No. 645,009. Patented Mar. 6, 1900.

L. C. REED.

SYSTEM OF ELECTRICAL DISTRIBUTION.

(Application filed July 17, 1899.)

(No Model.)

Fig. 1.

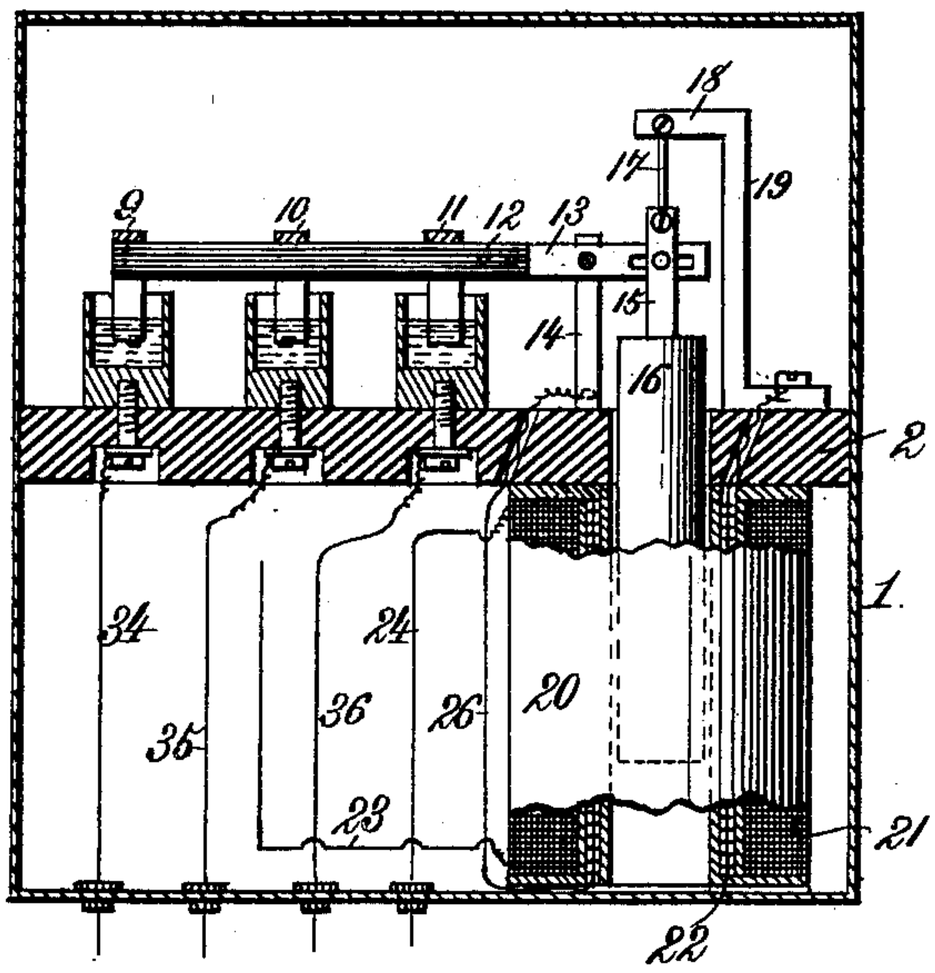


Fig. 2.

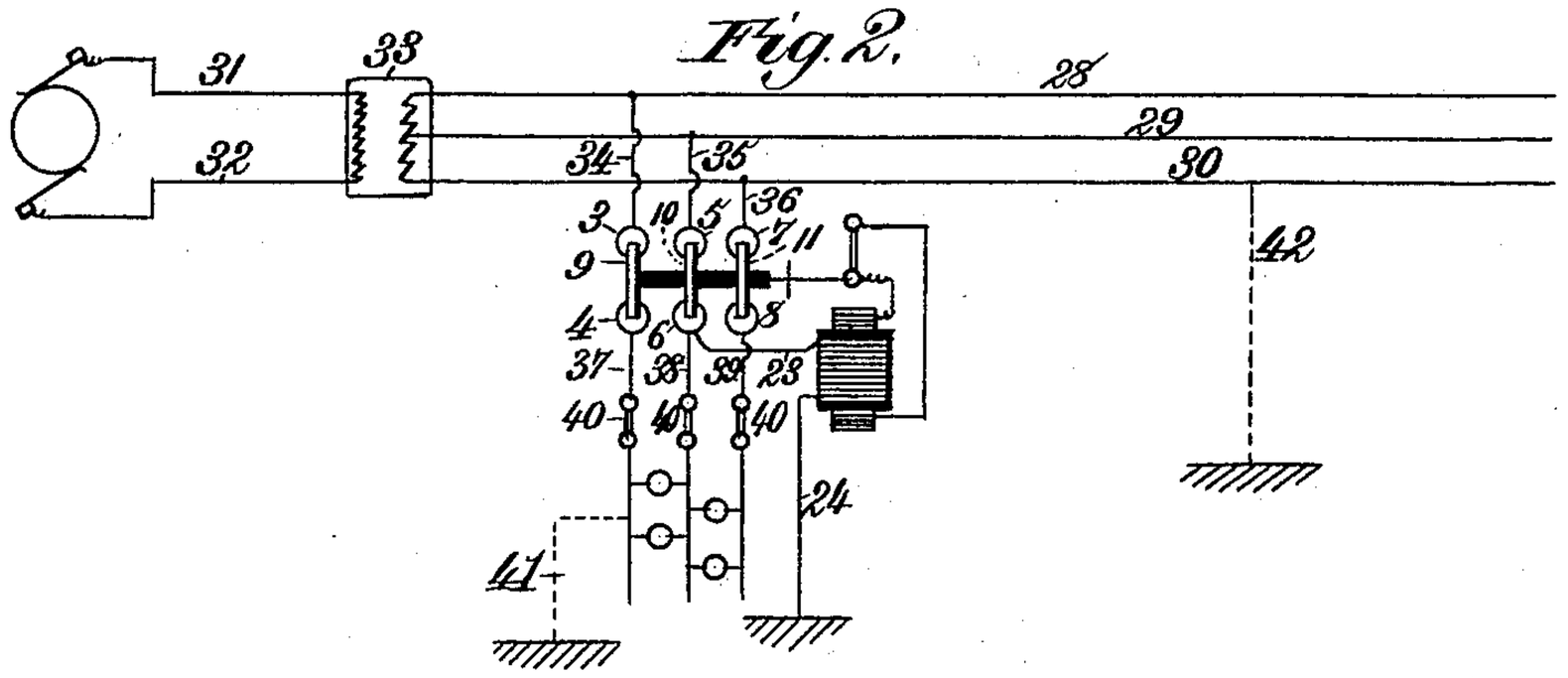
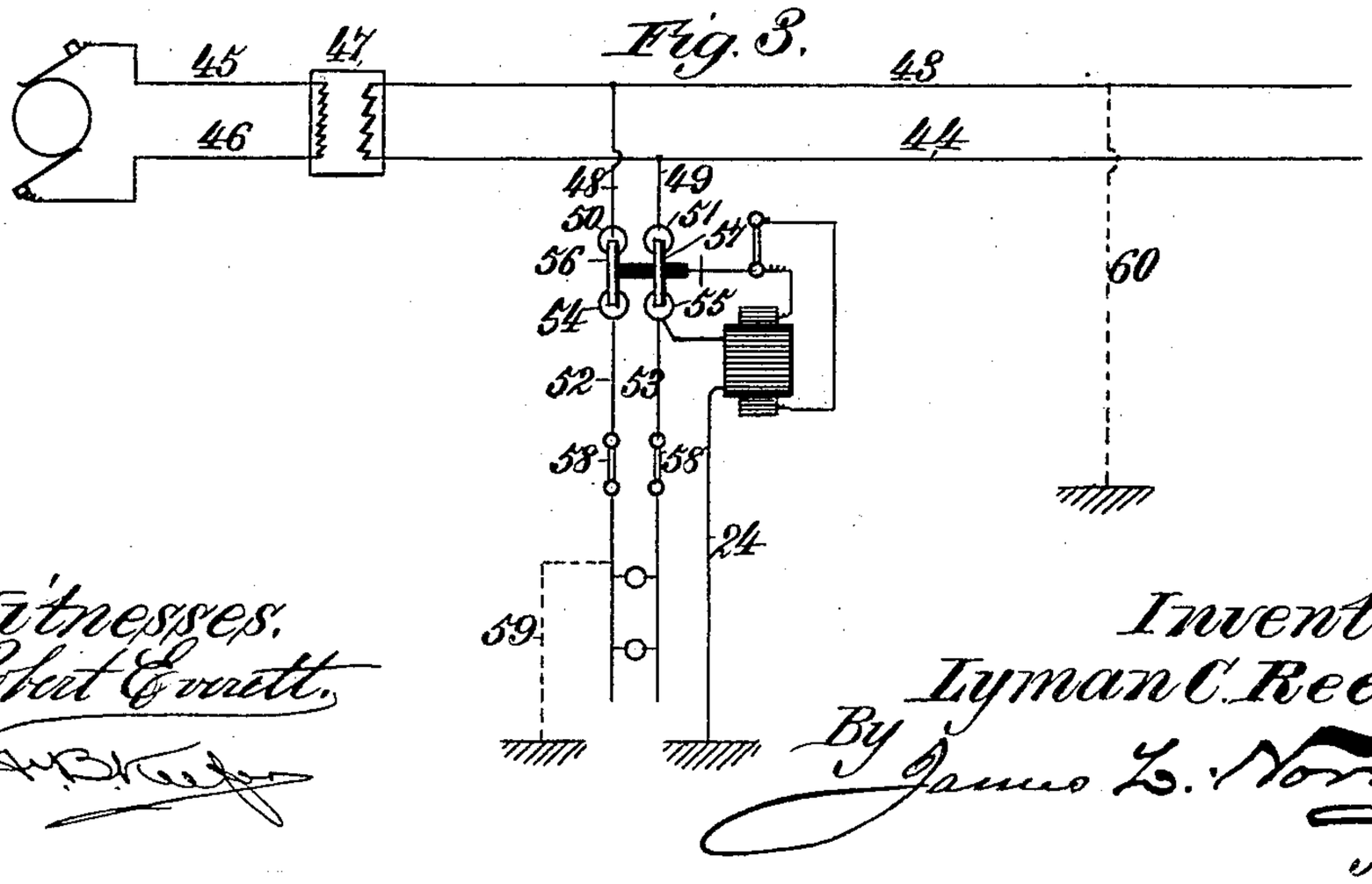


Fig. 3.



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UNITED STATES PATENT OFFICE.

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SYSTEM OF ELECTRICAL DISTRIBUTION.

SPECIFICATION forming part of Letters Patent No. 645,009, dated March 6, 1900.

Application filed July 17, 1899. Serial No. 724,068. (No model.)

To all whom it may concern:

Be it known that I, LYMAN C. REED, a citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented new and useful Improvements in Systems of Electrical Distribution, of which the following is a specification.

My invention relates to improvements in isolated alternating low-tension systems of electrical distribution, the object of the same being to prevent the continuous waste of current or any insiduous arcing in case of a ground occurring in the house-wiring or at other points of the distribution on the leg opposite that which is permanently grounded.

In carrying out the invention I employ in connection with the ordinary protective fuses an automatic circuit-breaker installed in the house-service, comprising a switch and a solenoid-transformer for operating the switch, one leg of the circuit being grounded through the primary of said solenoid-transformer. The circuit-breaker is designed to operate in the event of a ground in the house-service on the leg thereof opposite that which is permanently grounded through the solenoid-transformer and upon such currents as are not strong enough to burn out the protecting-fuses of the house, since the current flowing to ground cannot be, as shown below, of sufficient strength to blow said protecting house-fuses.

The details of my invention will be more fully set forth hereinafter, and the novel features thereof will be specifically defined in the claims.

In the drawings forming part of this specification, Figure 1 is a sectional elevation of the circuit-breaker employed. Fig. 2 is a diagrammatic view illustrating the application of the circuit-breaker in connection with the usual house-fuses on an isolated low-tension three-wire system of distribution, and Fig. 3 is a similar diagrammatic view illustrating the application of the circuit-breaker upon an isolated low-tension two-wire system of distribution.

Like reference-numerals indicate like parts in the different views.

The circuit-breaker employed is substantially the same as that disclosed in my application Serial No. 724,066, filed of even date herewith, and a description thereof sufficient merely to render its operation understood will be entered into herein.

As shown, the operative parts are mounted in a casing 1, having a bed-plate 2, of insulating material, therein. On the upper side of the bed-plate 2 are secured mercury-cups 3 4 5 6 7 8, with which coöperate the bridging contact-strips 9 10 11, which close the circuit between the cups 3 and 4, 5 and 6, and 7 and 8. Said contact-strips are themselves secured to a bar 12, of insulating material, connected at its rear end to a lever 13, of conducting material, fulcrumed upon a metallic support 14 and operatively connected to the stem 15 of an iron core 16. The said core is normally held in its raised position by means of a fuse 17, which is attached to the upper end of the stem 15 and to the overhanging arm 18 of the bracket or support 19. The core 16 fits between and is adapted to be actuated by a "solenoid-transformer" 20, the same comprising an outer primary coil 21 and an inner secondary coil 22. The primary coil 21 is in a normally-grounded circuit leading from the mercury-cup 6 through the wire 23 and to ground through the bottom of the casing 1 through wire 24. The secondary coil 22 is in a normally-closed circuit, including the wire 25, attached to the bracket 19, wire 26, support 14, lever 13, stem 15, and fuse 17. It will be understood that the passage of the alternating current through the primary coil 21 of the solenoid-transformer 20 will induce the current of lower potential but higher amperage in the closed secondary, which induced current will act to melt the fuse 17, when the core 16 will be drawn downwardly, opening the switch, consisting of the contact-strips 9, 10, and 11, and the mercury-cups 3, 4, 5, 6, 7, and 8.

As no claim is based upon the details of construction of the circuit-breaker, the foregoing description thereof is deemed sufficient.

The circuit-breaker shown in Fig. 1 and above described is adapted for use with the three-wire system of distribution. For the two-wire system one set of mercury-cups will

be dispensed with, and the ground through the primary of the solenoid-transformer 20 will be through the wire 27 from one of the mercury-cups on the house side of the instrument.

Fig. 2 shows the isolated three-wire low-tension alternating service-mains 28 29 30, fed from the primaries 31 32 through the transformer 33. The house-circuit wires 34 35 36 lead, respectively, to the mercury-cups 3, 5, and 7, and the wires 37 38 39 lead from the cups 4, 6, and 8, respectively, the latter wires being supplied with the usual house-protecting fuses 40. 41 represents an accidental ground in the house on one of the outer legs, and 42 a similar ground on one of the outer legs at some other point of the distribution outside the house.

In Fig. 3, 43 44 represent an isolated two-wire low-tension alternating service fed from the primaries 45 46 through the transformer 47. The house-service wires 48 49 lead to the mercury-cups 50 51, and the wires 52 53 lead from the cups 54 55 to the lights or other devices to be supplied. Contact is made between the cups 50 and 54 and 51 and 55 by means of the contact-strips 56 57, and the wires 52 53 are supplied with the usual house-protecting fuses 58. 59 represents an accidental ground in the house on the leg opposite that which is grounded by way of the wires 27 24 through the primary of the solenoid-transformer. 60 represents a similar ground at some other point of the distribution outside the house.

It will be understood that one or more house-installations may be connected with the low-tension alternating service. (Illustrated in both Figs. 2 and 3.) The number of installations, however, is supposed to be limited to five or six in order to demonstrate the operation of the circuit-breaker on an isolated system. If the ground 41 on some portion of the house-wire or the ground 42 on some other portion of the isolated system should occur on a leg opposite the grounded neutral through the solenoid-transformer, there will be a flow of current between the accidental ground 41 or 42 and the grounded neutral wire. The flow of current will be limited by the resistance of the accidental ground and the resistance of the ground-circuit through the solenoid-transformer. Should the accidental ground have a low resistance and the ground through the solenoid-transformer have an ohmic and an inductive resistance equivalent to about one hundred ohms, (there being only one solenoid-transformer connection to ground taken into consideration,) then the current flowing to ground continuously will amount to about one ampere when operated on a one-hundred-and-ten-volt system. This would mean a continuous waste, besides being a source of danger from derangements which might develop. This flow of current—that is, supposedly one ampere—is not sufficient to blow the protecting-fuses of the house-circuit, which in ordinary installations range from six amperes capacity upward, depending upon the size of the installation. To overcome this defect and avoid this waste, the solenoid-transformer is so designed that when it has a flow of current through the primary 21 of approximately one ampere the induced current in the secondary 22 is sufficiently strong to melt the supporting-fuse 17, thereby enabling the switch to operate. As above stated, however, this condition can only exist in an isolated alternating installation. Should the installation not be isolated, the resistance in multiple through many solenoid-transformers connected to the system would be sufficiently low to enable a large amount of current to flow to ground through any accidental ground which occurred, thereby immediately blowing the fuses. Furthermore, this operation of the circuit-breaker applies only to alternating currents, since in ordinary practice from the nature of the systems employed it is hardly possible to obtain an isolated direct service to a house unless the current be generated on the premises, in which case it cannot be considered a system.

The primary coil 21 of the solenoid-transformer is so constructed that when energized by a direct current of one hundred and ten volts its magnetic pull is not of sufficient strength to break the supporting-fuse 17. It will be seen, therefore, that on all systems so arranged that an accidental ground on the system is protected by the house-fuses of the system the solenoid-transformer which actuates the switch will not operate, but where the house-fuses do not protect against a continuous leakage to ground, as in the case of an isolated alternating installation, the solenoid-transformer 20 is so designed that it will operate the switch and disconnect the service.

In Fig. 3 the operation is identical with that described with reference to Fig. 2, the accidental grounds 59 and 60 indicating those occurring in the house-service in the one case and at another point of the distribution in the other case on the leg of the circuit opposite that which is grounded through the solenoid-transformer.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an isolated, low-tension, alternating system of electrical distribution, a service-circuit, one leg of which is permanently grounded, fuses in said circuit, and means, independent of said fuses for cutting out said circuit, the said means being thrown into operation by a current of insufficient volume to blow said fuses.

2. In an isolated, low-tension, alternating system of electrical distribution, a service-circuit, one leg of which is permanently grounded, fuses in said circuit, and means, independent of said fuses, for cutting out said cir-

cuit, the said means being thrown into operation by an accidental ground on the leg of the service opposite that which is permanently grounded which permits a flow of current of insufficient volume to blow said fuses.

3. In an isolated, low-tension, alternating system of electrical distribution, a service-circuit, one leg of which is permanently grounded, fuses in said circuit, a switch also in said circuit, and means, independent of said fuses, for operating said switch, the said means being thrown into operation by an accidental ground on the leg of the service opposite that which is permanently grounded, which permits a flow of current of insufficient volume to blow said fuses.

4. In an isolated low-tension alternating system of electrical distribution, a service-circuit, fuses in said circuit, a switch controlling said circuit, and a solenoid-transformer for operating said switch, one leg of said circuit being grounded through the primary thereof, the said solenoid-transformer being thrown into operation to actuate said switch by an accidental ground on the leg of the service opposite that which is grounded therethrough, which permits a flow of current of insufficient volume to blow said fuses.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

LYMAN C. REED.

Witnesses:
M. C. SONIAT,
L. RENE VEILARS.