March 26, 1940. H. S. GANO 2,195,004

CIRCUIT BREAKER

Filed Oct. 1, 1936

Fig. 1.

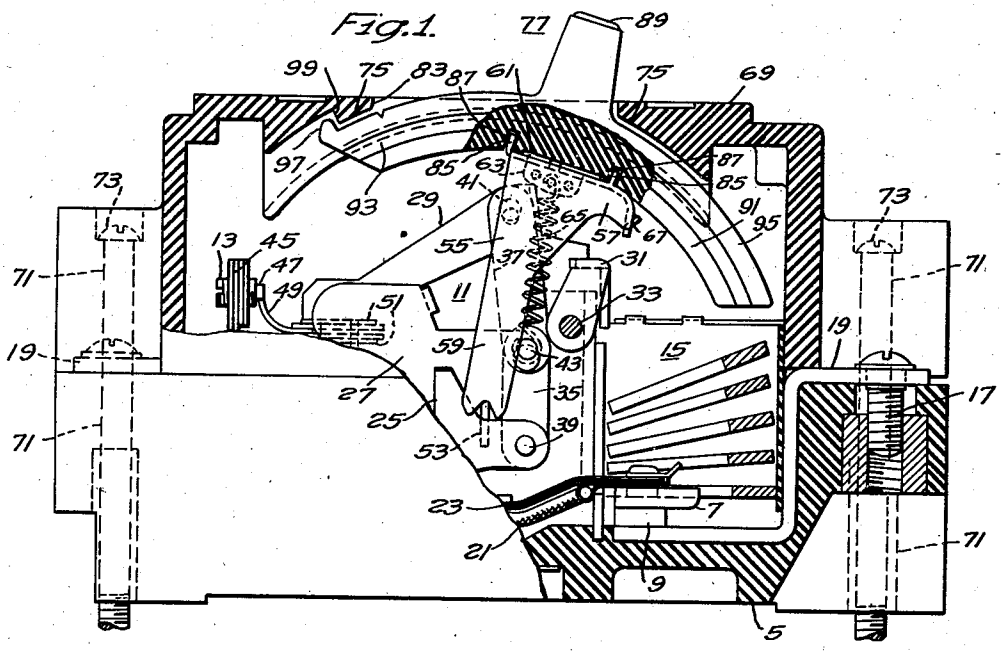


Fig. 3.

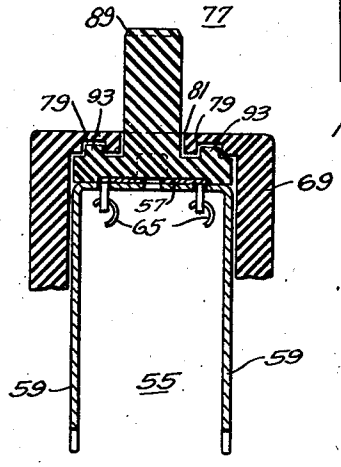
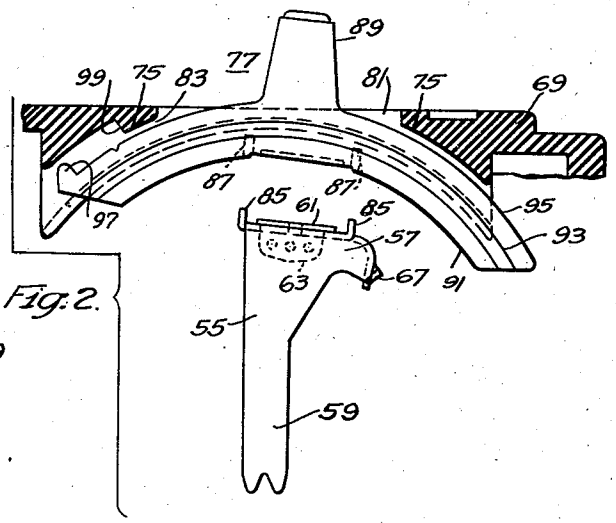


Fig. 2.



WITNESSES:

E. A. McCloskey.

Y. S. Parker

INVENTOR

Harlan S. Gano.

BY

Ralph H. Swingle

ATTORNEY

Patented Mar. 26, 1940 2,195,004

UNITED STATES PATENT OFFICE

2,195,004

CIRCUIT BREAKER

Harlan S. Gano, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application October 1, 1936, Serial No. 103,501

14 Claims. (Cl. 200—168)

My invention relates to circuit controlling apparatus in general, and more particularly to snap-acting circuit breaker structures for use in controlling lighting, industrial and distribution feeder circuits.

In the application of circuit breakers to such uses, they are often called upon to interrupt highly inductive load circuits or circuits on which a high magnitude overload or short-circuit condition exists. In such cases the flame and hot gases formed incident to the separation of the contacts are often blown out with considerable force through the opening provided in the casing for the operating handle by reason of the gas pressure developed within the casing. This condition is highly objectionable for obvious reasons.

It is accordingly an object of my invention to provide a means for preventing the exit of hot gases through the opening formed in the casing or cover of the breaker for the passage of the operating handle.

Another object of my invention is to provide a circuit breaker with an improved form of removable handle and mounting therefor together with a cooperating casing or cover structure, so constructed that the handle acts in the manner of a valve to seal the opening in the casing or cover against the passage of flame or hot gases therethrough.

Another object of my invention is to provide an improved form of operating handle and manner of removably mounting the same on the operating lever of a circuit controlling device without necessitating the use of screws or other similar forms of fastening means; and in which the handle acts as a sealing means to prevent the exit of flame or hot gases through the opening provided in the casing or cover of the device for the handle.

Another object of my invention is to provide an improved operating handle for a circuit controlling device and manner of coupling the same to the operating mechanism of the device in such a manner that if an exposed portion of the handle breaks off no metal part which is at line potential will be exposed.

In the application of circuit breakers to industrial or distribution system, the person on duty, in order to relieve himself of the work of resetting the breakers after they have opened in response to transient overloads, or for other reasons, will often insert a hairpin, tool or other object between the edge of the handle opening and the handle in an attempt to bend or hook the trip element and hold it so that it will no longer be capable of responding to overloads to open the contact of the breaker; or he will attempt to tamper in some way with the internal mechanism of the circuit breaker. In either case, damage to the breaker itself or to the equipment that it protests is apt to occur.

It is therefore a further object of my invention to provide a circuit breaker with a means for preventing the insertion of a tool or other object in the casing through the opening provided for the operating handle.

Another object of my invention is to provide an improved handle construction and cooperating casing or cover structure for preventing the insertion of a tool or other object in the casing through the opening for the operating handle.

The novel features that I consider characteristic of my invention are set forth in particular in the appended claims. The invention itself, however, both as to structure and operation, together with additional objects and advantages thereof, will best be understood from the following detailed description of a specific embodiment thereof when read in connection with the accompanying drawing, in which

Figure 1 is a side view, partly in elevation and partly in section, of a circuit breaker embodying the features of my invention.

Fig. 2 is a view showing a portion of the cover of the circuit breaker in cross-section, together with the operating handle and lever in elevation to illustrate the mounting or assembly of parts, and

Fig. 3 is a vertical sectional view of a portion of the cover, together with the operating handle and lever in assembled relation to illustrate certain features of my invention.

The invention has been shown in connection with a specific form of circuit breaker structure for illustrative purposes. It will readily be apparent as the description proceeds, however, that the invention is equally applicable to other forms of circuit controlling devices.

Referring to the drawing, the circuit breaker base 5 is of molded insulating material and has mounted thereon a movable contact 7, a stationary contact 9, the circuit breaker operating mechanism indicated generally at 11, the trip device 13, the arc extinguishing means 15 and the terminal means 17. The operating mechanism, arc extinguishing means and the trip device are substantially similar to the corresponding elements shown in the patent of H. D. Dorfman et al., No. 2,044,157 which is assigned to the assignee of this invention. Any suitable

operating mechanism, arc extinguishing means and trip device would be equally satisfactory, however, for the purposes of this invention.

The terminal means 17 (only one being shown) are mounted in recesses provided therefor adjacent the ends of the base and are connected by conducting strips 19, one to the stationary contact 9 and the other to one terminal of the bimetallic trip device 13. The other terminal of the trip device is connected by a flexible shunt connection 21 to the movable contact 7.

The movable contact 7 is secured or supported by one end of a strip 23 of resilient conducting material. The strip 23 is secured at its other end by means of rivets or other suitable fastening means to a U-shaped movable contact supporting frame 25. The frame 25 is pivotally supported by means of a pivot pin, not shown, to the legs of a U-shaped main supporting frame 27, which is rigidly secured to the base by any suitable means. A releasable trigger member 29 is pivotally supported at the forward end of the main frame by means of a yoke 31 and a pivot pin 33 carried by the legs of the main frame.

The forwardly projecting end of the movable contact supporting frame is pivotally connected to the releasable trigger member 29 by means of a pair of toggle links 35 and 37. The lower toggle links are pivotally connected to the forwardly projecting portion of the movable contact supporting frame 25 by means of a pin 39, while the upper toggle links are pivotally connected to the releasable trigger member by means of a pivot pin 41. A knee pivot pin 43 pivotally connects the upper and lower toggle links.

The releasable trigger member is adapted to be held in latched position as shown in Fig. 1 by means of a bimetallic trip element 13. The bimetallic trip element consists of a bimetallic strip 45 secured to the base 5 of the circuit breaker by any suitable means, and has a projecting adjustable latch piece 47 threaded through the free upper end thereof. The latch piece 47 is adapted to engage and hold a latch engaging portion 49 secured to the rearwardly projecting end of the releasable trigger member 29. The latch engaging portion 49 is insulated from the body of the trigger 29 by means of a plurality of mica plates 51.

A lug 53 is struck outwardly from each leg of the main frame 27 to provide a bearing for pivotally supporting a bifurcated operating member 55. The operating member 55 is constructed of a single piece of light metal formed to provide a hood portion 57 and a pair of legs 59. The lower ends of the legs of the operating member are bifurcated in order that they may be pivotally supported upon the outwardly struck lugs 53. A plate 61 rests on the top of the hood portion 57 of the operating member and is provided with a pair of spaced, downwardly projecting lugs 63 which pass through openings provided in the top of the hood portion. A pair of over-center springs 65 each has one end connected to the lugs 63, and the other end secured to the knee pivot pin 43 of the toggle links. The forward end of the hood of the operating member 57 carries a cross piece 67 adapted to engage a shoulder formed on the releasable trigger member 29. The cross piece 67 functions to reset the trigger member after its release in a manner which will hereinafter be described.

The arc extinguishing means consists of a series of spaced notched plates of magnetic material indicated generally at 15. The arc extinguishing means is not an important part of my invention and any suitable structure may be used for this purpose.

A cover 69 of molded insulating material is mounted on the base 5 for the purpose of enclosing the internal mechanism and parts of the circuit breaker. The cover 69 and base 5 are provided at each end with the aligned cylindrical openings 71 adapted to receive a threaded bolt 73 for clamping the cover securely on the base and mounting the base on any suitable form of support.

The means for preventing the exit of flame or hot gases through the opening provided in the cover for the operating handle will now be described. The under surface of the top of the cover 69 is formed to provide an arcuate seat 75 for cooperating with an arcuate closure portion of an operating handle 77. Referring to Fig. 3, the arcuate seat is provided with a pair of elongated grooves 79 which extend throughout the entire length of the seat. A central groove 81 of greater width than the grooves 79 is formed in the seat between the grooves 79. An elongated opening 83 of the same width as the central groove extends through the top of the casing and joins the recess formed by the center groove 81. The operating handle 77 is adapted to be mounted on the operating member 55 by means of a pair of short upwardly projecting spaced lugs 85 (see Fig. 2) formed on the hood portion 57 of the operating member. The lugs 85 engage in cooperating spaced recesses 87 formed in the inner surface of the arcuate closure portion of the handle 77. The recesses 87 are of slightly larger cross sectional area than that of the cooperating lugs 85, so that the handle 77 is loosely mounted on the operating member 55, and is adapted to be held in such mounted position by the seat 75 of the cover 69. The purpose of this particular means of mounting a handle on the operating member will be hereinafter described.

The handle 77 is of molded insulating material and has a knob portion 89 adapted to project through the opening 83 formed in the top of the cover 69, by means of which the circuit breaker is adapted to be manually controlled. The operating handle 77 is also provided with an arcuate portion 91 which acts as a closure for covering the opening in any position of the operating member 55 and handle 77. The arcuate portion is provided with a pair of spaced tongues 93 and a centrally disposed rib 95. The tongues 93 are adapted to have interfitting engagement with the corresponding grooves 79 formed in the seat 75 of the cover 69. It will be noted that in the normal position of the handle, as shown in Figs. 1 and 2, there is a slight clearance between the upper surface of the arcuate portion of the handle and the surface of the seat portion 75 of the cover 69. The removable mounting means for the handle comprising the lugs 85 and the recesses 87 allow the handle to have a slight radial play between the top of the operating member and the seat 75 of the cover 69.

The function of the particular mounting means for the handle 77 and that of the tongues and grooves will now be described. When the movable contact 7 is moved to the open circuit position, either automatically in response to a high magnitude overload or short circuit condition by means of the trip device 13, or manually to interrupt a highly inductive load circuit, an arc is formed between the contacts which results in the generation of considerable hot gases and flame.

The gas pressure developed in the prior art devices forced the flames and hot gases through the opening for the operating handle with considerable force which often resulted in damage and considerable danger. By the present invention, this objectionable feature has been substantially eliminated.

With the above described handle and cover structure, upon the occurrence of an explosion resulting from the separation of the contacts, the pressure of the gases generated force the loosely mounted operating handle 77 into sealing engagement with the seat of the cover portion 69. The tongues and grooves provide a tortuous path for any gas or flame attempting to make an exit through the opening 83, thus obviating the objectionable feature of the prior art devices.

The manner of mounting the handle on the operating member in addition to performing the above mentioned function also provides a safety feature. In the prior art devices it has been the practice to couple the handle to the operating member by a metal insert which projected into the knob portion of the handle. While this provided a rigid connection it was objectionable and dangerous by reason of the fact that when a portion of the knob broke off it exposed the insert which by being connected with the operating mechanism was at line potential. The exposed insert provided a convenient handle for operating the breaker but constituted a dangerous hazard to any one attempting to so operate the breaker. It will be noted that the projections 85 extend only a short distance into the bottom of the arcuate closure portion and hence even though the knob of the handle might be broken off no metal part would be exposed.

Another important feature of my invention comprises the means for preventing the insertion of a tool or other object into the casing between the edges of the opening and the operating handle. The means for preventing such insertion comprises a projection 97 carried on, or formed integral with the rear end of the arcuate portion of the operating handle 77 adjacent the trip device. The projection 97 is of the same width as the rib 95 and opening 83, and is adapted to engage a shoulder 99 formed in the central groove of the seat of the cover 69 in the closed circuit position of the operating handle. It will be readily apparent that the projection 97 effectively blocks the passage of any hairpin, tool or other object attempted to be inserted into the interior of the casing for the purpose of tampering with the internal mechanism of the breaker or the trip device or the adjustment thereof.

A brief description of the operation of the circuit breaker will be given at this point. With the parts in the position shown in Fig. 1, let it be assumed that it is desired to manually open the circuit breaker. The knob 89 of the operating handle is moved from the position shown in a counter-clockwise direction to the opposite edge of the opening 83. This movement of the operating handle causes counter-clockwise rotation of the operating member 55 which in turn moves the upper ends of the springs 65 over-center which results in the collapse of the toggle linkage comprising the links 35 and 37. The collapse of the toggle links 35 and 37 causes a counter-clockwise rotation of the movable contact carrying frame 25 about its pivot pin to effect movement of the movable contact to its full open position. In closing the circuit breaker substantially the reverse action takes place. The knob 89 of the operating handle is manually moved from the open circuit position back to the position shown in Fig. 1 which causes the springs 65 to change their line of action and move the toggle links 35 and 37 to their extended position shown in Fig. 1. This movement of the toggle links causes clockwise rotation of the movable contact carrying frame 35, moving the movable contact 7 to its closed circuit position as shown. The over-center springs and structure of the operating mechanism causes the movement of the movable contact to its open or its closed circuit position to be effected with a snap action. The automatic operation of the circuit breaker in response to overload conditions is as follows: The resulting increase in the current flowing through the bimetallic trip element 13 produces a heating action in passing through the bimetallic trip element and causes the same to bend in a direction away from the operating mechanism 11. When the free end of the trip element 13 has moved a sufficient distance, it effects the release of the trigger 29 which is based in a clockwise direction by the tension of the springs 65. After the trigger has moved a certain distance in a clockwise direction, the line of action of the springs 65 is changed to effect a collapse of the toggle links 35 and 37 with the resulting opening movement of the movable contact 7. To reset the circuit breaker after a tripping operation described above, it is necessary to move the operating handle to its full-open circuit position to re-latch the trigger 29. During this movement of the operating handle, the cross piece 67 on the hood of the operating member 55 engages the shoulder on the trigger member 29 and moves the same in a counter-clockwise direction to the position in which the latch engaging portion 49 is re-engaged under the latch piece 47. The circuit breaker is now in a reset condition and may be operated in the manner previously described.

It will thus be seen that by my improved cover and operating handle structure and mounting of the latter, I have provided an effective means for preventing the exit of flame or hot gases through the opening provided in the cover for the operating handle and also for preventing the insertion of a tool or other tampering object into the interior of the casing through said opening. It will be noted that the arcuate or closure portion of the handle acts in conjunction with the seat 75 in the manner of a valve to effectively seal the opening against the exit of flame or hot gases resulting from an explosion formed by the separation of the contacts upon the occurrence of an overload.

While, in accordance with the patent statutes, I have disclosed one embodiment of my invention, the principles herein involved are applicable to other structures, and I desire therefore that the language of the accompanying claims shall be accorded the broadest reasonable construction and that my invention be limited only by what is explicitly stated in the claims and by the prior art.

I claim as my invention:

1. In a circuit breaker, separable contact means, actuating means for opening and closing said contact means, a trip device operable in response to predetermined conditions to cause opening of said contact means, a casing for enclosing said elements, said casing having an opening, a movable operating handle for operating said actuating means, said handle having a portion projecting through said opening and movable there-

in and a closure portion beneath said opening for closing said opening in any position of said handle, and means carried in part by said closure portion for preventing the insertion of a tampering object in said casing at said opening.

2. In a circuit breaker, the combination of a casing provided with an opening, contact means, operating means for opening or closing said contact means, and a trip device responsive to predetermined conditions to cause opening of said contact means all mounted in said casing, said operating means including an operating member having a handle portion movable in and projecting through said opening and having a closure portion beneath said opening, means carried in part by said closure portion and in part by said casing adjacent said opening for preventing the insertion of a tampering object in said casing at said opening, and means for substantially blocking the passage of flame or hot gases through said opening.

3. In a circuit breaker, the combination of a casing provided with an opening, contact means, operating means for opening or closing said contact means, and a trip device responsive to predetermined conditions to cause opening of said contact means all mounted in said casing, said operating means including an operating member having a handle portion movable in and projecting through said opening and having a closure portion beneath said opening, means carried in part by said closure portion for preventing the insertion of an object in said casing at said opening, and means including interfitting tongues and grooves carried by said closure portion and said casing for substantially blocking the exit of flame and hot gases through said opening.

4. In a circuit breaker, the combination of a casing provided with an opening, contact means, operating means for opening or closing said contact means, and a trip device responsive to predetermined conditions to cause opening of said contact means, all of said elements being mounted in said casing, said operating means including an operating member having a handle portion movable in and projecting through said opening and having a closure portion of greater width and length than said opening beneath said opening, means for preventing the insertion of a tampering object in said casing at said opening, said means comprising an elongated rib carried by said closure portion of a width equal to that of said handle fitting in a groove of substantially similar width provided on the inner surface of said casing, the mid-portion of said groove joining said opening, and cooperating projections of a width equal to said rib and said groove formed one adjacent the end of said rib and the other adjacent the groove edge of said opening.

5. In a switch structure, the combination of contact means, operating means therefor including a movable operating member, a casing for enclosing said elements, said casing being provided with an opening in one wall thereof, a handle loosely and removably mounted on said member and retained in position thereon by said casing, said handle having a portion projecting through said opening and a closure portion beneath said opening for closing the opening in any position of said handle, said handle being movable a small amount relative to said operating member toward said wall.

6. In a circuit controlling device, contact means, an operating mechanism therefor including a movable operating member, a casing for enclosing said contact means and operating mechanism, said casing being provided with an opening, said operating member having a portion projecting through said opening and movable therein and a closure portion below said opening for closing said opening in any position of said operating member, said casing adjacent said opening and said closure portion of said handle each having a plurality of interfitting tongues and grooves to substantially block the exit of flame and hot gases through said opening.

7. In a circuit controlling device, a casing provided with an opening, contact means within the casing, operating means including an operating member mounted within the casing for controlling said contact means, an operating handle having a knob portion projecting through said opening and a closure portion beneath said opening for closing the opening in any position of said handle, means for loosely and removably coupling said handle to said operating member to operate the same comprising a short lug carried by said operating member projecting into a recess provided therefor in the bottom of said closure portion, said lug projecting only a short distance into said closure portion.

8. In a switch structure, contact means, an operating mechanism for said contact means, a casing for the switch structure having a seat on the inner surface of one of its walls and an opening extending through said wall, a movable handle for the operating mechanism having a portion projecting through said opening and a closure portion fitting in said seat to tightly close the opening when in close engagement with the seat, and said handle being mounted to freely move into close engagement with the seat and substantially prevent the escape of gas through the opening.

9. In a switch structure, contact means, an operating mechanism for said contact means including an operating spring, a casing for the switch structure having an opening therein, an operating handle having a portion extending through said opening and a portion for closing said opening, said handle being movable to actuate the operating mechanism and being freely mounted to make tight engagement with the casing without opposition from said operating spring to seal said opening upon development of a predetermined pressure in said casing.

10. In a switch structure, contact making means, an operating mechanism for said contact making means including an operating member and an operating spring connected at one end to said operating member and at the other end to move said contact making means, a casing for the switch structure having an opening therein, a handle having a portion extending through said opening and a portion for closing said opening, said handle being engageable with said operating member for actuating it and being mounted to freely move into tight engagement with the casing without stressing said operating spring upon the occurrence of a predetermined pressure in the casing.

11. In a circuit controlling device, relatively movable contact means, operating means including an operating member for opening and closing said contact means, a casing for enclosing said elements, said casing having an opening, an operating handle loosely and removably mounted on said operating member for moving said operating member to actuate said contact means, said handle having a portion projecting

through said opening and a closure portion beneath said opening for closing said opening, and cooperating interfitting tongues and grooves provided on said closure portion and on the inner surface of said casing adjacent said opening.

12. In a circuit interrupting device, relatively movable contact means, operating means for said contact means including a movable operating member, a casing for enclosing said elements, said casing having an opening and a seat around said opening, an operating handle having a portion projecting through said opening and a closure portion for fitting said seat and for closing said opening, means loosely mounting said handle on said operating member for moving the operating member and for allowing small movement of the closure portion into sealing engagement with said seat to seal said opening upon the occurrence of a predetermined pressure in said casing.

13. In a circuit interrupter, relatively movable contacts, operating means therefor including a movable operating member having a projection on one end thereof, a casing for enclosing said elements, said casing having an opening extending through one wall thereof, an operating handle having a knob portion extending through said opening and a closure portion of greater area than said opening for closing said opening, said handle being provided with a recess of slightly greater cross-section than that of said projection on the operating member for receiving said projection to loosely and removably mount said handle on said operating member, said casing retaining said handle in mounted position on said operating member.

14. In a circuit interrupter, relatively movable contacts, operating means therefor including a movable operating member having a projection on one end thereof, a casing for enclosing said elements, said casing having an opening extending through one wall thereof, an operating handle having a knob portion extending through said opening and a closure portion of greater area than said opening for closing said opening, said handle being provided with a recess of slightly greater cross-section than that of said projection on the operating member for receiving said projection to loosely and removably mount said handle on said operating member, said casing retaining said handle in mounted position on said operating member, said closure portion of said handle and said casing adjacent said opening being provided with interfitting tongues and grooves.

HARLAN S. GANO.