Oct. 1, 1957 E. A. BERTHIER 2,808,486

MANUALLY OPERABLE TRIP-FREE CIRCUIT BREAKER

Filed Feb. 12, 1954

Fig. 1

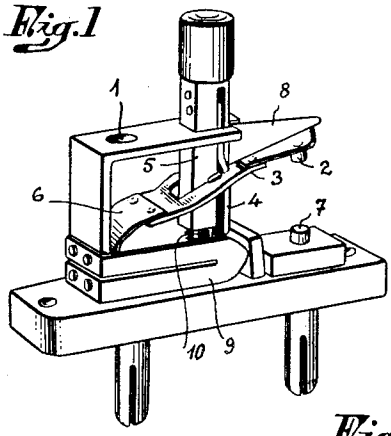


Fig. 2

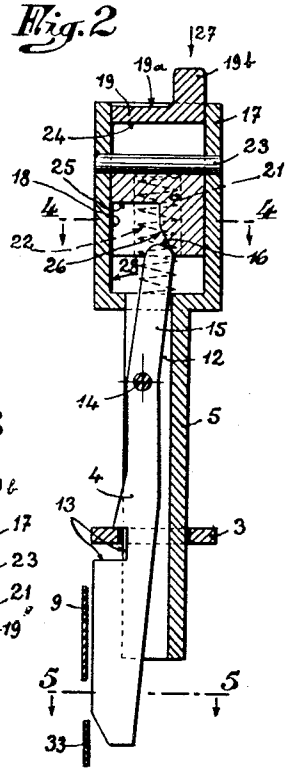


Fig. 3

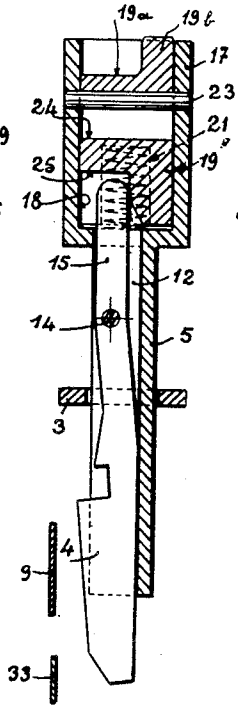


Fig. 4

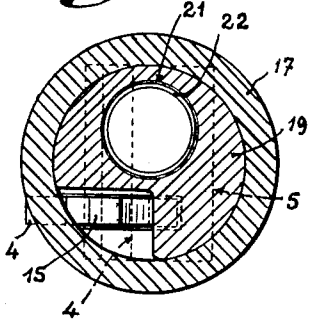


Fig. 5

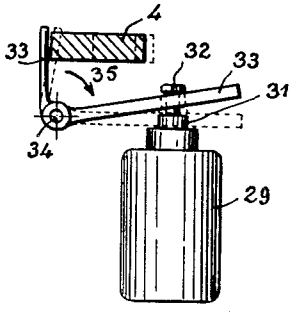
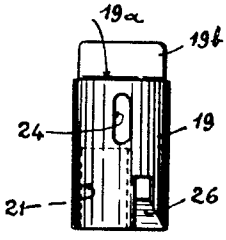


Fig. 6



Inventor:
EMILE ANDRÉ BERTHIER
By Richardson, Davis & Norton ATT'YS.

United States Patent Office 2,808,486 Patented Oct. 1, 1957

2,808,486

MANUALLY OPERABLE TRIP-FREE CIRCUIT BREAKER

Emile André Berthier, Villefranche-sur-Saone, France

Application February 12, 1954, Serial No. 409,969

Claims priority, application France February 16, 1953

8 Claims. (Cl. 200—116)

My invention has for its object an electric circuit breaker or cut-out of the general type disclosed in my prior U. S. Patent No. 2,467,653 issued on April 19, 1949.

The circuit breaker of the present invention includes, in addition to tripping mechanism which responds to electrical overloads, a compact manually operable reset mechanism of the trip-free type together with manually operable tripping mechanism.

A feature of the circuit breaker of the present invention resides in the compactness of the manual control portion of the circuit breaker which permits the breaker to be produced in a materially smaller size for the same rating as compared with circuit breakers of conventional construction.

Another feature of the invention involves the provision of a compact control unit which embodies both a manually operable tripping portion and a manually operable reset portion. In one embodiment of the invention a single push button extension of the tripping member serves to reset the breaker. With the breaker closed, increased pressure applied to the push button serves to trip the breaker manually.

Generally, the circuit breaker comprises an enclosing cover and a base member both formed of insulating material. Advantageously, the base member may be provided with terminals of the plug-in type. A fixed or relatively stationary contact member is carried by the base member. There is a movable contact member which is engageable with the fixed contact member, the movable contact member being carried at the free end portion of a movable contact arm. The movable contact member is movable toward and away from the fixed contact member, the movable contact arm being connected with the base member. The circuit to be controlled and protected against overload by the circuit breaker extends through the fixed and movable contact members which are serially included therein. Spring means or the like resiliently urge the movable contact member away from the fixed contact member.

A longitudinally inwardly movable control unit extends transversely of the movable contact arm in close proximity thereto. The control unit is pressed outwardly by a spring. The control unit comprises a control rod which is longitudinally slotted and which carries an elongated latch member disposed in the slot, the latch member being pivotally connected intermediate its ends to the control rod. The latch member has a notch formed therein inwardly of its pivotal connection to the control rod and this notch is selectively engageable with the movable contact arm for resetting the breaker and holding it closed, the breaker being tripped in all cases by disengagement between the contact arm and the notch.

The control unit also comprises a manually operable outwardly spring pressed tripping member which is longitudinally slidable with respect to the control rod. The tripping member has an outwardly extending projection which terminates in a button for manually tripping the

breaker, the tripping member being provided with a sloping cam surface which cooperates with an outer free end portion of the latch member for disengaging the notch from the contact arm to trip the breaker by inward pressure exerted on the tripping button. The tripping button is positioned adjacent to the outer end of the control rod. In one embodiment of the invention, the breaker is reset by inward pressure exerted on the outer end of the control rod independently and without pressing on the tripping button. Thus, the breaker may be manually reset or tripped at will by inward pressure exerted either on the outer end of the control rod or on the tripping button, respectively.

A further latch engages the control rod for holding the contacts closed and this further latch is tripped by the contact arm to free the control rod and allow it to move outwardly under the influence of its spring after the contact arm has first been released from the notch in the latch member. This provides the trip-free action in cooperation with the latch member which releases the contact arm.

In another embodiment of the invention the tripping button is actuated with reduced pressure to reset the breaker and an increased pressure is applied to the tripping button for manually tripping the breaker. Springs of different characteristics are provided for this purpose. By the use of a single button both for tripping and resetting the breaker, the compactness of the breaker may be greatly increased.

Various additional objects, features and advantages of the invention will become apparent upon reading the following specification together with the accompanying drawing forming a part hereof:

Referring to the drawing:

Fig. 1 is an incomplete or partial perspective view of my prior cut-out from which the cover has been removed.

Figs. 2 and 3 are longitudinal sectional views of the same breaker to which the improvements according to my invention have been applied, Fig. 2 showing it in its closed position and Fig. 3 showing it when tripped or released.

Figs. 4 and 5 are horizontal sectional views, respectively through lines **4**—**4** and **5**—**5** of Fig. 2.

Fig. 6 is a front elevational view of the manually operable inner releasing or tripping push member shown alone.

Referring to Fig. 1, there is shown diagrammatically the circuit breaker of my prior Patent No. 2,467,653, referred to above. It includes a movable contact **2** carried by a flexible blade **3** which is held in its set contact-making position by engagement of a latch blade **4** carried by a push rod **5**; this flexible blade **3** is acted upon by a spring **6** which may form part of it and the push rod **5** is held in its inward position corresponding to the closing of the movable contact **2** over the stationary contact **7** by a spring-urged pawl **8**. The release corresponding to the separation of the contacts **2** and **7** is produced by the deformation of a bimetallic strip **9**, which presses the latch blade to make it recede into its housing in the push-rod **5**, so releasing the flexible blade **3** which, being suddenly retracted, strikes the tail end of the pawl **8** thereby releasing the push rod which a further spring **10** urges into its outer released position, the latch blade **4** at the same time reengaging the released flexible blade **3** carrying the movable contact **2**.

By reason of the desirability of providing a positively controlled manual release from the outside of the casing of the breaker it is possible, as disclosed in my prior patent, to provide in an advantageous manner the said casing with an auxiliary push member, which is not illustrated in Fig. 1, said auxiliary push member when depressed through the opening at **1** acting through the

agency of a rocking lever, which is not illustrated, on the pawl 8 which holds the push rod 5 in its inward operative position; this operation of the auxiliary push member produces the release of the movable contact, which is no longer held in its operative position by the now released push rod. This arrangement has provided extremely satisfactory results. The mounting of the releasing push button leads, however, in addition, to a greater intricacy of structure, to a somewhat objectionable increase in size.

In order to remove these drawbacks, I have devised an improved cut out of the type referred to hereinabove, but with the difference that the releasing push member is inwardly coaxial with the upper hollow end of the resetting push rod and is adapted to produce the desired release through a pivotal shifting of the latch blade or lever, which forms the retaining member for the flexible blade carrying the movable contact or contacts, said pivotal movement of the latch member being produced by the shifting of the end of an arm, forming an extension of said latch member inside the resetting push rod, over a slope formed on the inner end of the releasing push member.

This inner releasing push member is slidingly housed inside a recess of the resetting push rod and is submitted therein to the action of a spring which urges it outwardly, said spring being either: more powerful than the spring 10 urging the resetting push rod into its released position so as to allow resetting by depressing indifferently either of the two knobs controlling the coaxial push member and rod, or else less powerful than said spring 10 urging the resetting push rod into its released position, which condition requires resetting by acting exclusively on the knob on the outer resetting push rod.

Furthermore, and according to another feature of my improved cut out, the speed of release is considerably increased, which is important in the case of large excess currents by shifting the rocking latch member which locks the push rod through the agency of a movable armature carried by the plunger core of an electromagnetic coil positioned on the base of the cut out and permanently fed by the electric current flowing through the circuit controlled by said cut out.

In all the figures, 5 designates again the resetting push rod associated with the latch blade or lever 4. In the embodiment illustrated of my improved cut-out, the resetting push rod 5 is longitudinally slotted at 12 for housing the latch lever 4 which is provided with a notch 13 for holding in position the flexible blade 3 carrying the movable contact, which is not shown in Figs. 2 to 6. Said latch lever 4, which is pivotally secured to a pivot 14 extending across the longitudinal slot 12, includes beyond said pivot an arm 15 the free end of which forms a tail piece 16, the part played by which will be disclosed hereinafter.

The upper hollow end of the pusher rod 5 forms an axially recessed section or push button 17 controlling the resetting of the cut-out. Inside the cylindrical recess 18 formed in the hollow push button 17 is slidably mounted an auxiliary push button 19 adapted to produce the positive release of the cut-out.

The inner push-button 19 is also provided with an axial recess 21 which opens into the lower end of said button while a coil spring 22 is held between the movable bottom of said recess 21 and the stationary bottom of the recess 18 in the outer push button 17, the two recesses facing each other. It is thus apparent that the spring 22 raises the inner push member 19 with reference to the outer push member 17, the movements of the push member 19 with reference to the push member 17 being however limited by a stay or the like stop 23 rigid with the outer push member 17, which stay extends through a vertically elongated slot 24 cut across the upper part of the inner auxiliary push member 19.

The arrangement and size of these different members

are selected in a manner such that the upper surface 19*a* of the push member 19 is flush with that of the outer push member 17 when inoperative and that there exists, between the lower surface of the inner push member 19 in its inoperative position and the bottom of the housing 18 in the outer push member 17, a spacing corresponding to the shifting of the inner push member required for releasing the cut-out. At its upper end, the inner push member 19 is furthermore provided with an upwardly projecting section 19*b* the height of which is equal to last mentioned spacing.

To produce the release of the cut-out, there is provided, inside the inner push member 19 and in register with the slot 12 in the push rod 5, a recessed area 25, the surface of which facing the slot 12 assumes a slope as shown at 26. This sloping surface is engaged by the tail-piece 16 on the arm 15 forming an extension of the latch member 4.

Obviously, when the cut-out is in its set position, the yielding blade 3 carrying the movable contact is held in position as illustrated in Fig. 2 by the stop formed by the notch 13 in the latch lever 4. Obviously also, the release of the cut-out is normally obtained as a result of the expansion of the bi-metallic strip 9, which latter when fed by an excess current of predetermined intensity is deformed and engages the lower end of the latch member 4 so as to make the latter rock round the pivot 14 and release the flexible blade 3 which consequently urges the movable contact away from the stationary contact.

In order to obtain manually and positively the same release, it is sufficient, according to my present invention, to depress the projecting section 19*b* of the inner push member 19. As a matter of fact, the depression of said push member 19 in the direction of the arrow 27 of Fig. 2 produces, through action of the slope 26 on the tail-piece 16 of the lever 15—4, an angular movement of the latter round the pivot 14, as illustrated by the arrow 28 in Fig. 2. As precedingly, the lower end of the lever 4 returns inside the housing 12 formed in the push rod 5 and the yielding blade 3 carrying the movable contact is again released and the push-rod 5 is sped upwardly as in the case illustrated in Fig. 1. The position thus reached is illustrated in Fig. 3.

For resetting the cut-out, it is sufficient to depress simultaneously the two push members 17 and 19, the latter being acted upon through its lower section 19*a*. This operation of the cut-out has been described with the assumption that the spring 22, acting on the inner push member 19, is less powerful than the spring 10, not illustrated in Figs. 2 to 6, urging upwardly the system including the push rod 5 and the push members 17 and 19. The operation in the case of a more powerful spring has been referred to hereinabove.

The release of the cut-out may be furthermore obtained automatically and in a practically instantaneous manner in the case of large excess currents by resorting to the electromagnetic coil 29 carried by the base of the cut-out (Fig. 5) underneath the push rod 5 and the latch lever 4. The plunger core 31 inside said electromagnetic coil includes as a matter of fact a head 32 engaging one of the arms of a right angled lever 33, the apex of which is rockably mounted on a stationary pivot 34 while its second arm faces the edges of the lower section of the latch lever 4. It is apparent that, if the coil 29 is fed with a sufficient excess current, it attracts the plunger core 31, which in its turn produces the pivotal movement of the lever 33 in the direction of the arrow 35 of Fig. 5 round the pivot 34. Consequently, the free arm of the lever 33 shifts the latch lever 4 which rocks round the pivot 14 and produces in the manner already disclosed the release of the cut-out.

Obviously, my invention should not be construed as defined by the limitations of the above disclosure and it covers in fact all the modifications thereof falling within the scope of accompanying claims.

What I claim is:

1. A circuit breaker of the class described, comprising: a base member; a fixed contact member carried by said base member; a contact arm connected with said base member and having a free end portion thereof movable toward and away from said fixed contact member; a movable contact member carried by said free end portion and engageable with said fixed contact member; an electrical circuit extending through said circuit breaker and controlled thereby, said fixed and movable contact members being serially included in said circuit; means resiliently urging said movable contact member away from said fixed contact member; a longitudinally movable control rod extending transversely of said contact arm in proximity thereto, said control rod having an outer end portion which is engageable for manually resetting said breaker; an elongated latch member carried by said control rod and pivotally connected thereto intermediate its ends, said latch member having a notch formed therein inwardly of said pivotal connection for selective engagement with said contact arm; a manually operable tripping member carried by said control rod longitudinally slidably with respect thereto, said tripping member having an outward extension which provides a manually operable tripping button disposed adjacent to the outer end portion of said control rod, said tripping member comprising a cam surface cooperating with an outer free end portion of said latch member for disengaging said notch from said contact arm in response to inward movement of said tripping member; a first spring means urging said tripping member outwardly with respect to said control rod; a second spring means urging said control rod outwardly with respect to said base member; further latch means for holding said control rod in its inward position to maintain said contact members in engagement during engagement of said notch with said contact arm, said further latch means being actuated to release said control rod by engagement with said free end portion of said contact arm upon movement thereof away from said fixed contact member; and electrically actuable tripping means serially included in said circuit, said electrically actuable tripping means comprising a movable portion which cooperates with an inner free end portion of said latch member to disengage said notch from said contact arm whenever the current in said circuit exceeds a predetermined maximum value.

2. A circuit breaker according to claim 1, in which said control rod has a longitudinal slot formed therein, said latch member being disposed in said slot.

3. A circuit breaker according to claim 1, in which said tripping button and said outer end portion of said control rod are of circular cross-sectional and said tripping button is concentrically disposed within said control rod outer end portion.

4. A circuit breaker according to claim 1, wherein said first spring means is weaker than said second spring means and wherein said control rod outer end portion is manually engageable independently of said tripping button.

5. A circuit breaker according to claim 1, wherein said

first spring means is stronger than said second spring means, said circuit breaker being resettable by pressing on said tripping button with a pressure sufficient to overcome the action of said second spring means yet insufficient to overcome the action of said first spring means, and said circuit breaker being manually trippable by pressing on said tripping button with pressure sufficient to overcome simultaneously the action of both of said first and second spring means.

6. A circuit breaker according to claim 1, wherein said electrically actuable means comprises a bimetallic thermally responsive member heated by current flow in said circuit.

7. A circuit breaker according to claim 1, wherein said electrically actuatable means comprises an electromagnetic device having an operating winding connected in said circuit.

8. A circuit breaker of the class described, comprising: two cooperating contacts; a first spring means resiliently urging one of said contacts away from the other; movable contact arm means connected with one of said contacts for maintaining said contacts in engagement and permitting said first spring means to cause disengagement therebetween; a control unit transversely movable with respect to said contact arm, said control unit comprising a control rod member; a second spring means urging said control rod in the contact disengaging direction of movement of said contact arm; a latch member carried by said control rod and having a notch formed therein for selective engagement with said contact arm, said latch member being pivotally connected intermediate its ends to said control rod member; a manually engageable outwardly spring pressed tripping member included in said control unit and movable with respect thereto to engage said latch member for causing contact arm disengaging movement of said notch; said circuit breaker further comprising further latch means for holding said control unit to maintain said contacts engaged with said contact arm engaged in said notch, said further latch means being tripped to release said control unit by contact disengaging movement of said control arm; an electrical circuit extending through said contacts for control thereby, and electrically actuable tripping means serially included in said circuit, said electrically actuable tripping means comprising a movable portion which cooperates with said latch member to disengage said notch from said contact arm whenever the current in said circuit exceeds a predetermined maximum value.

References Cited in the file of this patent

UNITED STATES PATENTS

1,990,122	Hauser	Feb. 5, 1935
2,043,470	Dyer et al.	June 9, 1936
2,127,319	Zahradnik	Aug. 16, 1938
2,156,761	Jackson et al.	May 2, 1939
2,335,082	Platz	Nov. 23, 1943
2,467,653	Berthier	Apr. 19, 1949
2,519,297	Stump et al.	Aug. 15, 1950