May 1, 1934. H. LANGFRITZ 1,957,273

CIRCUIT BREAKER

Filed March 18, 1931

Fig. 1.

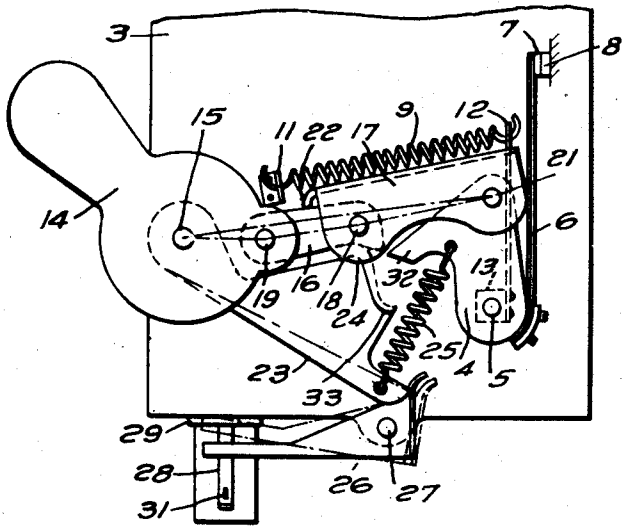
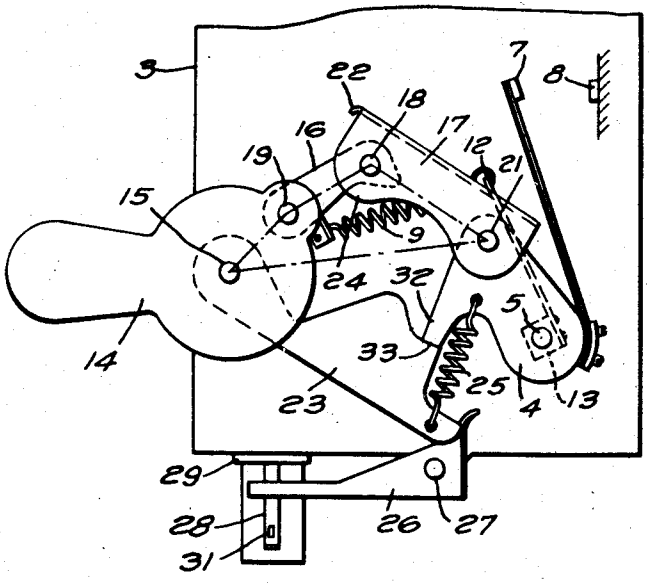


Fig. 2.



WITNESSES.
E. A. McCaskey.
J. H. Kenley.

INVENTOR
Hans Langfritz.
BY
Oberlin & Carr
ATTORNEY

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CIRCUIT BREAKER

Hans Langfritz, Schwabach, Germany, assignor to Westinghouse Electric & Manufacturing Company, a corporation of Pennsylvania

Application March 18, 1931, Serial No. 523,496
In Germany March 18, 1930

25 Claims. (Cl. 200—89)

My invention relates to circuit breakers and particularly to circuit breakers of the trip-free-of-handle type used for controlling the lighting circuits of residences, apartments, etc. and for controlling small motors.

An object of my invention is to provide a circuit breaker that shall be responsive to severe overloads and short-circuit conditions in the circuit and which shall be provided with means for automatically returning the trip mechanism to its normal operative position after each opening operation of the circuit breaker in response to an abnormal current condition.

A further object of my invention is to provide a circuit breaker wherein the contact arm is manually moved to open and to closed position and wherein the device is rendered trip-free of the operating handle by means of an over-center toggle.

A further object of my invention is to provide a circuit breaker wherein opening movement of the contact arm causes resetting of the trip mechanism.

These and other objects that will be made apparent throughout the further description of my invention are obtained by means of the apparatus hereinafter described, and illustrated in the accompanying drawing, wherein:

Figure 1 is an elevational view of a circuit breaker embodying features of my invention, showing the closed position of the circuit breaker.

Fig. 2 is a similar view of the circuit breaker in open position.

Referring to the drawing, the circuit breaker comprises a supporting plate 3 upon which is mounted a switch arm 4 which is pivoted for rotation about a shaft 5 that is mounted on the plate 3. The switch arm 4 is provided with a flexible contact arm 6 having a contact plate 7 which conductively engages a stationary contact 8. The switch arm is biased toward the open position shown in Fig. 2 by means of a spring 9 that is connected between a bracket 11 on the plate 3 and an arm 12 that is attached to a hub lug 13 on the switch arm.

The switch arm is manually moved to open and closed positions by means of an operating handle 14 that is pivotally mounted for rotation upon a shaft 15 that is secured to the plate 3. The operating handle is connected to the switch arm 4 by means of a pair of toggle links 16 and 17 that are pivotally connected by a knee pivot 18 and are respectively pivoted to the operating handle 14 and to switch arm 4 by means of pivot shafts 19 and 21.

The toggle links are so arranged that, when the knee pivot 18 is moved past a center line through the pivot shafts 15 and 21, the toggle remains in "made" position, wherein its collapse in one direction is prevented by means of a stop 22 on the link 17 that engages the link 16. Collapse of the toggle for releasing the switch arm may be caused by moving the knee pivot 18 above the above mentioned center line. This may be caused by a counter clockwise movement of the handle 14 or by a trip arm 23 that is pivoted for rotation about the pivot shaft 15 and is provided with a projection 24 that is adapted to strike the toggle links adjacent to the knee pivot thereof.

The trip arm 23 is normally biased toward the knee pivot of the toggle by means of a spring 25 that is connected between the free end of the trip arm 23 and the contact arm 4, as indicated in the drawing. By having one end of the spring 25 connected to the contact arm 4, the contact arm is biased to open position by the spring 25 as well as by spring 9.

A current-responsive latch 26, that is pivoted for rotation about a shaft 27 secured to the plate 3, serves to normally restrain the trip arm 23 and to permit of tripping movement thereof only when the latch has been moved in a clockwise direction. Movement of the latch is effected by a core 28 of a solenoid 29 that is connected in the circuit controlled by the switch contacts 7 and 8. The core or armature 28 is provided with a pin 31 that strikes the free end of the latch 26 and moves it upwardly when a predetermined overload or short-circuit condition occurs in the circuit through the solenoid. When a severe overload or a short-circuit condition occurs, the core is quickly raised to strike the latch 26 to effect release of the trip arm 23, which, in turn, strikes the knee of the toggle and causes its collapse, whereupon the switch arm will assume the open position indicated in Fig. 2.

The switch arm 4 is provided with a projection 32 that strikes the trip arm 23 at the point 33 when the contact arm 4 is moved to open position by the springs 9 and 25. This action causes clockwise movement of the trip arm 23 to return to its normal latched position shown in Fig. 1. The closing movement of the contact arm 4 is caused by clockwise movement of the operating handle 14, this movement stressing the spring 25 to place the trip arm under sufficient tension to return it to latching engagement with the latch 26 and to draw the trip arm with a snap action, into engagement with the knee of the toggle at the instant the trip arm is released.

By reason of this construction, it is apparent that a simple mechanism is provided for automatically resetting the trip arm in latched position.

This construction is of particular advantage because the latch is operated only in response to abnormal current conditions and, as such conditions are of infrequent occurrence, the wear on the latched parts is negligible. It will be noted that, during the manual operation of the circuit breaker, it is unnecessary to trip any latches, the opening operation being accomplished by the simple movement of the operating handle which moves the knee pivot of the toggle into a position which causes it to collapse under the tension of the spring 9.

While I have illustrated only one embodiment of my invention, it will be apparent to those skilled in the art that various changes, modifications, substitutions, additions and omissions may be made in the apparatus illustrated without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. The combination with a circuit breaker having an operating member, a movable contact moved to close position thereby and trip-free thereof and a trip member, of a current-responsive means for releasably restraining the trip member, and means positively moved by opening movement of the contact member in response to release of the trip member to automatically return the latter to restrained position, said return movement being made irrespective of the position of said operating member.

2. The combination with a circuit breaker having an operating handle, a movable contact moved to opened and to closed position thereby and trip-free thereof and a trip member normally biased toward tripped position, of a current-responsive means for releasably restraining the trip member, and means positively moved by opening movement of the contact member in response to release of the trip member to automatically return the latter to restrained position, said return movement being made irrespective of the position of said operating handle.

3. A circuit breaker comprising a movable contact member, means for biasing the contact member toward open position, operating means for the contact member comprising an operating member and an over-center toggle for releasably retaining the contact member in closed position, an actuating member for engaging and breaking the toggle, a current-responsive latch for restraining the actuating member, and means positively moved by opening movement of the contact member in response to release of the actuating member to automatically return the latter to restrained position, said return movement being made irrespective of the position of said operating member.

4. A circuit breaker comprising a movable contact member, means for biasing the contact member toward open position, operating means for the contact member comprising an operating member and an over-center toggle for releasably retaining the contact member in closed position, an actuating member for releasing the toggle, a spring connecting the contact member and the actuating member, a current-responsive latch for restraining the actuating member, and means whereby opening movement of the contact member in response to release of the actuating member automatically returns the latter to restrained position.

5. A circuit breaker comprising a movable contact member, biasing means for moving the contact member toward open position, operating means for moving the contact member to opened and to closed position conprising an operating member and an over-center toggle for releasably retaining the contact member in closed position, a tripping member movable to release the toggle in response to current flow, and means whereby opening movement of the contact member in response to release of said tripping member automatically returns said tripping member to restrained position irrespective of the position of said operating member.

6. A circuit breaker comprising a movable contact member, biasing means for moving the contact member toward open position, operating means for moving the contact member to opened and to closed position comprising an operating member and an over-center toggle for releasably retaining the contact member in closed position, an actuating member for releasing the toggle, a current-responsive latch for restraining the actuating member, and means positively moved by opening movement of the contact member in response to release of the actuating member to automatically return the latter to restrained position irrespective of the position of said operating member.

7. In a circuit interrupter, a contact member, means for normally moving said contact member to open and close the circuit, means biasing said contact member to open position, means movable from a set to a tripped position in response to the flow of a predetermined current for causing said contact member to move to open position under the force exerted thereon by said biasing means, and said means biasing said contact member to open position exerting a force on said means movable from a set to a tripped position sufficient to return it to set position in response to movement of said contact member to open position, said return movement being made irrespective of the position of said means for normally moving the contact member.

8. In a circuit interrupter, a contact member, means for normally moving said contact member from open to closed position, biasing means for moving said contact member to open position, releasable means holding said contact member in closed position against said biasing means, a trip member movable to a tripped position for causing release of said means holding said contact member, and means movable with said contact member by said biasing means as said contact member moves to open position for engaging said trip member and moving it out of said tripped position, said return movement being made irrespective of the position of said means for normally moving the contact member.

9. In a circuit interrupter, a contact member movable to open and close the circuit, an operating member for moving said contact member from open to closed position, biasing means for moving said contact member to open position, a current responsive latch member, a member movable from a position in engagement with said latch to an unlatched position for causing movement of said contact member to open position by said biasing means, and means for returning said movable member to latched position irrespective of the position of said operating member.

10. In a circuit interrupter, a contact member

movable to open and close the circuit, an operating member for moving said contact member from open to closed position, biasing means for moving said contact member to open position, a pair of toggle links for retaining said contact member in closed position against said biasing means, a member movable from a set to a released position, the movement of said member to released position causing said toggle links to be broken and allow said contact member to be moved to open position by said biasing means, a releasable latch member for retaining said movable member in set position, a current responsive member movable to cause actuation of said latch member, and means for returning said movable member to set position after its movement to released position, said movable member being returned to set position independently of the position of said operating member.

11. In a circuit interrupter, a contact member movable to open and close the circuit, an operating member for moving said contact member from open to closed position, means biasing said contact member to open position, a pair of toggle links for retaining said contact member in closed position against said biasing means, a member movable from a set to a released position, said member in moving from set to released position engaging one of said toggle links and breaking toggle thereby allowing said contact member to be moved to open position by said biasing means, a releasable latch member for retaining said movable member in set position, a current responsive member movable to actuate said latch member, said contact member having means movable therewith during opening movement for engaging said movable member and positively returning it to set position by the force exerted by said means biasing the contact member to open position, and the return of said movable member being independent of the position of said operating member.

12. In a circuit interrupter, a contact member movable to open and close the circuit, a link movable for causing movement of said contact member to open and close the circuit, current responsive tripping means including a trip member, energy storing means biasing said trip member, means releasably restraining said trip member against movement by said energy storing biasing means, said means restraining said trip member releasing said trip member upon the occurrence of a predetermined current condition, and the energy stored in said biasing means being transmitted to said link through said trip member only and being applied to move said link after said trip member is released, an operating member movable for normally moving said link to open and closed positions without causing release of said restraining means for the trip member, and said movement of said link due to movement of said trip member causing opening of said contact member irrespective of the position of said operating member, and means requiring only the actuation of said operating member for reclosing said contact member after being caused to open by movement of said trip member and including means for rigidly engaging said trip member and returning it to restrained position prior to movement of said contact member to closed position.

13. In a circuit interrupter, a contact member movable to open and close the circuit, a link movable for causing movement of said contact member to open and close the circuit, a single manually operable handle member for normally moving said link to both open and closed positions, and current responsive tripping means including a trip member, energy storing means biasing said trip member toward tripped position at all times, means releasably restraining said trip member against movement by said energy storing biasing means, said means restraining said trip member releasing said trip member upon the occurrence of a predetermined current condition, and the energy stored in said biasing means being transmitted to said link through said trip member only and being applied to move said link after said trip member is released, said movement of said link causing opening of said contact member irrespective of the position of said handle member, and means requiring only the actuation of said handle member to return said link to close the circuit after being moved to open position by said trip member and including means for rigidly engaging said trip member and returning it to restrained position against its biasing means and thereby storing energy in said biasing means for moving the trip member when again released, said return of said trip member to restrained position being made prior to movement of said contact member to closed position.

14. In a circuit breaker, a fixed contact member, a contact member movable into and out of engagement with said fixed contact member to open and close the circuit, a link having one end pivoted to said contact member for moving said contact member to open and close the circuit, a pivoted operating member having a handle at one end thereof, means connecting said pivoted operating member to said link for normally moving said link to open and closed positions upon the actuation of said handle, said connecting means between said pivoted operating member and said link permitting movement of said link from closed position to open position irrespective of the position of said operating member, and current responsive tripping means including a trip member mounted to rotate about the pivot of said pivoted operating member, a spring for storing energy and applying a force to said trip member tending to rotate it about its pivot point toward tripped position, a latch member engaging and releasably restraining said trip member against movement by said spring, said latch member disengaging and releasing said trip member to move under the force exerted by said spring upon the occurrence of a predetermined current flow through the circuit interrupter, and the force exerted by said spring when said trip member is released being applied to said link through said trip member only and moving said link and the contact member connected thereto to open position irrespective of the position of said handle, and a rigid member movable into engagement with said trip member for rotating it into position where it is restrained by said latch member prior to the movement of said contact member to closed position by said handle.

15. In a circuit breaker, a fixed contact member, a contact member movable into and out of engagement with said fixed contact member to open and close the circuit, a link having one end pivoted to said contact member for moving said contact member to open and close the circuit, a pivoted operating member having a handle at one end thereof, means connecting said pivoted operating member to said link for normally moving said link to open and closed positions upon the actuation of said handle, said connecting means between said pivoted operating mem-

ber and said link permitting movement of said link from closed position to open position irrespective of the position of said operating member, and current responsive tripping means including a trip member mounted to rotate about the pivot of said pivoted operating member, a spring for storing energy and applying a force at all times to said trip member tending to rotate it about its pivot point toward tripped position, a latch member engaging and releasably restraining said trip member against movement by said spring, said latch member disengaging and releasing said trip member to move under the force exerted by said spring upon the occurrence of a predetermined current flow through the circuit interrupter, and the force exerted by said spring when said trip member is released being applied to said link through said trip member only and moving said link and the contact member connected thereto to open position irrespective of the position of said handle, and a rigid member movable into engagement with said trip member for rotating it into position where it is restrained by said latch member against said spring and thereby storing energy in said spring for moving the trip member when again released, said return of the trip member to latched position being made prior to the movement of said contact member to closed position by said handle.

16. In a circuit interrupter, means movable to cause opening and closing of the circuit, biasing means for moving said means for opening and closing the circuit to open position, restraining means opposing movement of said means for opening and closing the circuit to open position, a trip member responsive to predetermined conditions for releasing said restraining means, biasing means for said trip member, and means for reducing the stress exerted by said biasing means on said trip member other than due to movement of the trip member, when the interrupter is tripped to open the circuit.

17. In a circuit interrupter, means movable to cause opening and closing of the circuit, biasing means for moving said means for opening and closing the circuit to open position, a trip member movable in response to predetermined conditions and in response to movement of which said biasing means moves said means for opening and closing the circuit to open position, a spring for biasing said trip member, one end of said spring being connected to transmit the stress thereof to said trip member, and the other end of said spring being connected to means movable upon the tripping of the circuit interrupter in such direction as to reduce the stress exerted by said spring on said trip member.

18. In a circuit interrupter, means movable to cause opening and closing of the circuit, biasing means for moving said means for opening and closing the circuit to open position, a trip member movable in response to predetermined conditions and in response to movement of which said biasing means moves said means for opening and closing the circuit to open position, biasing means for said trip member, means for reducing the stress exerted by said biasing means on said trip member other than due to movement of the trip member, when the interrupter is tripped to open the circuit, and means for returning said trip member to untripped position while said trip member is under reduced biasing stress.

19. In a circuit interrupter, means movable to cause opening and closing of the circuit, biasing means for moving said means for opening and closing the circuit to open position, a trip member movable in response to predetermined conditions and in response to movement of which said biasing means moves said means for opening and closing the circuit to open position, a spring for biasing said trip member, one end of said spring being connected to transmit the stress thereof to said trip member, and the other end of said spring being connected to means movable upon the tripping of the circuit interrupter in such direction as to reduce the stress exerted by said spring on said trip member, means for returning said trip member to untripped position prior to reclosure of the circuit interrupter and while the stress on the trip member is reduced, and further movement of the circuit interrupter after return of the trip member increasing the stress on said trip member.

20. In a circuit interrupter, a contact member movable to open and close the circuit, a link movable for causing movement of said contact member to open and close the circuit, current responsive tripping means including a trip member, energy storing means biasing said trip member, means releasably restraining said trip member against movement by said energy storing biasing means, said means restraining said trip member releasing said trip member upon the occurrence of a predetermined current condition, and the energy stored in said biasing means being transmitted to said link through said trip member only and being applied to move said link after said trip member is released, a single manually operable handle member movable for normally moving said link to both open and closed positions without causing release of said restraining means for the trip member, and said movement of said link due to movement of said trip member causing opening of said contact member irrespective of the position of said handle member, and means requiring only the actuation of said handle member to return said link to close the circuit after being moved to open position by said trip member and including means for rigidly engaging said trip member and returning it to restrained position prior to movement of said contact member to closed position.

21. In a circuit breaker, a fixed contact member, a contact member movable into and out of engagement with said fixed contact member to open and close the circuit, a link having one end pivoted to said contact member for moving said contact member to open and close the circuit, a pivoted operating member having a handle at one end thereof, means connecting said pivoted operating member to said link for normally moving said link to open and closed positions upon the actuation of said handle, said connecting means between said pivoted operating member and said link permitting movement of said link from closed position to open position irrespective of the position of said operating member, and current responsive tripping means including a trip member mounted to rotate about the pivot of said pivoted operating member, a spring for storing energy and applying a force to said trip member tending to rotate it about its pivot point toward said tripped position, a latch member engaging and releasably restraining said trip member against movement by said spring, said latch member disengaging and releasing said trip member to move under the force exerted by said spring upon the occurrence of a predetermined current flow

through the circuit interrupter, and the force exerted by said spring when said trip member is released being applied to said link through said trip member only and moving said link and the contact member connected thereto to open position irrespective of the position of said handle, said handle being manually operable to cause said contact member to move to open position without release of said latch member, and means requiring only the actuation of said handle for reclosing said contact member after being caused to move to open position due to movement of said trip member and including a rigid member actuable into engagement with said trip member for rotating it into position where it is restrained by said latch member prior to the movement of said contact member to closed position by said handle.

22. In a manually and automatically operable switch, a switch frame, a manually operable member pivotally mounted on said frame, an automatically operable member pivoted on a pin extending through said manually operable member, a contact carrier pivotally mounted on said frame, a spring connecting said automatically operable member and said contact carrier, a latch member normally preventing automatic movement of said automatically operable member by said spring, said latch member being movable out of engagement with said automatically movable member to thereby release it to be moved by said spring, said automatically operable member when moved by said spring causing movement of said contact carrier to open the circuit irrespective of the position of said manually operable member, and a member movable in response to the occurrence of a predetermined condition in the circuit to cause movement of said latch member out of engagement with said automatically operable member to open the circuit.

23. A manually and automatically actuable switch having fixed and movable contacts, said movable contact being pivoted about an axis, fixed relative to said fixed contacts, means to actuate manually said movable contact, means to actuate automatically said movable contact, said automatic means being carried by a pin extending through said manual means but capable of movement independent thereof upon occurrence of overload, a spring connecting said automatic means and said movable contact, said spring biasing said movable contact and biasing said automatic means to move in a direction to cause opening of the movable contact, a latch member normally engaging said automatic means and preventing said independent movement thereof by said spring, and a current responsive member for causing movement of said latch member to disengage said automatic means and permit it to move due to the bias of said spring to cause opening of the movable contact.

24. In a manually and automatically operable switch, a switch frame, a manually operable member pivotally mounted on said frame, an automatically operable member pivoted on a pin extending through said manually operable member, a contact carrier pivotally mounted on said frame, a spring connecting said automatically operable member and said contact carrier, said spring biasing said automatically operable member to move and thereby cause opening of the switch, a latch to which the force tending to move said automatically operable member is transmitted and which normally prevents the force exerted by said spring from moving said automatically operable member, said latch being mounted for pivotal movement about a fixed point on said frame and current responsive means fixedly mounted on said frame for causing movement of said latch about its fixed pivot to release said automatically movable member to open the switch.

25. A manually and automatically actuable switch having fixed and movable contacts, said movable contact being pivoted about an axis, fixed relative to said fixed contacts, means to actuate manually said movable contact, means to actuate automatically said movable contact, said automatic means being carried by a pin extending through said manual means but capable of movement independent thereof upon occurrence of overload, a spring connecting said automatic means and said movable contact, said spring at all times biasing said automatic means to move in the direction to cause opening of the movable contact, a latch pivoted about an axis, fixed relative to said fixed contact, for normally preventing movement of said automatic means by said spring, and current responsive means fixedly mounted relative to said fixed contact and having a portion movable to release said latch and thereby cause movement of said automatic means and opening of the circuit by said movable contact irrespective of the position of said manual means.

HANS LANGFRITZ.