June 25, 1957 F. L. GELZHEISER ET AL 2,797,278

CIRCUIT BREAKER

Filed Oct. 29, 1954 2 Sheets-Sheet 1

Fig. 1.

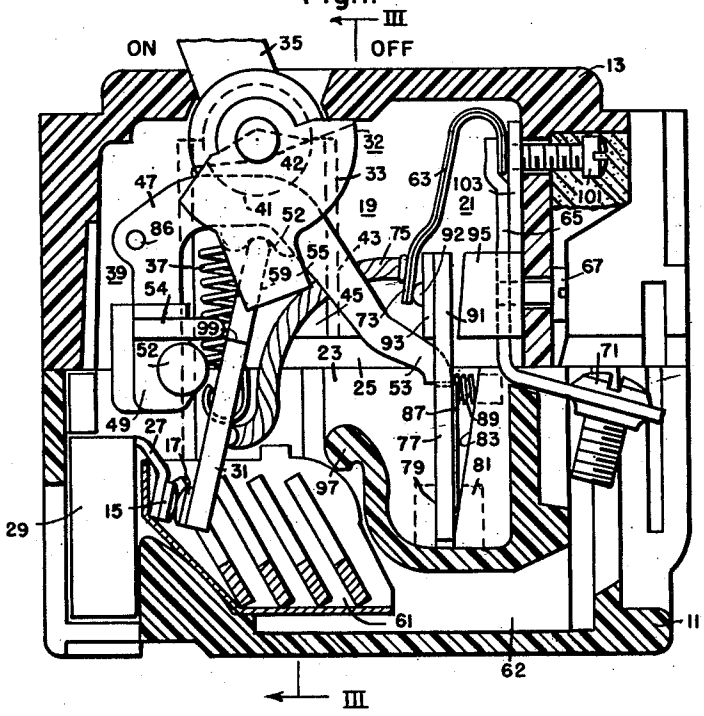
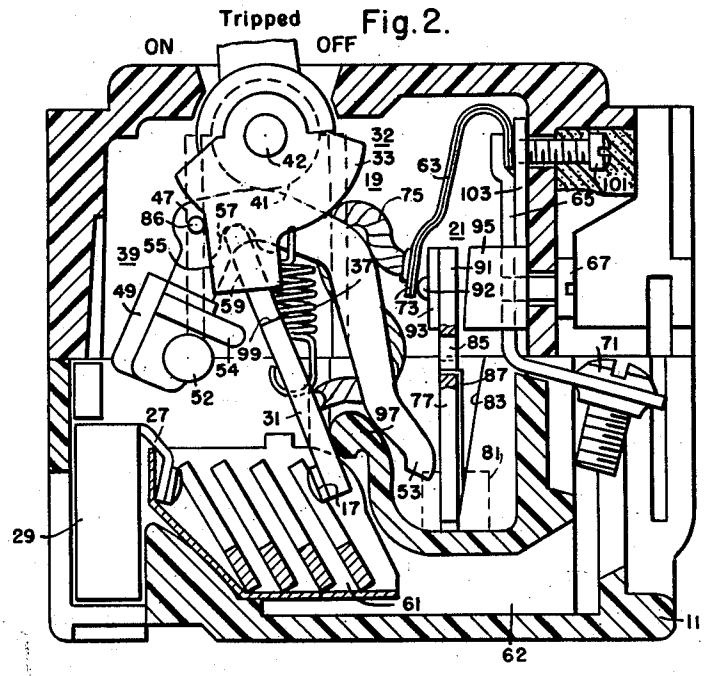


Fig. 2.



June 25, 1957 F. L. GELZHEISER ET AL 2,797,278

CIRCUIT BREAKER

Filed Oct. 29, 1954 2 Sheets-Sheet 2

Fig.3.

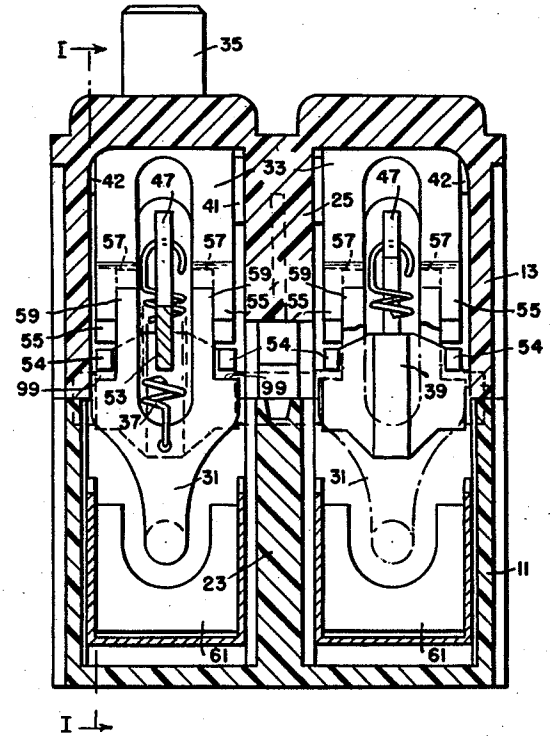
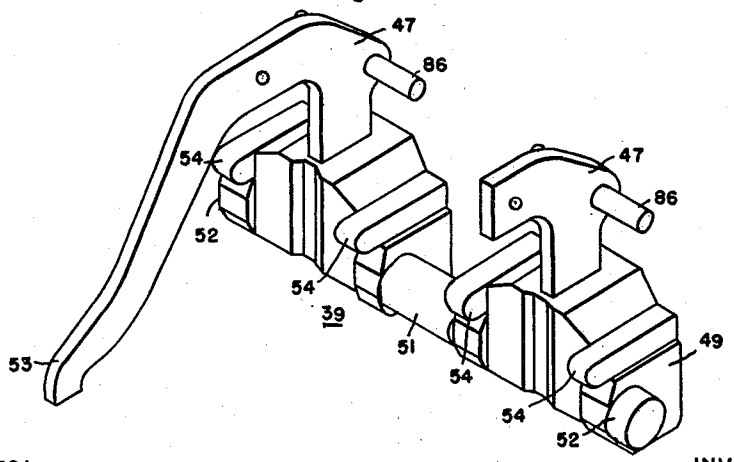


Fig.4.



WITNESSES:
E. A. McCloskey.
Paul O. Harlow.

INVENTORS
Francis L. Gelzheiser
Robert H. Flick
and Howard E. Reichert.
BY
Ralph L. Swingle
ATTORNEY

United States Patent Office 2,797,278 Patented June 25, 1957

2,797,278

CIRCUIT BREAKER

Francis L. Gelzheiser, Robert H. Flick, and Howard E. Reichert, Beaver, Pa., assignors to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application October 29, 1954, Serial No. 465,486

7 Claims. (Cl. 200—116)

This invention relates to circuit breakers and more particularly to circuit breakers for controlling lighting and moderate power circuits.

An object of this invention is to provide a circuit breaker embodying a releasable trip member which is actuated by stored energy means to cause opening movement of a movable switch member, the releasable trip member having means thereon for engaging and starting the movable switch member in opening direction.

Another object of the invention is to provide a manually operable circuit breaker embodying a releasable trip member which, when released, is actuated by stored energy means to cause automatic opening movement of the movable switch member, the releasable trip member having means thereon for engaging and starting the movable switch member in opening direction, the parts being so disposed and arranged that the switch member does not engage the starting means on manual operation thereof.

A further object of the invention is to provide a circuit breaker which is of simple and rugged construction, safe and reliable in operations, and which is inexpensive to manufacture. The separately pivoted kickoff member used in prior art constructions has been eliminated, but its function has been retained, thus reducing the cost of the breaker.

An additional object is to provide in a circuit breaker having a contact arm pivoted on a manually operated member, with an overcenter spring connected between the contact arm and a releasable trip member, a projection integral with the trip member which hits and moves the contact arm if it is slow to open, or if the contacts tend to stick closed, during a tripping operation. This is accomplished without interferring with the snap action operation of the overcenter spring on manual opening of the contacts, since there is clearance between the projection on the trip member and the contact arm when the contact arm is moved by the manually operated member, but not when the trip member is moved.

The invention both as to structure and operation, together with additional objects and advantages thereof, will be best understood from the following detailed description thereof when read in conjunction with the accompanying drawing.

In said drawing:

Fig. 1 is a vertical sectional view of a circuit breaker taken substantially on line I—I of Fig. 3 embodying the principles of the invention, the circuit breaker being shown in the closed position;

Fig. 2 is a vertical sectional view similar to Fig. 1 but showing the breaker in the open position;

Fig. 3 is a vertical sectional view taken on line III—III of Fig. 1 and looking in the direction indicated by the arrows;

Fig. 4 is a perspective view of the releasable trip member.

Referring to Fig. 1 of the drawing, the circuit breaker generally comprises a two-piece housing of molded insulating material including a base 11 and cover 13, a stationary contact 15 and movable contact 17 for each pole of the breaker, an operating mechanism 19 and a trip device 21. The housing is divided into two separate compartments by means of matching barriers 23 and 25 molded integral respectively with the base 11 and the cover 13.

The stationary contacts 15 for each of the two poles of the breaker case are mounted on the inner ends of conducting members 27 integral with a plug-in or other connector 29 supported in the base 11 of the housing. The moving contact 17 for each pole is rigidly secured to a U-shaped switch or contact arm 31. Both of the contact arms 31 (Figs. 1 and 3) are operated to open and closed positions by the single operating mechanism 19 to open and close the contacts.

The operating mechanism 19 comprises an operating member 32 having an integral operating lever 33 for each pole of the breaker and a single operating handle 35, an overcenter spring 37 and a releasable trip member 39. The operating member 32 including the handle 35 and the operating levers 33 for both poles of the breaker comprises a single member of molded insulating material so that operation of the handle simultaneously moves both of the levers 33. Molded on the operating member 32 is a central bearing surface 41 for pivotally supporting the member in the barrier 25 in the cover 13. Similar bearing surfaces 42 (Fig. 3) on the ends of the member 32 are provided for pivotally supporting the ends of the member in the side walls of the cover 13. The barrier 25 is provided with a slot 43 having a semicircular bearing portion at its upper end for securing and positioning the operating member. After the operating member 32 is inserted in the slot 43, a support and closure member 45 of insulating material is inserted in the slot and suitably secured thereon. The upper end of the member 45 has a semicircular bearing surface engaging and supporting the bearing portion 41 of the member 32. The end bearing portions 42 of the member 32 are similarly secured and supported in the side walls of the cover 13.

The releasable trip member 39 (Figs. 1, 2 and 4) comprises a spring support lever or trip arm 47 for each of the poles of the breaker, each of the spring supports on the trip lever being secured adjacent its pivot axis to a tie rod or cross bar 49 of molded insulating material for unitary pivotal movement. The tie rod 49 is provided with a central bearing portion 51 (Fig. 4) for pivotally supporting the releasable trip member 39 in the barrier 25 and end bearing portions 52 for supporting the ends of the releasable trip member 39 in bearing portions (not shown) in the side walls of the cover 13 and base 11. The spring support on trip lever 47 for one of the poles of the breaker extends toward the right (Figs. 1 and 2) and toward the left (Fig. 4) and has a latch end 53 which is normally engaged and releasably held by a single latch element of the trip device 21 (to be later described) to releasably hold both of the trip arms 47 of the releasable trip member 39 in operative position. The trip member 39 is provided with a pair of spaced projections 54 for each of the poles, the purpose of which will be described later, the projections 54 being molded integral with or suitably fixedly secured to the cross bar 49 so as to move rigidly therewith at all times.

Each of the operating levers 33 is bifurcated and the spaced legs 55 thereof are provided with notches 57 in which are seated and pivoted the inner ends of the legs 59 of the U-shaped switch members 31. The switch members 31 are held in place by the overcenter operating springs 37 which are connected under tension between the switch members 31 and the corresponding spring supports 47 of the releasable trip member 39. In the position shown in Fig. 1 the spring 37 biases the switch member 31 to

the closed position, and, as shown in Fig. 2 the spring 37 biases the switch member 31 to the open position.

The circuit breaker is opened manually by moving the operating member 32 (Fig. 1) by the handle 35 clockwise from the "on" to the "off" position. During this movement the inner ends of the switch arms 31 are carried over to the left of the line of action of the overcenter springs 37 whereupon the springs move the switch arms to the open position with a snap action. The contacts are closed by reverse movement of the operating member 32, that is, from the "off" to the "on" position. During this movement the inner ends of the switch members 31 are moved over to the right of the line of action of the overcenter springs which then move the switch members to the closed position with a snap action.

An arc extinguisher 61 may be disposed in a recess or arc chamber in the base 11 for each pole of the breaker for quickly extinguishing the arc drawn when the circuit is interrupted. The arc extinguishers may be of any suitable type, the one shown comprising a series of spaced, slotted plates of magnetic material into which the arc is drawn and quickly extinguished. The arc gases are drawn into a passage 62 along the bottom of the base 11 and vented out the end of the housing opposite the stationary contacts.

The circuit breaker is tripped open automatically in response to overload currents by operation of the trip device 21. A trip device 21 is provided for each pole of the breaker but since the trip devices are alike only one will be described. The trip device comprises a bimetal element 63 having one end rigidly secured to the inner end of a conducting strip 65 with the high expansion side of the bimetal element on the outside of the loop. The conducting strip 65 which is secured by means of a screw 67 to the end wall of the cover 13, extends out through an opening in the base 11 below the cover 13 and has a terminal connector 71 at its outer end.

The free end 73 of the bimetal element is conductively connected to the switch member 31 by means of a flexible conductor 75. A movable trip member 77 formed from a single piece of insulating material extends across both poles of the breaker to be actuated by the trip device 21 for either pole. The trip member 77 is supported at its ends in notches 79 formed by projections 81 molded in the base 11 adjacent the sidewalls thereof. The barrier 23 in the base 11 is provided with a V-shaped opening 83 for receiving the trip member 77 which at this point terminates just below the barrier 25 in the cover 13 so that when the cover is in place it will hold the trip member in place. As shown in Fig. 2 the trip member 77 has an opening 85 therein into which extends the angular upper end of a latch member 87 suitably secured to the side of the trip member. The latch member 87 normally engages the latch end 53 of the trip arm 47 and restrains the releasable trip member 39 in operative position. A spring 89 compressed between a spring seat in the barrier 23 and the trip member biases the trip member to its latching position.

In each of the compartments the trip member 77 has an upwardly extending projection 91 which at its upper end has rigidly secured thereto by means of a rivet 92 an armature 93 for cooperating with a U-shaped magnet yoke 95. The magnet yoke 95 is mounted on the end wall of the cover 13 with the yoke portion thereof disposed between the conducting strip 65 and the end wall and surrounds three sides of the conducting strip 65. The magnet yoke is rigidly secured in place by the screw 67 which secures the conducting strip to the end wall.

Upon the occurrence of an overload current of, for example, up to 1000% of normal rated current the bimetal element 63 becomes heated and when heated a predetermined amount bends rearwardly in a direction to close the loop, since the high expansion side is on the outside of the loop, and moves the free end 73 thereof toward the right. This causes the bimetal to engage the rounded head of the rivet 92 and rock the trip member 77 clockwise disengaging the latch member 87 from the releasable trip arm 47 thus releasing the entire trip member 39 (Fig. 4). As soon as the releasable trip arm 39 is released, the springs 37 for both poles of the breaker rotate the releasable structure 39, including the spring support or trip member 47 for each pole, in a clockwise direction to the position shown in Fig. 2, where it is arrested by its engagement near the latch end 53 of the spring support or trip arm 47 with a projection 97 on the base 11 of the breaker housing. This movement of the releasable trip member 39 carries the line of action of the springs 37 for both poles of the breaker over to the right of the pivot (at 57) of the associated switch members 31, and the spring 37 then moves the switch members to the open position with a snap action. When the springs 37 move overcenter, they act through the switch members 31 to move the handle 35 to an indicating position (Fig. 2) between the "on" and "off" positions, giving a single indication that both poles of the circuit breaker have been tripped open.

Upon the occurrence of a heavy overload current, of, for example, 1000% or more of rated current or a short circuit current, the armature 93 is attracted to the magnet yoke 95, actuating the trip member 77 to disengage the latch 87 to instantaneously trip the breaker.

Before the contacts can be closed following an automatic opening operation, it is necessary to reset and relatch the mechanism. This is accomplished by moving the handle 35 and the operating member 32 to a position slightly beyond the "off" position. During this movement the legs 55 of the levers 33 engage a pin 86 in the releasable trip members 47 and restore the entire releasable structure 39 for both of the poles to the latched position. The contacts are then closed in the previously described manner by movement of the handle 35 and the levers 33 to the "on" position.

The latch overlap and, hence, the thermal tripping time of the trip devices are adjusted by means of screws 101, there being a screw 101 for each pole of the breaker. The screws 101 threadedly engage upwardly extending portions 103 of the magnet yoke 95 and their rounded inner ends apply a pressure to the supported legs of the bimetal elements 63 at the point where they are secured to the inner ends of the conducting strips 65. Turning the screws 101 varies the pressure on the conducting strip 65 and moves the bimetal element 63 according to the direction the screws 101 are turned. This varies the amount of latch overlap and thus varies the thermal tripping time of the breaker.

When the circuit breaker is tripped open in response to overload or short circuit currents the contacts may be slow in separating or may tend to weld or stick. If the contacts should fail to separate, neither the switch members 31 nor the handle would move although the releasable member 39 would be released by operation of the trip device. Means is provided to prevent such an occurrence by positively initiating opening movement of the switch members 31 for both poles when the releasable member 39 is released in response to an overload current or a short circuit current.

The means for positively initiating opening movement of the switch members 31 on automatic tripping operation includes the projections 54 which are molded integral with the cross bar 49. As seen in Figs. 3 and 4, two projections 54 are provided for each pole of the breaker and are spaced apart so as to engage both legs 59 of the switch members 31. When the releasable trip member 39 is released by operation of the trip device 21 it is rotated clockwise about its pivot 52 by the action of both of the operating springs 37 causing the rounded ends of the projections 54 to engage shoulders 99 on the switch members 31 and positively start the switch members in opening direction.

When the circuit breaker is opened manually by movement of the handle from the "on" position to the "off" position, the levers **33** first move the inner ends of the switch members **31** in a counterclockwise direction, the switch members pivoting about the contacts **15—17** as a pivot point. If, during this initial movement of the switch members **31**, they were to engage the projections **54** the pivot point would be shifted from the contacts **15—17** to the projections **54** and the switch members would pivot counterclockwise about the projections **54**. Thus, the handle **35** could be moved slightly in opening direction, just far enough to separate the contacts, and held there. This would defeat the snap action function of the overcenter spring and could cause dangerous arcing and burning of the contacts. This situation is avoided by locating the shoulders **99** only below the ends of the projections **54** and forming the legs **59** of the switch members with cutout or narrowed portions above the shoulders **99** so that they clear the projections as seen in Fig. 3. With this arrangement both the legs **59** and the shoulders **99** of the switch members **31** clear the projections **54** making it necessary to move the handle **35** far enough in opening direction to move the inner ends of the switch members overcenter to the left of the line of action of the springs **37** before the contacts separate.

There is provided a circuit breaker in which a manual operating lever supports and actuates the movable switch member to manually open and close the breaker contacts. Releasable means is provided which, when released, actuates the overcenter spring to effect automatic opening movement of the switch members. The releasable means has projections thereon for engaging and starting the switch member in opening direction upon release of the releasable member, thus assuring positive initial opening movement of the switch member. The projections and the portions of the switch member engaged thereby on automatic opening of the breaker are so positioned relative to each other that the switch member does not engage the projections when the breaker is manually opened thus preventing teasing of the breaker or partial opening of the breaker contacts to a dangerous arcing position.

While the invention has been disclosed in accordance with the provisions of the patent statutes, it is to be understood that various changes in the structural details and arrangement of parts thereof may be made without departing from the spirit of the invention.

We claim as our invention:

1. A circuit breaker comprising stationary and movable contacts, operating means comprising a manual operating lever, a movable switch member supported on said manual operating lever and having said movable contact rigidly secured thereon, a releasable trip member movable when released to effect automatic opening movement of said switch member, trip means responsive to abnormal current conditions to effect release of said releasable trip member, a portion of said releasable trip member upon release thereof engaging and starting said switch member in opening direction, and means defining a clearance space on said switch member disposed to prevent engagement of said switch member with said portion of said releasable trip member during manual movement of said switch member.

2. A circuit breaker comprising stationary and movable contacts, operating means comprising a manual operating lever, a movable switch member supported on said manual operating lever and having said movable contact rigidly mounted thereon, a releasable trip member movable when released to effect automatic opening movement of said switch member, means for releasing said trip member, a projection rigid with said releasable trip member engaging and starting said switch member in opening direction, and means defining a clearance space on said switch member disposed to prevent engagement of said switch member with said projection during manual movement of said switch member.

3. A circuit breaker comprising stationary and movable contacts, operating means comprising a manual operating lever, a movable switch member supported on said manual operating lever and having said movable contact rigidly mounted thereon, a releasable trip member movable when released to effect automatic opening movement of said switch member, means for releasing said trip member, a projection on said releasable trip member engaging and starting said switch member in opening direction, said switch member and said projection being movable relative to each other and being disposed so that they engage only on automatic operation of said breaker, and means defining a clearance space on said switch member disposed to prevent engagement of said switch member with said projection during manual movement of said switch member.

4. A circuit breaker comprising stationary and movable contacts, operating means comprising a manual operating lever, a movable switch member supported on said manual operating lever and actuated thereby to open and closed positions, a pivoted trip member releasable to effect automatic opening movement of said switch member, said switch member in the closed position extending adjacent the pivot of said trip member, means for releasing said trip member, and a projection fixedly positioned on said pivoted trip member adjacent the pivot thereof to move with the trip member at all times, said projection engaging said switch member to initiate opening movement of said switch member upon release of said trip member, said switch member being formed to provide a clearance space thereon preventing engagement of said switch member with said projection during manual movement of said switch member.

5. A circuit breaker having relatively movable contacts, a switch member movable to open and closed positions to open and close said contacts, operating means comprising a manual operating lever supporting and manually moving said switch member to open and closed positions, a releasable trip member movable from a normal position to another position to effect automatic movement of said switch member to said open position, trip means normally restraining said releasable trip member and operable in response to abnormal circuit conditions to release said releasable trip member, a projection on said releasable trip member engaging said switch member when said releasable trip member moves from said normal position to start said switch member in opening direction, said switch member being formed to provide a clearance space thereon preventing engagement of said switch member with said projection during manual movement of said switch member.

6. A multipole circuit breaker having a housing divided into compartments, relatively movable contacts in each compartment, a movable switch member in each compartment having one of said contacts thereon, a common operating lever extending into a plurality of said compartments, said operating lever having a portion in each of said plurality of compartments operatively supporting one end of the movable switch member in the compartment, a common releasable member extending into said plurality of compartments and having a support lever secured thereto in each compartment, an overcenter spring in each compartment connected under tension between the movable switch member and the support lever in each compartment, said common releasable member when released effecting overcenter action of all of said overcenter springs to cause opening movement of all of said switch arms, and projections on said releasable member in each compartment when said releasable member is released engaging said switch members and starting all of said switch members in opening direction.

7. A multipole circuit breaker having a housing divided

into compartments, relatively movable contacts in each compartment, a movable switch arm in each compartment having one of said contacts thereon, a common operating lever extending into a plurality of said compartments, a pivoted trip arm in each of a plurality of said compartments, a cross bar portion connecting said trip arms for common pivoted movement, said cross bar portion being positioned substantially at the pivot axis of said trip arm, a trip device normally engaging one of said trip arms and thereby holding all of said trip arms stationary while said switch arms are each moved to open and close the circuit upon actuation of said common operating lever extending into said compartments, a spring in each of a plurality of said compartments, each of said springs biasing one of said switch arms to move to open position upon pivotal movement of said

trip arms when released by said trip device, and projections on said cross bar portions in each compartment engaging and starting said switch arms in opening direction upon pivotal movement of said trip arms when released by said trip device.

References Cited in the file of this patent

UNITED STATES PATENTS

2,322,285	Dorfman	June 22, 1943
2,416,170	Gano et al.	Feb. 18, 1947
2,624,815	Gano et al.	Jan. 6, 1953
2,678,359	Brumfield	May 11, 1954
2,692,926	Cole	Oct. 26, 1954
2,693,516	Drobney	Nov. 2, 1954
2,701,829	Krieger	Feb. 8, 1955