

June 17, 1952

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2,600,734

TOTALIZED CURRENT RELEASE DEVICE FOR CIRCUIT BREAKERS

Filed Aug. 30, 1946

3 Sheets-Sheet 1

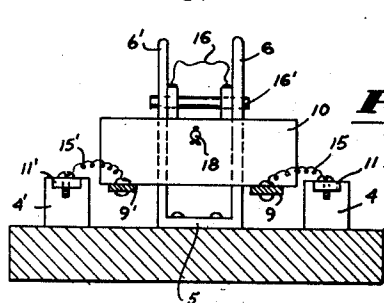
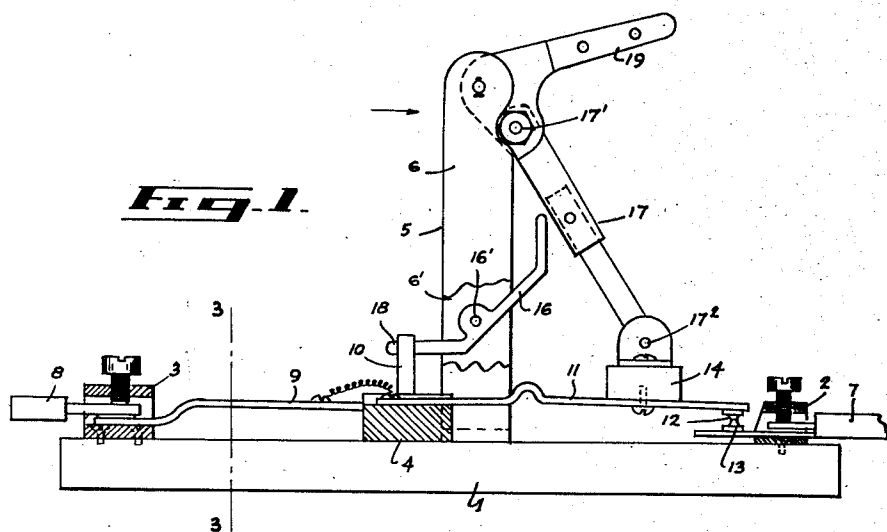


Fig. 3.

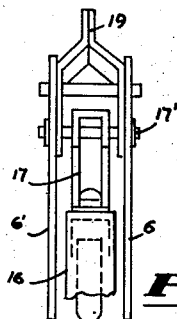


Fig. 4.

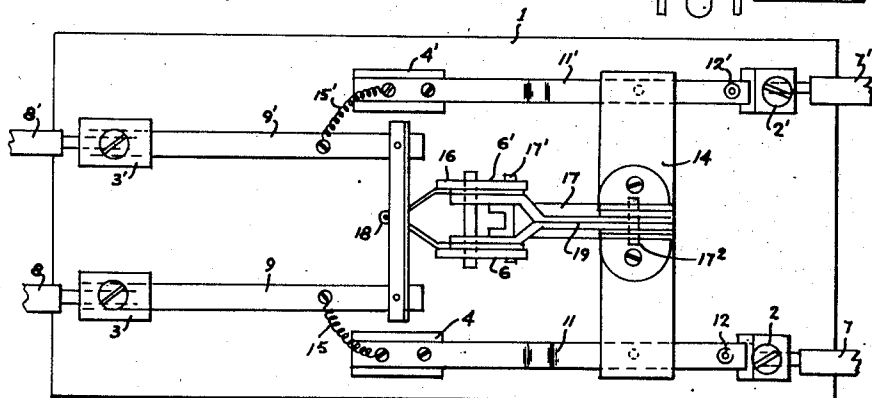


Fig. 2.

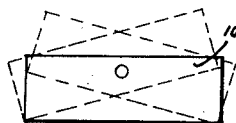


Fig. 6.

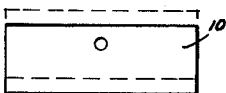


Fig. 5.

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3 Sheets-Sheet 2

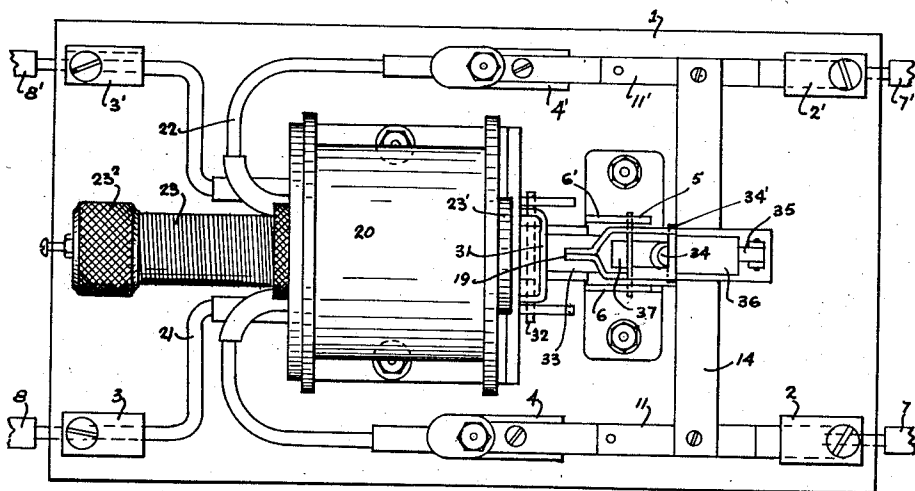
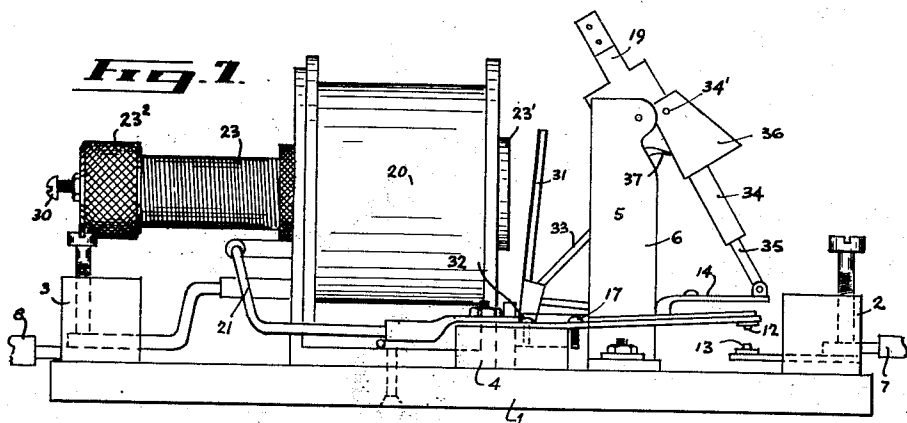


Fig. 8.

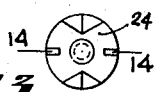


Fig. 13.

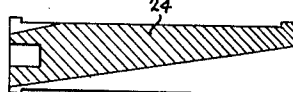


Fig. 14.

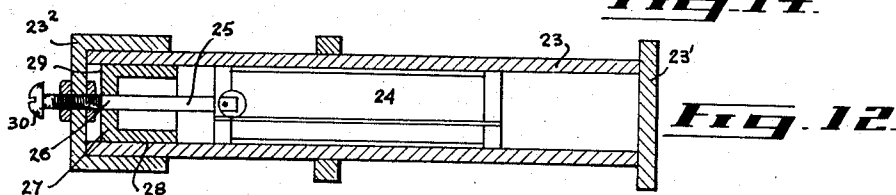


Fig. 12.

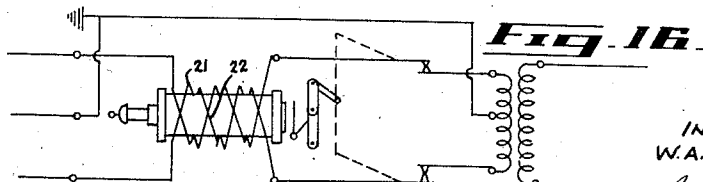


Fig. 16.

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3 Sheets-Sheet 3

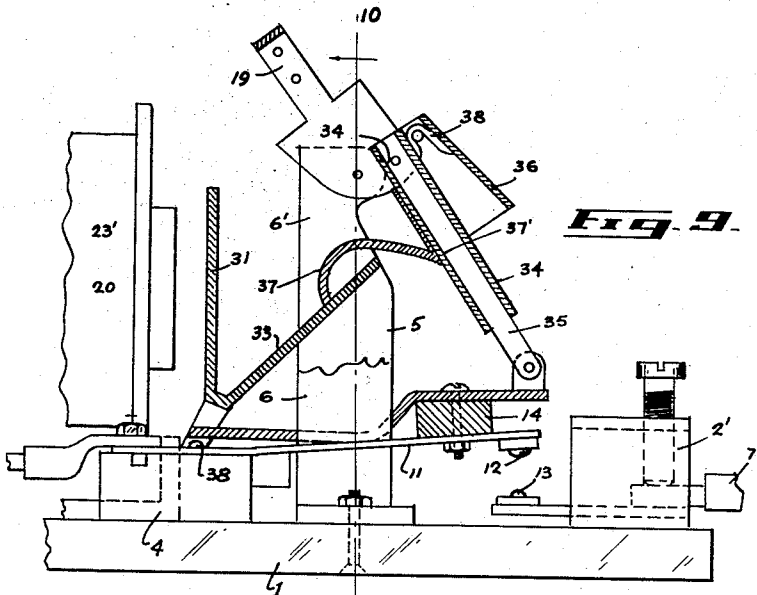


Fig. 9.

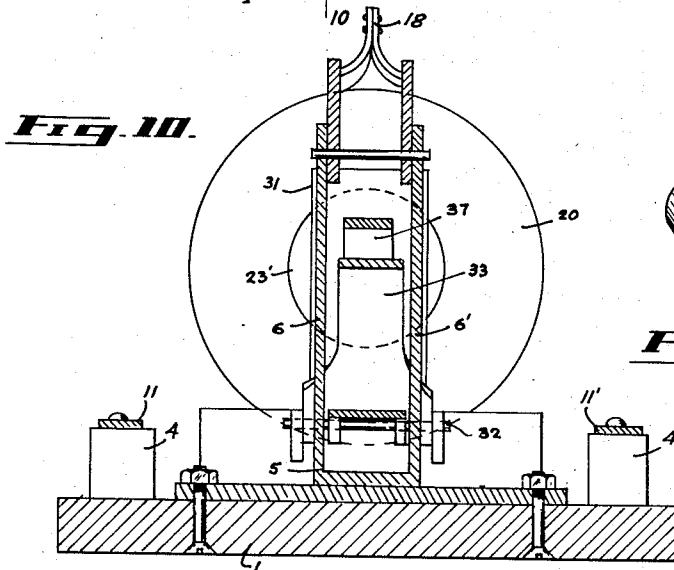


Fig. 10.

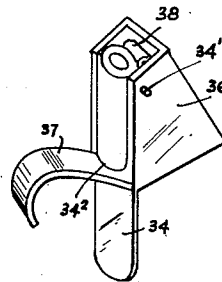


Fig. 11.

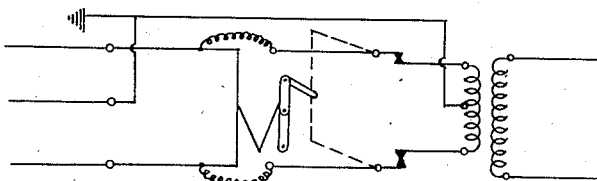


Fig. 15.

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UNITED STATES PATENT OFFICE

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TOTALIZED CURRENT RELEASE DEVICE
FOR CIRCUIT BREAKERS

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Application August 30, 1946, Serial No. 694,121

8 Claims. (Cl. 175—294)

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My invention relates to circuit breakers, and more particularly to current responsive, automatic release devices for multipole circuit breakers, the automatic release of which is actuated by the totalized current in all the poles.

Heretofore multipole circuit breakers have been of a type where each pole individually can release one or all of the poles of the circuit breaker. According to my invention in order to protect say the secondary of say a single phase 115 volt/230 volt, three wire transformer where current or load may be applied to either winding of the secondary or to both windings simultaneously, a tripping or release device sensitive to the total load on both windings, regardless whether they are evenly or unevenly loaded, is provided, to allow maximum loading of the transformer, and regardless of division of load between the two windings.

It is well known that a transformer rating is based on its thermal capacity, which depends on the total load, regardless of which secondary winding carries the load. On such account, release devices actuated by the load of one winding only or both windings separately, only function efficiently if the load is evenly divided between the two windings. In my circuit breakers, the trip mechanism or release device is, as above stated, sensitive to the total load of both windings, of the secondary of the transformer.

For a complete understanding of my invention reference should now be had to the accompanying drawings in which

Fig. 1 is a side view of one type of circuit breaker embodying my invention, parts being broken away and other parts appearing in vertical section.

Fig. 2 is a plan view of the device shown in Fig. 1.

Fig. 3 is a vertical section at 3—3 Fig. 1 and looking towards the right.

Fig. 4 is a side view of the upper end of the bracket or post and associated parts.

Figs. 5 and 6 are views showing approximate positions of the totalizing lever at various loads.

Fig. 7 is a side view of another type of circuit breaker embodying my invention.

Fig. 8 is a plan view of the parts appearing in Fig. 7.

Fig. 9 is an enlarged vertical sectional view longitudinally and centrally through the right hand end of the device shown in Fig. 7.

Fig. 10 is a vertical cross sectional view at 10—10 Fig. 9 and looking in the direction of the applied arrow.

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Fig. 11 is a perspective view of part of the toggle mechanism.

Fig. 12 is an enlarged vertical longitudinal sectional view centrally through the cylinder of the induction coil.

Fig. 13 is an end view of the plunger contained within the cylinder.

Fig. 14 is a longitudinal sectional view at 14—14 Fig. 13.

Fig. 15 is a diagrammatic view of the device appearing in Figs. 1 and 2.

Fig. 16 is a diagrammatic view of the device appearing in Figs. 7 and 8.

In the drawings like characters of reference indicate corresponding parts in the several figures.

I may initially state that in carrying out my invention, the totalizing of the currents in all the poles of the multipole circuit breaker may be accomplished in a number of ways, and I have herein shown in detail two ways of doing it. In Figs. 1 to 4 inclusive the totalizing is accomplished thermally while in the type shown in Figs. 7 to 14 inclusive it is done magnetically. In both instances there is a mechanical switch release or trip mechanism employed which is sensitive to the total load on both the windings of the three wire power transformer and regardless of whether they are evenly or unevenly loaded.

Referring to Figs. 1 to 4 I will now describe the circuit breakers therein shown.

An insulating base plate 1 is provided and it is supplied with pairs of end terminals 2, 2' and 3, 3', a pair of insulating blocks 4, 4' and with a central fixed bracket or post 5, presenting spaced legs 6 and 6'.

The power wires 7 and 7' from the secondary of the conventional three wire transformer are connected to the terminals 2, 2' and the load wires 8 and 8' are connected to the terminals 3 and 3'. Similar bimetallic elements in the form of spring bars 9 and 9' are connected permanently to the terminals 3 and 3' and have their free elevated ends extending towards the bracket 5. A cross lever 10 of insulating material connects the free ends of the bars. A pair of spring switch arms 11 and 11' are secured permanently to the blocks 4 and 4' and the said arm contact points 12 are normally held, by a trip mechanism later described, in closed contact with contact points 13, associated with the terminals, 2 and 2'. The switch arms are connected by a cross bar 14 of insulating material. The latter parts constitute a double pole switch as will be readily under-

stood. The switch arms are connected electrically by flexible connections 15 and 15' to the bimetallic strips as shown.

The trip mechanism comprises a bell crank 16 and a toggle 17, the bell crank being pivotally mounted on a cross pin 16' carried by the bracket 5 and having one end thereof pivotally connected centrally to the lever 10 at 18, and the toggle having its upper end pivotally connected at 17' to a switch lever 19, and its lower end pivotally connected at 17² centrally to the cross bar 14 of the two pole switch. The arrangement of the bell crank and toggle is such that the switch remains locked in closed position by the toggle until the toggle joint is broken by the movement of the bell crank under the combined influence of the bimetallic elements. The switch lever is provided so that the two pole switch can be closed or opened by an attendant as and when desired.

It will be obvious from the above disclosure that the switch trip mechanism is directly controlled by the lever 19 which is actuated by the bimetallic elements 9 and 9' and that the flexing movement of the respective bimetallic elements is directly proportioned to the heat generated by the currents flowing, at any given time, through such elements. Consequently the varying distances to which the point 18 rises is directly dependent on the currents flowing through the bimetallic elements and such currents are directly responsive to the loads applied to either or both secondary windings of the multipole power transformer.

The trip mechanism functions to release the two pole switch upon the point 18 having risen to a position where the totalized currents flowing in the secondaries have reached the maximum loaded condition of the transformer.

In Figures 5 and 6 I have illustrated various positions of the totalizing lever 19 under varying load conditions. In Fig. 5 the full outline, indicates a zero ampere condition on both sides of the secondary, and the dot and dash outline can represent say 30 amperes on both sides of the secondary. In Fig. 6 the one dot and dash outline can represent zero amperes on say the right side of the secondary and say 60 amperes on the left side, while the other dot and dash outline can indicate zero amperes on the left side of the secondary and 60 amperes on the right side.

Reverting now to the modified form of circuit breaker and wherein the totalizing of the currents is accomplished magnetically, it will be seen that the general arrangement is much the same, the same reference numbers having been used and applied to the figures of the drawings to indicate identical parts in the two shown types. To the base block 1 to the left of the bracket 5, I secure an induction coil or solenoid 20, having the coils 21 and 22 thereof (see Fig. 16) insulated one from the other, and wound in opposite directions. The ends of the coil 21 are connected to the terminal 3 and to the switch arm 11 at the block 4 and the ends of the coil 22 are connected to the terminal 3' and to the switch arm 11'.

Internally the solenoid presents a brass cylinder 23, one end of which terminates in a pole face 23' and the other end of which projects beyond the solenoid and is closed by a screw cap 23². Internally the cylinder receives slidably an iron plunger 24, to which I have connected a valve stem 25 carrying a tapered valve 26 adapted to engage a tapered seat 27 formed in the end wall of a sleeve 28. The cylinder contains oil and an oil escape passage 29 is supplied in the

end of the sleeve or the said sleeve can make a loose fit with the cylinder. It will be here understood that in operating position the circuit breaker is so positioned that the plunger and oil gravitate into the capped end of the cylinder and that accordingly any movement of the plunger upwardly is retarded by the oil in passage through the opening 29. It will also be noticed that when the plunger gravitates, the valve 26 opens to allow of quick passage of oil from the under to the upper side of the sleeve. The plunger is longitudinally slotted to stop eddy currents and an adjusting screw 30 is supplied to allow one to adjust the position of the gravitated plunger within the cylinder.

Under normal load conditions in the lines served from the terminals 3 and 3' there is not sufficient flux created by the coils to draw the plunger upwardly into the solenoid, so that it remains inert in its down position.

The total flux created equals the sum of the fluxes generated by the current flowing in the coils and is accordingly directly responsive to the loads applied to either or both secondary windings of the power transformer. The plunger is designed to engage with and magnetize the pole face 23' when the total load on the line is reaching a point which would be damaging to the thermal capacity of the transformer.

I have associated an armature and a switch tripping mechanism with the solenoid and the arrangement is such that upon the pole face becoming magnetized by contact with the plunger, the armature is drawn towards the pole face and actuates the trip mechanism to cause the two pole switch to open.

The armature 31 is pivotally mounted on a cross pin 32 and has associated therewith an arm 33 which extends angularly upwardly between the side legs of the post 5. The switch trip mechanism actuated by the armature may be of any desired type, its only function being to release or open the switch upon the armature being drawn into contact with the pole face 23'. In the present instance it embodies a sleeve 34 and a rod 35 slidable within the sleeve, the outer end of the rod being pivotally connected to the cross bar of the switch and the upper end of the sleeve being pivotally connected at 34' to the switch lever 19. A hood like member 36 spans the upper end of the sleeve and is pivotally mounted on the pin 34' and has a curved finger 37 permanently secured to the lower inner corner thereof which is provided with a jaw or dog 37' entering the sleeve through a side slot 34² cut in the sleeve. A coil spring 38 is supplied to hold the jaw normally projected within the sleeve, and in contact with the upper end of the rod 35. The finger overlies the arm 33 associated with the armature.

Assuming the parts in the position best shown in Fig. 9, it will be seen that if the lever 19 be thrown to the right the switch will be brought to closed position where it will become locked and here it will be observed that the rod cannot slide in the sleeve as it is held by the jaw. Subsequently upon the armature being drawn into contact with the pole face 23' the arm 33 trips the finger to withdraw the jaw and free the rod to escape upwardly and in so doing open the switch.

In the second type of circuit breaker, the oil and sleeve associated with the plunger act as a dash pot to give a time delay action; and in the first type the bimetallic elements themselves function for the same purpose. Various other

means may be employed to effect the time delay action.

What I claim as my invention is:

1. A switch comprising a pair of conductors, pairs of relatively movable contacts one in each of said conductors, a lever, means operatively connecting the center of said lever to at least one of each pair of contacts, and means controlled by the current in each of said conductors for moving the respective ends of said lever in a direction to open said pairs of contacts upon increase in the current, whereby said lever is moved to open said conductors when the total current in said conductors exceeds a predetermined value.

2. In combination with the secondary windings of a three winding transformer having secondary load circuits connected thereto, a switch comprising pairs of relatively movable contacts, one pair in each of at least two of said circuits, a movable member operatively connected to at least one of each pair of said contacts for opening both pairs of contacts, and means controlled by the combined current in both said circuits to move said member to open said pairs of contacts when the total current in said circuits exceeds a predetermined value.

3. In combination with the secondary windings of a three winding transformer having secondary load circuits connected thereto, a switch comprising pairs of relatively movable contacts, one pair in each of at least two of said circuits, a movable member operatively connected to at least one of each pair of said contacts for opening both pairs of contacts, a lever pivoted at an intermediate point to said movable member, movable parts operatively connected to said lever at spaced points remote from said pivot, and means responsive to the current in each of said circuits to move one of said movable members, so as to open said pairs of contacts when the total current in said circuits exceeds a predetermined value.

4. In combination with the secondary windings of a three winding transformer having secondary load circuits connected thereto, a switch comprising pairs of relatively movable contacts, one pair in each of at least two of said circuits, a movable member operatively connected to at least one of each pair of said contacts for opening both pairs of contacts, a lever pivoted at an intermediate point to said movable member, movable parts operatively connected to said lever at points on opposite sides of said pivot, and means responsive to the current in each of said circuits to move one of said movable members, so as to open said pairs of contacts when the total current in said circuits exceeds a predetermined value.

5. A switch comprising a pair of conductors, pairs of relatively movable contacts one in each of said conductors, a movable member operatively connected to at least one of each pair of said contacts for opening both pairs of contacts, a lever pivoted at an intermediate point to said movable member, movable current responsive means engageable with said lever at points on opposite sides of said pivot, said current responsive means movable in response to current in each of said conductors to move said lever and movable member so as to open said pairs of contacts when the total current in said contacts exceeds a predetermined value.

6. A switch comprising a pair of conductors, at least two movable contacts one in each conductor, at least two cooperating stationary contacts one in each conductor, and operating linkage for moving said movable contacts into and out of engagement with said stationary contacts, an operating lever operatively engageable with said linkage for operating the same, a totalizing lever pivoted on said operating lever, and current responsive means pivoting and reciprocating the totalizing lever to move said operating lever to operate said linkage and move said contacts in response to predetermined current values in said conductors.

7. A switch comprising a pair of conductors, at least two movable contacts one in each conductor, at least two cooperating stationary contacts one in each conductor, and operating linkage for moving said movable contacts into and out of engagement with said stationary contacts, an operating lever operatively engageable with said linkage for operating the same, a totalizing lever pivoted between its ends on said operating lever, and current responsive means engaging said totalizing lever on opposite sides of its pivot for pivoting and reciprocating the totalizing lever to move said operating lever to operate said linkage and move said contacts in response to predetermined current values in said conductors.

8. A switch comprising a pair of conductors, at least two movable contacts one in each conductor, at least two cooperating stationary contacts one in each conductor, a piece connected to both said movable contacts, a toggle linkage connected to said piece, an operating lever operably engageable with said linkage to break the same and thereby to move the movable contacts away from the fixed contacts, a totalizing lever pivoted intermediate its ends to said operating lever, and current responsive means one in each conductor to shift the ends of the totalizing lever in response to current changes in the conductors so as to break the toggle when the sum of such currents exceeds a predetermined value.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
689,836	Wheeler	Dec. 24, 1901
831,071	Hill	Sept. 18, 1906
1,173,569	Harris	Feb. 29, 1916
1,281,482	Baruch	Oct. 15, 1918
1,457,109	Frost	May 29, 1923
1,714,722	Moss	May 28, 1929
1,920,037	Tauber	July 25, 1933
2,066,935	Hodnette	Jan. 5, 1937
2,185,524	Sachs	Jan. 2, 1940
2,312,753	Coy	Mar. 2, 1943
2,494,346	Martin	Jan. 10, 1950

FOREIGN PATENTS

Number	Country	Date
616,288	France	Oct. 26, 1926
600,489	Germany	July 26, 1934