc contact and the overload contact and to tension said disc and locking the disc in tensioned position, means biasing the cam in the reverse direction tending to unlock the follower and draw it in a direction to move the disc away from the overload contact, biasing action occurring when the tension is removed from the disc by snapping of the disc to its hot position, and manually operable means having a lost-motion connection with said cam to drive it against its bias, a shunting bar associated with said shunting contact, a lost-motion between the manual means and the cam allowing the manual means to drive the shunting bar into shunting position against the shunting contact.

3. A circuit breaker comprising a frame part carrying an overload contact and a shunting contact, a snap-acting thermostatic disc carrying a mating contact for the overload contact, a carrier for said disc and movable for actuation toward and away from said overload contact, the disc having a cold position concave toward the contact and a hot position concave away from the contact, a follower on the carrier, a cam cooperating with the follower and shaped so that upon one movement it drives the disc toward the overload contact a distance to bring together the disc contact and the overload contact and to tension said disc and locking the disc in tensioned position, means biasing the cam in the reverse direction tending to unlock the follower and draw it in a direction to move the disc away from the overload contact, biasing action occurring when the tension is removed from the disc by snapping of the disc to its hot position, and manually operable means having a lost-motion connection with said cam to drive it against its bias, a shunting bar associated with said shunting contact, and also having a lost-motion connection with said manually operable means, the lost-motion between the bar and the manual means being taken up during actuation of the follower by the cam, thereafter lost-motion between the manual means and the cam allowing the manual means to drive the shunting bar into shunt circuit against the shunting contact.

4. A circuit breaker comprising a frame carrying a circuit contact, a snap-acting thermostatic member operating a mating circuit-closing contact for said circuit contact, a carrier for said thermostatic member movable for actuation toward and away from said circuit contact, the thermostatic member having a cold position concave toward the circuit contact and a hot position concave away from it, a follower on the carrier, a cam movable with respect to the frame and

cooperating with the follower and shaped so that upon one movement it drives the thermostatic member toward the circuit contact a distance to bring together both of said contacts and to tension said thermostatic member, the cam and the tensioned thermostatic member cooperating to hold the tensioned thermostatic member in position, means biasing the cam in the reverse direction tending to release the follower and permit its movement in a direction to withdraw the thermostatic member from the circuit contact, biasing action automatically occurring when the tension is removed from the thermostatic member by snapping of the thermostatic member to its hot position.

5. A circuit breaker comprising a frame carrying a circuit contact, a thermostatic member carrying a mating circuit-closing contact for said circuit contact, a carrier for said thermostatic member movable for actuation of the thermostatic member toward and away from said circuit contact, the thermostatic member having a cold position concave toward the circuit contact and a hot position concave away from it, a follower on the carrier, a cam movable with respect to the frame and having a driving portion terminated by a locking portion, said cam cooperating with the follower so that upon cam movement by means of said driving portion it first drives the thermostatic member towards the circuit contact a distance to bring together both of said contacts and tension the thermostatic member and then by said locking portion locks the thermostatic member in a tensioned contact-closing position, means biasing the cam away from its locking position but not strong enough to unlock except upon movement of the thermostatic member toward its hot position.

6. A circuit breaker comprising a frame carrying a circuit contact, a snap-acting thermostatic member carrying a mating circuit-closing contact for said circuit contact, a carrier for said thermostatic member movable for actuation of the thermostatic member toward and away from said circuit contact, the thermostatic member having a cold position concave toward the circuit contact and a hot position concave away from it, a follower on the carrier, a cam movable with respect to the frame and having a sloping portion terminated by a positively-holding notched portion, said cam cooperating with the follower so that upon cam movement by means of said sloping portion it first drives the thermostatic member towards the circuit contact a distance to bring together both of said contacts and tension the thermostatic member and then by means of said notched portion to lock the thermostatic member in a tensioned contact-closing position, means biasing the cam away from its locking position but not strong enough to unlock except upon movement of the thermostatic member toward its hot position, said sloping and notched portions of the cam comprising a slot cooperating with the follower in a manner positively to draw the follower and the supported thermostatic member in a contact-opening direction.

7. A circuit breaker comprising a frame forming a straight-line guide, a cam member sliding in the guide, said cam member having a sloping slot therein terminated by a locking notch, means biasing the cam member toward a starting position, a circuit contact on the frame, a snap-acting thermostatic member operating a circuit-closing contact for said circuit contact, a carrier for said thermostatic member movable for actuation of the thermostatic member toward and away from said circuit contact and simultaneously tensioning the thermostatic member, the thermostatic member having a cold position concave toward the circuit contact and a hot position concave away from it, a follower on the carrier, said slot cooperating with the follower so that upon initial movement the sloping part of the slot drives the follower and tensions the thermostatic member to bring together both of said contacts and upon final movement the locking notch locks the follower in view of said tension, means biasing the cam in reverse direction tending to unlock the follower and to withdraw the thermostatic member to contact opening position, biasing action automatically occurring when the tension is removed from the thermostatic member by snapping of the same to its hot position.

8. A circuit breaker comprising a frame forming a straight-line guide, a cam member sliding in the guide, said cam member having a sloping slot therein terminated by a locking notch, means biasing the cam member toward a starting position, a circuit contact on the frame, a snap-acting thermostatic member operating a circuit-closing contact for said circuit contact, a carrier for said thermostatic member movable for actuation of the thermostatic member toward and away from said circuit contact and simultaneously tensioning the thermostatic member, the thermostatic member having a cold position concave toward the circuit contact and a hot position concave away from it, a follower on the carrier, said slot cooperating with the follower so that upon initial movement it drives the follower and tensions the thermostatic member to bring together both of said contacts and upon final movement to lock, means biasing the cam in reverse direction tending to unlock the follower and to withdraw the thermostatic member to contact opening position, biasing action automatically occurring when the tension is removed from the thermostatic member by snapping of the same to its hot position, manual operating means for the cam member comprising a slide having a lost motion with respect thereto, a shunt contact, a movable shunt bar cooperable with the shunt contact, lost motion of the slide with respect to the cam member upon manual operation extending the slide with respect to the cam member to move the shunt bar to engage the shunt contact regardless of the hot or cold condition of the thermostatic member and means biasing the shunt bar away from the shunt contact and to take up said lost motion whenever the cam member is allowed to move to its starting position.

9. A circuit breaker comprising a frame carrying a circuit contact, a snap-acting thermostatic member operating a mating circuit-closing contact for said circuit contact, a carrier for said thermostatic member, a guide for the carrier, said thermostatic member being movable for actuation toward and away from said circuit contact, the thermostatic member having a cold position concave toward the circuit contact and a hot position concave away from it, a follower on the carrier, a cam movable in respect to the frame crosswise to said guide and having a driving portion terminated by a positively-holding portion, said cam cooperating with the follower so that upon movement it first drives the thermostatic member towards the circuit contact a distance to

bring together both of said contacts and then to lock the thermostatic member in a tensioned contact closing position, the movement of the cam during actuation being greater than that of the carrier, and means biasing the cam away from its locking position but not strong enough to unlock except upon movement of the thermostatic member toward its hot position.

10. A circuit breaker comprising a frame part carrying a first contact, an inherently snap-acting thermostatic member carrying a second and mating contact for the first contact, a carrier for said thermostatic member movable for actuation toward and away from said first contact, the thermostatic member having at one temperature inherent stresses therein which tend to move parts of it carrying the second contact toward the first contact and at another temperature having inherent stresses which tend to move said parts carrying the second contact away from the first contact, a follower on the carrier, a cam movable with respect to the frame and cooperating with the follower and shaped so that upon one movement it bodily drives the thermostatic member toward the first contact a distance to bring together the second contact and the first contact and to apply stress to said thermostatic member, the cam and the stressed thermostatic member cooperating to hold the stressed disc in position, means biasing the cam in the reverse direction tending to release the follower and draw it in a direction to move the thermostatic member bodily away from the first contact, biasing action automatically occurring when the stresses are removed from the thermostatic member by snapping of the thermostatic member to its position away from the first contact.

11. A circuit breaker comprising a frame part carrying a first contact and a shunting contact, an inherently snap-acting thermostatic member carrying a second contact mating with the first contact, a carrier for said thermostatic member movable for actuation toward and away from said first contact, the thermostatic member having a position at one temperature in which inherent stresses therein tend to move parts of it carrying the second contact toward the first contact and another at another temperature in which inherent stresses therein tend to move said parts carrying the second contact away from said first contact, a follower on the carrier, a cam cooperating with the follower and shaped so that upon one movement it bodily drives the thermostatic member toward the first contact a distance to bring together the second contact and the first contact and to apply stress to the thermostatic member and locking the thermostatic member in stressed position, means biasing the cam in the reverse direction tending to unlock the follower and draw it in a direction to move the thermostatic member bodily away from the first contact, biasing action automatically occurring when the stress is removed from the thermostatic member by its snapping to its position away from the first contact, and manually operable means having a lost-motion connection with said cam to drive it against its bias, a shunting bar associated with said shunting contacts, and a lost-motion between the manual means and the cam allowing the manual means to drive the shunting bar into shunting position against the shunting contact.

12. A circuit breaker comprising a frame carrying a first contact and a shunting contact, an inherently snap-acting thermostatic member carrying a second contact for cooperation with the first contact, a carrier for said thermostatic member movable for actuation toward and away from said first contact, the thermostatic member having at one temperature a position in which inherent stresses therein tend to move parts of it carrying the second contact toward the first contact and at another temperature another position in which inherent stresses therein tend to move said parts carrying the second contact away from the first contact, a follower on the carrier, a cam cooperating with the follower and shaped so that upon one movement it bodily drives the thermostatic member toward the first contact a distance to bring together the second contact and the first contact and to apply stress to the thermostatic member while locking it in stressed position, means biasing the cam in the reverse direction tending to unlock the follower and draw it in a direction to move the thermostatic member bodily away from the first contact, biasing action occurring when the stress is removed from the thermostatic member by the snapping of it to its position away from the first contact, and manually operable means having a lost-motion connection with said cam to drive it against its bias, a shunting bar associated with said shunting contact, and also having a lost-motion connection with said manually operable means, the lost-motion between the bar and the manual means being taken up during actuation of the follower by the cam, thereafter lost-motion between the manual means and the cam allowing the manual means to drive the shunting bar into shunt circuit against the shunting contact.

13. A circuit breaker comprising a frame carrying a circuit contact, a snap-acting thermostatic member operating a mating circuit-closing contact for said circuit contact, a carrier for said thermostatic member movable for actuation toward and away from said circuit contact, the thermostatic member having two positions of stability due to its own inherent stresses, in one of which positions said contacts may be closed and in the other opened, said positions of stability being determined by temperature, said thermostatic member being movable from one position in which the contacts are closed to another in which they are opened, a follower on the carrier for bodily moving the thermostatic member, a cam movable with respect to the frame and cooperating with the follower and shaped so that upon one movement it drives the thermostatic member toward the circuit contact to bring together both of said contacts and to apply stress to said thermostatic member, the cam and the stressed thermostatic member cooperating to hold the thermostatic member in contact-closed position, means biasing the cam in the reverse direction tending to release the follower and permit its movement in a direction to withdraw the thermostatic member from contact closing position, biasing action automatically occurring when the stress is removed from the thermostatic member by snapping of it to its position of stability wherein the contacts are open.

JOHN D. BOLESKY.