

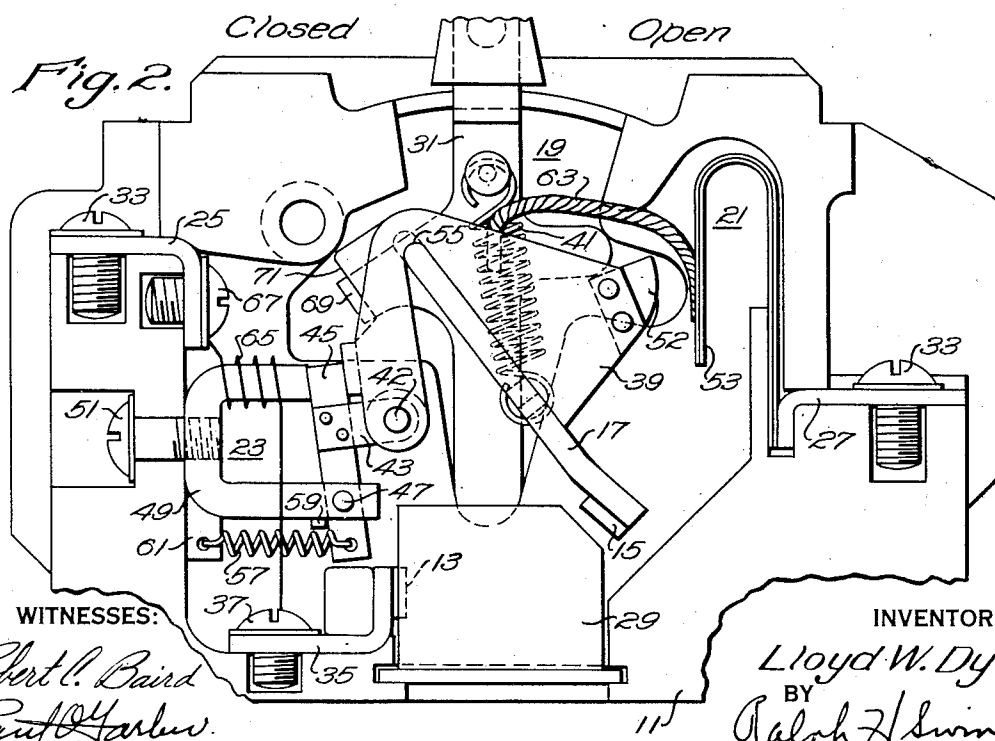
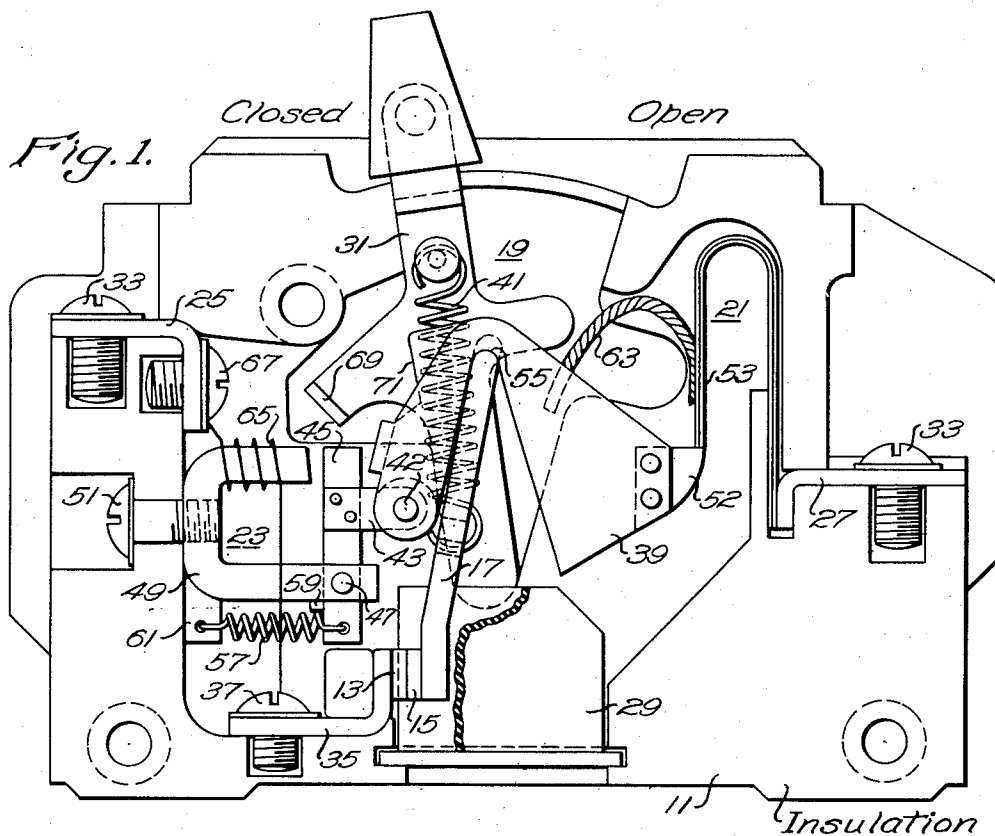
Feb. 20, 1945.

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2,370,024

CIRCUIT BREAKER

Filed July 28, 1942



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2,370,024

CIRCUIT BREAKER

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Application July 28, 1942, Serial No. 452,568

11 Claims. (Cl. 200—88)

This invention relates to circuit breakers and, more particularly, to manually and automatically operable circuit breakers for controlling lighting and other moderate power electric circuits.

An object of the instant invention is to provide a circuit breaker having an improved trip device responsive to two different conditions.

Another object of the invention is to provide a circuit breaker having an improved electromagnetic trip device wherein a releasable member is pivotally supported on a movable armature and is movable bodily to trip the breaker.

Another object of the invention is to provide a circuit breaker having an improved trip device in which an electromagnet operates in response to predetermined abnormal circuit conditions to move a releasable member relative to a latch to effect opening of the breaker.

Another object of the invention is to provide a circuit breaker having an improved trip device comprising an electromagnet operable to bodily move a releasable member relative to a latch to cause opening of the contacts, the latch being controlled by a bimetal element operable when heated a predetermined amount to release the releasable member.

The novel features that are considered characteristic of the 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 be best understood from the following detailed description of one embodiment thereof when read in conjunction with the accompanying drawing, in which:

Figure 1 is a side elevational view of the circuit breaker with the side plate of the casing removed to illustrate the mechanism, the breaker being shown in the closed circuit position; and

Fig. 2 is a view similar to Fig. 1, but showing the parts in the positions they assume when the breaker is tripped in response to an overload current above a predetermined value, or by a short-circuit.

Referring to Fig. 1 of the drawing, the circuit breaker of the present invention includes, generally, a housing 11 constructed in two separate parts of molded insulating material, a stationary contact 13, a movable contact 15 cooperating with the stationary contact, a contact arm 17, an operating mechanism 19, a thermally responsive trip device indicated generally at 21, a magnetically responsive trip device indicated generally

at 23, a pair of terminals 25 and 27, and an arc extinguisher 29.

The part of the housing 11 shown in the drawing is open at one side. The parts are assembled through the open side of the housing, and a side closure plate (not shown) forming the other part of the housing is mounted on the open side of the part 11 to complete the housing and to retain some of the parts in position.

The entire breaker mechanism is enclosed in the housing 11 with the exception of the handle portion of a manual operating lever 31 and the outer ends of the terminals 25 and 27 which project out through openings in the end walls of the housing. Each terminal is provided with suitable means, as, for instance, screws 33 for connecting the breaker in an electrical circuit. The stationary contact 13 is rigidly mounted on an angular bracket 35 secured to the housing 11 by means of a screw 37, and the movable contact 15 is rigidly mounted on the contact arm 17.

The arc extinguisher 29 comprises a stack of slotted plates of magnetic material into which the arc is drawn when the movable contact passes therethrough. The arc is broken up and quickly cooled and extinguished.

The operating mechanism of the circuit breaker comprises a releasable member 39 of conducting material on which the contact arm 17 is pivotally supported, the manual operating lever 31, and an overcenter spring 41 connected under tension between the contact arm 17 and the operating lever 31. The releasable member 39 comprises a pair of identical arms (only one being shown) spaced apart and mounted at one end on a pivot 42 supported in a pair of brackets 43 (only one being shown) secured to an armature 45. The armature 45 is pivoted at 47 on one leg of a U-shaped magnet core 49 rigidly mounted by means of a screw 51 on the end wall of the housing. The armature 45 and core 49 form part of the electromagnetic trip device 23. The free ends of the arms of the releasable member 39 are joined by a latch member 52 which normally engages a U-shaped bimetal element 53 comprising the thermal trip device 21 to maintain the releasable member 39 in normal position. The pivoted end of the manual operating lever 31 is seated in a bearing recess in the side wall of the housing 11. The contact arm 17 of conducting material is bifurcated at one end to form spaced legs (only one being shown), the ends of which legs are notched to pivotally engage the spaced arms of the releasable member 39 at the apex of the releasable member 39 as indicated at 55.

The overcenter spring 41 acting through the contact arm 17 constantly biases the releasable member 39 in a counterclockwise direction. The armature 45 is biased by means of a spring 57 in a clockwise direction against a stop 59, thereby normally holding the pivot 42 of the releasable member 39 in a normal fixed position. The spring 57 is connected under tension between the armature 45 and a part 61 secured to the end wall of the housing 11. The bimetal element 53 is rigidly secured to the inner end of the terminal 27 and is electrically connected to the releasable member 39 by means of a flexible shunt conductor 63. An energizing coil 65 surrounding one leg of the U-shaped core 49 is connected to the inner end of the terminal 25 by means of a screw 67 and to the bracket 35 which supports the stationary contact by the screw 37. The circuit of the breaker extends as follows: From the terminal 25 through the coil 65, the bracket 35, the stationary contact 13, movable contact 15, contact arm 17, releasable member 39, flexible shunt conductor 63, and the bimetal element 53 to the terminal 27.

The circuit breaker is adapted to be opened automatically in response to predetermined abnormal circuit conditions by the trip devices 21 and 23; on overloads above a predetermined value, for instance, above approximately 1000% of normal rated current, or on short-circuits, by the trip device 23, and after a time delay on overloads below the predetermined value, by the thermal trip device 21. When heated in response to a persistent overload below the predetermined value, the bimetal element 53 deflects in a direction to release the releasable member 39. When this occurs, the overcenter spring 41, acting through the contact arm 17, rotates the member 39 in a counterclockwise direction about the pivot 42. During this movement, the pivot point 55 of the contact arm 17 passes to the left of the line of action of the spring 41. As soon as this occurs, the spring 41 acts to move the contact arm 17 with a snap action to its open circuit position. This action also moves the manual operating lever 31 slightly in a clockwise direction from the closed circuit position to an intermediate position (Fig. 2) to indicate that the breaker has been tripped open.

Before the breaker may be manually closed, it is necessary to relatch the releasable member with the bimetal element 53. The breaker cannot be reset after it has been tripped in response to a light overload until the bimetal 53 cools and assumes its normal position with the free end thereof in the path of travel of the latch member 52. Resetting of the breaker following a tripping operation is effected by manually moving the operating lever 31 from its tripped position (Fig. 2) clockwise to its manual open position. At this movement, an ear 69 projecting laterally from the operating lever 31 engages a projection 71 of one arm of the member 39 and moves said member clockwise about its pivot 41. During this movement, the latch member 52 wipes by the free end of the bimetal element, the member 39, moving slightly toward the left and rocking the armature slightly counterclockwise and the bimetal 53 springing slightly to the right until the latch member 52 escapes the bimetal. The spring 57 then acts to move the member 39 to its latched position and the bimetal snaps back to its normal latched position.

Movement of the lever 31 in a counterclock-

wise direction from the manual open position to the position in which the lever appears in Fig. 1 effects closing of the contacts. During this movement, as soon as the spring 41 passes over center to the left of the pivot point 55, it acts to rock the contact arm 17 clockwise to the closed circuit position with a snap action.

When a sudden heavy overload, say, for instance, 1000% or more of the normal current value for which the breaker is rated, or a short-circuit occurs, the breaker is tripped substantially instantaneously. Under such circumstances, the coil 65 is immediately energized sufficiently to attract and rock the armature 45 counterclockwise about the pivot 47. This movement, through the connecting pivot 42, moves the member 39 bodily toward the left (Fig. 1) and releases the latch member 52 from the bimetal latch 53. The overcenter spring 41 then acts in the previously described manner to rotate the member 39 counterclockwise about the pivot 42 and opens the contacts. The parts are shown with the contacts open and the armature 45 in the attracted position in Fig. 2. As soon as the circuit is interrupted and the electromagnet deenergized, the spring 57 restores the armature to its unattracted position, moving the member 39 toward the right. The member 39 may now be moved into latching engagement with the bimetal element 53 and the contacts closed in the previously described manner.

The circuit breaker may be operated manually to open the circuit by moving the operating lever 31 in a clockwise direction from the Fig. 1 position to the open position. As soon as the line of action of the spring 41 passes to the right of the pivot point 55, the spring acts to move the contact arm 17 with a snap action to its open circuit position. Counterclockwise movement of the lever from the open position to the closed position effects closing of the contacts with a snap action, as hereinbefore described.

Having described a preferred embodiment of the invention in accordance with the patent statutes, it is to be understood that various changes and modifications may be made in the structural details disclosed without departing from some of the essential features of the invention. It is, therefore, desired that the language of the appended claims be given as reasonably broad interpretation as the prior art permits.

I claim as my invention:

1. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including a releasable member operable to cause opening of said contacts, means comprising an overcenter spring for operating said releasable member, means mounted in a fixed support for normally restraining said releasable member against operation, and a trip device including an electromagnet operable to withdraw the releasable member from said restraining means without displacing said restraining means to effect release of said releasable member.

2. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating handle and a spring operated thereby to manually open and close said contacts, a releasable member operable when released to cause automatic opening of the contacts, said releasable member remaining stationary during manual opening and closing of said contacts, a latch for normally restraining said re-

leasable member against operation, and a trip device including an electromagnet having an armature operable to withdraw the releasable member from said latch without movement of said latch to effect release of said releasable member.

3. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating handle for closing said contacts, a releasable member operable upon release to cause opening of the contacts irrespective of the position of said handle, an overcenter spring operable by said handle to move said movable contact to open and closed circuit positions, said overcenter spring being operable to actuate the releasable member to effect automatic movement of the movable contact to open position, a latch for normally restraining said releasable member against operation, and a trip device including an electromagnet having an armature operable to move the releasable member relative to said latch to effect release of said releasable member, said latch being movable to release said releasable member by a bimetal element in response to predetermined circuit conditions said latch and said armature being disposed at opposite ends of said releasable member

4. A circuit breaker comprising relatively movable contacts, operating mechanism including a manual operating handle, an overcenter spring operated by said handle to open and close the contacts with a snap action and a support member for said movable contact movable from a normal position to a tripping position to cause automatic opening of said contacts irrespective of the position of said handle, said overcenter spring biasing said support member to tripping position, means normally restraining said support member in normal position, an armature movably supporting said support member and operable to move said member relative to said restraining means, and an electromagnet operable in response to predetermined abnormal circuit conditions for operating said armature to effect release of said support member.

5. A circuit breaker comprising relatively movable contacts, operating mechanism including a manual operating handle and an overcenter spring operable by said handle to open and close the contacts with a snap action, a releasable member pivotally supporting the movable contact, said member being biased to a tripping position and operable to cause automatic opening of the contacts irrespective of the position of said handle, a latch cooperating with one end of said releasable support member to normally restrain said member against operation, an armature connected to the other end of said support member and operable to withdraw said member from said latch to effect release of said support member, an electromagnet operable in response to predetermined abnormal circuit conditions to operate said armature, said latch being operable to release the releasable member.

6. A circuit breaker comprising relatively movable contacts, operating mechanism for said contacts including a manually operable handle movable to open and close said contacts, a releasable member movable when released to cause automatic opening of the contacts, said releasable member remaining stationary during manual opening and closing of said contacts, a thermal latch for normally restraining the releasable member and operable when heated a predetermined amount to release said member, and an electromagnet operable in response to abnormal

circuit conditions to withdraw the releasable member from said thermal latch without movement of said latch to cause release of said member, said thermal latch and said electromagnet each being operable to cause release of the releasable member irrespective of the position of the manually operable handle.

7. A circuit breaker comprising relatively movable contacts, a switch member movable to open and close said contacts, operating mechanism for said switch member including a releasable member movably supporting said switch member and operable to cause opening of the contacts, means including an overcenter spring operable to move said switch member to open and close said contacts with a snap action, a latch cooperating with one end of the releasable support member for normally restraining said releasable member against operation, a pivoted armature for pivotally supporting the other end of said releasable support member, and an electromagnet operable in response to predetermined abnormal circuit conditions to operate the armature and move the releasable support member laterally to unlatch said member from the latch.

8. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including a releasable member operable to cause opening of said contacts, latch means cooperating with one end of said releasable member for normally restraining said releasable member against operation, and a trip device including electroresponsive means cooperating with the other end of said releasable member and operable in response to predetermined circuit conditions to withdraw the releasable member from said restraining means to effect release of said member, means biasing said member against withdrawing movement by said electroresponsive means, and spring means normally biasing said contacts closed when the breaker is in closed position and effective upon release of the releasable member to open said contacts.

9. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including a releasable member movable upon release to cause opening of said contacts, means for normally restraining said releasable member against movement, and a trip device operable independently of said restraining means in response to predetermined abnormal circuit conditions to withdraw the releasable member from said restraining means to effect release of said member and opening of the contacts, means biasing said releasable member against said withdrawing movement away from said restraining means.

10. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including an operating handle for opening and closing said contacts, a releasable member operable upon release to cause automatic opening of said contacts an overcenter spring connecting said operating handle and the movable contact, said spring biasing said releasable member in opening direction irrespective of the position of said handle, a bimetal element normally engaging one end of said releasable member to restrain said member against movement, and a trip device operable separate from said bimetal element and in response to abnormal circuit conditions to move the releasable member away from the bimetal element to effect release of said member without displacing said bimetal element, said bimetal element being operable when heated a predetermined amount in response to abnormal

circuit conditions below a predetermined value to release the releasable member.

11. A circuit breaker comprising relatively movable contacts, operating mechanism therefor including a handle for manually operating said contacts to closed position and a member movable when released to cause automatic opening of said contacts irrespective of the position of said handle, said movable member remaining stationary during manual closing of the contacts,

5 a thermally responsive latch for normally restraining said movable member against automatic opening movement but being operable to release said releasable member, and current responsive magnetic means for moving said movable member to disengage it from said latch without movement of said latch and thereby permit said member to move to cause automatic opening of said contacts.

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