No. 793,493. PATENTED JUNE 27, 1905.

W. C. YATES & A. M. FENWICK.

RHEOSTAT.

APPLICATION FILED SEPT. 26, 1904.

Fig. 1.

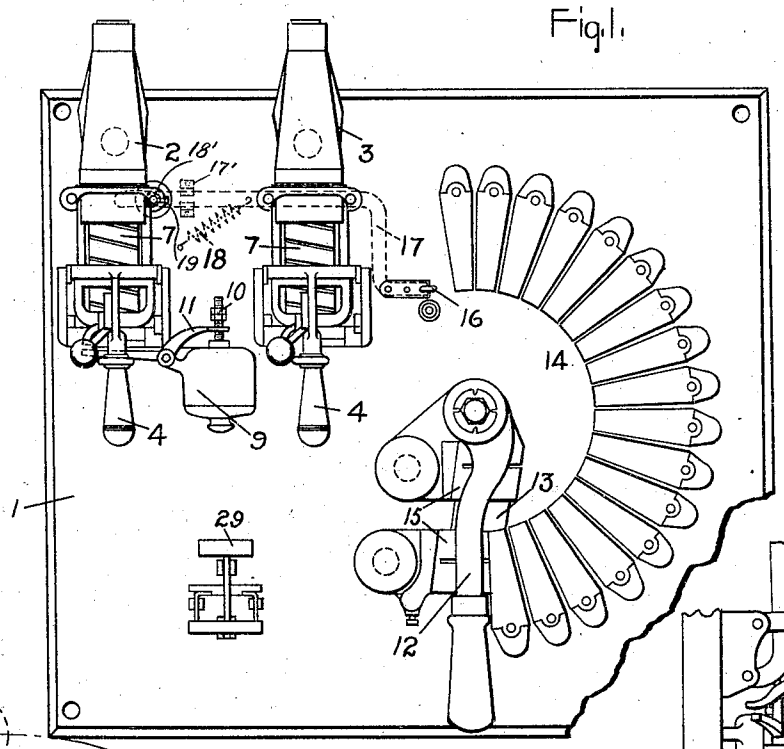


Fig. 2.

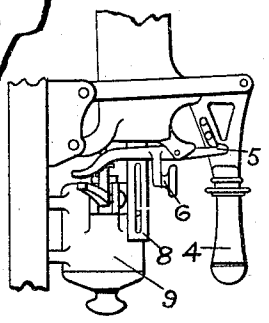


Fig. 3.

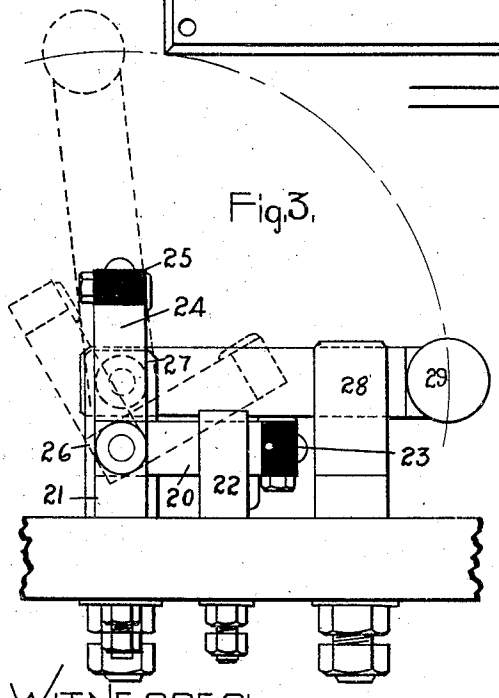
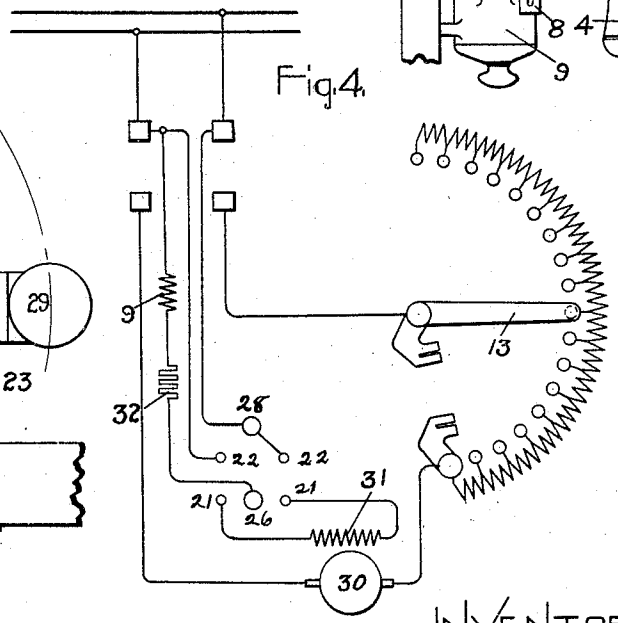


Fig. 4.



WITNESSES:

Benjamin B. Hull,

Helen Orford

INVENTORS.

William C. Yates

Alexander M. Fenwick

by Albert G. Davis, Atty.

No. 793,493. Patented June 27, 1905.

UNITED STATES PATENT OFFICE.

WILLIAM C. YATES AND ALEXANDER M. FENWICK, OF SCHENECTADY, NEW YORK, ASSIGNORS TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 793,493, dated June 27, 1905.

Application filed September 26, 1904. Serial No. 225,877.

To all whom it may concern:

Be it known that we, WILLIAM C. YATES and ALEXANDER M. FENWICK, citizens of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Rheostats, of which the following is a specification.

This invention relates to the control of electric motors; and its object is to provide a rheostatic starting device for a shunt-wound electric motor which shall be simple, compact, and inexpensive and so designed that the parts interlock to make the device foolproof.

Our invention is particularly applicable to devices for starting large shunt-wound electric motors in which it is not desired to break the motor-circuit at the rheostat-contacts because the contact-surfaces would be pitted by the spark formed when the circuit is broken; but it must be understood that the principles of the invention are applicable to rheostatic controlling devices for motors of all sizes and to speed-regulating rheostats, as well as starting-rheostats.

The novel features of our invention will be definitely indicated in the claims appended hereto.

The details of construction and the mode of operation of our improved rheostatic controller will be better understood by reference to the following description, taken in connection with the accompanying drawings, which show the preferred embodiment of our invention, and in which—

Figure 1 is a front view of the panel; Fig. 2, an enlarged detail view of one of the circuit-breakers; Fig. 3, an enlarged elevation of the field-switch, and Fig. 4 is a diagram of the circuits.

Referring to the drawings, 1 indicates a panel of soapstone, marble, or other insulating material, preferably supported in an upright position by suitable standards, on which is also secured a subpanel carrying the resistance. Mounted on the panel are two circuit-breakers 2 and 3. The breakers shown in the drawings are of a standard type well known to users of electrical apparatus and consist of a pivoted switch-blade coöperating with suitable contacts and operated by a handle 4 and a latch 5 for holding the blade in the closed position, provided with a handle 6 for tripping the latch. Each breaker is provided with an overload-coil 7, which in response to a predetermined overload draws up a plunger 8, provided with a projection adapted to engage the latch 5 and trip the breaker. One of the breakers is provided with a no-voltage coil 9, suitably incased, which on failure of the line voltage or when the circuit is opened allows its core to drop and rock a pivoted lever 11 to trip the latch 5. Pivotally mounted on the panel is a switch-arm 12, carrying a blade 13, in the path of movement of which is a series of contact-plates 14, arranged in the arc of a circle. Switch-clips 15 are mounted on the panel in position to be cross-connected by the blade 13 when the switch-arm is in the final position to cut out of circuit all the resistance. Pivoted in an opening in the panel is a lever 16, which is engaged by the switch-arm when on the first contact-plate of the series 14 to move a rod 17 in guides 17′ on the back of the panel to a position in which an opening in the rod (indicated by the dotted circle in Fig. 1) is in alinement with a projecting stud 18′, adjustably secured by a set-screw 19 in an opening in the circuit-breaker 2. When the switch-arm 12 is moved away from the first contact-plate 14, a spring 18, having one end attached to rod 17 and the other to a post on the back of the panel, tends to move rod 17 in its guides to carry the opening in rod 17 out of alinement with the projecting stud 18′, so that if the blade 13 is out of engagement with the lever 16 and the breaker 2 is open the breaker cannot be closed, as the projection thereon would engage the rod 17, and thus prevent the breaker from being thrown in far enough to close the circuit.

Mounted on the panel below the circuit-breakers 2 and 3 is a switch for the motor-field. This switch consists of two parallel

blades 20, pivoted in clips 21, mounted on the panel and connected at their ends by a cross-bar 23, of wood or other insulating material. Switch-clips 22 are also mounted on the panel in position to be engaged by the blades 20. Secured to or integral with the blades 20 and at right angles thereto are blades 24, which are connected at their ends by a cross-bar 25, of insulating material, similar to the bar 23. No handle is provided on this switch. Instead it is operated by a switch which interlocks therewith and controls the circuit of the no-voltage release-coil 9. Mounted on the panel between the clips 21 is a switch-clip 26, somewhat longer than clips 21, and a switch-blade 27 is pivoted in this clip and extends out between the cross-bars 23 and 25. Mounted on the panel is a switch-clip 28, of about the same length as the clip 26, in position to be engaged by the blade 27, and an operating-handle 29 is provided on the end of blade 27. The armature 30 of the motor is connected to the supply-mains through the breakers 2 and 3 and so much of the resistance connected to the contact-plates 14 as is cut into circuit by the blade 13. The motor-field 31 is connected to the switch-clips 21, and the clips 22 are connected to the lines above the breakers 2 and 3. The no-voltage release-coil 9 and a resistance 32 in series therewith are connected across the lines through the blade 27.

The operation of the device will be readily understood from the foregoing description. When the motor is not in operation, the breakers 2 and 3 are open and the switch-blades 20 and 27 are out of clips 22 and 28, respectively. In starting, the circuit of the motor-field should be closed first. If it is attempted to close the armature-circuit without first closing the field, the breaker 3 may be thrown in and will be held by its latch 5, thus closing one side of the armature-circuit. The other side, however, cannot be permanently closed, for if breaker 2 is thrown in the latch 5 will not catch, as the circuit of the no-voltage release-coil 9 is open and the lever 11 will be held by the core 10 of the no-voltage release in a position to prevent latch 5 from holding the breaker in, and the switch 27 for the no-voltage release-circuit cannot be closed without closing the field-circuit. Thus the armature-circuit cannot be closed before the field-circuit except by the operator intentionally closing the field-switch otherwise than by handle 29 and blade 27 or by holding the breaker 2 in. To properly start the motor, blade 27 is turned on its pivot by the handle 29 and engages cross-bar 23, thus pushing the blades 20 into clips 22 and closing the field-circuit. On further movement of the handle 29 blade 27 enters the clip 28 and closes the circuit of the no-voltage release-coil 9, which raises its plunger, and thus permits lever 11 to move out of engagement with the end of latch 5. The armature-circuit should then be closed by the breakers 2 and 3. When the armature-circuit is closed, the switch-arm 13 for regulating the resistance should be on the first contact-plate 14, so that all of the resistance is included in circuit to cut down the current admitted to the motor-armature immediately at starting. If the blade 13 is not on the first contact, the rod 17 is drawn to such a position by spring 18 that the opening therein is out of alinement with the projection carried by the breaker 2, and the breaker cannot be closed. With the field-circuit of the motor closed and blade 13 on the first contact-plate 14 the breaker 2 can be closed, thus starting the motor. Switch-arm 12 is then turned on its pivot, moving blade 13 over the contact-plates 14 to cut resistance out of the armature-circuit, and thus bring the motor up to speed until it reaches its final position, where it engages clips 15 and connects the armature directly across the lines. In event of an overload, coils 7 on the breakers draw up the plungers 8 and open the breakers to open the armature-circuit. In event of an underload or of an opening of the circuit core 10 falls, rocking lever 11 and latch 5, and thus opening the circuit at the breaker 2. In either case the spring 18 moves rod 17 in its guides to prevent the armature-circuit from being closed again without first bringing the rheostat-arm 13 around to the first position. The armature-circuit may be intentionally opened by pressing the handle 6 on latch 5 of either of the breakers. The field-circuit of the motor, however, cannot be opened while the armature-circuit is closed. If switch-blade 27 is pulled out by means of handle 29, circuit through the no-voltage release-coil 9 is opened as soon as the blade leaves clip 28, and the release-coil opens breaker 2 immediately. Further movement of blade 27 brings it into engagement with cross-bar 25, and thus forces the blades 20 out of the clips 22 to open the field-circuit. Thus the armature-circuit of the motor cannot be permanently closed before the field-circuit is closed, the field-circuit cannot be opened until after the armature-circuit is opened, and the armature-circuit cannot be closed except when the switch-arm 13 is on the first contact-plate 14, in which position all of the resistance is cut into the armature-circuit.

It will be evident that many modifications can be made in the design and construction of our improved rheostat without departing from the spirit of the invention.

Such modifications of the controlling device illustrated and described herein we consider within the scope of our invention, and we aim to cover them in the claims appended hereto.

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

1. The combination of a motor, a switch for closing the armature-circuit thereof, an adjustable resistance in the armature-circuit,

means preventing closure of said switch unless all the resistance is in circuit, means for closing the field-circuit of the motor, and means preventing opening the field-circuit before the armature-circuit is opened.

2. The combination with an electric motor, of a circuit-breaker for closing the armature-circuit thereof, a low-voltage release device therefor, means for closing the circuit of the low-voltage release device, and means for closing the field-circuit of the motor arranged to insure closure of the field-circuit before the circuit of the low-voltage release device is closed.

3. The combination with an electric motor, of a circuit-breaker for closing the armature-circuit thereof, a low-voltage release device therefor, means for closing the circuit of said device, and means for closing the field-circuit of the motor arranged to insure opening the circuit of said release device before the field-circuit is opened.

4. The combination with an electric motor, a circuit-breaker for closing the armature-circuit thereof, and a low-voltage release device for the breaker, of a switch for closing the field-circuit of the motor, and a switch interlocked therewith for closing the circuit of said low-voltage release device.

5. The combination with an electric motor, a circuit-breaker for closing the armature-circuit thereof, and a low-voltage release device for the breaker, of a switch for closing the field-circuit of the motor, and a switch for closing the circuit of said low-voltage release device interlocked to insure closure of the field-circuit before the circuit of the low-voltage release device is closed.

6. The combination with an electric motor, a circuit-breaker for closing the armature-circuit thereof, and a low-voltage release device for the breaker, of a switch for closing the field-circuit of the motor, and a switch for closing the circuit of said low-voltage release device interlocked to prevent opening the field-circuit before the circuit of the low-voltage release device is opened.

7. The combination with a motor, of a circuit-breaker for closing the armature-circuit thereof, a low-voltage release device for said circuit-breaker, an adjustable resistance in the armature-circuit, means preventing closure of the breaker unless all the resistance is in circuit, a switch for closing the field-circuit, and a switch for closing the circuit for said low-voltage release device, said switches being interlocked to prevent opening the field-circuit before the circuit of the low-voltage release device is opened.

In witness whereof we have hereunto set our hands this 23d day of September, 1904.

WILLIAM C. YATES.
ALEXANDER M. FENWICK.

Witnesses:
BENJAMIN B. HULL,
HELEN ORFORD.