

Aug. 19, 1930.

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AUTOMATIC RECLOSING CIRCUIT BREAKER

Filed July 11, 1925

2 Sheets-Sheet 1

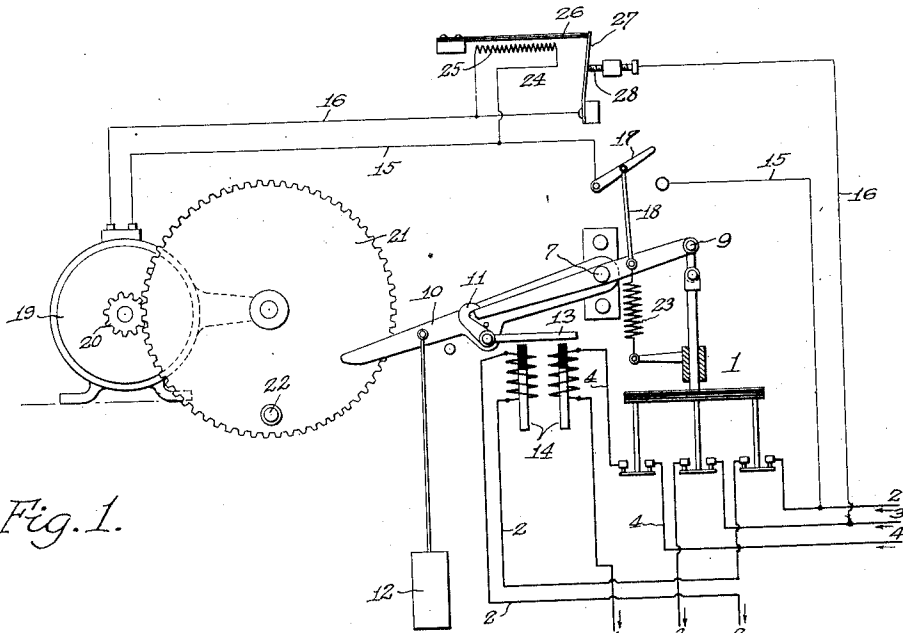


Fig. 1.

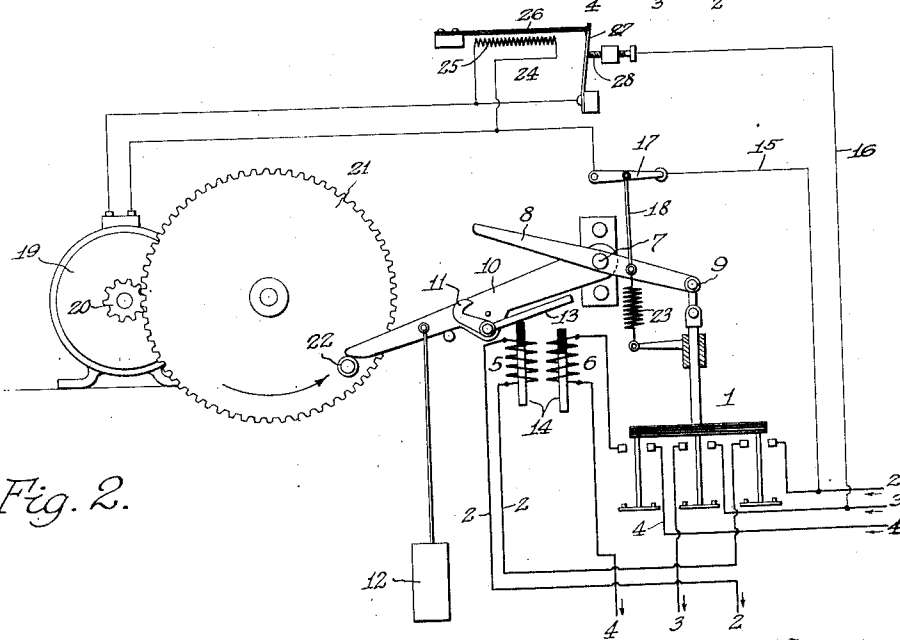


Fig. 2.

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2 Sheets-Sheet 2

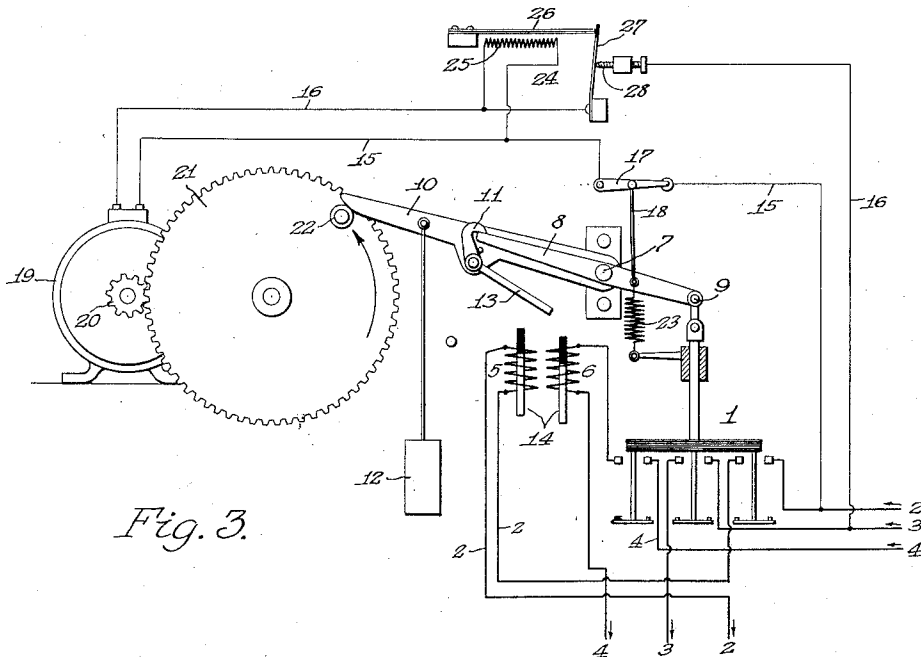


Fig. 3.

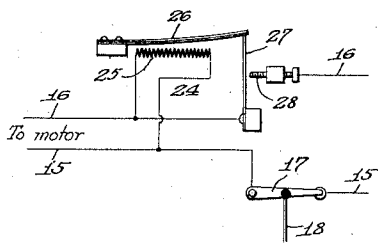


Fig. 4.

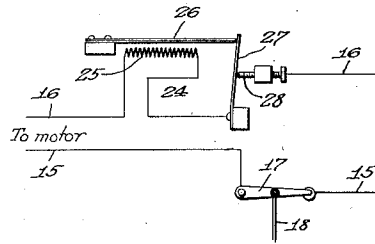


Fig. 5.

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AUTOMATIC RECLOSING CIRCUIT BREAKER

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It is common practice to connect an automatic circuit breaker in a power circuit to protect other devices connected therein against overload or current surges in the line, and in certain instances, it is particularly desirable that such automatically operating circuit breakers should be automatically reclosed after a certain period of time, thereby obviating the necessity for manual closing when the overload is of short duration, and further, it is most desirable that such reclosing mechanism be automatically operated several times at fixed intervals, in order that the line may be automatically closed when the trouble is of comparatively short duration, but persists for a longer period than that for which the mechanism is set to first operate. Further, it is desirable, after a certain number of reclosing operations, that the operation be discontinued and prevented from further operation until such time as the trouble on the line has been remedied, and the mechanism reset manually.

The present invention relates to such automatic reclosing mechanism for circuit breakers and its object is to provide simple and efficient, combined mechanical and electrical mechanism for operating a circuit breaker to impart thereto a plurality of reclosing operations, with the operation of said mechanism controlled by overload on the main line and the duration of such operation limited, to limit the number of reclosing operations. It is also an object to provide an arrangement whereby an electric motor may be employed as part of the operating mechanism to actuate the mechanical devices of said mechanism, and whereby the operation of the motor may be controlled in a simple and efficient manner by means within the motor circuit.

A further object is to provide simple and efficient automatic motor controlling means within the motor circuit controlled by current flow in the circuit, whereby a delay of predetermined duration in the breaking of the circuit is effected to permit of a predetermined number of reclosing operations of the circuit breaker, the motor is protected against overload, and operation is stopped until such time as the device be manually re-

set. It is also an object to provide certain other new and useful features in the construction, arrangement and combination of parts, all as hereinafter more fully described.

With the above and other ends in view, the invention consists in providing mechanical means for operating a circuit breaker, which means is arranged to normally hold the circuit breaker closed, together with electrically operated means for releasing said mechanical means to open the main circuit upon overload, and an electric motor for operating said mechanical means to effect a plurality of reclosing operations of the circuit breaker, said motor being controlled in its operation by means in its circuit operated by current flow in the circuit and thermally, to delay its operation, said means being effective to open the motor circuit and protect the motor against injury from excessive current flow through its windings. The invention further consists in certain other new and useful features, all as hereinafter described and more particularly pointed out in the appended claims, reference being had to the accompanying drawings, in which:—

Figure 1 is a diagrammatic view of a circuit breaker operating mechanism illustrative of the present invention and showing the parts in normal position with the main circuit closed;

Figure 2 is a similar view with the parts in position which they will assume when an overload occurs on the main line, and the circuit breaker is opened;

Figure 3 is a view similar to Figures 1 and 2, to further illustrate the operation and showing the parts in another position of their movement; and

Figures 4 and 5 are diagrammatic views to illustrate the operation of a thermally operating control device in the motor circuit.

In Figures 1, 2 and 3 of the drawings, a well known form of circuit breaker is shown in a conventional manner and indicated as a whole by the numeral 1, and the main circuit, shown as a three-wire circuit in which the circuit breaker is connected, is indicated by the numerals 2, 3 and 4, these wires being connected to the usual terminals of the circuit

breaker. Within the circuit formed by the wires 2, is connected a solenoid 5 and within the circuit 4 is connected a solenoid 6. The plunger of the circuit breaker 1 is operated by means of a double lever, which is pivotally supported at 7, said lever comprising a rocker bar 8 pivotally supported intermediate its ends by the pivot 7 with one end pivotally connected at 9 to the plunger of the circuit breaker. The opposite end of this rocker bar is connected to a lever 10, which forms the other member of the double lever, said end of the rocker bar being so connected to the lever by means of a latch 11, the lever 10 being pivotally supported at one end by the pivot 7, and having connected thereto adjacent its opposite end, a weight 12. The latch 11 has a tail piece 13, which projects laterally from the pivot of the latch and extends over the upper ends of the movable cores 14 of the solenoids 5 and 6.

In the normal position of these parts, as shown in Fig. 1, the weight 12 is effective to rock or turn the double lever upon its pivot 7 and raise the plunger of the circuit breaker 1, holding the circuit breaker closed. Upon overload in the main line, caused by heavy surges, or a short circuit, one of the solenoids 5 or 6, depending upon the line in which the overload occurs, will be energized, and its plunger, or core member 14, will be raised, as shown in Figure 2, into contact with the tail piece 13 of the latch 11, thus turning the latch out of engagement with the end of the rocker bar 8, and thus releasing this bar so that the weight of the plunger of the circuit breaker will turn it upon its pivot, allowing the plunger to fall and break the main circuit.

Upon breaking of the main circuit by overload, as described, an auxiliary, or motor circuit indicated by the wires 15 and 16, is closed by a suitable switch 17, which switch is connected by a rod 18 with the bar 8, so that upon the opening of the circuit breaker 1, the downward movement of the bar 8 will close the switch 17. The closing of this switch 17 closes the motor circuit 15 and 16, within which circuit is a suitable electric motor 19, upon the shaft of which motor is mounted a pinion 20 to engage a large gear wheel 21, mounted upon a suitable supporting bearing adjacent the motor. Upon this gear wheel 21 is a roller stud 22, which stud is positioned to engage the end of the lever 10 upon rotation of the gear wheel 21, caused by the closing of the motor circuit and the operation of the motor upon the opening of the main circuit.

Therefore, upon overload in the main line, the lever mechanism is released by one of the controlling solenoids in the main line, as indicated in Figure 2, and the releasing of the latch 11 permits the plunger of the circuit breaker to fall and open the circuit. This

movement of the plunger is accelerated by means of a spring 23, attached to the rocker bar 8, and as the switch 17 in the line 15 of the motor circuit is connected to this rocker bar, said switch will be closed and the motor circuit will be energized, thus starting the motor 19, which will effect the rotation of the gear 21 and by such rotation, bring its stud 22 into engagement with the end of the lever 10, as shown in Fig. 2, and continued rotation of the gear 21 will raise said lever 10 to the position shown in Fig. 3, causing the latch 11 to reengage the end of the rocker bar 8.

The operation of the motor 19 will continue as the motor circuit is still closed, and, therefore, the stud 22 will pass from beneath the lever 10, as indicated in Fig. 3, and thus permit the weight 12 to act upon the lever and turn it upon its pivot 7. As the latch 11 has been reengaged with the rocker bar 8 by the lifting of the lever 10, upon falling movement of said lever, the rocker bar will be carried with it, or turned upon the pivot 7, the weight 12 being sufficient to overcome the weight of the plunger of the circuit breaker 1, and the action of the spring 23.

If the overload condition in the main circuit still persists, when the stud 22 passes from beneath the end of the lever 10, and said lever and rocker bar 8 are turned by the weight 12 upon their pivotal support, the tail piece 13 of the latch 11 will again be engaged by the core member 14 of the energized solenoid, and the latch will be released thereby from engagement with the end of the rocker bar 8, thus again releasing the rocker and permitting the plunger of the circuit breaker to fall to open position.

The above described cycle of operation will continue so long as the overload continues in the main circuit, the circuit breaker being periodically opened and closed at fixed intervals, and thus operating to try out the main circuit at fixed intervals for a period of time to determine whether or not, in the meantime, the overload has not disappeared from the main circuit, as where the overload is caused by surges of short duration, and if it has so disappeared, the parts will assume their normal position, as shown in Fig. 1, with the motor circuit open and the operation of the motor discontinued.

However, it is not desirable that this cycle of operation should be continued indefinitely where the overload in the main circuit persists for a considerable length of time and, therefore, means has been provided for positively stopping all operation of the device after a predetermined number of closing operations of the circuit breaker has taken place, and to hold the mechanism in inoperative condition until such time as the overload condition has been removed from the main line, and the mechanism has been manually reset. As providing such a time-delay

cut-out to stop all operation after a predetermined number of intermittent reclosing operations of the circuit breaker, a thermal relay, indicated as a whole by the numeral 24 and shown in detail in Figs. 4 and 5, is connected in the motor circuit. This relay device, as shown in Figs. 1 and 4, comprises a resistance coil 25, having one of its terminals connected to the wire 16, and its other terminal connected to the wire 15, and arranged in proper relation to this coil, is a spring member 26 formed of two strips of metal secured together throughout their length, the metals of the strips having different temperature coefficients of expansion, so that when heated by the resistance coil 25, they will bend laterally, and these strips are arranged to engage at their free end, the free end of a spring arm 27 connected in the circuit of the wire 16 and normally held bent laterally to contact with the contact member 28 to which the wire is connected. The member 26 thus normally holds the spring arm 27 in contact with the terminal 28 and the circuit through the wire 16 is closed, but upon continued flow of current through the motor circuit for a considerable period of time, the resistance coil 25 will be gradually heated by such flow and in turn will heat the spring strips 26, causing them, after a certain period of time, to deflect sufficiently to release the spring arm 27, which will then move laterally out of contact with the terminal 28, as shown in Fig. 4, and thus open the motor circuit and hold it in open position by the engagement of the spring arm beneath the free end of the spring strip 26, until such time as the spring arm be manually moved laterally to contact the terminal and to be re-engaged by the end of the strip 26, which will hold it in such contact with the motor circuit closed.

By properly proportioning the resistance coil and the spring strips of the relay to the current flow through the motor circuit, the desired time will elapse between the first reclosing operation of the circuit breaker and the final opening and the holding open of the motor circuit which will stop all operation of the mechanism. Therefore, upon overload in the main circuit, a series of periodical reclosing operations of the circuit breaker will be effected by the operation of the lever mechanism described, which lever mechanism is actuated by the electric motor, and then the thermal relay which has been delayed in its operation by the gradual heating of the strips 26 by current flow in the motor circuit, will operate to positively open the motor circuit and thus discontinue all operation until such time as the relay be manually reset as described.

By this arrangement of a thermal relay in the motor circuit, the motor is protected against injury due to excessive current flow-

ing through its windings, (as when the motor fails to start from any cause,) as the flow of current to the motor will cause the relay to operate and open the circuit before the motor windings are damaged by the continued and excessive flow of current.

The resistance coil 25 may be connected in multiple with the motor in the motor circuit, as shown in Figs. 1 to 4 inclusive, or it may be connected in series, as shown in Fig. 5. In either case, the flow of current through the coil will be sufficient to operate the relay at the desired time, and in case of the motor failing to start, will operate at such a time as to protect the motor against injury.

As before stated, the parts of the mechanism have been shown diagrammatically and, therefore, the drawings are merely illustrative of an embodiment of the invention, and it is obvious that the construction, arrangement and combination of elements shown and described may be varied within the scope of the appended claims without departing from the spirit of the invention.

Having thus fully described our invention, what we claim is:—

1. The combination with a main circuit and a circuit breaker in said circuit, of lever mechanism for operating the circuit breaker, electrically operated means connected in the main circuit in which the circuit breaker is connected, for releasing said lever mechanism upon overload in the circuit, a motor for imparting motion to said lever mechanism, an electric circuit for the motor, and means operated by current flow in the motor circuit for opening said circuit after a predetermined number of reclosing operations of the circuit breaker.

2. The combination with a main circuit, of a circuit breaker in said main circuit, lever mechanism for operating the circuit breaker, an electric motor for operating the lever mechanism, a circuit for the motor, means within the motor circuit operated by said lever mechanism for opening the motor circuit when the circuit breaker is closed, and separate time-delay means in the motor circuit for opening the same after a predetermined number of operations of the circuit breaker.

3. The combination with a main circuit, and a circuit breaker for said main circuit, of lever mechanism for operating the circuit breaker, an electric motor for imparting motion to the lever mechanism and effecting a plurality of reclosing operations of the circuit breaker, an electric circuit for the motor, means within said motor circuit operated by said lever mechanism for opening said circuit in timed relation to the closing movement of the circuit breaker, and a thermal relay in the motor circuit including circuit opening means for effecting a delayed opening of the motor circuit.

4. The combination with a circuit breaker, of a double lever mechanism for operating the circuit breaker comprising a part connected to the circuit breaker, a part operable independently of the part connected to the circuit breaker and a connecting member for detachably connecting said parts, means connected in the main circuit within which the circuit breaker is connected for releasing said connecting member upon overload in the main circuit, means for effecting an operation of the double lever mechanism to close the circuit breaker and hold the same closed when there is no overload on the main circuit, and driving means for effecting a plurality of reengaging movements of the connecting member and movements of the lever mechanism to close the circuit breaker, and time-delay means for controlling the operation of said driving means to stop its operation after a predetermined number of reclosing operations of the circuit breaker.

5. The combination with a circuit breaker, of lever mechanism for operating the circuit breaker, including a rocker bar pivotally supported intermediate its ends with one end operatively connected with the circuit breaker, and a lever pivotally supported at one end to swing independently of said rocker bar, said lever mechanism also including a connecting member for detachably connecting one end of the rocker bar with said lever, means for turning said lever in one direction upon its pivotal support, electrically operated means within the main circuit in which the circuit breaker is connected, for operating said connecting member upon overload in the main circuit to release said rocker bar and permit the circuit breaker to open, and driving means for imparting motion to said lever to effect a plurality of movements thereof, and reengage said connecting member with said rocker bar after each opening movement of the circuit breaker.

6. The combination with a circuit breaker, of lever mechanism for operating said circuit breaker, including a rocker bar pivotally supported intermediate its ends with one end connected to the circuit breaker, a lever pivoted at one end to swing independently of said rocker bar, and a latch member carried by said lever to detachably engage the free end of the rocker bar and connect said rocker bar and lever to turn together, means for turning the lever upon its pivot in one direction and to turn the rocker bar therewith when the lever and rocker bar are connected by said latch member, electrically operated means within the main circuit for releasing the latch member upon overload in the main circuit to permit the rocker bar to turn independently of said lever and permit the circuit breaker to close, an electric motor, an electric circuit for the motor, a rotary member driven by the motor and provided with means to en-

gage the free end of the lever during the rotation of said member and turn the lever upon its pivot, a switch in the motor circuit connected to and operated by said lever mechanism to open the motor circuit in timed relation to the closing of the main circuit by the circuit breaker, and a thermal relay in the motor circuit for opening said circuit after a predetermined number of operations of the circuit breaker.

In testimony whereof we affix our signatures.

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