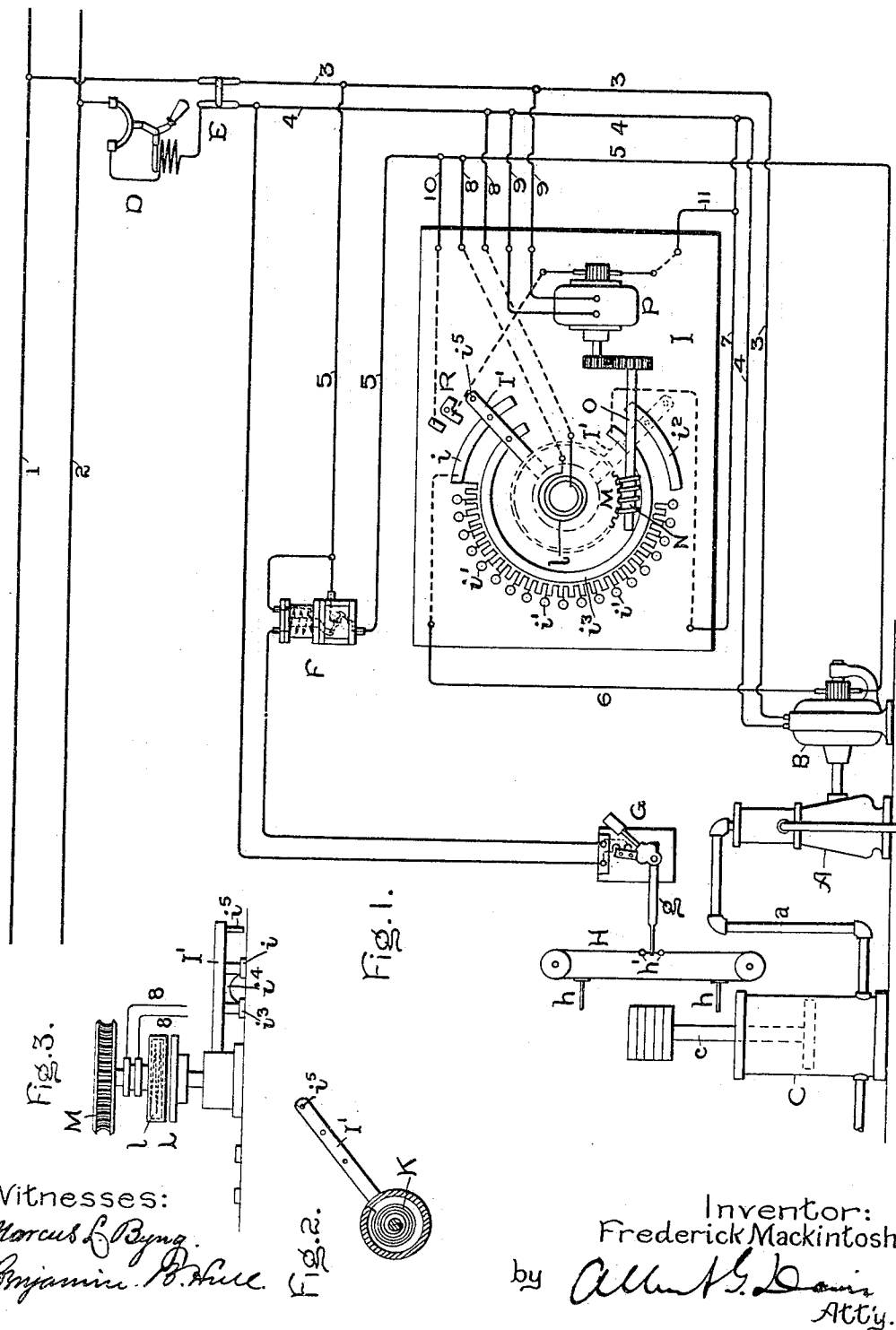


No. 769,619.

PATENTED SEPT. 6, 1904.

F. MACKINTOSH.
STARTING RHEOSTAT.
APPLICATION FILED JULY 26, 1901.

NO MODEL.



Witnesses:
Marcel L. Byng.
Benjamin B. Hill.

Inventor:
Frederick Mackintosh
by *Allen H. Davis*
Att'y.

UNITED STATES PATENT OFFICE.

FREDERICK MACKINTOSH, OF SCHENECTADY, NEW YORK, ASSIGNOR TO
GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

STARTING-RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 769,619, dated September 6, 1904.

Application filed July 26, 1901. Serial No. 69,807. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK MACKINTOSH, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Starting-Rheostats, of which the following is a specification.

This invention relates to electric motors; and its object is to provide improved means for automatically starting and stopping a motor-driven pump without danger of burning the rheostat-contacts.

The invention consists in a rheostat whose switch-arm is normally held in the "off" position by a coiled spring. When the motor is to be started, an electromagnetic clutch connects the arm to a small driving motor for the rheostat, whereby the arm will be swept over the rheostat-points until the pump-motor receives full-line voltage, at which point the arm opens a supplemental switch in the armature-circuit of the rheostat-motor, which at once stops, and the switch-arm then remains stationary, being held by the electromagnetic clutch. An accumulator is connected with the pump, and its plunger controls a switch by means of which the circuits of the rheostat-motor, the electromagnetic clutch, and the armature of the pump-motor are controlled, preferably through an intermediate electromagnetic switch. When the accumulator is full, the switch opens these circuits and the pump-motor stops. At the same time the rheostat switch-arm is released by the deenergizing of the clutch and the spring returns said arm to off position. On its way the arm closes the supplementary switch in the armature-circuit of the small motor, and thus puts said motor in readiness to start when the accumulator throws back its switch. The rheostat-arm therefore does not go to the off position until after the pump-motor circuit is broken, so that there is no arcing at the rheostat-contacts, and they are thus kept from being injured. Whatever arcing takes place on breaking the pump-motor circuit is restricted to the electromagnetic switch, where it can be properly cared for.

In the accompanying drawings, Figure 1 is

a diagrammatic representation of a pump-accumulator, pump-motor, rheostat, and the various circuits and switches above referred to. Fig. 2 shows the spring in the rheostat switch-arm. Fig. 3 illustrates the relative positions of the switch-arm and the electromagnetic clutch.

In Fig. 1 the pump A is driven by the electric motor B, and its delivery-pipe *a* is connected with an accumulator C, provided with the usual weighted plunger *c*. The field-coils of the pump-motor B are energized by current led through branch conductors from the mains 1 2, preferably through an automatic circuit-breaker D and double-pole switch E, controlling the branch conductors 3 4. An electromagnetic switch F is connected across the conductors 3 4 through a float-switch G, whose lever *g* is controlled by the up and down movements of the accumulator-plunger, preferably by arranging an endless belt H adjacent to said plunger, with tappets *h* to be struck by the plunger near the ends of its stroke, whereby the belt will be moved, and buttons *h'* thereon will actuate the switch-arm *g*, closing the switch G on the downstroke of the plunger and opening it on the upstroke.

The electromagnetic switch F is preferably such a one as is shown in the application of F. E. Case, filed February 28, 1898, Serial No. 671,994. It controls a conductor 5, which takes current from the conductor 3 and leads to one brush of the pump-motor B. The other brush is connected by wire 6 with a contact-segment *i* of the starting-rheostat I. In the same circle as this segment are the several contact-points *i'* and a segment *i''*. Concentric with these is a long segment *i'''*, connected by wire 7 with the conductor 4. A switch-arm I' is pivoted concentric with these segments and carries a bridging-contact *i'*, serving to connect the segment *i'''* with those in the other circle. A spring K, preferably coiled in the hub of the switch-arm I', tends to keep the arm in the off position, (indicated by dotted lines.)

In order to swing the rheostat-arm I' over the points *i'*, and thus cut out the resistance from the circuit of the pump-motor and start

the same, the arm carries one part of an electromagnetic clutch L, whose other part is secured to a shaft on which is a worm-gear M, engaged by a worm N on a shaft O, which is rotatable by a small electric motor P. The coil of the clutch is permanently connected by wires 8 with the conductors 5 4, so that it is controlled by the electromagnetic switch F. The field-coil of the rheostat-motor P is permanently connected by wires 9 with the conductors 3 4, so that it is constantly energized. A wire 10 connects the conductor 5 with the stationary contact of a switch R, whose movable arm is connected with one armature-brush of the rheostat-motor P. The other brush is connected by wire 11 with the other side of the circuit. On the rheostat-arm I' is a pin ⁵, which moves the arm of the switch R, opening it as the arm I' reaches full "on" position and closing it as it starts back to off position.

The operation of my invention is as follows: Suppose the parts to be in the position shown in Fig. 1, with the pump-motor running at full speed and the plunger of the accumulator slowly rising. The rheostat-motor is not running, its armature-circuit being open at the switch R. The rheostat-arm is held in its full on position by the clutch, which is energized through its leads 8. The switches F G are closed. Now when the plunger rises high enough to strike the upper tappet the belt is moved along, pulling down the lever of the float-switch and opening the circuit of the electromagnetic switch, which in turn breaks the circuit through the conductor 5. This opens the pump-motor armature and deenergizes the electromagnetic clutch, releasing the rheostat-arm, whose spring at once throws it around to off position, and in so doing it closes the switch R in the rheostat-motor circuit.

When the accumulator-plunger sinks low enough to move the belt in the opposite direction, the switch G is closed, thereby closing the switch F, which results in energizing the clutch, starting the rheostat-motor, and sending current through the pump-motor with increasing voltage as the motor P turns the rheostat-arm over the resistance-points until said motor is stopped by the arm I' opening the switch R. The parts have then arrived again at the position shown in Fig. 1.

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

1. The combination of a work-circuit, a motor-operated rheostat in the same, a clutch between the motor and the movable contact of the rheostat, means operated by the work-circuit for storing energy, and means for restoring the rheostat to the "off" position after a determinate amount of energy has been stored.

2. The combination of a work-circuit, a motor-operated rheostat in the same having a movable contact biased toward an "off" position, a clutch between the motor and the

movable contact, means operated by the work-circuit for storing energy, and means whereby the movable contact of the rheostat is released after a determinate amount of energy has been stored.

3. The combination of a work-circuit, a motor-operated rheostat in the same having a movable contact biased to movement toward an "off" position, an electromagnetic clutch between the motor and the movable contact, means operated by the work-circuit for storing energy, and means whereby said electromagnetic clutch is deenergized after a determinate amount of energy has been stored.

4. In a motor-operated pump the combination of a driving-motor for the pump, a motor-operated rheostat, a clutch between the motor and the movable contact of the rheostat, and means governed by the pressure stored by the pump for opening the clutch and restoring the rheostat to its off position.

5. In a motor-operated pump, the combination of a driving-motor, an electrically-operated rheostat having its movable contact biased toward an off position, a clutch between the rheostat-motor and the contact, a cut-out for the rheostat-motor actuated at or near its full on position, means for closing the cut-out by return movement of the contact, and means determined by the pressure stored by the pump to open the clutch.

6. In a motor-operated pump, the combination of an electric pump-motor, an automatic rheostat in its circuit, a clutch between the rheostat-motor and the movable contact, a cut-out for the rheostat-motor opened at or near its full on position, means for closing the same by a return movement of the contact, and an electrically-operated switch for opening and closing the pump-motor circuit at determinate pressures in the pump system.

7. A starting-rheostat for electric motors, comprising a resistance, a movable contact for cutting out said resistance, an electric motor for moving said contact, an electromagnetic clutch for connecting said contact with the motor, an electromagnetic switch controlling the circuits through the resistance, motor and clutch, and a switch controlling the electromagnetic switch.

8. A starting-rheostat for electric motors, comprising a resistance, a movable contact for cutting out said resistance, an electric motor for moving said contact, an electromagnetic clutch for connecting said contact with the motor, and means whereby said contact opens the motor when all the resistance has been cut out.

9. A starting-rheostat for electric motors, comprising a resistance, a movable contact for cutting out said resistance, an electric motor for moving said contact, an electromagnetic clutch for connecting said contact with the motor, a spring for returning said contact to "off" position when the clutch is deenergized.

gized, a work-circuit including the rheostat, means for closing the motor-circuit by the movement of the contact, and means controlled by the work-circuit for deenergizing the clutch-magnet.

10 10. The combination with an electric motor, of a starting-rheostat in series therewith, means for automatically actuating said rheostat to cut out the resistance when the motor-circuit is closed, means for automatically opening the circuit of the actuating means when all the resistance has been cut out, a work-circuit including the rheostat and means for automatically cutting in said resistance, when
15 the working circuit is broken.

11. The combination with an electric motor, of a starting-rheostat in circuit therewith, an electric motor for actuating the rheostat to

cut out the resistance, a switch for said motor controlled by the rheostat-arm, a clutch for
20 connecting the arm to the motor, and a spring for returning said arm to "off" position.

12. The combination with an electric motor, of a starting-rheostat therefor, an electric motor for actuating the rheostat, and an elec-
25 tromagnetic clutch for said motor, said clutch, rheostat-motor and main motor being all connected in multiple, and a switch controlling one side of said circuit.

In witness whereof I have hereunto set my
30 hand this 24th day of July, 1901.

FREDERICK MACKINTOSH.

Witnesses:

BENJAMIN B. HULL,
FRED RUSS.