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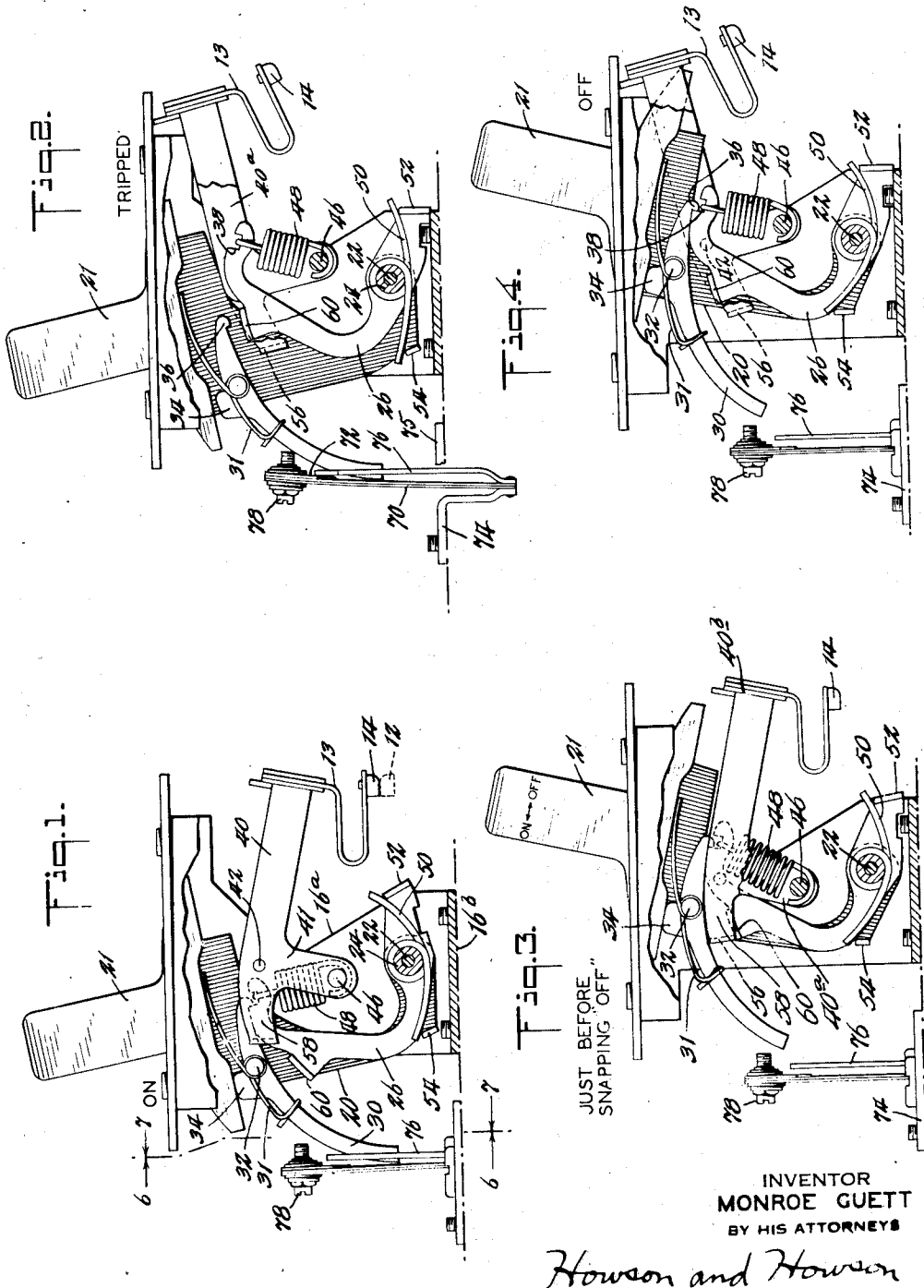
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AUTOMATIC CIRCUIT BREAKER

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AUTOMATIC CIRCUIT BREAKER

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17 Claims. (Cl. 200—116)

This invention relates to circuit breakers which may be actuated manually at any time, or actuated automatically upon the occurrence of predetermined current conditions in the circuit which the circuit breaker controls.

It is an object of my invention to make a circuit breaker of the above type which is reliable and quick in operation and in which the current responsive device is not under stress.

Another object is to make a circuit breaker of the above type in which the setting for tripping the circuit breaker may be accurately maintained.

Another object is to cut manufacturing costs of a circuit breaker of the above type without the sacrifice of quality or reliability of operation of the device.

Another object is to make a circuit breaker which can be manufactured mainly from stamped metal parts.

Another object is to provide protective means for current responsive devices which are used to bring about the breaking of a circuit.

Another object is to provide a current responsive device for circuit breakers which is protected against overheating upon the occurrence of an excess current.

Another object is to provide a current responsive device for automatic circuit breakers which device is provided with a shunt to carry the excess current as soon as the device has responded to the excess current sufficiently to trip the circuit breaker.

Other objects and advantages of my invention will become apparent as it is described in connection with the accompanying drawings.

In the drawings:—

Figure 1 is a side elevation view with part of the switch frame broken away to show the position of the parts when the circuit breaker is closing the circuit.

Figure 2 is a view similar to Figure 1 but showing the parts of the circuit breaker just after the breaker has been tripped.

Figure 3 is a view similar to Figure 1 but showing the parts in the position they take just before the breaker has been manually snapped to circuit breaking position.

Figure 4 is a view similar to Figure 1 but showing the parts of the device in circuit breaking position.

Figure 5 is a side elevation view of my new circuit breaker.

Figure 6 is an end elevation looking into the left end of the switch as shown in Figure 1 but with

the thermally responsive mechanism and its guard removed.

Figure 7 is an end elevation of the thermally responsive mechanism and guard, which were removed for the purpose of making Figure 6.

This invention is an improvement of the invention described in my application Serial No. 500,352 filed December 5th, 1930, patented May 30, 1933, No. 1,911,893.

Referring to the drawings the circuit breaker may be conveniently mounted upon a base 10 of insulating material having a pair of spaced stationary contacts 12 at one end which are adapted to be bridged by a movable bridging member 13 which carries contacts 14 to engage with the contacts 12. It is often desirable to mount the contacts 12 resiliently to offset uneven wearing away of the contacts due to friction or the action of an electric arc as the device becomes worn.

The moving parts of the circuit breaking mechanism and the frame of the circuit breaker, whose functions and operations are about to be described may (except for the springs) be made from sheet material, preferably metal, and given the desired or necessary shape and form by bending and stamping operations. The irregular shape of the parts may best be understood by reference to the drawings.

The moving parts of the circuit breaking mechanism are mounted between the legs 16a of a frame 16, formed of a metal plate bent in U-form, the base portion 16b of the frame being secured to the insulating base 10 by screws. A manually movable member 20 provided with an insulating handle 21 is pivotally mounted upon a pivot pin 22 which is located slightly above the base portion 16b of the frame and parallel to said base portion. This manually movable member 20 is held approximately midway between the legs 16a of the frame 16 by means of collars 24 upon the pivot pin 22. Also pivotally mounted upon the pivot pin 22 is an approximately C-shaped member 26 which is automatically moved upon tripping of the circuit breaker as will hereinafter be described. This member 26 lies next to the manually movable member 20 and is held against movement axially of the pin 22 by the collars 24.

Two factors contribute to compel the member 26 to move with the manually movable member under normal conditions, that is to say during manual operation of the circuit breaker. One factor is an arcuate latching member 30 which is mounted upon a pivot pin 32 located in the upper portion of the manually movable member 20 and passing through the center portion of the latch-

ing member. The latching member 30 as viewed in Figures 1 to 4 is normally urged clockwise by means of a wire spring 31 looped about the pivot pin 32 and engaging respectively with the handle 21 and the latching member 30. Upon the latching member 30 there is a nub 34 which engages with the handle 21 to prevent overthrow of the latching member by the spring 31. The latching member is provided with a hooked nose 36 which engages with a complementary shoulder 38 on the upper or free end of member 26 and causes the member 26 to move with the manually movable member 20 as the member 20 is moved from "off" position as shown in Figure 4 to "on" position as shown in Figure 1.

The second factor, which causes the member 26 to move with member 20 is a stiff wire spring 50 coiled about one of the collars 24 and having its opposite ends engaging, respectively, an out-turned lug 52 at the lower extremity of the member 26 on one side of the pivot 22, and an int-turned lug 54 on the lower part of the shank of the member 20 and on the opposite side of the spindle 22 from lug 52. When the handle 21 moves member 20 from "on" position to "off" position the lug 54 causes winding up of the spring 50 and transmission of its power to lug 52 thus causing the member 26 to move with member 20. The spring 50 and member 26 perform additional and different functions during operation of the switch automatically, as hereinafter appears.

The movable bridging contact 13 is carried by a carrier member 40 which is pivotally mounted upon a pair of fixedly located coaxial pins 42 which pass through the legs 16a of the frame 16 and through side arms 40a of the carrier. The movable contact is secured, in insulated relation, to the cross bar 40b of the carrier. The carrier's side arms each have an extension 41 projecting at right angles to the arms in the direction of the base of the frame 16. By these extensions 41 the side arms of the carrier become, substantially, bell crank levers. In order that these extensions 41 will have plenty of room to pivot about the pins 42, the pins 42 are located in the frame legs 16b well above the pin 22.

Through the ends of the extensions 41 and connecting them a pin 46 passes, and around it is anchored one end of a coil spring 48 whose function is to move the carrier with a snap action when its other end is moved through dead center position as hereinafter described. Said other end of the spring is looped about the upper or free end of the member 26, adjacent the shoulder 38. This spring 48 may be considered as a primary spring means since it is responsible for the snap movement of the movable contacts on actuation of the switch either automatically or manually.

From the foregoing it may now be observed that as the manually movable member 20 is pivoted about pin 22 from the position shown in Figure 1 to the position shown in Figure 4, the spring 48 is carried past an imaginary line between the pin 46 and the pivot pins 42. When the spring reaches this imaginary line it is stressed and tends to rotate the extensions 41 about the pin 42 causing the movable bridging contact 13 to be moved away from the fixed contacts 12 to open the circuit. The principle involved in the action just described is well known in the electric switch art and hence the manual operation of this device need not be further described. In order to hold the movable contact in contact with the fixed contacts 12 until the spring 48 is stressed to a maximum, an int-turned lug 56 is provided

upon a longitudinal extension 58 on one of the side arms 40a of the carrier 40. This lug engages with a complementary lug 60 which is turned out from the member 26. As the manually movable member is moved from the position shown in Figure 1 to that shown in Figure 4 the lug 60 on the member 26 slides beneath and rubs against the edge of the lug 56 upon the carrier 40 and prevents movement of the carrier until the lug 60 passes from under the lug 56 on the carrier 40. The position of the parts just before the lug 60 passes from under the lug 56 is shown in Figure 3. When the circuit breaker is in this condition the spring 48 is well stressed and the handle is almost in "off" position, only a slight further movement toward "off" position being necessary to release the carrier for snap action to circuit breaking position as shown in Figure 4.

Just the opposite action takes place when the switch is moved from open to closed circuit position, i. e. from position of Figure 4 to the position of Figure 1. In that operation the lug 60 slides over the upper surface of the lug 56 and holds the carrier 40 stationary until the handle 21 is near the end of its travel from right to left (see Figure 4), and then suddenly releases the carrier so that the spring 48, (by that time in highly stressed condition) can move the carrier 40 and bridging contact 13 into closed circuit position (see Figure 1) with a snap.

In order that the switch may be operated automatically when an overload occurs in the circuit, I have provided a bimetallic device which responds to predetermined current conditions in the circuit by bending and engaging with the latching member 30. This bimetallic device comprises a pair of parallel bimetallic strips 70 which are connected at their tops by an integral bridge which is supplemented by a conducting plate 72 of high conductivity such for example as copper. To the lower ends of the bimetallic strips are riveted or otherwise secured terminal members 74, 75 and substantially rigid bars 76 of low resistance which run parallel to the bimetallic strips, but out of contact therewith. These bars 76 extend up to the upper end of the bimetallic strips opposite the plate 72 and terminate there. Upon an excess current passing through the bimetallic strips they are bent by the heat of such current until the conducting plate 72 engages, as shown in Figure 2, with the bars which serve to shunt the current around the bimetallic element, thus relieving it of the excess current burden and further effort to distort.

Passing through the free end of the bimetallic element is an adjusting bolt 78 which engages with the latching lever 30 when the bimetallic element is bent to a predetermined degree as shown in Figure 2. This bolt makes possible setting of the breaker to trip on different degrees of overload. When the bimetallic element is bent as shown in Figure 2, the latching lever 30 is caused to pivot about the pin 32 disengaging the shoulder 36 from the shoulder 38. Then spring 50, which is normally restrained by latching member 30, is free to act and carries the upper end of the member 26, in clockwise direction, as shown in Figure 1, about pivot pin 22 thus carrying spring 48 through dead center position. As soon as this movement has proceeded far enough to move the lug 60 on member 26 from under lug 58 on the carrier, then the action of spring 48 will be exerted on the carrier to cause disengagement of the switch contacts.

It will thus be seen that the spring 50 is in es-

sence a secondary spring means since it is active only upon tripping of the circuit breaker and then only to cause the primary spring 48 to cause the actual contact movement.

5 To reset the switch the handle must be moved to "off" position permitting the latch member 30 to engage with the member 26 again. Then the switch is ready for manual operation once more. It will be observed that in case the conditions in the circuit which impose the excess current have not changed that the current responsive device will again move the latching member 30 and trip the switch. It is impossible to hold the circuit breaker in the "on" position by means of holding the handle in "on" position, for the reason that the tripping of the circuit breaker is independent of the handle.

It will be observed that the circuit breaker could be tripped by electromagnetic means or any other current responsive device, as well as by the thermal device shown and that this thermal device may be used in connection with other circuit breakers. Obviously many changes and modifications may be made within the scope of my invention and therefore I do not limit the invention to the specific embodiment shown in the drawings.

I claim:

1. An electric switch comprising fixed and movable contacts, manually operable means to move said movable contact, a carrier for said movable contact, primary spring means actuatable by said manually operable means to move said carrier with a snap, and secondary spring means releasable upon overload to move said primary spring means and thereby cause said primary spring means to move said movable contact, and a latching member normally restraining said secondary spring means, in combination with a pair of bimetallic current carrying members electrically connected at one end, a pair of low resistance bars connected to the other ends of said bimetallic members, conducting means adapted to engage said bars, when said bimetallic members move to trip said latch, to shunt the current around said bimetallic members.

2. An electric switch comprising fixed and movable contacts, manually operable means to move said movable contact, a carrier for said movable contact, primary spring means actuatable by said manually operable means to move said carrier with a snap, and secondary spring means released for operation upon overload to move said primary spring means and thereby cause said primary spring means to move said movable contact.

3. An electric switch comprising fixed and movable contacts, manually operable means to move said movable contact, movable contact carrying means pivotally mounted about a fixed axis, primary spring means actuatable by said manually operable means to move said carrier with a snap, and secondary spring means released for operation upon overload to move said primary spring means and thereby cause said primary spring means to move said movable contact.

4. An electric switch comprising fixed and movable contacts, manually operable means to move said movable contact, a carrier for said movable contact, primary spring means actuatable by said manually operable means to move said carrier with a snap, and spring pressed auxiliary means for moving said primary spring means and said carrier, said auxiliary means being normally restrained but releasable upon overload.

5. An electric switch comprising fixed and movable contacts, manually operable means to move said movable contact, a carrier for said movable contact, primary spring means actuatable by said manually operable means to move said carrier with a snap, and spring pressed auxiliary means for moving said primary spring means and said carrier, said auxiliary means being pivotally mounted about a fixed axis and being normally restrained but releasable upon overload.

6. An electric switch comprising fixed and movable contacts, manually operable means to move said movable contact, a carrier for said movable contact, primary spring means actuatable by said manually operable means to move said carrier with a snap, and spring pressed auxiliary means for moving said primary spring means and said carrier, said auxiliary means being normally restrained but releasable upon overload, and said manually operable means and said auxiliary means being pivotally mounted about the same fixed axis.

7. An electric switch comprising fixed and movable contacts, manually operable means to move said movable contact, movable contact carrying means pivotally mounted about a fixed axis, primary spring means actuatable by said manually operable means to move said movable-contact-carrying means with a snap, and a spring-pressed auxiliary means for moving said primary spring means and said movable-contact-carrying means, and said manually operable means and said auxiliary means being pivotally mounted about the same fixed axis.

8. An electric switch comprising fixed and movable contacts, movable-contact-carrying means, spring means, manually movable means, spring-pressed means pivoted about a fixed axis and normally movable with said manually movable means to carry said spring means through dead center position to actuate said movable contact with a snap, said spring-pressed means being released upon overload to carry said spring means through dead center position independent of said manually movable means.

9. An electric switch comprising fixed and movable contacts, movable-contact-carrying means, spring means, manually movable means, spring-pressed means pivoted about a fixed axis and normally movable with said manually movable means to carry said spring means through dead center position to actuate said movable contact with a snap, said spring-pressed means being released upon overload to carry said spring means through dead center position independent of said manually movable means, said spring-pressed means and said manually movable means being pivotally mounted about the same fixed axis.

10. An electric switch comprising fixed and movable contacts, movable - contact - carrying means, spring means, manually movable means, spring-pressed means pivoted about a fixed axis, and normally movable with said normally movable means to carry said spring means through dead center position to actuate said movable contact with a snap, a latch normally holding said spring-pressed means for movement with said manually movable means, means to trip said latch upon overload to release said spring-pressed means, said spring-pressed means upon release, carrying said spring means through dead center position to actuate said movable contacts.

11. An electric switch comprising fixed and movable contacts, a manually movable member pivoted about a fixed axis, an auxiliary member

also pivoted about said axis and normally movable with said manually movable member, a carrier for said movable contacts, primary spring means movable through a dead center position to actuate said movable contact with a snap, secondary spring means urging said auxiliary member in one direction, said secondary spring means being normally restrained but being released upon overload causing said auxiliary member to carry said primary spring means through dead center position.

12. A current responsive device comprising a plurality of low resistance metallic bars, bimetallic current carrying members secured to one end of said bars, conducting means bridging the other ends of said members, adapted to engage said bars when said members are distorted by heat of an excess current.

13. A current responsive device comprising a pair of parallel bimetallic current carrying members, conducting means bridging said members at one end, a pair of low resistance bars secured to the other ends of said members and extending alongside of them, said conducting means being adapted to engage said bars, when said members are distorted by heat, to shunt current around said members.

14. In an electric switch, a manually movable member, a switching member, spring means movable through dead center by said manually movable member to cause movement of said switching member with a snap, and means engaging during a portion of the movement of said manual

member to prevent snapping of said switching member until said spring is well past dead center.

15. In an electric switch, a manually movable member, a switching member, spring means movable through dead center by said manually movable member to cause movement of said switching member with a snap, and means engaging prior to said spring means coming into dead center position and continuing for a substantial portion of the movement thereafter but finally releasing said switching member for snapping movement.

16. In an electric switch, a pivotally mounted manually movable member, a pivoted switching member, spring means movable through dead center by said manually movable member to cause movement of said switching member with a snap, and means engaging during a portion of the movement of said manual member to prevent snapping of said switching member until said spring is well past dead center.

17. In an electric switch, a manually movable member, a switching member, spring means movable through dead center by said manually movable member to cause movement of said switching member with a snap, and means on said manually movable member cooperating with means on said switching member to hold said switching member against movement as said spring is moved through dead center position and for a substantial movement thereafter but finally releasing said switching member for snapping movement.

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