Oct. 17, 1944. P. HUTT 2,360,682

CIRCUIT BREAKER

Filed May 15, 1943

Fig. 1.

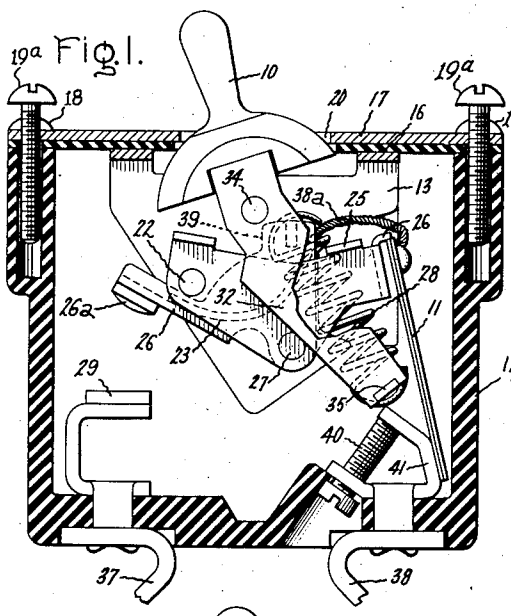


Fig. 2.

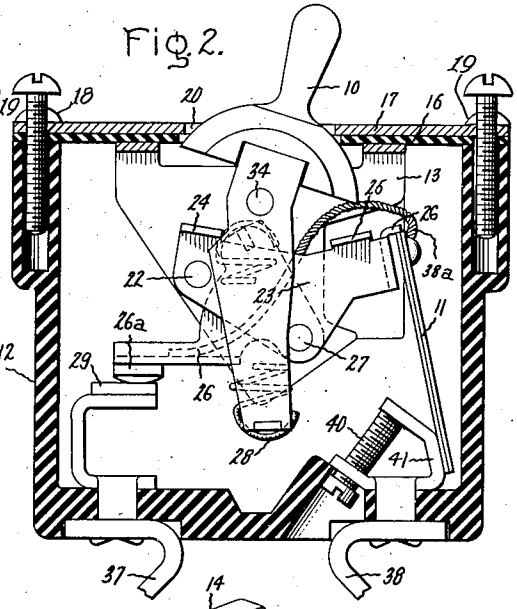


Fig. 3.

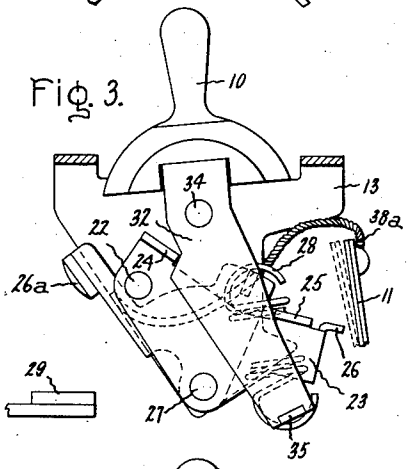


Fig. 4.

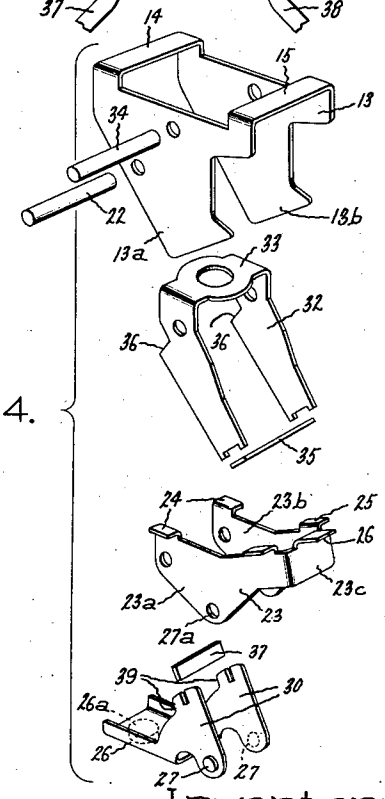
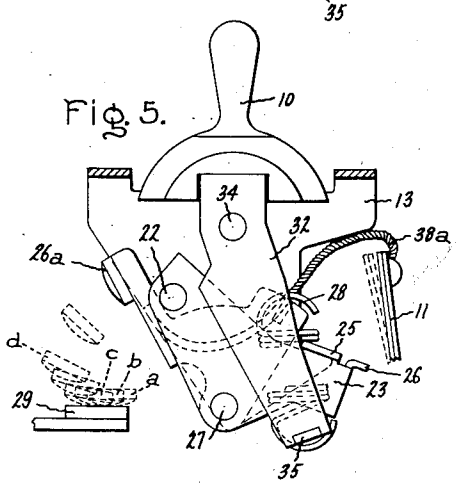


Fig. 5.



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CIRCUIT BREAKER

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Application May 15, 1943, Serial No. 487,104

6 Claims. (Cl. 200—116)

My invention relates to circuit breakers, more particularly to automatic circuit breakers of the thermal current responsive type, and has for its object a simple, reliable and inexpensive device of this type.

In carrying out my invention, I utilize a single helical over-center spring for operating the switch arm manually between its open and closed circuit positions, and also for moving the switch arm to its open circuit position in response to movement of the thermal current responsive device. In one form of my invention I provide a supporting member pivotally mounted at one end on a stationary pivot and having its other end normally secured by a bimetallic thermostat, together with a switch arm pivotally mounted on the supporting arm and extending along the supporting arm past the pivot of the supporting arm whereby when the thermostat releases the supporting arm, a wiping action is produced between the contacts before separation of the contacts. I also provide on the switch arm an extension to which one end of a helical over-center operating spring is secured, the other end of the spring being secured to a manually operated member, this spring extending substantially at right angles with the switch arm when the switch arm is in its closed circuit position.

For a more complete understanding of my invention, reference should be had to the accompanying drawing in which Fig. 1 is an elevation view with the enclosing casing in section of a thermal circuit breaker embodying my invention, and showing the circuit breaker in its open circuit position; Fig. 2 is a view similar to Fig. 1 but showing the circuit breaker in its closed circuit position; Fig. 3 is a view of the operating mechanism of Figs. 1 and 2 but showing it in the automatc current responsive open position; Fig. 4 is a view showing various parts of the mechanism in disassembled relation; while Fig. 5 is a view similar to Fig. 3 showing a modified form of my invention.

Referring to the drawing, I have shown my invention in one form as comprising an operating handle 10 by means of which the circuit breaker can be opened and closed manually and with a thermal temperature responsive device, shown as a bimetallic thermostat 11, for opening the circuit breaker in response to a predetermined heavy current through the circuit breaker.

As shown, I provide an enclosing casing 12 made of insulating material and a metal supporting framework 13 comprising two side pieces 13a and 13b which are fitted in shallow recesses formed for them in the side walls of the casing and at their upper ends are connected to each other by cross bars 14 and 15. The supporting framework 13, with the other parts heretofore described assembled thereon, is put in position in the casing, as shown in Figs. 1 and 2, then an insulating layer 16 is placed on top of the cross bars 14 and 15, the upper sides of which are flush with the opening of the casing, and then a metal enclosing sheet 17 is placed over the layer of insulating material and held in place by screws 18 and 19 fitting into tapered holes in the casing. Apertures 20 are provided in the sheets 16 and 17 for the handle 10 which projects outside of the casing.

It will be understood that a screw 18 or 19 is provided through each of the four corners of the layer 16 and sheet 17 so as to secure them firmly to the casing 12. For the purpose of securing the casing 12 and circuit breaker parts mounted in it to a support such as a panel, an additional central hole is provided at each end of the layer 16 and sheet 17 extending therethrough and registering with a hole in the casing. This hole in the metal sheet 17 is tapped to receive a screw 19a which, it is contemplated, will extend through the supporting part or panel, and into the corresponding hole in the casing provided for it.

The operating parts supported on the frame 13 comprise a supporting arm 23 having its left-hand end mounted on the stationary pivot pin 22 secured to the frame. As shown in Fig. 4, this supporting arm 23, in fact, consists of two arms 23a and 23b in parallel relation with each other and connected rigidly together at their right-hand ends by a cross member 23c. This arm 23 is positioned between the sides 13a and 13b of the frame. It is provided with lugs 24 at its left-hand end turned outwardly and fitting loosely between the sides of the frame while at its right-hand end similar lugs 25 are provided. Also, a latch lug 26 is provided on its right-hand end which normally, as seen in Figs. 1 and 2, rests on the upper end of the bimetallic thermostat whereby the supporting arm is held in the position shown.

A switch arm 26, also comprising two parallel parts, as will be understood from Fig. 4, is mounted on a pivot 27 on the supporting arm at a point intermediate the length of the supporting arm and on the lower side of the supporting arm as seen in the drawing. This switch arm fits loosely between the sides of the supporting arm so as to be freely operable about the pivot 27. Also, to provide for movement of the helical tension oper-

ating spring 28, the pivot pin 27 does not extend across the two parts of the supporting arm. This pin 27, in fact, consists of two external short pins projecting from the outer sides of the switch arm into holes 27a provided for them in the supporting arm. Thus, these short pivot projections 27 define a pivot parallel with the pivot pin 22. A movable contact 26a on the end of the switch arm is movable about the pivot 27 into engagement with a stationary contact 29 adjacent the pivot 22 of the supporting arm.

It will be noted in Fig. 2 that the supporting arm 23 extends away from the stationary contact 29 and the switch arm 26 when in its closed circuit as well as open circuit position, as shown in Fig. 2, is substantially parallel with a line drawn through the center of the pivot pin 22 and the upper end of the thermostat 11, and extends along the supporting arm past the pivot 22 in substantially parallel relation with the supporting arm. Furthermore, in this closed circuit position, the switch arm is substantially at right angles with the helical operating spring 28.

Also provided on the switch arm to form an attachment for the upper end of the spring 28 is a pair of parallel projections 30, clearly shown in Fig. 4, extending laterally upward at an acute angle with respect to the switch arm itself and across the supporting arm. At the upper ends these projections have each a slot in which fits a cross pin 31. The upper end of the spring 28 is secured to this cross pin and the spring extends between the two parallel parts of the switch arm, i. e., between the projections 30 and also between the two pivots 27 during portions of its movement. These two projections form together an operating extension or projection on the switch arm.

At its lower end the spring 28 is secured to an operating member or lever 32 which is movable by the handle 10 to move the lower end of the spring from one side to the other of the pivot 27 and thereby operate the switch arm between its open and closed circuit positions. This operating lever 32 also, as shown in Fig. 4, is provided with two parallel links rigidly connected together by a cross portion 33 at their upper ends. The handle 10 is suitably secured to this cross portion 33. These parallel portions fit loosely just inside the plates of the supporting frame 13 and embrace the parallel sides 23a and 23b of the supporting arm. It is pivotally mounted near its upper end on a pivot pin 34 mounted on the frame 13 and parallel with the pin 22. At its lower end the operating lever has a cross member 35 to which the lower end of the spring is connected. It will be understood that this cross member is suitably secured, as by welding or brazing, to the two arms of the operating lever 32, and the cross bar 31 is likewise suitably secured in place on the extension 30 of the switch arm. Thus the extensions 30 form an operating member which is pivoted on the pivot 27 and has secured to it the switch arm 26.

In the operation of the device when it is in its open circuit position, as shown in Fig. 1, the switch arm 26 is held in engagement with the pivot pin 22 by the spring 28, the center line or line of force of the spring then being to the right of the pivot 27. Also, in this position the spring applies a counterclockwise force to the operating lever 32, moving it to its extreme counterclockwise position defined by the projections 25 with which it is in engagement.

To close the switch the handle 10 is moved toward the right, or clockwise, thereby to carry the lower end of the spring 28 toward the left until, when the center line or line of force of the spring moves to the left of the center of the pivot 27, the spring reverses its bias on the switch arm and moves the switch arm counterclockwise to the closed circuit position, as shown in Fig. 2. In this position the projections 36 on the operating lever engage the projections 24 thereby to limit the clockwise movement of the operating lever. The spring now applies a tension force on the switch arm 26 tending to move it counterclockwise about the pivot 27 and holding the movable contact in engagement with the stationary contact. Also, at this time the spring, in pulling downward on the cross bar 37, applies a downwardly directed force to the pivot 27, which force tends to move the supporting lever 23 in a clockwise direction about its pivot 22 although, as shown in Fig. 2, the supporting lever is held by the thermostat 11.

The electric circuit through the circuit breaker may now be traced from the external connector 37 to the stationary contact 29, and thence through the switch arm 26 and through a flexible conductor 38a to the upper end of the thermostat 11, and thence through the thermostat to the external terminal 38. As shown the flexible conductor extends between the projections 30 and between the upper end of the spring 28 and the cross pin 31. Its ends are suitably secured as by welding to the switch arm and to the thermostat near the upper end of the thermostat.

As the thermostat is heated by the current passing through it, it flexes thereby to cause its upper end to move toward the right, as seen in Fig. 2. Upon the occurrence of a current greater than a predetermined current, the upper end of the thermostat moves far enough toward the right to release the supporting arm whereupon the spring snaps the parts to the automatic current responsive open position shown in Fig. 3.

At the beginning of the opening movement the supporting arm swings about the pivot 22, and the lugs 24 on the supporting arm in engagement with the projections 36 on the operating arm move the operating arm counterclockwise about its pivot 34. In other words, the pivot 27 is moving toward the left which carries the switch arm substantially bodily toward the left and also brings the pivot 27 nearer the center line of the spring, while the spring itself is moving in an opposite direction to meet the pivot 27. The movable contact 26a is thereby caused to slide or wipe over the stationary contact, as shown in dotted lines in Fig. 5, from the position *a* through the position *b* approximately to the position *c*. Also during this preliminary movement the switch arm moves counterclockwise about its pin 27 with relation to the supporting arm. Just before the projections 33 on the switch arm engage the pivot pin 22, the pivot 27 moves across the center end of the spring to its left-hand side whereupon the spring snaps the switch arm to its full open position about the pivot 27. It will be observed that this opening movement of the switch arm is in a clockwise direction with respect to the supporting arm. The parts come to rest with the switch arm in engagement with the pin 22 and the operating lever 32 in a central position in engagement with the stops 25 on the supporting arm, as seen in Fig. 3.

For reclosure of the circuit breaker, the handle may be moved in either direction. If moved toward the left at its upper end, i. e., counterclock-

wise, then its lower end by engagement with the projections 25 lifts the supporting arm upward to the position of Fig. 1 ready to be held by the thermostat when the thermostat has cooled sufficiently and moved back in position to hold it. Then the circuit breaker can be closed by moving the handle toward the right, as previously described.

Also, the supporting arm can be reset by moving the handle toward the right, i. e., clockwise from the position shown in Fig. 3, whereby the projections 36 by engagement with the projections 24 move the supporting arm to its normal position. This at the same time, however, snaps the switch arm to its closed circuit position, the parts finally arriving in the positions shown in Fig. 2. These projections 24 are provided primarily for the purpose of making the device non-trip-free. That is, by holding the handle in its extreme right-hand position as shown in Fig. 2, the supporting arm may be held in its normal position even though the thermostat releases it and the circuit breaker may be prevented from opening automatically.

The lugs 24 are omitted entirely to obtain a trip-free circuit breaker, as shown in Fig. 5. This changes somewhat the automatic opening operation.

During this automatic opening movement of the form of Fig. 5 the pivot 27 of the switch arm moves clockwise around the pivot 22, and during the beginning of the movement therefore causes a sliding movement of the movable contact on the stationary contact, the movable contact moving toward the left, as shown in dotted lines in Fig. 5 as previously described. The movable contact thus slides (Fig. 5) directly from the dotted position *a* through dotted position *b* to the dotted position *c*. At this point projections 39 on the extensions 30 of the switch arm engage the pivot pin 22 and the contact arm is swung in a fixed relation with the supporting arm about the pivot 22 and thereby the switch arm is lifted to separate the contacts whereby the movable contact is moved to the position *d*, shown in dotted lines in Fig. 5. However, just before the movable contact reaches the position *d* the pivot 27 moves across the center line of the spring to the left of the center line whereby the spring applies a force to the contact arm tending to move it clockwise about the pivot 27. This effects additional movement of the contact arm about the pivot 27 to its full automatic open position in engagement with the pin 22. Also, the spring applies a counterclockwise bias to the operating handle and arm 32 whereby the handle is moved to a mid position, as shown in Fig. 3, to indicate the automatic open position. The parts come to rest with the spring pulling the operating lever 32 into engagement with the projections 25 on the supporting arm.

Current responsive adjustment of the end of the thermostat is made by means of a screw 40 whereby the support 41 for the lower end of the thermostat may be bent to give the desired adjustment of the thermostat.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A circuit breaker comprising a stationary contact, a supporting arm mounted on a stationary pivot, current responsive means normally securing said supporting arm, a switch arm having one end pivotally mounted on said supporting arm, a movable contact on the other end of said switch arm, an operating arm mounted on a stationary pivot, a spring connected to said switch arm and to said operating arm, means for moving said operating arm on its stationary pivot thereby to move the line of force of said spring from one side to the other of said switch arm pivot for operation of said switch arm between open and closed circuit positions, and means whereby when said current responsive means releases said supporting arm said switch arm moves pivotally in one direction relative to said supporting arm to effect a sliding action of said movable contact on said stationary contact and when said switch arm pivot moves to the other side of the line of force of said spring said switch arm is snapped pivotally in the opposite direction relative to said supporting arm to its open circuit position.

2. A circuit breaker comprising a stationary contact, a supporting arm mounted at one end on a stationary pivot, current responsive means normally securing the other end of said supporting arm, a switch arm having one end pivotally mounted on said supporting arm at a point intermediate the length of said supporting arm and extending past said stationary pivot, a movable contact on the other end of said switch arm, an operating extension on said switch arm extending laterally with respect to said switch arm across said supporting arm, an operating arm mounted on a stationary pivot adjacent the end of said operating extension and extending across said supporting arm to the opposite side of said switch arm pivot, a helical tension spring having its ends connected to the end of said extension and to the end of said operating arm, means for moving said operating arm on its stationary pivot thereby to move said spring from one side to the other of said switch arm pivot for operation of said switch arm between open and closed circuit positions, and means whereby when said current responsive means releases said supporting arm said switch arm moves pivotally in one direction relative to said supporting arm to effect a sliding action of said movable contact on said stationary contact and when said switch arm pivot moves to the other side of said spring said switch arm is snapped pivotally in the opposite direction relative to said supporting arm to its open circuit position.

3. A thermal circuit breaker comprising a stationary contact, a supporting arm mounted at one end on a stationary pivot, a bimetallic thermostat normally securing the other end of said arm, a switch arm having one end pivotally mounted on said supporting arm at a point intermediate the length of said supporting arm and extending past said stationary pivot, said switch arm being arranged to engage said stationary contact, an operating extension on said switch arm extending laterally with respect to said switch arm across said supporting arm, an operating arm mounted on a stationary pivot adjacent the end of said extension and extending across said supporting arm to the opposite side of said switch arm pivot, a helical tension spring having its ends connected to the end of said extension and to the end of said operating arm, and means for moving said operating arm on

its stationary pivot thereby to move said spring from one side to the other of said switch arm pivot for operation of said switch arm between open and closed circuit positions, said spring when said switch arm is in its closed circuit position applying a force to said switch arm in a closed circuit direction, which force is also applied to said supporting arm on said switch arm pivot so that when said supporting arm is released by said thermostat said spring moves said supporting arm about its stationary pivot and effects relative pivotal movement of said contact arm with relation to said supporting arm in one direction thereby to cause said contact arm to slide on said stationary contact while being maintained in engagement with said stationary contact during such preliminary sliding movement and thereafter said switch arm pivot moves to the opposite side of said spring so that said spring then snaps said switch arm about its pivot in an opposite direction with relation to said supporting arm to its full open position.

4. A thermal circuit breaker comprising a stationary contact, a supporting arm mounted at one end on a stationary pivot, a bimetallic thermostat normally securing the other end of said arm, a switch arm having one end pivotally mounted on said supporting arm at a point intermediate the length of said supporting arm and extending past said stationary pivot, said switch arm being arranged to engage said stationary contact, an operating extension on said switch arm extending laterally with respect to said switch arm across said supporting arm, an operating arm mounted on a stationary pivot adjacent the end of said extension and extending across said supporting arm to the opposite side of said switch arm pivot, a helical tension spring having its ends connected to the end of said extension and to the end of said operating arm, and means for moving said operating arm on its stationary pivot thereby to move said spring from one side to the other of said switch arm pivot for operation of said switch arm between open and closed circuit positions, said spring when said switch arm is in its closed circuit position applying force to said switch arm in a closed circuit direction, which force also is applied to said supporting arm on said switch arm pivot so that when said supporting arm is released by said thermostat said spring moves said supporting arm about its stationary pivot and effects pivotal movement of said contact arm with relation to said supporting arm in one direction thereby to cause said contact arm to slide on said stationary contact while being maintained in engagement with said stationary contact during such preliminary sliding movement, and projection means on said extension engaging said supporting arm stationary pivot after a predetermined amount of said pivotal movement of said switch arm relative to said supporting arm whereupon said switch arm is moved by said spring with said supporting arm toward an open circuit position and said switch arm pivot moves to the opposite side of said spring so that said spring then snaps said switch arm about its pivot in an opposite direction with relation to said supporting arm to its full open position into engagement with said supporting arm pivot.

5. A circuit breaker comprising a supporting arm mounted at one end on a stationary pivot, current responsive means normally engaging said supporting arm thereby to secure said supporting arm against movement on said pivot, a stationary contact mounted adjacent said stationary pivot and spaced with respect to said pivot in a direction transverse of the length of said supporting arm, a switch arm having one end pivotally mounted on said supporting arm at a point on a first side of said supporting arm adjacent said stationary contact, said switch arm being arranged to engage said stationary contact, an operating extension on said switch arm extending laterally with respect to said switch arm across said supporting arm, an operating arm mounted on a stationary pivot and extending across said supporting arm to said first side of said supporting arm, a spring having its ends connected to the end of said extension and to the end of said operating arm whereby when said operating arm is in one position, said spring applies a force to said switch arm to hold it in engagement with said stationary contact and when said operating arm is moved to move said spring to the opposite side of the pivot of said switch arm, said switch arm is moved to an open circuit position, said operating extension being arranged when said supporting arm is released by said thermostat to engage said stationary pivot after a predetermined relative movement of said switch arm by said spring with respect to said supporting arm after which said switch arm is moved with said supporting arm.

6. A circuit breaker comprising a supporting arm mounted at one end on a stationary pivot, a bimetallic thermostat normally securing the other end of said arm, a stationary contact mounted adjacent said stationary pivot and spaced with respect to said pivot in a direction transverse of the length of said supporting arm, a switch arm having one end pivotally mounted on said supporting arm at a point intermediate the length of said supporting arm and on the side of said supporting arm adjacent said stationary contact, said switch arm extending in substantially parallel relation with said supporting arm and being arranged to engage said stationary contact, an operating extension on said switch arm extending laterally with respect to said switch arm across said supporting arm to the side of said supporting arm opposite said stationary contact, an operating arm mounted on a stationary pivot adjacent the end of said extension and extending across said supporting arm to the opposite side of said supporting arm, a spring having its ends connected to the end of said extension and to the end of said operating arm whereby when said operating arm is in one position, said spring applies a force to said switch arm to hold it in engagement with said stationary contact and when said operating arm is moved to move said spring to the opposite side of the pivot of said switch arm, said switch arm is moved to an open circuit position into engagement with said stationary pivot of said supporting arm, said operating extension being arranged when said supporting arm is released by said thermostat to engage said stationary pivot after a predetermined relative movement of said switch arm by said spring in one direction with respect to said supporting arm after which said switch arm is moved by said spring in the opposite direction with respect to said supporting arm to its open circuit position in engagement with said stationary pivot.

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