July 16, 1935. W. H. FRANK 2,008,174

AUTOMATIC RESET CIRCUIT BREAKER

Filed April 21, 1933 3 Sheets-Sheet 1

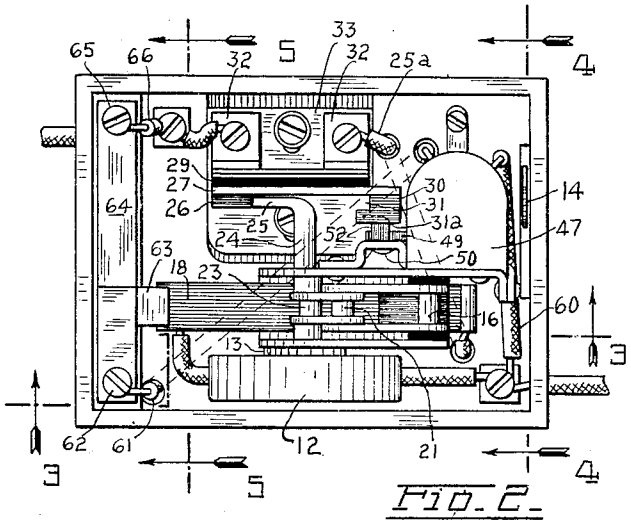


Fig. 2.

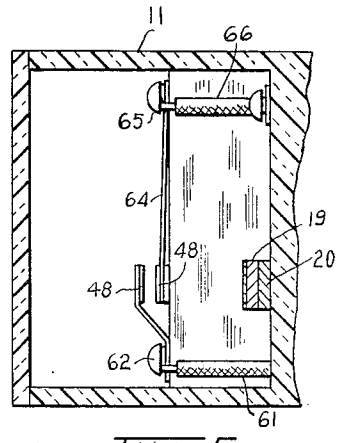
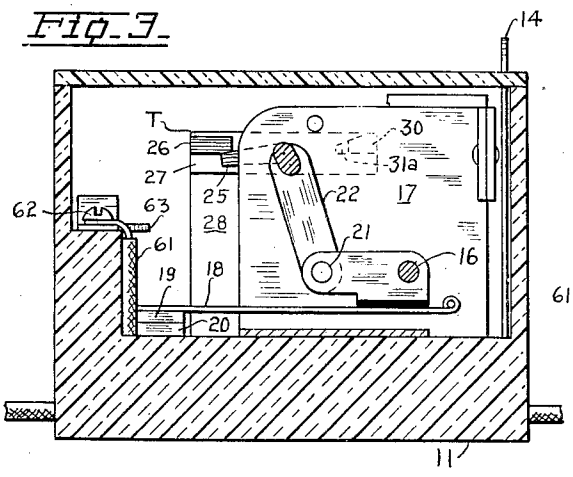


Fig. 5.

Fig. 3.



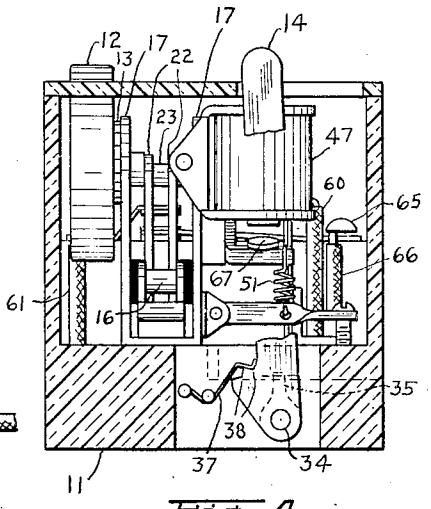


Fig. 4.

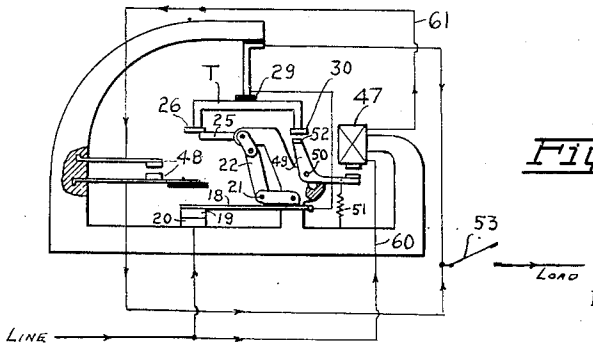


Fig. 1.

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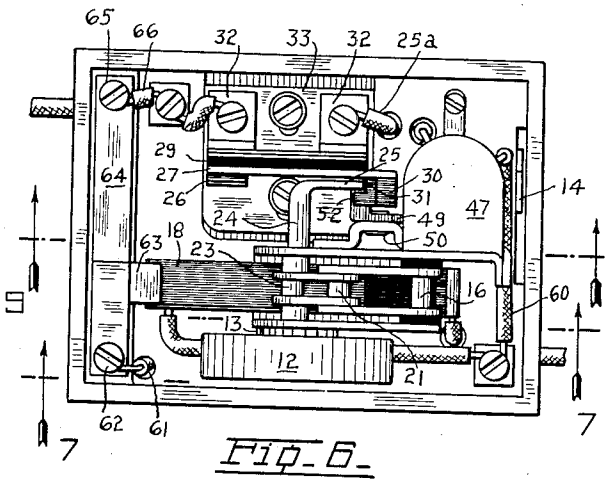


Fig. 6.

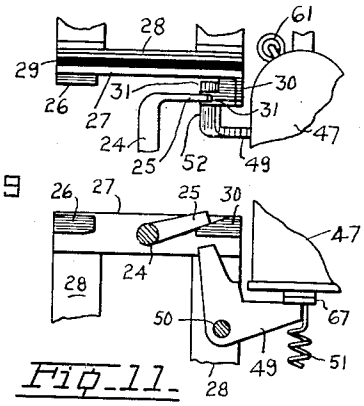


Fig. 11.

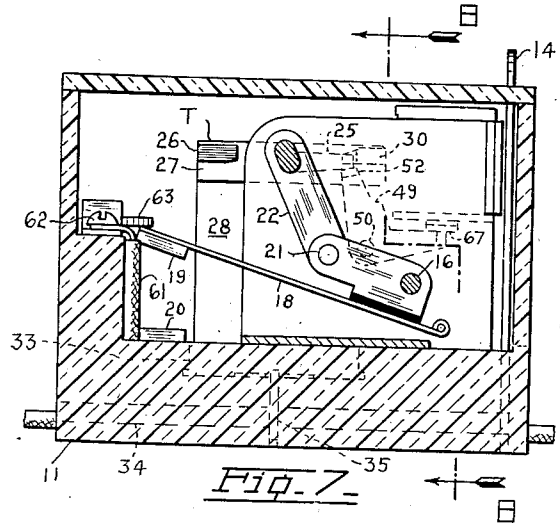


Fig. 7.

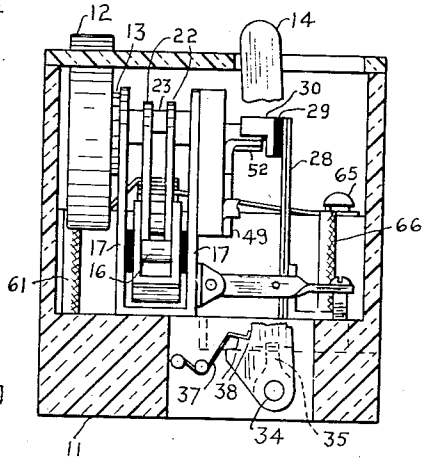


Fig. 8.

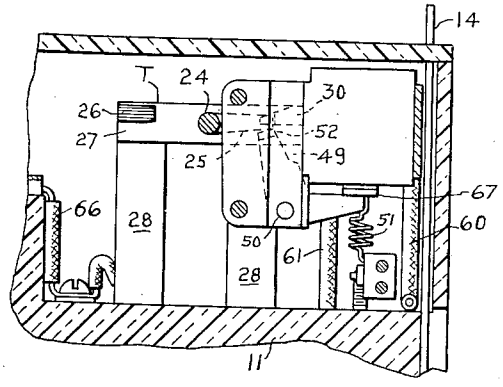


Fig. 9.

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AUTOMATIC RESET CIRCUIT BREAKER

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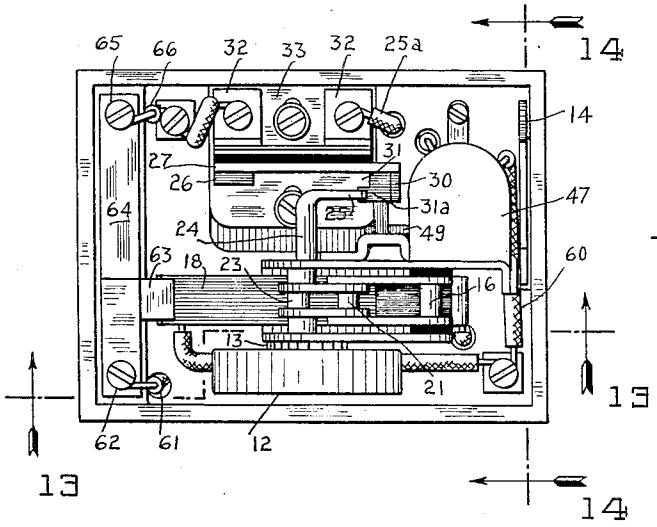


Fig. 12.

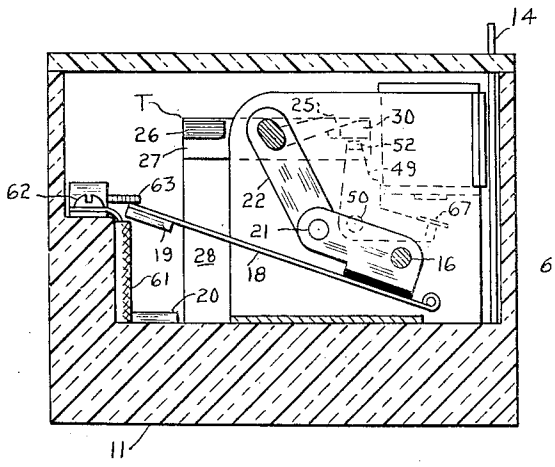


Fig. 13.

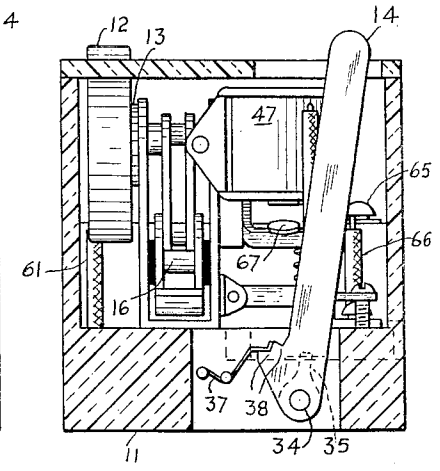


Fig. 14.

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UNITED STATES PATENT OFFICE

2,008,174

AUTOMATIC RESET CIRCUIT BREAKER

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Application April 21, 1933, Serial No. 667,150

14 Claims. (Cl. 175—294)

This invention relates to automatically resetting circuit protective devices and can best be understood with reference to a copending application, Serial No. 667,149, filed April 21, 1933.

In the prior application above mentioned, there is disclosed an automatically resetting circuit breaker. The instant application discloses an automatically resetting circuit breaker, which fundamentally is like the circuit breaker disclosed in the above mentioned application, but which further includes an automatically operated "off" holding means, for holding the circuit breaker in open circuit so that when the contact arm moves to open circuit position on overload, it will automatically be held in such open circuit position, until the overload is taken off or cut out of the line.

It will be observed that it is not considered desirable to have the circuit breaker held open after the overload has been taken off or cut out of the line, because so to hold it open, would require the user to reset it manually.

The invention, therefore, aims to provide in connection with an automatically resetting circuit breaker, an automatically operating means for holding the circuit breaker in open position, the means being constructed to release and close the breaker when the overload is taken off or cut out of the line.

In view of the fact that the means which takes the overload off the line, or cuts it out of the line, may be remote from the breaker, it can be said that the invention provides a remotely controlled automatically resetting circuit breaker having an automatically operating means for holding the circut breaker in open position, the means being constructed to release and close when a remotely positioned means is operated to take off or cut out of the line, the overload condition.

Other objects of the invention will presently appear upon reference to the following detailed description of a preferred embodiment of the same, the embodiment being shown in the appended drawings. In these drawings,

Fig. 1 is a structural diagrammatic view of the embodiment.

Fig. 2 shows the embodiment in top plan view.

Figs. 3 and 4 are, respectively, elevation and end sections of the same.

Fig. 5 is a section on line 5—5 of Fig. 2.

Figs. 6, 7 and 8 are views like those of Figs. 2, 3 and 4, but showing the parts in "overload release" position.

Fig. 9 is a section on line 9—9 of Fig. 6.

Figs. 10 and 11 are detailed views, in plan and elevation, of a critical part of the embodiment.

Figs. 12, 13 and 14, are respectively, plan, elevation, and end section views of the embodiment in an "off" position created by movement of a manual control handle.

The breaker of Figs. 1–10

The automatically resetting circuit breaker of this application, like the breaker of Figs. 1–10 of the prior application mentioned, is characterized by the fact that the thermal element moves in the direction of the operating shaft, and functions to release the breaker shaft for trip or reset. The breaker parts are mounted upon a base 11 of insulating material and are enclosed within a cover, also of insulating material, the cover having slots through which projects the two manually engageable parts of the breaker, namely, the winding drum 12 and the manual control handle 14. The breaker parts will now be described specifically.

Pivotally mounted on an axle pin 16, to and between the upstanding fixed frame plates 17, is the breaker contact arm 18, the arm having a contact 19 for engaging the fixed line contact 20 of the breaker. Pivotally connected by an axle pin 21, to two upstanding parts of the breaker contact arm 18 are connecting rod links 22 which at their upper ends are connected to a crank 23 formed on the breaker operating shaft 24, the latter being trunnioned in aligned bearing holes of the upstanding frame plates 17. It is observed that the rotation of the operating shaft 24 operates, through the medium of the crank 23 and the connecting rod links 22, to move the contact arm to and from contact making and breaking position, and that the crank and links provide a toggle clamping action for the arm, when the latter is in "on" position.

One end of the operating shaft is bent perpendicularly from the axis of the shaft to provide a holding crank 25, adapted to be held by one or another of the stops, provided on the thermal element, referenced generally "T". The latter is connected by a flexible lead 25a at one end, to arm 18 and at the other to the load.

The "on" holding stop, that is to say, the stop which holds the holding crank 25 in the "on" position, is referenced 26 and is in the nature of a lug provided on a plate 27 which bridges the upper ends of the relatively electrically and mechanically connected, upstanding, thermal bimetallic warping strips 28 of the element "T"

and is insulated from these ends by an insulating strip 29. The other stop, that is to say, the stop which holds the crank 25 in the "off" position, Figs. 6 to 8, is referenced 30, and is also in the nature of a lug provided on the plate 27. The stop 30 has a notch 31 directly in line with the stop 26, and has a tooth 31a somewhat out of line from stop 26.

The lower ends of the strips 28 of bimetallic material, forming the thermal element, are mounted on a bracket 32 in turn positioned upon a block of insulating material 33, disposed in a depression in the upper surface of the base, and mounted on key and groove runways therein, and so proportioned as to be able to slide in such depression in a direction parallel to the axis of the operating shaft 24.

For manually sliding the block 33 in its depression, there is provided an actuating device whose handle has previously been referred to as a manual control handle 14. This handle is journalled in the base 11 on the end of a cross shaft 34, which shaft is provided with an upstanding finger 35 engaging in a notch in the lower surface of block 33, and it will be observed that movement of the actuating handle 14 rotates the shaft 34 and slides the block 33 in its depression. For latching the handle 14 in the "on" position of Fig. 4 or in the "off" position of Fig. 14, there is provided a spring 37 adapted to engage one or another of a pair of notches 38, formed in that part of the handle near the shaft 34.

On the end of the operating shaft opposite that end thereof which is formed as a holding crank 25, is a drum previously referenced 12 and containing a clock spring (not shown), wound upon the end of the operating shaft and having one end fixed to the shaft and the other end fixed to the drum. This spring tends to rotate the operating shaft clock-wise and its influence is opposed by the stops 26 and 31a previously mentioned.

For winding the spring, the user rotates the drum, which is rotatably journalled on the shaft, and is held against reverse rotation by a ratchet wheel 13 fixed to the drum and disposed between a frame plate 17 and the drum, as indicated in Fig. 2. A clockwork pawl cooperates with the ratchet to prevent movement of the drum in the counter-clockwise direction as the drum is being rotated to wind the spring, it being observed that the drum can be wound by moving it with the thumb, as can readily be seen from Fig. 3.

If desired, the shaft 24 may be operatively connected, as by gears, to a conventional speed reducing means, as a governor device, which will reduce the speed of operation of the device. In a small size breaker, such an improvement is scarcely necessary, but in a large breaker, such an improvement might well be provided.

In order to provide an automatically operating means for maintaining the contact arm 18 in "off" position, once the contact arm has been moved to "off" position by an overload, there is provided a means which specifically embraces much of the novelty that this application possesses over the copending application Serial No. 667,149, filed April 21, 1933, above mentioned. In order to aid in the understanding of this device, reference will be had particularly to Fig. 1.

As indicated in this figure, there is electrically connected in parallel with the contact arm 18 and the thermal element "T", an electro-magnet 47 whose energizing circuit (shunting the main circuit) is adapted to be closed by a pair of contacts 48, which engage to close the magnet circuit when the contact arm 18 is elevated on overload. When this electro-magnet is energized, that is to say, after the breaker has opened, it rotates bell crank 49 about the fixed pivot 50 against the influence of spring 51 and projects a stop lug 52 of the bell crank under the notch 31 of the "off" stop, holding this lug in this position so long as the magnet remains energized. With the lug 52 under notch 31, return of the thermal element, due to cooling after overload, does not cause return of the crank 25 to "on" position, the crank being engaged by the lug 52 and being held in "off" position.

The magnet remains energized until the overload is taken off or cut out of the line, that is to say, when the service switch 53 is opened. When this is done, the magnet is de-energized, releasing the bell crank 49 and the holding crank 25. The shaft 24 then rotates to "on" position, resetting the circuit breaker for normal use.

The parts just described in connection with the diagrammatic disclosure of Fig. 1 will now be described more completely in connection with the other figures of the drawings which show the parts structurally and more in detail. The electro-magnet 47 is fixedly mounted on the frame considerably above the base of the breaker and is electrically connected to the line conductor which goes to the contact 20. Through the contacts 48, the other side of the magnet is electrically connected to the load. The lower one of the contacts 48 has an extension 63 of insulating material positioned in the path of contact arm 18, and this lower contact 48 is mounted on the end of a spring leaf 64, anchored by means of a binding screw 65 which is electrically connected to the load.

The bell crank 49 is pivotally mounted in a fixed pivot 50 of a frame part and has an armature 67 to which the coil spring 51 is connected, the spring having one end adjustably anchored to the frame. The stop lug 52 of the bell crank 49 is bent laterally from the bell crank so that it can be placed in alignment with and under the notch 31, in the path of the crank 25.

The operations of the breaker will now be described in complete detail.

Assume the parts to be in "on" position. At this time the holding crank 25 engages and is disposed under the "on" stop 26 and the operating shaft and its associated parts are held in the "on" position, with the contact arm 18 in a horizontal position, so that contact 19 engages contact 20, the parts being held against the influence of the spring which tends to rotate the operating shaft clockwise. It is observed that the thermal element "T" occupies such a position on normal load that the stop 26 is directly in line with holding crank 25.

Upon the arising of an overload, the thermal element "T" will warp in the direction of the axis of the operating shaft 24, that is to say, towards the right of Fig. 4, sufficiently to move stop 26 away from the holding crank 25. The spring in drum 12 consequently rotates the parts clockwise with an extremely rapid movement. Such rotation causes an upward pull on the connecting rod links 22 and pivots contact arm 18 to the position of Fig. 7 from the position of Fig. 3; that is to say, it opens the circuit. When thermal element "T" is warped to the right of Fig. 4, it placed tooth 31a in line with the crank 25. Consequently the crank rotates on overload but one-half turn and is engaged by the top of stop 30, to restrain further rotation of the parts. When the circuit has been opened sufficiently long for the

thermal element "T" to cool and warp back to its original position, the stop **30** will move away from crank **25** and notch **31** will be placed in line with this crank.

This does not, however, free the operating shaft to rotate back to "on" position, because of the intervention of the automatically operated latch previously described, it being observed that when the contact arm **18** moved, to open circuit position on overload, it caused magnet **47** to be energized and caused stop lug **52** to be placed under notch **31**, in the path of crank **25**, to hold the crank in "off" position.

The parts remain in this position until the defective load consuming device is taken off the line, or until the switch **53** is opened. Either of these operations deenergizes magnet **47** and frees the operating shaft, for rotation. With the operating shaft free to rotate, the spring will rotate the shaft another half turn clockwise to reset the breaker and to bring holding crank **25** once more under and against stop **26**.

For manual control operation, the actuating handle **14** is utilized. If the breaker is to be moved from the "on" position, Fig. 3, to the "off" position, Fig. 13, the handle **14** is moved from the position of Fig. 4 to the position of Fig. 14. Such movement of the handle causes the block **33** to slide to the right and this movement, carrying the thermal element "T" with the block, takes the stop **26** out of the path of the crank **25** and places the tooth **31***a* in the path of the crank **25**. The spring in drum **12** then rotates the operating shaft to "off" position. To restore the parts to "on" position, the actuating handle is moved back to the position of Fig. 3 which serves to place notch **31** in line with crank **25**, freeing the latter and the shaft for movement by the spring in drum **12** which then rotates the shaft until the crank **25** is engaged by the stop **26**.

Auxiliaries

It is at present contemplated to combine with the devices shown in this application, and the combinations effected through the use of these devices, certain auxiliaries which are not here disclosed but which are disclosed in detail in certain copending applications which are being filed simultaneously herewith.

For example, in application Serial No. 667,149, filed April 21, 1933, there are disclosed in Figs. 1–10 and 11–18 two different forms of circuit breakers, and it is at present contemplated to combine the novel means of this application with either of those forms of breakers. Similarly, it is contemplated to combine the novel means of this application with the multipole unit of Figs. 19–28 of that application, and with the controlling breaker relays of Figs. 20–30 of that application.

Further, in application Serial No. 667,151, filed April 21, 1933, there is shown a wind demand latch and indicator, and a spring rewinding device, either or both of which devices may be incorporated in the circuit breaker here shown to function in a manner described in the application just mentioned.

Further, in application Serial No. 667,152, filed April 21, 1933, there is shown a means for limiting the number of cycles of overload release and automatic reset that can occur before the operator is called upon to reset the device. This auxiliary may be added to the breaker here shown, if desired, with the instant device being constructed to operate on any desired one of the limited number of cycles permitted by the device of said application.

Further, various combinations of the devices and features here shown and of the devices and features shown in the copending applications just referred to may be effected, and it is the present intention to cover in this application, as well as in the applications above referred to combinations of the auxiliaries specifically shown in those applications with any or all of the devices or combinations here shown.

I claim:

1. An automatic release and reset circuit protecting breaker including automatically operating releasing and resetting mechanism, means operable for opening the breaker controlled line, and means operable automatically after, and supplied with electrical energy only by and upon, an automatic release operation of said mechanism for preventing automatic reset operation of said mechanism until the breaker-controlled line is opened by operation of the first mentioned means.

2. An automatic release and reset circuit protecting breaker including automatically operating releasing and resetting mechanism, means operable for opening the breaker controlled line, and means operable automatically after, and supplied with electrical energy only by and upon, an automatic release operation of said mechanism for preventing automatic reset operation of said mechanism until the breaker-controlled line is opened by operation of the first mentioned means, the second mentioned means being deenergized automatically, and rendered inoperable to prevent reset, immediately upon opening of the aforesaid line.

3. An automatic release and reset circuit protecting breaker including automatically operating releasing and resetting mechanism, means operable for opening the breaker controlled line, and means operable automatically after, and supplied with electrical energy only by and upon, an automatic release operation of said mechanism for preventing automatic reset operation of said mechanism until the breaker-controlled line is opened by operation of the first mentioned means, and a latch operable manually, at any stage of the functioning of the mechanism, for preventing automatic reset operation of said mechanism, without causing, requiring, or preventing, automatic release operation of said mechanism.

4. An automatic release and reset circuit protecting breaker including automatically operating releasing and resetting mechanism, means operable for opening the breaker controlled line, and means operable automatically after, and supplied with electrical energy only by and upon, an automatic release operation of said mechanism for preventing automatic reset operation of said mechanism until the breaker-controlled line is opened by operation of the first mentioned means, the second mentioned means being deenergized automatically, and rendered inoperable to prevent reset, immediately upon opening of the aforesaid line, and a latch operable manually, at any stage of the functioning of the mechanism, for preventing automatic reset operation of said mechanism, without causing, requiring, or preventing automatic release operation of said mechanism.

5. An automatic release and reset circuit protecting breaker comprising a main circuit in series with the supply and load and, including con-

trolling parts for releasing or resetting the breaker, and automatically operable means for moving said parts to released position, on a main circuit overload, and for thereafter moving said parts to reset position, means operable for opening the main circuit and a shunt circuit including means for preventing the reset operation of the first mentioned means so long as the circuit overload persists, the shunt circuit normally being completely deenergized but being arranged to be supplied with electrical energy automatically by and upon the overload-caused opening of the main circuit, and to be deenergized thereafter upon the opening of the main circuit by operation of the second mentioned means.

6. An automatic release and reset circuit protecting breaker comprising a main circuit in series with the supply and load and, including controlling parts for releasing or resetting the breaker, and automatically operable means for moving said parts to released position, on a main circuit overload, and for thereafter moving said parts to reset position, means operable for opening the main circuit and a shunt circuit including means for preventing the reset operation of the first mentioned means so long as the circuit overload persists, the shunt circuit normally being completely deenergized but being arranged to be supplied with electrical energy automatically by and upon the overload-caused opening of the main circuit, and to be deenergized thereafter upon the opening of the main circuit by operation of the second mentioned means, the shunt circuit being deenergized automatically and rendered inoperable to prevent reset operation, immediately upon opening the main circuit.

7. An automatic release and reset circuit protecting breaker comprising a main circuit in series with the supply and load and, including controlling parts for releasing or resetting the breaker, and automatically operable means for moving said parts to released position, on a main circuit overload, and for thereafter moving said parts to reset position, means operable for opening the main circuit and a shunt circuit including means for preventing the reset operation of the first mentioned means so long as the circuit overload persists, the shunt circuit normally being completely deenergized but being arranged to be supplied with electrical energy automatically by and upon the overload-caused opening of the main circuit, and to be deenergized thereafter upon the opening of the main circuit by operation of the second mentioned means, and a latch operable manually, at any stage of the functioning of the mechanism, for preventing automatic reset operation of said mechanism, without causing, requiring, or preventing, automatic release operation of said mechanism.

8. An automatic release and reset circuit protecting breaker comprising a main circuit in series with the supply and load and, including controlling parts for releasing or resetting the breaker, and automatically operable means for moving said parts to released position, on a main circuit overload, and for thereafter moving said parts to reset position, means operable for opening the main circuit and a shunt circuit including means for preventing the reset operation of the first mentioned means so long as the circuit overload persists, the shunt circuit normally being completely deenergized but being arranged to be supplied with electrical energy automatically by and upon the overload-caused opening of the main circuit, and to be deenergized thereafter upon the opening of the main circuit by operation of the second mentioned means, the shunt circuit being deenergized automatically and rendered inoperable to prevent reset operation, immediately upon opening the main circuit, and a latch operable manually, at any stage of the functioning of the mechanism, for preventing automatic reset operation of said mechanism, without causing, requiring, or preventing, automatic release operation of said mechanism.

9. An automatic overload release and reset circuit breaker including a movable circiut closing member, means providing therefor a constant tendency towards cyclic movement to and from released and reset positions, a circuit responsive control means for controlling the cyclic movement of said circuit closing member in release and reset cycles, means operable for opening the breaker controlled line, and means operating on release operation of said member for thereafter preventing reset operation of said member and rendered inoperable for preventing reset immediately upon opening the breaker controlled line by operation of the first mentioned means.

10. An automatic overload release and reset circuit breaker including a movable circuit closing member, means providing therefor a constant tendency towards a cyclic movement to and from released and reset positions, a circuit responsive control means for controlling the cyclic movement of said circuit closing member in release and reset cycles, means operable for opening the breaker controlled line, means operating on release operation of said member for thereafter preventing reset operation of said member and rendered inoperable for preventing reset immediately upon opening the breaker controlled line by operation of the first mentioned means, and a latch operable manually, at any stage of the functioning of any of the aforesaid parts for preventing automatic reset operation of said member, without causing, requiring, or preventing automatic release operation of said mechanism.

11. An automatic release and reset circuit protecting breaker including automatically operating releasing and resetting mechanism, means operable for opening the breaker controlled line, and means operable immediately after, and supplied with electrical energy only by and upon a automatic release operation of said mechanism, for thereafter preventing automatic reset operation of said mechanism, said means being rendered inoperable for preventing reset immediately upon opening the breaker controlled line by operation of the first mentioned means.

12. An automatic release and reset circuit protecting breaker including automatically operating releasing and resetting mechanism, means operable for opening the breaker controlled line, and means operable immediately after, and supplied with electrical energy only by and upon an automatic release operation of said mechanism, for thereafter preventing automatic reset operation of said mechanism, sa.d means being rendered inoperable for preventing reset immediately upon opening the breaker controlled line by operation of the first mentioned means, and a latch operable manually, at any stage of the functioning of any of the aforesaid parts for preventing automatic reset operation of said member, without causing, requiring, or preventing automatic release operation of said mechanism.

13. A combination of the character specified in

claim 11 wherein the automatic reset preventing means operates to prevent reset before the automatic reset mechanism can operate to cause reset.

14. A combination of the character specified in claim 11 wherein the automatic reset preventing means operates to prevent reset before the automatic reset mechanism can operate to cause reset, the former being constructed to have an instantaneous action, and the latter being constructed to have a delayed action.

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