No. 799,790. PATENTED SEPT. 19, 1905.

J. D. HILLIARD, Jr.

ELECTROMAGNETIC LOCK FOR AUTOMATIC CIRCUIT BREAKERS.

APPLICATION FILED NOV. 17, 1902.

2 SHEETS—SHEET 1.

Fig. 1.

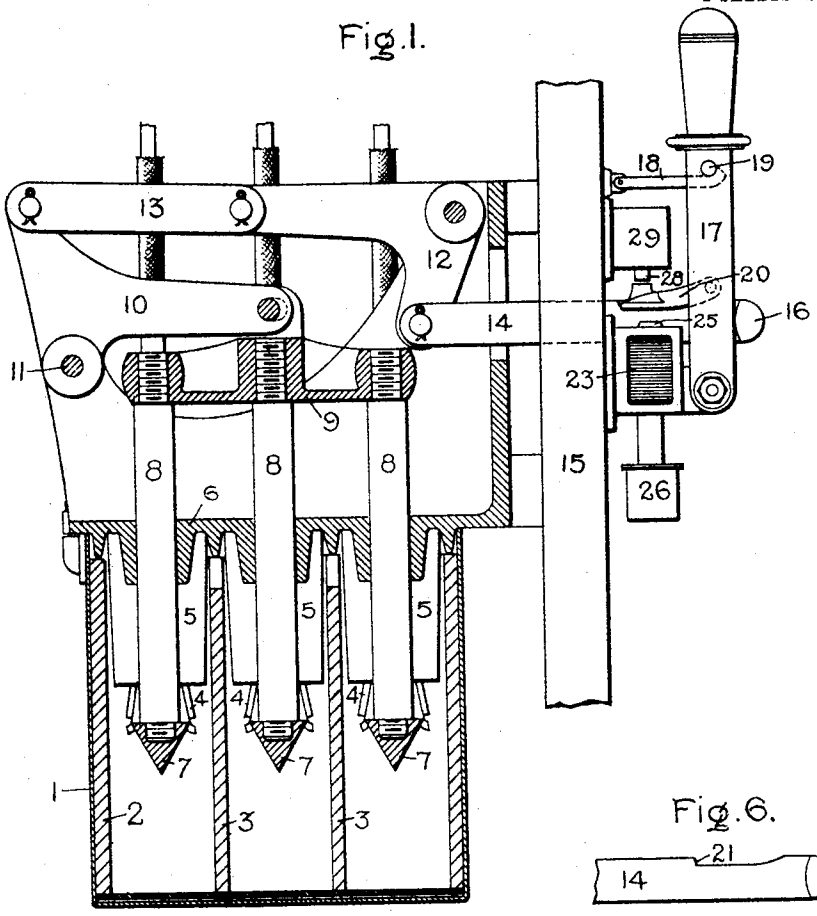
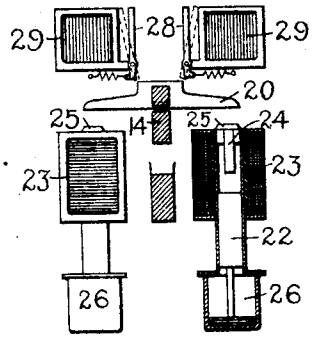


Fig. 6.

Fig. 2.



Witnesses.

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2 SHEETS—SHEET 2.

Fig. 3.

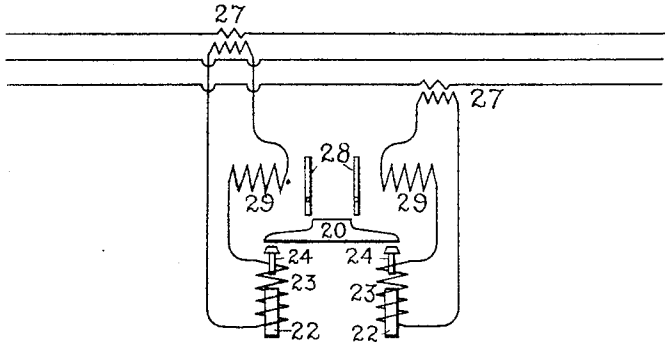


Fig. 4

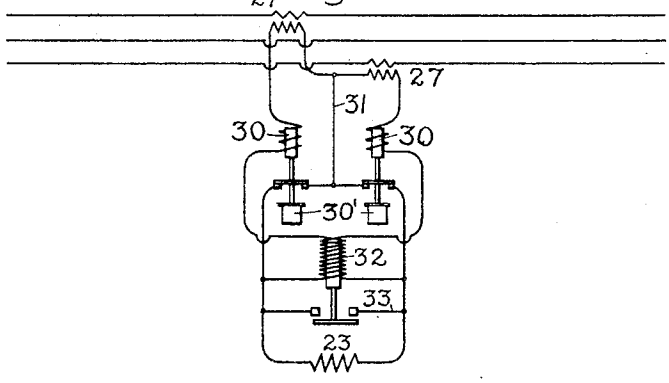
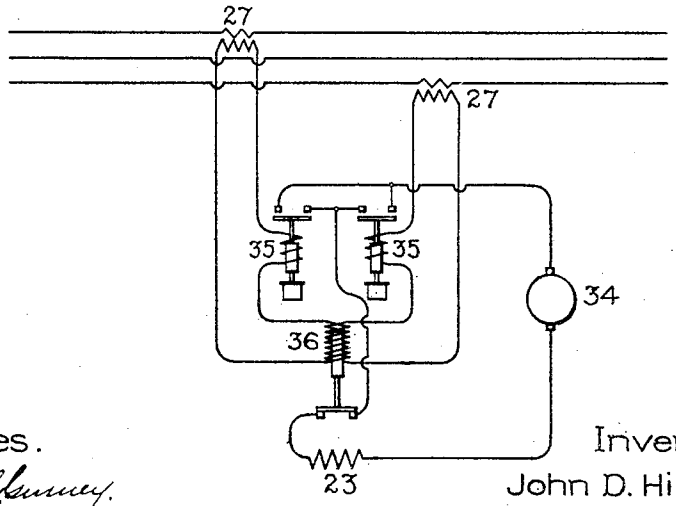


Fig. 5



Witnesses.

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UNITED STATES PATENT OFFICE.

JOHN D. HILLIARD, JR., OF GLENS FALLS, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

ELECTROMAGNETIC LOCK FOR AUTOMATIC CIRCUIT-BREAKERS.

No. 799,790. Specification of Letters Patent. Patented Sept. 19, 1905.

Application filed November 17, 1902. Serial No. 131,670.

To all whom it may concern:

Be it known that I, JOHN D. HILLIARD, Jr., a citizen of the United States, residing at Glens Falls, county of Warren, State of New York, have invented certain new and useful Improvements in Electromagnetic Locks for Automatic Circuit-Breakers, of which the following is a specification.

This invention relates to switches or circuit-breakers for electric circuits, and especially to high-tension alternating-current distribution systems.

Circuit-breakers are ordinarily calibrated to operate at or above a predetermined maximum load; but it sometimes happens that an excessively heavy load occurs suddenly and only for a brief period—such, for instance, as takes place when an alternating-current generator is short-circuited and before the self-regulating action of the machine can operate to pull down the enormous current which flows temporarily through the windings. It is manifestly desirable that the circuit-breaker shall not operate under such circumstances, since the apparatus can safely withstand the overload for a brief interval; but each circuit-breaker should respond only to the load for which it is designed. Similarly a switch should be rendered incapable of operation under a current far beyond its rated capacity, other switches of greater capacity in the circuit being relied on to act under such loads.

The object of my invention is to provide an automatic lock which prevents the circuit-breaker from operating on a sudden excessive overload, but which lock is released as soon as the current declines to an overload value within the breaking capacity of the switch.

It comprises, more specifically, a dog which is thrown into operative position to lock the circuit-breaker by means of an electromagnet responsive to the overload.

In the accompanying drawings, Figure 1 is a longitudinal cross-section of an automatic circuit-breaker equipped with my automatic lock. Fig. 2 is a sectional elevation of the tripping-coils, lock-magnets, and adjacent parts. Fig. 3 is a diagram of circuits. Figs. 4 and 5 show diagrams of modifications, and Fig. 6 is a detail.

The invention is applicable to any type of switch or circuit-breaker; but I have selected for illustration one of the oil-switches used for handling high-tension triphase alternating currents. It is fully set forth in the pending application of Emmet and Hewlett, filed February 14, 1901, Serial No. 47,222, and comprises a casing or oil-tank 1, lined with wood or other insulating material 2 and divided into chambers by the insulating-partitions 3. The fixed terminals 4 of the circuit are supported on porcelain insulators 5, which are firmly seated in the cover 6 of the oil-tank and dip into the oil. The movable contacts 7 are carried on the lower ends of wooden rods 8, whose upper ends are secured to a cross-head 9, to which is loosely pivoted an arm of a bell-crank lever 10, fulcrumed at 11 on an upward extension of the cover 6. On an opposite extension of said cover is fulcrumed a second bell-crank lever 12, one arm of which is connected by a link 13 with the second arm of the lever 10. The other arm of the lever 12 is pivoted to a bar 14, which passes through the switchboard 15 and has a head 16, against which a hand-lever 17 rests. A catch 18 engages a pin 19 and holds the handle in its upright position. A pawl 20 is pivoted to the hand-lever and engages with a shoulder 21 on the bar 14 to keep the switch closed. When the pawl is lifted, the weight of the cross-head and movable contacts pulls the switch open. The pawl can be tripped by the movable cores 22 of the solenoids 23, arranged vertically beneath it, and after a certain vertical movement of the cores 22 giving a quick hammer-blow to the loose pins 24 normally hanging by their heads 25 in the upper ends of said solenoids. The movement of the cores 22 is at first retarded by the dash-pots 26. The solenoids are in circuit with a source of current which will energize them when the line is overloaded, and thus open the switch—such, for instance, as series transformers 27 in the main circuit, as indicated in Fig. 3 and set forth fully in my allowed application, Serial No. 82,094.

The switch above described is shown merely by way of example. My locking-switch consists of one or more locking-dogs 28, normally out of line with the pawl 20 and therefore not interfering with its being lifted out of engagement with the shoulder 21. By means of an electromagnet 29 each dog can be swung into the vertical path of the pawl, so as to prevent it from rising and opening the switch.

The coils 29 are in series with the tripping-solenoids 23, but are so wound as not to respond to the moderate overload which the switch can safely handle and for which it is calibrated to open. A sudden heavy overload will energize the coils 29 and throw the locking-dogs into line with the pawl before the slower-acting tripping-solenoid cores can lift it.

In Fig. 3 the locking-coils and tripping-solenoids are shown in two separate circuits, each including the secondary of a transformer 27, whose primary is in series with one branch of a three-phase line.

In Fig. 4 the dogs 28 and coils 29 are dispensed with. In circuit with each secondary of the transformer is a circuit-opening solenoid 30, and the two circuits have a common return 31. A dash-pot 30′ retards each solenoid-core. In series with each solenoid is one coil of a double-wound magnet 32, the two coils being of the same ampere-turns, and the magnet controls a shunt 33 around the tripping-coil 23 of the main switch. Ordinarily the current through the two coils of the magnet 32 is insufficient to lift the core, and the shunt remains open. An overload for which the switch is calibrated will cause one or the other of the solenoids 30 to open its circuit and send the current from the corresponding secondary through the tripping-coil; but a sudden heavy overload will energize a coil or coils of the magnet 32 and close the shunt 33 before the slow-acting solenoid 30 can operate, so that the current which would ordinarily energize the tripping-coil is shunted past it.

When the tripping-solenoid 23 is energized by direct current derived, for instance, from a small generator 34, the secondaries of the two transformers are in circuit, respectively, with the two coils 35, each controlling the tripping-circuit, and the two coils of the magnet 36, also controlling the tripping-circuit. An ordinary overload energizes a coil 35 and trips the switch. A sudden heavy overload energizes one coil of the magnet 36 and opens the tripping-circuit before the slow-acting coil 35 can operate.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an electric switch or circuit-breaker, the combination with a switch element of means responsive to an excessive overload acting to prevent an opening movement of said switch element.

2. In an electric switch or circuit-breaker, the combination with a switch element of a coil responsive only to an excessive overload and acting to prevent its opening movement.

3. The combination with an automatic circuit-breaker, of a slow-acting device for causing the tripping of said circuit-breaker, and a quick-acting device responsive to a heavy overload for preventing the circuit-breaker from tripping.

4. The combination with an automatic circuit-breaker, of a slow-acting coil for causing the tripping of said circuit-breaker, and a quick-acting coil in series with said slow-acting coil, said quick-acting coil being responsive to an excessive overload and preventing the circuit-breaker from tripping.

5. The combination with a polyphase line, of an automatic circuit-breaker, two or more series transformers, a quick-acting coil and a slow-acting coil in series with each other and with the secondary of each transformer, and means whereby an excessive overload energizing the quick-acting coil will prevent the slow-acting coil from tripping the circuit-breaker.

6. In a switch or circuit-breaker for electric circuits, a lock restraining its release under excessive current strengths, and means for opening said lock under a lesser current strength.

7. In a switch or circuit-breaker for electric circuits a lock normally released, and means for setting the lock to prevent the operation of the switch or circuit-breaker when current beyond the capacity of the switch passes.

In witness whereof I have hereunto set my hand this 15th day of November, 1902.

JOHN D. HILLIARD, Jr.

Witnesses:

Edward Williams, Jr.,

Helen Orford.