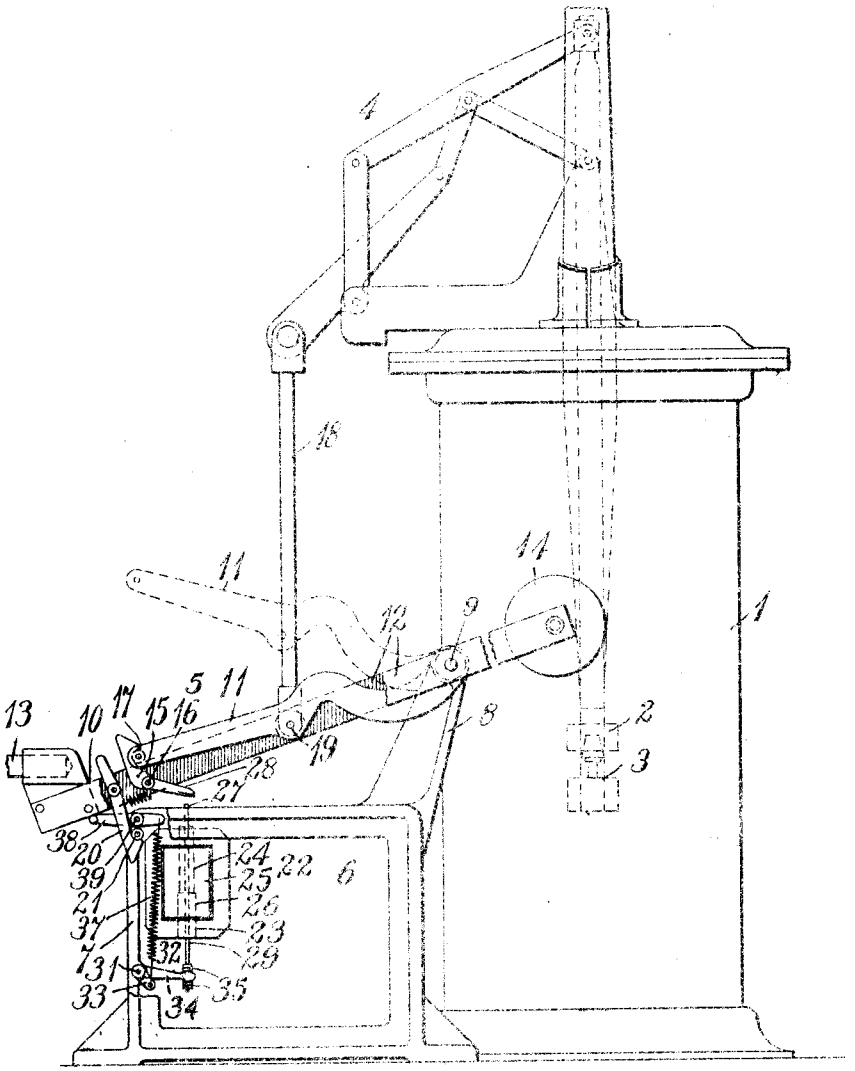
F. W. HARRIS.

CIRCUIT INTERRUPTER.

APPLICATION FILED DEC. 5, 1910.

1,132,772. Patented Mar. 23, 1915.



WITNESSES:

Fred. H. Miller

D. H. Mace

INVENTOR

Ford W. Harris

BY

Wesley G. Carr

ATTORNEY

UNITED STATES PATENT OFFICE.

FORD W. HARRIS, OF WILKINSBURG, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

CIRCUIT-INTERRUPTER.

1,132,772. Specification of Letters Patent. Patented Mar. 23, 1915.

Application filed December 5, 1910. Serial No. 595,638.

To all whom it may concern:

Be it known that I, FORD W. HARRIS, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Circuit-Interrupters, of which the following is a specification.

My invention relates to circuit interrupters for electric circuits, and it has special reference to automatic tripping devices for such apparatus.

The object of my invention is to provide a simple and effective device of the above-indicated character which shall be particularly adapted to trip out the operating mechanism of a circuit interrupter under conditions of no-voltage and shall embody means whereby the release magnet is relieved of its usual severe function of raising the movable core when the circuit interrupter is closed.

According to my invention, I provide a tripping device that embodies an electromagnet having a movable core which normally rests upon the stationary core and is held in engagement therewith under predetermined voltage conditions against the action of a spring which tends to actuate the movable core to release the operating mechanism of the interrupter when the interrupter is closed. In case the voltage fails, the spring projects the movable core against a latch, and the operating mechanism is released. When the interrupter is open, the spring is inactive and the movable core is allowed to fall by gravity into engagement with the stationary core member. It is, therefore, manifest that the tripping magnet is never required to raise its movable core, and hence, the usual severe operating conditions are eliminated and the size and cost of the customary tripping magnet may be considerably reduced. When magnets of this character are used on alternating current circuits, the amount of current taken and, consequently, the heating, varies with the condition of the magnetic circuit. That is to say, if the magnetic circuit is closed and is of relatively low reluctance, small heating and small current will be manifested. If, however, the magnetic circuit is open, a large magnetizing current will flow and the coil will rapidly overheat unless it is designed large enough to stand this condition.

According to my invention, the release magnet cannot be left with its magnetic circuit open for any appreciable time, inasmuch as this circuit is open only during the period required for the actual opening of the breaker. This condition results in a smaller magnet and a more efficient operation thereof.

The single figure of the accompanying drawing is a side elevation of a circuit interrupter which embodies my invention.

Referring to the drawing in detail, the circuit interrupter comprises a liquid-containing tank 1, stationary contact terminals 2, a movable bridging contact member 3, an operating mechanism 4 for said movable contact member, an operating lever 5, and an automatic tripping device 6.

Inasmuch as my invention resides in the tripping device 6 and pertains in no way to the rest of the circuit interrupter, except as the various parts thereof perform functions of an operative combination, no detailed description of the cooperating stationary and movable contact members 2 and 3, and the operating mechanism 4 will be given. These devices, as shown, are only intended to be illustrative of suitable means for accomplishing particular purposes and it is evident that any other suitable means may be employed.

The tripping device 6 comprises a supporting frame 7 having an upwardly projecting standard 8 at its upper right-hand corner, upon which the operating lever 5 is pivotally mounted by means of a shaft 9. The operating lever 5 is of compound structure and comprises an outer member 10 and an inner member 11. The outer member 10 is formed of two rigidly associated parallel bars 12 between which the inner member 11 is pivotally mounted upon the shaft 9. One end of the operating lever 5 is provided with a suitable handle 13 while the other end carries a counter-weight 14, according to the usual practice. A latch 15 is pivotally mounted upon a pin 16 between the bars 12, which constitute the outer member 10, and is adapted to engage a roller 17 with which the free end of the inner member 11 is provided and thereby lock the two members together.

The upper end of a rod 18 is connected to the operating mechanism 4, which is adapted to effect the engagement of the coöperating contact members 2 and 3, and the lower end of said rod is pivotally connected to the inner member 11, substantially midway between its ends, by means of a pin 19. Furthermore, the outer end of the outer member 10 is provided with a pivotally mounted latch 20 which is adapted to engage a stop 21 on the supporting frame 7 and thereby lock the operating lever in its lower, or closed, position.

An electromagnet 22, which is mounted upon the supporting frame 7, is of a common type of construction and comprises a stationary core 23, a movable core 24 and a winding 25. The movable core 24 is adapted to rest upon the middle leg 26 of the stationary core and is provided with a hammer rod 27 at its upper end, so located as to engage a tripping lever 28 of the latch 15, under certain conditions. A rod 29 is also secured to the movable core 24 and projects downwardly through an opening in the stationary core 23.

Upon a shaft 31, is mounted a lever 32 which comprises a short arm 33 and a relatively long arm 34. The outer end of the longer arm 34 is associated with the rod 29 by means of nuts 35, while the outer end of the shorter arm 33 is connected to the lower extremity of a spring 37, the upper end of which is connected to one end of a lever 38 which is pivotally mounted upon a pin 39. The other end of the lever 38 is adapted to be engaged by the outer member 10 of the operating lever 5 when said outer member is in its lower position, whereby a tension on the spring 37 is maintained, as will be readily understood.

Assuming the circuit interrupter to be closed and the various parts of the apparatus to occupy the positions shown, it is evident that the tension of the spring 37 tends to rotate the lever 32 in a counter-clockwise direction and to raise the movable core 24 in opposition to the weight of said core and the magnetism of the electromagnet 22. If, for any reason whatsoever, the voltage upon the circuit interrupter fails, the electromagnet 22 is deënergized, and it is obvious that the action of the spring 37 causes the movable core 24 and associated rod 27 to be projected against the arm 28 of the latch 15 to release the operating mechanism. The circuit interrupter is then opened by reason of the weight of its component parts, and the inner operating member 11 assumes the position shown in the dot and dash lines. No movement of the outer member 10 takes place, however, on account of the fact that it is locked in position by the latch 20. Hence, the spring 37 is maintained under tension and the movable core 24 is held in its upper position, as will be readily understood. In order to reset the interrupter, the latch 20 is disengaged from the stop 21 and, by means of the handle 13, the outer operating lever 10 is raised to its uppermost position, in which the latch 15 engages the roller 17 at the outer end of the inner lever 11. It is evident that, as the outer member 10 is raised out of engagement with the lever 38, the coil spring 37 is allowed to relax and, hence, the movable core 24 is allowed to fall by gravity into engagement with the stationary core 26. In order to close the interrupter, the operating lever 5 is forced into its lowermost position until the latch 20 engages the stop 21, thereby causing the operating mechanism 4 to effect an engagement of the movable contact member 3 with the coöperating stationary contact terminals 2. As the operating lever 5 reaches its lower position, the lever 38 is engaged thereby and is moved in a counter-clockwise direction to place the spring 37 under tension. In case no voltage exists upon the interrupter at the moment of closing, it is evident that the spring 37 immediately actuates the movable core 24 into engagement with the latch 15 and the operating mechanism is again released. If, however, voltage does exist, the electromagnet 22 is energized and the magnetism developed therein is sufficient to overcome the action of the spring 37 and the interrupter remains closed, so long as normal voltage remains upon the circuit.

Those skilled in the art will readily understand that the electromagnet 24 is not required to raise its movable core, but is relieved of this severe duty by means of the spring 37. Hence, a magnet of much less liberal design may be employed, which results in considerable economy of space and expense.

Although I have shown and described a tripping device of a specific structure, it is evident that various modifications in size and in the arrangement and location of parts may be effected without exceeding the spirit of my invention, and I desire that such modifications be included within its scope.

I claim as my invention:

1. The combination with a circuit interrupter, and an operating mechanism therefor, of a tripping device for releasing said operating mechanism and comprising a magnet having coöperating stationary and movable cores that are normally held together magnetically, and means operatively connected to the movable core of said magnet and to the operating mechanism under predetermined operating conditions for lifting said movable core to release said operating mechanism.

2. The combination with a circuit interrupter, an operating mechanism and means

for holding the same in circuit-closing position, of mechanical releasing means normally dependent upon said operating mechanism and independent of gravity, and electro-responsive means for opposing the releasing action of said mechanical means, said mechanical releasing means being interposed between said operating mechanism and said electro-responsive means under predetermined operating conditions.

3. The combination with a circuit interrupter and an operating mechanism therefor, of resilient means operatively connected to said operating mechanism only under predetermined operating conditions and tending to release said mechanism, and means operatively connected to said resilient means and dependent upon predetermined circuit conditions for restraining the action of said resilient means.

4. The combination with a circuit interrupter, an operating mechanism therefor and an operating lever for said mechanism, of means for restraining said mechanism in its closed position, mechanical means mechanically associated with said operating lever and tending to release said restraining means only when said interrupter is closed, and electro-responsive means for opposing said mechanical means when said interrupter is closed and predetermined circuit conditions obtain.

5. The combination with a circuit interrupter and an operating mechanism therefor, of means for restraining said mechanism in its closed position, spring-actuated means associated with said mechanism and tending to release said restraining means only when said interrupter is closed, and an electromagnet to oppose the action of said spring-actuated means under predetermined voltage conditions.

6. The combination with a circuit interrupter, an operating mechanism therefor, and an operating lever, of means for restraining said operating mechanism in its closed position, mechanical means tending to release said restraining means and dependent upon a spring which is active only when said operating lever is in its closed position, and an electromagnet adapted to act in opposition to said mechanical means under predetermined voltage conditions.

7. The combination with a circuit interrupter, an operating mechanism therefor, and an operating lever, of a latch for restraining said operating mechanism, an electro-magnet having movable and stationary cores adapted to be magnetically held together under predetermined circuit conditions, two movable members and a spring connected between the same, one member being associated with said movable core and the other member being adapted to coöperate with said operating lever to cause said spring to tend to trip said latch, in opposition to the action of said electromagnet, when said operating lever is in circuit-closing position.

8. The combination with a circuit interrupter, an operating mechanism therefor, and a restraining means for said mechanism, of an electromagnet having a movable core to engage said restraining means, and a stationary core upon which said movable core normally rests, and mechanical means tending to actuate said movable core to release said restraining means in opposition to the pull of said electromagnet when said circuit interrupter is closed, said mechanical means embodying a spring interposed between the movable core and a pivotally mounted lever which is engaged by said mechanism in its closed position.

In testimony whereof, I have hereunto subscribed my name this 23rd day of Nov. 1910.

FORD W. HARRIS.

Witnesses:
WILSON L. WRIGHT,
B. B. HINES.