

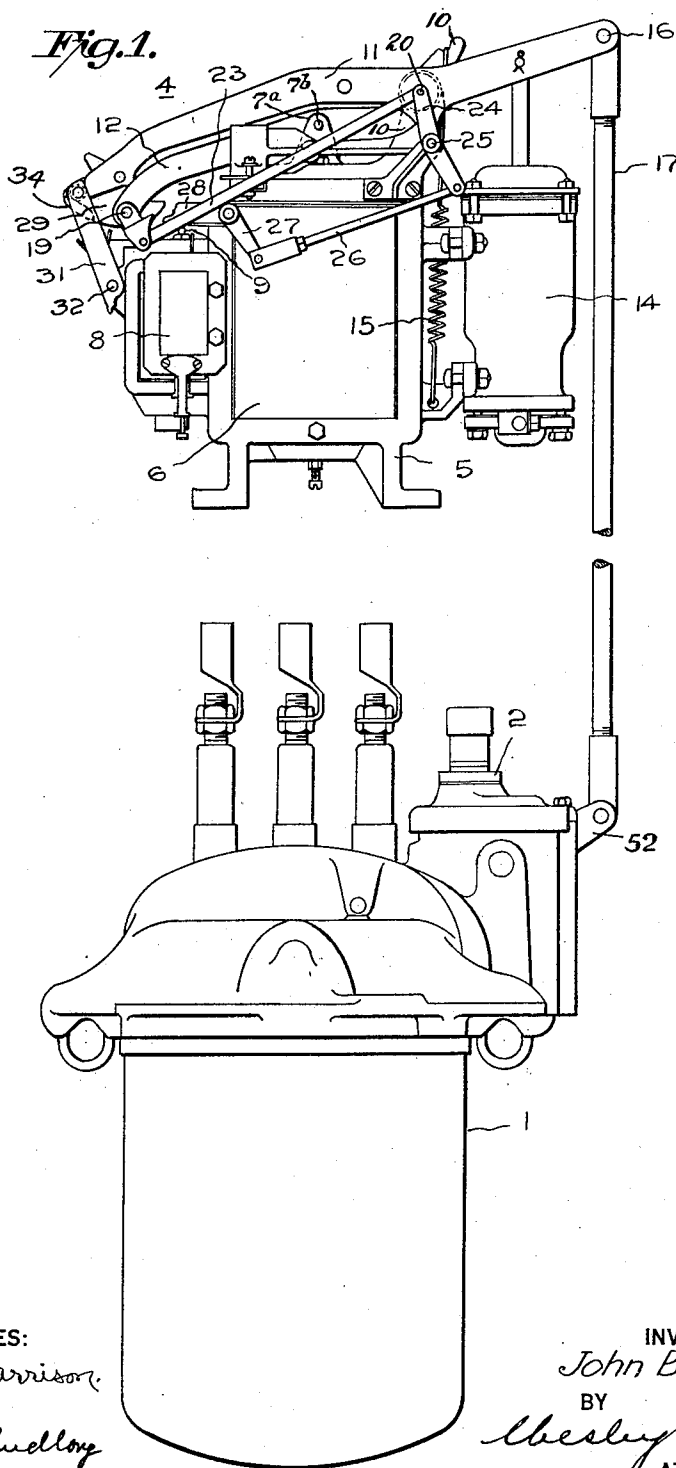
May 6, 1930.

J. B. MacNEILL
CIRCUIT INTERRUPTER

1,757,643

Filed Feb. 18, 1925

3 Sheets-Sheet 1



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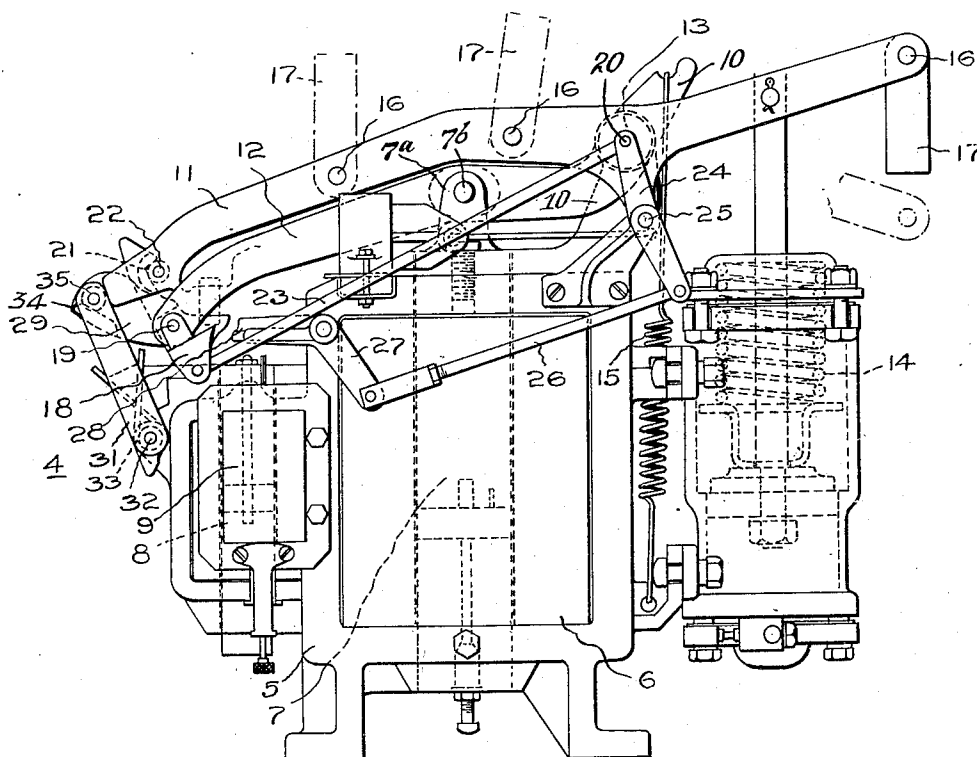
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3 Sheets-Sheet 2

Fig. 2.



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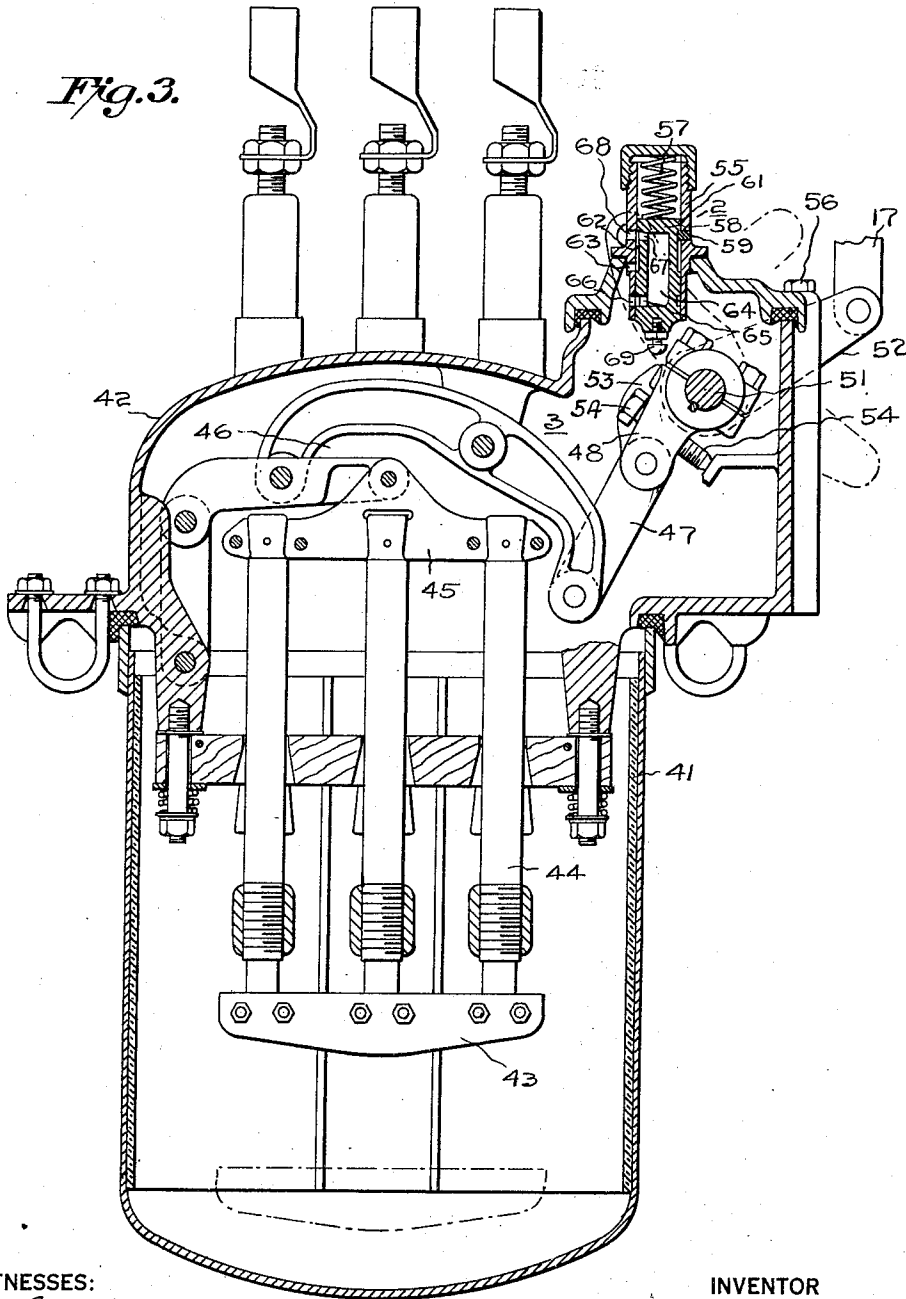
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3 Sheets-Sheet 3

Fig. 3.



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CIRCUIT INTERRUPTER

Application filed February 18, 1925. Serial No. 10,032.

My invention relates to electrical protective devices and particularly to circuit interrupters and operating mechanisms therefor.

One object of my invention is to provide a circuit interrupter of the oil-immersed type in which a vent is operated directly by the actuating mechanism of the circuit interrupter.

Another object of my invention is to provide an improved actuating device for circuit interrupters that shall be trip-free under conditions of overload at any point in the path of travel of the main lever elements thereof.

Another object of my invention is to provide circuit interrupter actuating means having an operating lever and an actuating lever that are coaxially mounted and that shall have an improved latching means for securing the two levers relative to each other and relative to the frame thereof.

During the operation of oil-immersed circuit interrupters, there is a large amount of gas generated, which gas must be liberated therefrom. In the preferred form of my invention, a vent is disposed in the cover of the circuit interrupter and in direct engagement with the operating mechanism of the circuit interrupter such that the circuit interrupter is open to ventilation when its contact members are either in their full open or closed position, but which is closed when the contact members are in an intermediate position. The intermediate position corresponds to the position of the contact members when the arc is interrupted.

In circuit interrupter operating devices, it is general practice to have an operating lever that is connected to the mechanism of the circuit interrupter and which is biased to a position corresponding to the open position of the circuit interrupter, together with an actuating lever. The actuating lever follows the operating lever to its open position where the two are engaged by a latch, after which an electromagnet, attached to the actuating lever, draws them both into the circuit-closing position.

It occasionally happens that short-circuit conditions appear on the protected circuit

during the time in which the two levers are drawing the circuit interrupter into its closed position. Under such conditions, it is desirable that the latch be operated to free the operating lever from the actuating lever at any intermediate position of the circuit interrupter between its open and its closed position. In carrying out this feature of my invention I have devised a system of levers for controlling the latch in which one of the members is normally coaxially mounted with respect to the actuating lever whereby the latch normally occupies a fixed position relative to the actuating member, but upon the shifting of the lever's pivotal point, the latch's position relative to the actuating lever changes sufficiently to liberate the operating lever.

In the accompanying drawings,

Figure 1 is an elevational view of a circuit interrupter having my improved actuating mechanism connected thereto.

Fig. 2 is an enlarged elevational view of the actuating mechanism, and

Fig. 3 is a view, partially in elevation and partially in section, of a circuit interrupter embodying my invention.

In the several figures of the drawing, similar reference numerals indicate like parts.

My invention comprises, in general, a circuit interrupter 1 having a vent 2 that is actuated in accordance with the position of portions of the circuit interrupter operating mechanism 3.

The circuit interrupter is provided, also, with actuating mechanism 4 comprising a frame 5 that supports a solenoid 6 having an armature 7 of the plunger type, an overload tripping solenoid 8 having an armature member 9 of the plunger type, an operating lever 11 and an actuating lever 12 that are coaxially mounted on a shaft 13 supported on an extension 10 of the frame 5. The armature 7 terminates at its upper end in a bifurcated extension 7^a that is pivotally supported to the lever 12 by a pin 7^b and is employed to operate the said lever in a counter-clockwise direction. The operating lever 11 is normally biased to its inoperative, or circuit interrupter open position, by a compression

spring and connecting rod 14, while the actuating lever is normally biased to its inoperative position by a tension spring 15. The operating lever 11 is connected, as at 16, to a suitable rod 17 for connection with the circuit interrupter 1. The position of the rod 17 may be varied along the operating lever 11, as desired, as is shown by dotted lines in Fig. 2. This variation regulates the length of travel and the amount of force exerted by the operating mechanism. The rod 17 shown to the right of the pin 13 produces an upward pull and will be referred to hereinafter in describing the operation of the mechanism. The rods 17 shown in dotted line attached to the lever 11, to the right of pin 13, indicate positions in which it may be attached to produce a downward pull, when such is desired, the distance from the pin 13 regulating the length of travel and the amount of force exerted.

A latch 18 is pivotally mounted at 19 upon the actuating lever 12 near the end that is opposite to the spring 15. The latch 18 is provided with a re-entrant surface 21 for engagement with a roller 22 carried by the operating lever 11. The roller 22 is mounted a short distance from the end of the lever 11 for a purpose to be hereinafter described. The latch 18 is connected by a rod 23 to a lever 24 that is pivoted to the frame 5, as at 25. The rod 23 and the lever 24 are connected by a pin 20 that is in alignment with the pin 13 when the latch 18 is in normal latching position. The other end of the lever 24 is connected by a rod 26 to a bell crank 27, one arm 28 of which extends into the path of the armature 9 of the overload relay 8.

A second latch for securing the united levers 11 and 12 to the frame 5 when the solenoid 6 is de-energized, is constituted by an extension 29 on the actuating lever 12 and a bar 31 that is pivoted by a shaft 32 to the frame 5. A coil spring 33 surrounds the shaft 32 to which it is secured. By this arrangement, the bar 31 is permitted a limited amount of turning movement, but is always returned to an initial position. A lug 34 is formed on the extension 29 and extends beyond the end of the operating lever 11 but at an angle thereto in such manner that the space therebetween converges in a downward direction. By reason of the converging relation between the lug 34 and the end of the lever 11, there is insufficient room for a roller 35 mounted on the bar 31 to pass therebetween and, so long as the lever 11 remains latched to the lever 12, the roller 35 bears against the end of the lever 11 and the lug 34 and holds both levers 11 and 12 secured to the frame 5.

Referring to Fig. 3, the circuit interrupter 1 comprises a tank 41 having a cover mem-

ber 42 of any suitable construction and in which a movable bridging member 43 is mounted for causing one or more movable contact members (not shown) to engage co-operating stationary contact members (not shown) for completing an electrical circuit. The bridging member 43 is supported by a plurality of pull rods 44 from a header 45 that is moved in a vertical direction by a suitable system of levers 46. The details of the foregoing parts of the circuit interrupter form no part of the present invention, except in so far as they are necessary to complete the combination hereafter described and, accordingly, may be of any preferred construction.

The lever mechanism 46 is operated through a toggle lever 47 that is connected to an arm 48 mounted on a shaft 51 that extends exteriorly of the cover 42 and is connected through an arm 52 to the connecting rod 17 heretofore described. A boss 53 is mounted on the arm 48 for a purpose hereinafter described. A set screw 54 is mounted on the arm 48 for controlling the movement thereof.

The venting device 2 comprises a housing 55 that is secured by suitable bolts 56 to the cover 42. Within the housing 55 there is disposed a coil spring 57 that bears downwardly against a plunger 58 for maintaining the latter in its downward position. A lug 59 on the housing 55 cooperates with a shoulder 61 formed by a groove 62 in the plunger 58 for limiting the downward movement thereof. The groove 62 also functions in combination with a port 63 as an air duct or passageway under conditions hereinafter described. The interior of the plunger 58 is preferably hollow, as at 64, and is connected by ports 65 and 67 with ports 66 and 68 in the housing 55, respectively. A set screw 69 is disposed in the lower end of the plunger 58 for engagement with the boss 53.

Assuming the circuit interrupter to be in its closed position as shown in Figs. 1 and 3, upon the occurrence of overload conditions in the circuit, the plunger 9 of the overload solenoid 8 is raised upwardly with a sharp movement and the arm 28 of the bell crank 27 is turned clockwise. The movement of the bell crank 27 is transmitted through rod 26, lever 24 and rod 23 to the latch 18 and the latter is caused to turn in a counter-clockwise direction about its pivot 19 with the result that the roller 22 on the lever 11 is freed from the surface 21.

As soon as the lever 11 is freed from the latch 18, the expansive force of the compression spring 14, together with the weight of the connecting levers, cause the lever 11 to turn in a clockwise direction about its pivot 13, which operation permits the opening of the circuit interrupter 1. As soon as the end of the lever 11 moves out of engagement with

the roller 35 and the solenoid 6 becomes de-energized, the spring 15 tends to turn the actuating lever 12 in a clockwise direction and the bar 31 is shifted slightly as the roller 35 passes over the lug 34. As soon as the lug 34 is freed from the roller 35, it follows the lever 11 until they engage each other, whereupon the surface 21 again engages the roller 22. By reason of the coaxial alignment of the end of the rod 23 and the shaft 13, the latch 18 remains in its closed position during the travel of the levers 11 and 12.

As the operating lever 11 turns in a clockwise direction, the rod 17 is depressed, thereby imparting a clockwise turning movement to the shaft 51 and the arm 48. The movement of the arm 48 causes the mechanism 46 of the circuit interrupter 1 to move the bridging member 43 downwardly thereby causing the contact members (not shown) to separate. When this movement is started, the interior of the tank 41 is in communication with the atmosphere through the ports 65, 66, the space 64, the ports 67, 68 as well as the ports 63, 68 and the groove 62. However, as soon as the boss 53 engages the set screw 69, the plunger 58 is moved upwardly against the compressive force of the spring 57, thereby causing the relative position of the several ports to shift such that communication between the interior of the tank and the atmosphere is interrupted. The plunger 58 may be made to move ahead of, and independently of, the boss 53 or directly with it as desired.

The intermediate position of the plunger 58 should be so timed with relation to the position of the bridging member 43 that the arc generated in the circuit interrupter is then extinguished. Continued turning of the shaft 51 causes the boss 53 to continue to travel along the set screw 59 and the port 64 is brought opposite to the port 63, whereupon communication between the inside 64 of the plunger 58 and the tank 41 is completed. At the same time, the groove 62 is brought opposite to the port 68 and communication between the interior 64 of the plunger 58 and the atmosphere is completed through the port 67, the groove 62 and the port 68.

It will thus be seen that the interior of the circuit interrupter 1 is in communication with the atmosphere in the beginning and at the completion of the circuit opening operation, but that it is shut off from the air at the time when the arc is extinguished. This prevents the throwing of oil from the circuit interrupter at the moment of maximum excitation thereof, although permitting the ventilation of the circuit interrupter before and after the quenching of the electrical arc.

The circuit interrupter 1, being in its open position and it is desired to close it, the solenoid 6 is energized by any suitable means

and its armature 7 is drawn downwardly, which operation turns the actuating lever 12 and, through the latch 18, the operating lever 11 in a counter-clockwise direction. However, should the overload relay 8 be actuated at any time, the latch 18 is operated to release the operating lever 11, as has been described. During the closing movement, springs 14 and 15 are again placed under compression and tension, respectively. Near the end of the downward stroke of the armature 7, the roller 35 engages the under-surface of the lug 34 and is given a slight counter-clockwise movement. By reason of the tension of the spring 33, the roller 35 moves around and over the end of the lug 34 and drops into the space between the upper surface and the end of the lever 11, thereby locking the levers in relation to the frame 5.

During the closing movement of the actuating mechanism 4, the rod 17 is drawn upwardly, thereby depressing the arm 48 and the boss 53 during which operation, the spring 57 expands and forces the plunger 58 downwardly until the upper surface of the groove 62 engages the lug 59, whereupon the parts are in the relative positions shown in Fig. 3. The foregoing cycle of operations may be continued indefinitely.

It will thus be seen that I have provided a circuit interrupter that cannot be closed during the condition of overload by reason of the operating characteristics of the mechanism heretofore described. I have also provided a circuit interrupter tank that is in communication with the atmosphere before and after the quenching of an electrical arc, but that is closed to the atmosphere at the time of maximum gas generation in order that oil may not be splashed from the tank. By reason of the venting of the tank immediately after the quenching of the arc, excessive pressures within the circuit interrupter are relieved and the gases generated are permitted to escape into the atmosphere.

I do not wish to be restricted to the specific circuit connections or arrangement of parts herein set forth, as various modifications thereof may be effected without departing from the spirit and scope of my invention. I desire, therefore, that only such limitations shall be imposed as are indicated in the appended claims.

I claim as my invention:

1. In an electrical actuating device, an operating lever and an actuating lever coaxially mounted, means for independently biasing said levers into an inoperative position, means attached to one of said levers for retrieving it from its inoperative position, means for latching said levers, electromagnetic tripping means for the latching means, a link for the latching means mounted coaxially with the levers and a linkage system supporting the coaxial end of the link and

adapted to impart a motion to the link and, therefore, to the latch to release the levers anywhere in their path of movement when the tripping means is actuated.

5 2. In an electrical actuating device, an operating lever and an actuating lever coaxially mounted, means for independently biasing said levers into an inoperative position, means attached to one of said levers for
10 retrieving it from its inoperative position, means for latching said levers, and means including a member coaxially mounted with said levers for operating said latching means at any point in the path of travel of said
15 levers.

3. In an electrical actuating device, an operating lever and an actuating lever coaxially mounted, means for independently biasing said levers into an inoperative position, means attached to one of said levers
20 for retrieving it from its inoperative position, means for latching said levers, and means including a system of levers including a member coaxially mounted with respect to
25 and extending substantially parallel with, one of said levers but having independent movement relative thereto for operating said latching means at any point in the path of travel of said levers.

30 4. In a latching device, a lever, a latch member mounted at one end of the lever, and means for operating the latch member including a member normally coaxially mounted with respect to said lever and means for
35 shifting the pivot point of said member.

5. In a latching device, a lever, a latch member mounted at one end of the lever, and means for operating the latch member including a member normally coaxially
40 mounted with respect to said lever and a system of levers for shifting the pivot point of said member.

6. A latching device for independently movable members comprising a projection on
45 one member that extends beyond the end of a second member, a lug on said projection disposed in converging relation to the second member, a latch mounted on the first member for engaging and restraining the second member,
50 means for releasing the latch, and a resiliently mounted member secured to a frame and having a roller extending into the space between said lug and the end of the second member, whereby upon the release of the
55 second member by the latch, the end of the second member moves out of the path of the roller and permits the lug to displace the roller sufficiently to free the first member.

In testimony whereof, I have hereunto subscribed my name this 11th day of February,
60 1925.

JOHN B. MacNEILL.