

[54] **NO-FUSE CIRCUIT BREAKER**

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335/191

[51] **Int. Cl.**..... **H01h 9/20**

[58] **Field of Search**..... 335/174, 175, 35,
335/38, 221, 167, 168, 169, 170, 191, 21, 172

[56] **References Cited**

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[57]

ABSTRACT

A no-fuse circuit breaker comprising at least one movable contact arm, one end portion of which is rotatably supported on a mechanism frame and the other end of which is provided with a contact point engageable with a stationary contact in the mechanism. An intermediate portion of the movable contact arm is operatively connected to one end of a pair of links operatively connected in series, the other end of the links being operatively connected to an operating handle rotatably mounted on the mechanism frame. A latching member is rotatably mounted on the mechanism frame, being engageable with one end of a releasable member, the other end of the releasable member being operatively connected to a knee connection between the pair of links, whereby the movement of the knee connection is restricted by the releasable member when latched by the latching member. Thus, the movable contact arm is actuated by the operating handle when the releasable member is latched by the latching member, and the movable contact arm can be tripped when the restriction in the movement of the knee connection of the links is released due to disengagement of the releasable member with the latching member as may be caused by the rotation thereof.

3 Claims, 5 Drawing Figures

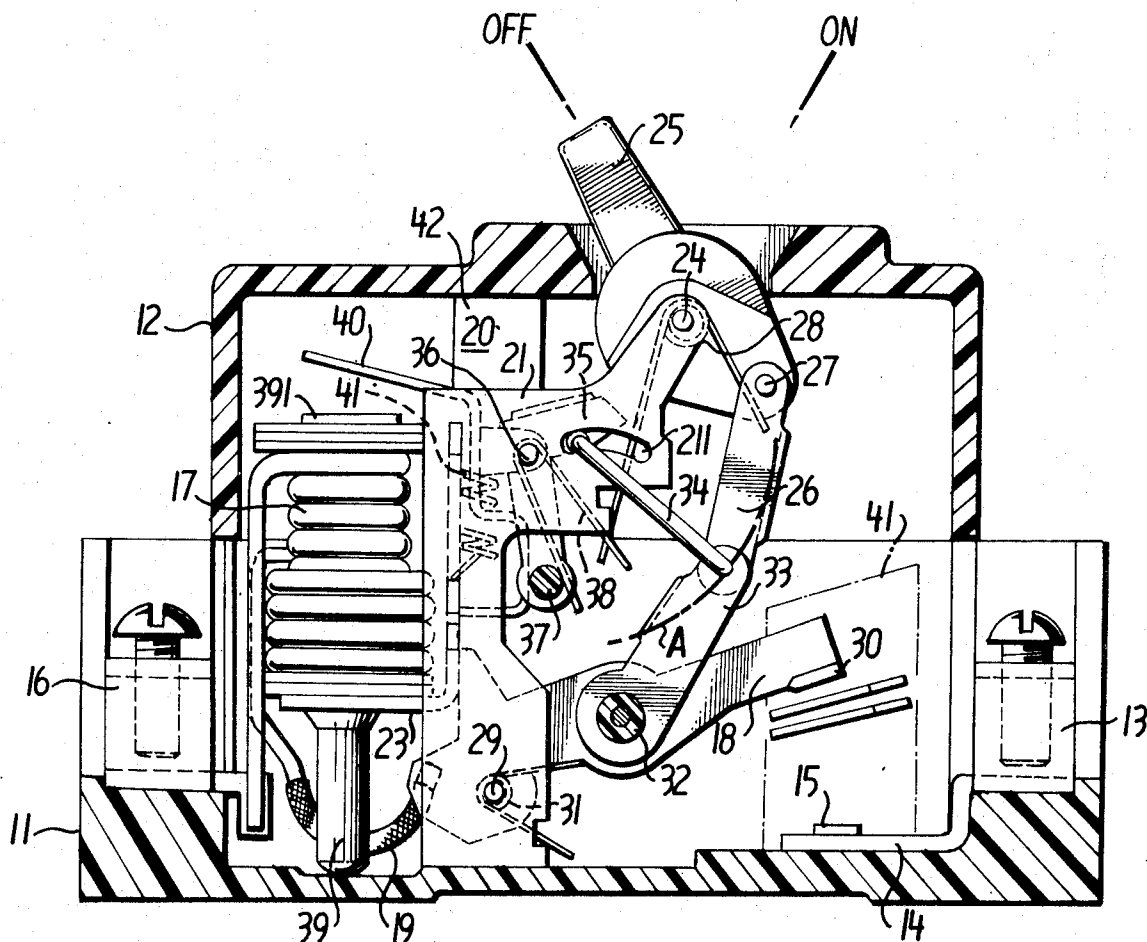


FIG. 1

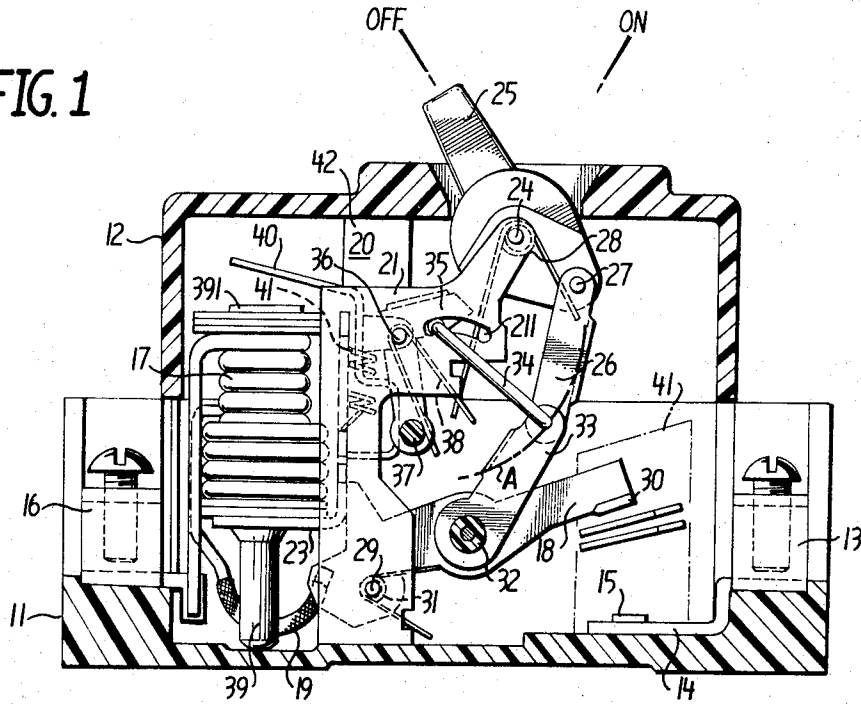
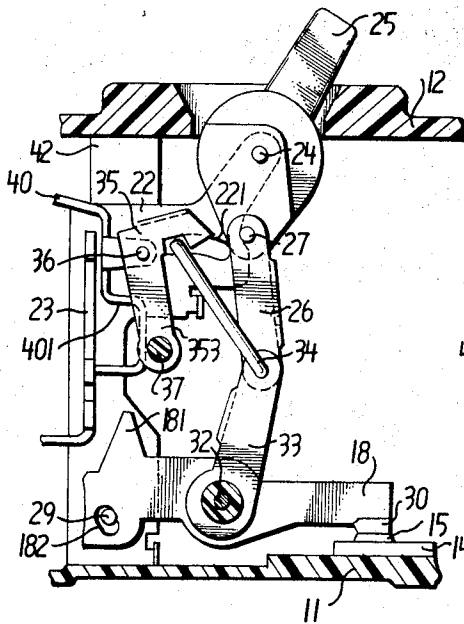


FIG. 2

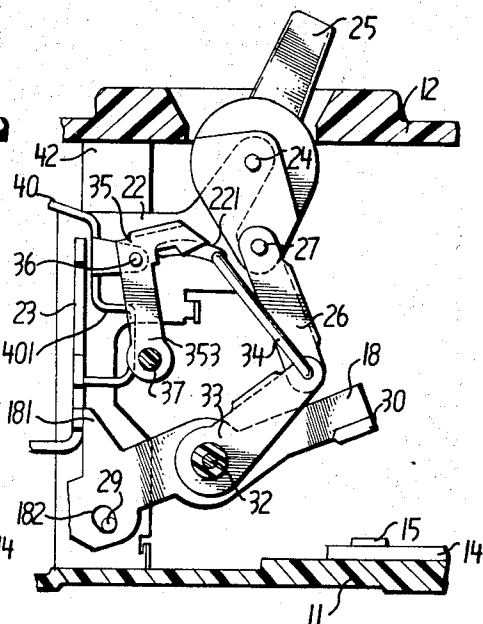


FIG. 3

FIG. 4

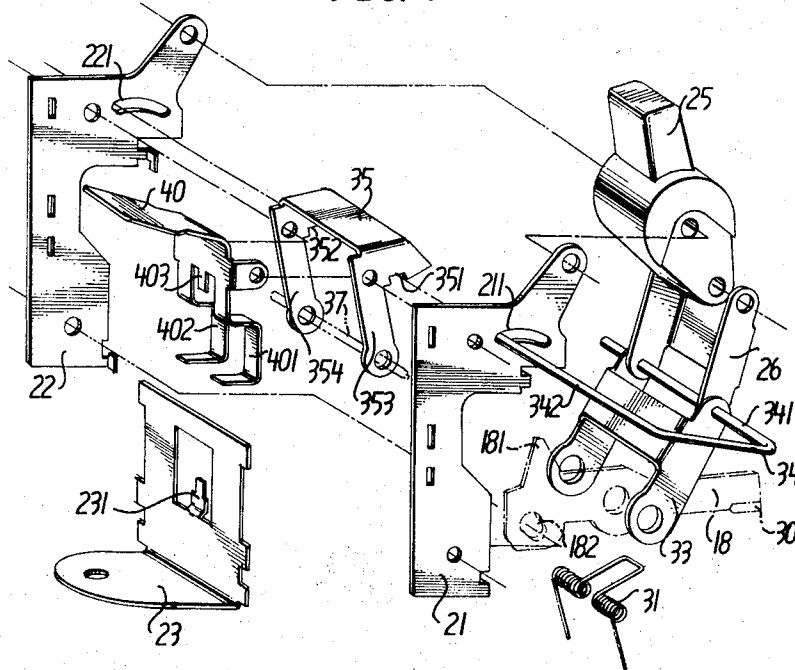
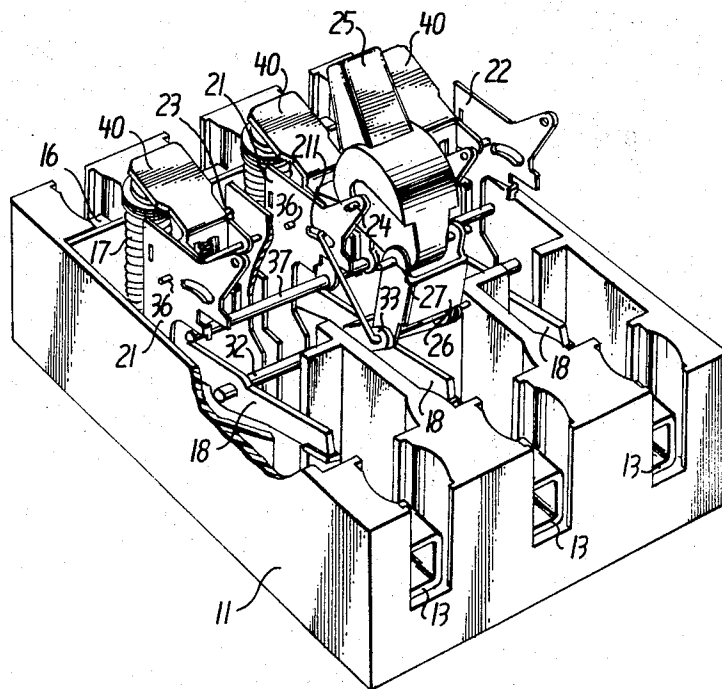


FIG. 5



NO-FUSE CIRCUIT BREAKER

BACKGROUND OF THE INVENTION

1. Field of The Invention

This invention relates generally to a no-fuse circuit breaker of a relatively small rated overload current.

2. Description Of The Prior Art

Many kinds of mechanisms for use as relatively small no-fuse circuit breakers have heretofore been developed, but these mechanisms that are adapted for use in combination with an electromagnetic trip arrangement, while being generally successful, have had such disadvantages that they have not been found to be entirely satisfactory. For example, these mechanisms have been relatively complicated and therefore difficult to adjust, and in addition, a high degree of manufacturing accuracy has thus been required.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a no-fuse circuit breaker of relatively small size and of simple construction.

Another object of this invention is to provide a no-fuse circuit breaker which is capable of being tripped by a relatively small force.

Still another object of this invention is to provide an improved no-fuse circuit breaker, which is adapted for use in combination with an electro-magnetic trip arrangement.

Briefly stated, the foregoing objects and others are achieved according to one aspect of this invention through the provision of a circuit breaker having a movable contact arm rotatably supported about one end in a mechanism frame and having a contact member on its other end engage-able with a stationary contact member mounted in the mechanism frame, an operating handle rotatably supported in said mechanism frame and operatively connected through a pair of serially connected links to an intermediate portion of the movable contact arm, a releasable member formed in a U-shaped configuration having one leg rotatively connected through the axis of the knee connection of the links and the other slidably guided in arcuate slots in the mechanism frame, and a latching member rotatably mounted in the frame capable of latching the other end of the releasable member and resiliently biased to be kept in engagement therewith. An electromagnetic trip arrangement is provided for actuating the latching member to disengage it from the releasable member responsive to a current larger than a predetermined value in the circuit.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description when considered in conjunction with the accompanying drawings wherein like reference numerals designate like or corresponding parts throughout the several views, and in which:

FIG. 1 is a schematical side view, shown partially in cross-section, of a preferred embodiment of the present invention, the mechanism being shown in the circuit open state;

FIG. 2 is a schematical side view, with parts omitted, of the necessary portion of the embodiment shown in

FIG. 1 for illustrating the operation thereof, the mechanism being shown in the circuit closed state;

FIG. 3 is a view similar to that shown in FIG. 2 wherein the mechanism is shown in the open state just after having been tripped;

FIG. 4 is a perspective view of important portions in the embodiment shown in FIG. 1; and

FIG. 5 is a perspective view, partially broken away and with some parts omitted of a "three-pole" no-fuse circuit breaker according to the mechanism of the embodiment shown in FIG. 1.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, and particularly to FIG. 1 thereof, a no-fuse circuit breaker is shown having a casing which comprises a base 11 and a cover 12 of insulating material.

A line terminal 13 is provided in the base 11 at one end thereof having an extension 14 carrying a stationary contact 15. On the other end of the base 11 there is provided a load terminal 16 electrically connected to a coil 17, to be described, which in turn is electrically connected to a movable contact arm 18 through a flexible conductor 19.

There is provided a mechanism frame 20 comprising a pair of side plate members 21 and 22 and L-shaped yoke member 23, all of these members being made of metal. The side plates 21 and 22 are symmetrical in construction and disposed in parallel planes, as shown in FIG. 4, and are secured to the yoke member 23 by suitable means, such as by a force fit. (In FIG. 1 the side plate 22 is not seen, and in FIGS. 2 and 3 the side plate 21 is omitted.) Arcuate slots 211 and 221 are provided in the side plates 21 and 22, respectively, as shown in FIG. 4.

Rotatably mounted on the top of the frame 20 by a pin 24 is an operating handle 25, of conventional design being made of insulating material, which is operatively connected to a link 26 by a pin 27. The handle 25 is spring biased in the counter clockwise direction, as viewed in the drawings, by a pair of spring 28 provided around the pin 24 and outside the lower extension of the handle 25 between the side plates 21 and 22, as shown in FIG. 1, only the one spring of the side viewed in the drawing being shown.

The movable contact arm 18 has an integral projected portion 181 at one end for functioning as a stop and an egg-shaped hole 182 having a pin 29 inserted therein for supporting the arm 18 on the frame 20. The movable contact arm 18 is provided also with a contact 30 at its other end, being engageable with the stationary contact 15. The idle clearance between the hole 182 and the pin 29, by incorporating a spring 31, permits contact pressure to be provided between the movable and stationary contacts 30 and 15. The spring 31 gives a biasing force in the counter-clockwise direction, as viewed in the drawings, and is of the shape shown in FIG. 4. The intermediate portion of the movable contact arm 18 is operatively connected by an insulated pin 32 to a lower link 33 which is rotatably connected, at the top end portion thereof, to the bottom end portion of the upper link 26 to form a knee connection.

A releasable member 34 is provided, a lower end thereof being connected to the knee connection between the upper and lower links 26 and 33. An upper end of the member 34 is slidable in the slots 211 and

221, and is adapted to be latched. Thus, the movement of the knee connecting axis is restricted by the releasable member when the same is latched. In detail, the releasable member 34 is a U-shaped rod as shown in FIG. 4, one leg portion 341 thereof acting as a connecting pin for links 26 and 33, and the other leg portion 342 being inserted through the slots 211 and 221 of the side plates 21 and 22 so as to be slidably guided by the slots 211 and 221.

Latching of the releasable member 34 is provided by a latching member 35 rotatably mounted on the mechanism frame 20 by a pin 36. The member 35 has tooth portions 351 and 352 capable of latching the upper leg portion 342 of the releasable member 34, and has arms 353 and 354 to support an actuating rod 37 of insulating material, as clearly shown in FIG. 4. The latching member 35 is also spring biased in the clockwise direction, as viewed in the drawings, by a spring 38 provided around the pin 36 between the arms 353 and 354. An operation to move the rod 37 rightward, as seen in FIG. 4, will cause the releasable member 34 to be released from its engagement with the latching member 35.

In order to actuate the rod 37 in the rightward direction when a current larger than a predetermined value flows from the line terminal 13 to the load terminal 16, the coil 17, already mentioned, is arranged in series with the current path between the line and load terminals 13 and 16. Mounted in the axial bore of the coil 17 is a core member 39 of soft ferro-magnetic material, such as soft iron, which is fixed to the yoke member 23 and has a pole portion 391 at the top end thereof. Facing the pole portion is an armature member 40, also of soft ferro-magnetic material, such as soft iron, which is rotatably mounted on the mechanism frame 20 by the pin 36 together with the latching member 35, but independently therefrom. As clearly shown in FIG. 4, the armature 40 has a pair of extensions 401 and 402, each having a lower portion bent in a substantially U-shaped configuration the base of which can abut on the rod 37 to move the same to the right when the armature 40 rotates about the pin 36 in the counter-clockwise direction. The armature 40 is also spring biased in the clockwise direction by a compression spring 411 provided between a tab 403 of the armature 40 and a tab 231 of the yoke member 23.

A suitable arc extinguishing structure 41 of conventional design is provided in the base 11. The reference numeral 42 designates a projection of elongated cube-like shape integrally provided on the inner wall of the cover 12 for limiting the upward movement of the mechanism frame 20.

In operation, in order to close the circuit breaker from the open state shown in FIG. 1, the operating handle 25 must be moved from the "OFF" position to the "ON" position. In the "OFF" position, which also means the "RESET" position, the latched leg portion 342 of the releasable member 34 is engaged with the tooth portions 351 and 352 of the latching member 35, so that the releasable member 34 is latched by the latching member 35, whereby the knee connection of the links 26 and 33 can be moved only along the circular locus as indicated by the reference character A in FIG. 1. Accordingly, the operating handle 25 is operated to rotate in the clockwise direction, against the biasing force of the springs 28 and 31, whereupon the movable contact arm 18 rotates substantially around the pin 29 in the clockwise direction to contact the

movable contact 30 with the stationary contact 15. In accordance with that movement, the intermediate portion of the contact arm 18 is then moved further downward by the link 33, and the contact arm 18 is rotated in the counter-clockwise direction substantially around the contact point of the contacts 15 and 30 because of the presence of the clearance 182 about the pin 29. Thus, the biasing force of the spring 31 functions to provide suitable contact pressure between the movable and stationary contacts 30 and 15. When the pin 27 passes substantially over an imaginary line defined by connecting the pin 24 and the knee connection axis of the links 26 and 33, the upward force in the link 33 caused by the spring 31 urges the handle 25 to rotate in the clockwise direction against the biasing force of the springs 28, but such clockwise rotation of the handle 25 is now limited by the collision of the pin 27 with side plates 21 and 22, as shown in FIG. 2. Hence the mechanism holds the closed state of the circuit. In this connection, the latched leg 342 of the releasable member 34 will move to the right because it is slidably guided by the slots 211 and 221 as well as being pulled by the links 26 and 33, but the leg 342 still remains latched by the latching member 35.

Manual opening of the circuit is performed by rotating the handle 25 in the counter-clockwise direction. The movements of each of the parts are similar, but in reverse relation, so that the detailed explanation thereof may be omitted.

Next the trip operation which occurs when a current above a predetermined value flows in the circuit will be described.

In the closed state of the circuit, as shown in FIG. 2, the armature 40 is pulled down to contact the pole 391 of the core 39 when the flow of current in the coil 17 becomes larger than a predetermined value. The movement of the extensions 401 and 402 of the armature 40 pushes the insulator rod 37 supported by the arms 353 and 354 of the latching member 35 to the right so that the latching member 35 rotates in the counter-clockwise direction to release the latched leg 342 of the releasable member 34. Accordingly, the upper leg 342 of the releasable member 34, which was latched until this time, as shown in FIG. 2, becomes movable rightwardly and moves rightward along the slots 211 and 221 of the side plates 21 and 22, because the member 34 is pulled by the links 26 and 33. In other words, restriction in the movement of the knee connection axis of the links 26 and 33 is now removed, and the movable contact 30 becomes separated from the stationary contact 15, as shown in FIG. 3.

Slightly after this, or substantially at the same time, the operating handle 25 is caused to rotate in the counter-clockwise direction by the springs 28. In response to this, the link 26, first moves downwardly and clockwise, and then moves upwardly and clockwise, with result that the upper leg 342 of the releasable member 34 moves leftwardly along the slots 211 and 221 to be re-engaged by the latching member 35. Thus, when an overload current flows, the mechanism is automatically tripped and reset, as shown in FIG. 1.

As understood from the above description, by a relatively small force, the latching member can be actuated to release the upper latched leg 342 of the releasable member 34, because the upper latched leg 342 is slidably guided by means of the slots 211 and 221 in the side plates 21 and 22, and the mechanism can be com-

5

posed of a relatively small number of parts which, in addition, have relatively simple shape. This in turn means that a mechanism of stabilized characteristics and of good performance can be provided which is low in cost and takes little space.

It is noted that this invention is also applicable to a polyphase circuit breaker such as a "three-pole" circuit breaker, although the description hereinabove refers to only a "single-pole" circuit breaker.

In FIG. 5 which shows a perspective view of the three-pole no-fuse circuit breaker according to this invention, the central pole has substantially the same construction except that the rod 37 mounted on the latching member 35 and the rod 32 for actuating the movable contact arm 18 extend axially beyond both ends from that shown in FIGS. 1-4. Each of the two outside mechanisms has no handle 25 of their own, nor the upper and lower links 26 and 33, the releasable member 34, and the latching member 35. The respective movable contact arms 18 in the two outside mechanisms are connected to the actuating rod 32 of the central mechanism, whereby all of the movable contact arms 18 are operated simultaneously, and the latching member 35 provided only in the central mechanism can be moved by operation of at least one of the armatures 40 provided on the respective poles. Thus, all of the movable contact arms 18 can be operated manually by the handle 25, and all of the circuits can be tripped when an overload current flows in any one of the poles.

Obviously many modifications and variations of the present invention are possible in light of these teachings. It is therefore to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A no-fuse circuit breaker comprising:

an insulative casing;

a mechanism frame mounted in said casing at one side thereof and having a pair of side plates arranged in parallel relation, each of said side plates having an elongated slot therein;

a stationary contact member mounted on the other side of said casing at the bottom thereof;

a movable contact arm supported at one end thereof by and between said side plates, having a contact

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portion at the other end thereof engageable with said stationary contact member and being spring biased to normally separate said contact portion thereof from said stationary contact member;

an operating handle rotatably supported by and between said side plates and having one portion extending outwardly from said casing;

an upper link rotatably connected at one end portion thereof to said operating handle at another portion;

a lower link operatively connected at one end portion thereof to the other end portion of said upper link, the other end portion of said lower link being rotatably connected to an intermediate portion of said movable contact arm;

a releasable member operatively connected at one end portion thereof to the connection between said upper and lower links, and being slidably guided at its other end portion by said slots in said side plates;

a latching member rotatably mounted on and between said side plates, being capable of latching said other end portion of said releasable member, and being spring biased to be resiliently kept in position engageable with said other end portion of said releasable member; and

means for actuating said latching member to disengage from said releasable member in response to a flow of current larger than a predetermined value; whereby said movable contact arm may be actuated to open and close said movable contact portion thereof and said stationary contact by said operating handle when said releasable member is latched by said latching member, and said movable contact arm can be tripped when the engagement of said releasable member with said latching member is released by the operation of said actuating means.

2. A no-fuse circuit breaker as claimed in claim 1, where

said releasable member is a substantially U-shaped rod, one leg portion thereof being adapted to function as a connecting pin for said upper and lower links and the other leg portion thereof being inserted through said slots in said side plates.

3. A no-fuse circuit breaker as claimed in claim 1, wherein

said means for actuating said latching member is an electromagnetic trip arrangement.

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