No. 775,445. PATENTED NOV. 22, 1904.

M. W. DAY.

CONTROLLING SWITCH FOR ELECTRIC CIRCUITS.

APPLICATION FILED MAY 9, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

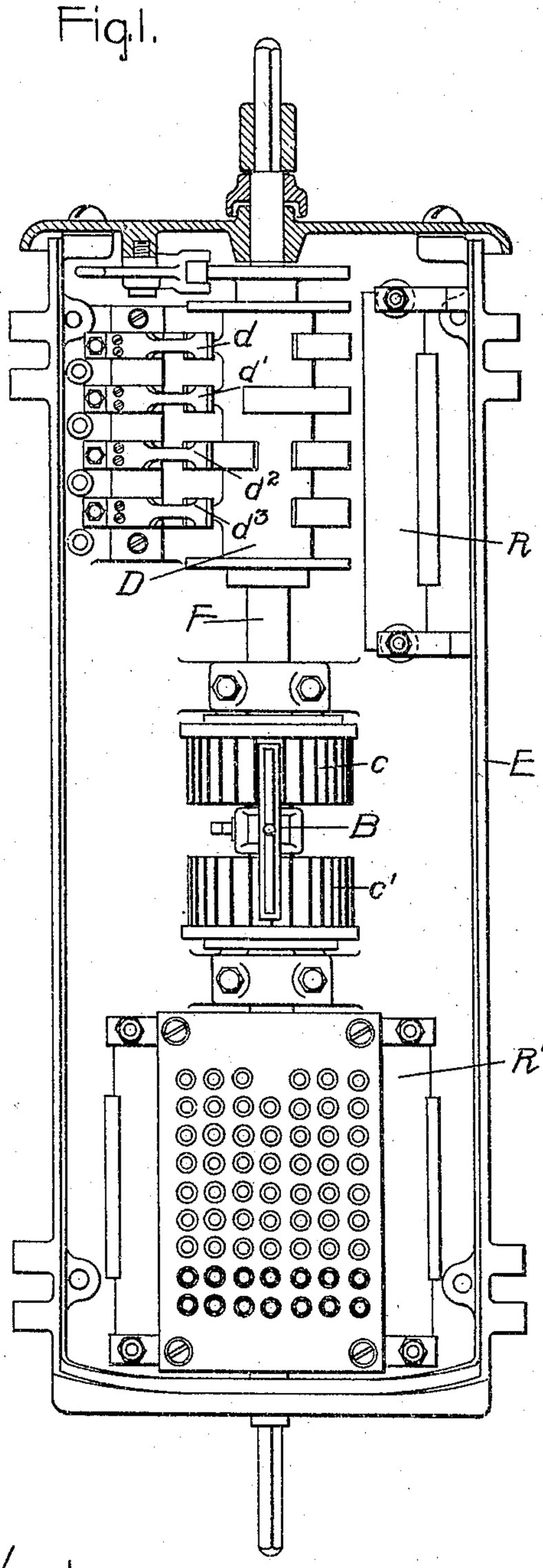
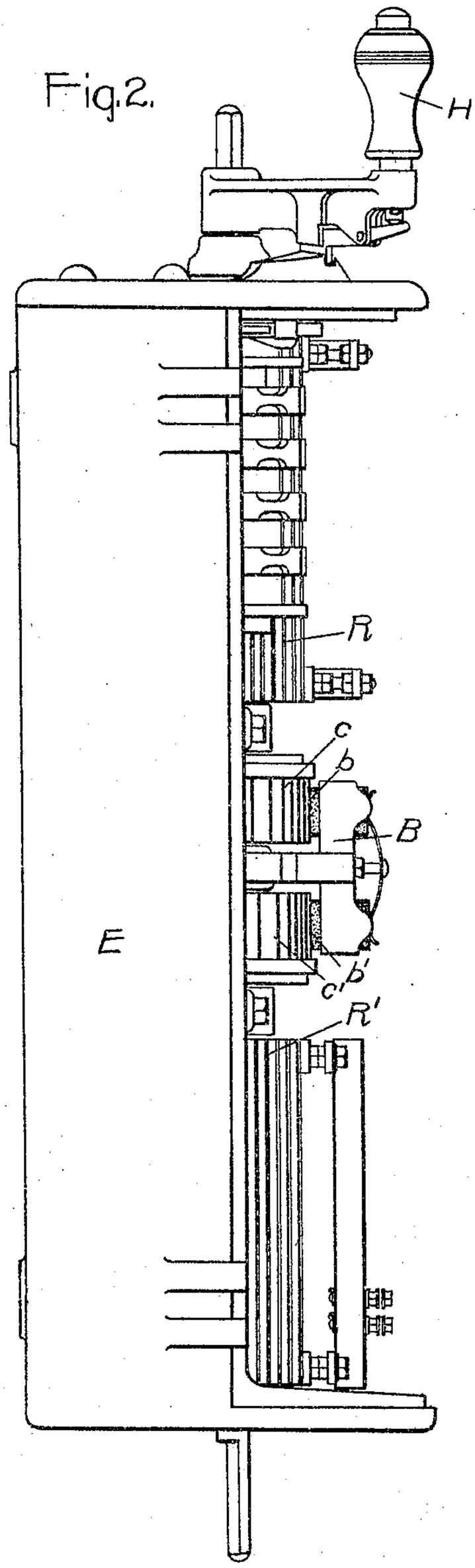


Fig. 2.



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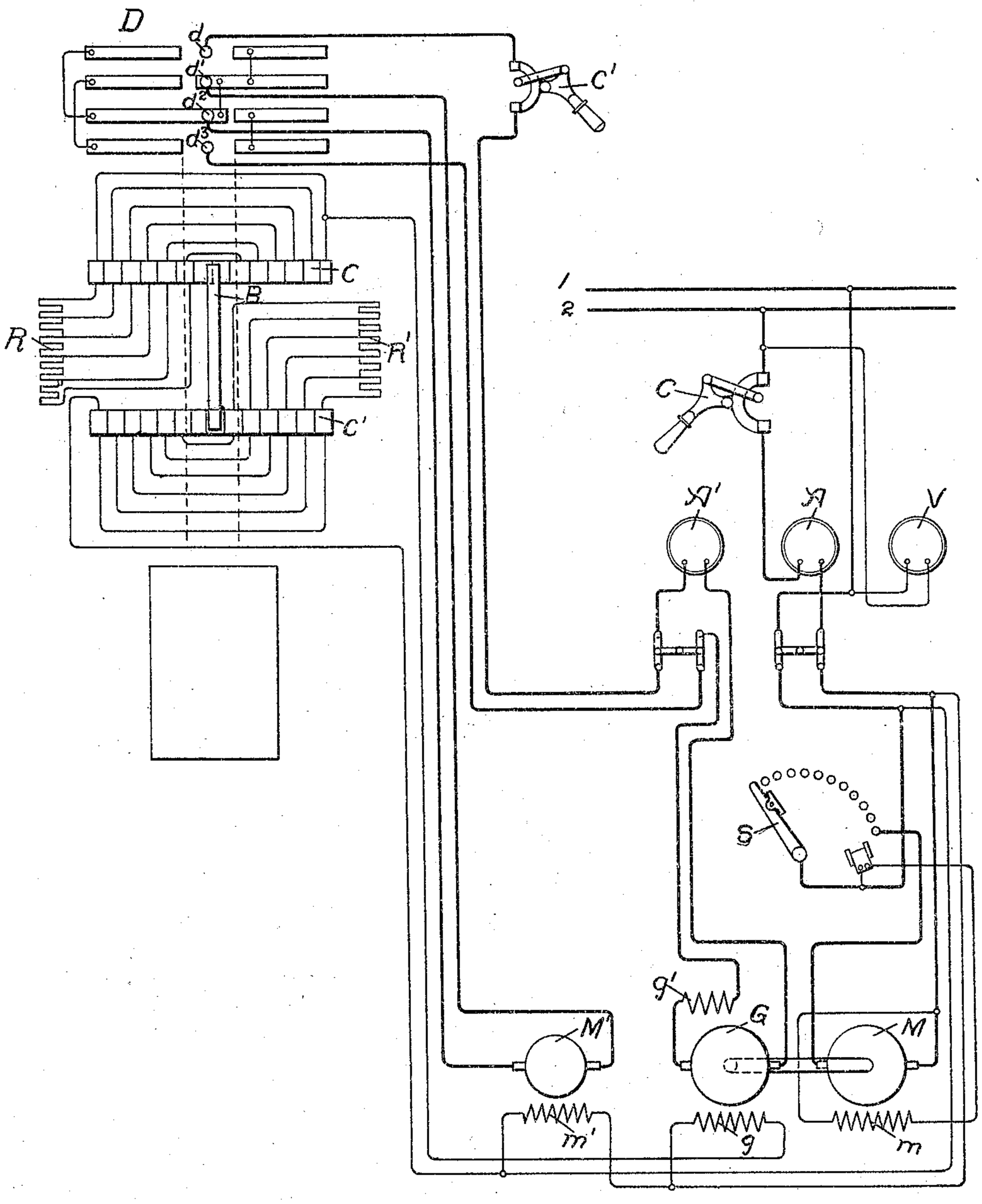
APPLICATION FILED MAY 9, 1904.

NO MODEL. 2 SHEETS—SHEET 2.

Fig.3.



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UNITED STATES PATENT OFFICE.

MAXWELL W. DAY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CONTROLLING-SWITCH FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 775,445, dated November 22, 1904.

Application filed May 9, 1904. Serial No. 207,019. (No model.)

To all whom it may concern:

Be it known that I, MAXWELL W. DAY, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Controlling-Switches for Electric Circuits, of which the following is a specification.

My invention relates to switches for electric circuits; and its object is to provide in a single compact structure means for opening and closing an electric circuit, for reversing the direction of current-flow therein, and for controlling the amount of current-flow from zero through a large number of finely-divided steps to maximum.

I shall describe a controlling-switch constructed in accordance with my invention as applied to a system of control for a generator and motor, both having separately-excited fields, together with means for controlling the strength of one or both fields over wide ranges in order to obtain corresponding variations in the motor speed. My invention is not limited, however, to this specific application; but a switch constructed in accordance with my invention may be used to advantage in many cases in which it is desired to reverse and to control over wide ranges the current in an electric circuit.

My invention will best be understood from the accompanying drawings, in which—

Figure 1 shows a front elevation of a switch arranged in accordance with my invention, the front of the casing being removed. Fig. 2 shows a side elevation of the same, and Fig. 3 shows the circuit connections of the switch applied to the system of control above referred to.

In Figs. 1 and 2, E represents the controller-casing, which furnishes bearings at top and bottom for the vertical shaft F. H is a handle by means of which shaft F may be rotated. Shaft F carries near its upper end the drum D, of the type ordinarily employed in controllers. d to d^3 represent stationary contact-fingers adapted to engage the movable contacts carried by drum D. Secured to shaft F near its central portion is the bridge member B, which carries two spring-pressed brushes b and b', which bear on the stationary commutators c and c', respectively, which are concentric with shaft F. It will be noticed that the segments of the two stationary commutators c c' are staggered with respect to each other, so that when the brush b is on the center of one segment of commutator c the other brush, b', is passing from one segment of converter c' to another. R and R′ represent two resistances, which may be of any suitable type, one of which is supported near the top of the controller-casing opposite to the stationary contact-fingers d d' and the other of which is carried at the bottom of the casing below the commutators c c'. The two resistances are connected to the two commutators, as will be hereinafter described.

Referring now to Fig. 3, I shall describe the controller connections. 1 and 2 represent line-wires connected to a suitable source of current. M represents a motor the armature of which is connected to the line-wires 1 and 2 through the starting-switch S, the ammeter A, and the circuit-breaker C. The field m of motor M is also connected in shunt to the line-wires. V represents a voltmeter connected across the line-wires. G represents a generator driven by any suitable prime mover, such as the motor M, the field g of which is connected to the line-wires 1 2 through the controlling-switch, as will be hereinafter explained. Its armature is connected through its series field g', ammeter A′, circuit-breaker C′, and the controlling-switch to the armature of motor M′, the speed of which is to be controlled. The field m' of motor M′ is connected directly to the line 1 2. The controlling-switch is shown diagrammatically with its contacts developed on a plane surface.

With the controlling-switch in the position shown it will be seen that the circuit of the generator-armature is open at fingers d and d^3. Its field-circuit is also opened at the com-

mutators c and c'. Now if the controller-shaft be rotated to move bridging member B a distance equal to the breadth of one segment in either direction the generator-field g will be closed as follows: from line-wire 2, through circuit-breaker C and ammeter A to the left-hand terminal of field g; from the right-hand terminal of field g to resistance R, through the entire resistance to bridging member B, to resistance R', through the entire resistance, to line-wire 1. The field-circuit of generator G is thus closed with both resistances R and R' in series therewith. Since both commutators have their segments which are symmetrically disposed with reference to the off position cross-connected, it makes no difference in the strength of field g which way the controlling-switch is moved from its central or off position. As the movement of the controlling-switch is continued resistances R and R' are gradually cut out, the sections of the two resistances being cut out alternately. This is accomplished by the staggering of the commutator-segments relative to each other, which has been pointed out heretofore. By the use of two commutators thus staggered a larger number of steps for a given movement of the controller and a given width of the commutator-segment can be obtained than is possible with a single commutator. Instead of staggering the commutators the equivalent arrangement of offsetting the brushes bearing on the two commutators might of course be used.

As the controller is moved from its off position in either direction the armature-circuit of generator G is closed through the armature M' as soon as stationary contacts d d^3 are engaged by the movable contacts. It will be seen by tracing out the circuits that the direction of current-flow through motor-armature M' is in one direction or the other, according to the direction of movement of the controlling-switch. Thus by means of a single compact structure the motor M' may be started, stopped, reversed, and controlled in speed over a wide range.

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

1. In a controlling-switch for electric circuits, a rotatable shaft, a controller-drum carried thereby, stationary contacts adapted to be engaged by said drum, two stationary commutators concentric with said shaft and having their segments staggered with respect to each other, resistances connected to said commutators, and a bridging member carried by said shaft and engaging said commutators.

2. In a controlling-switch for electric circuits, a shaft rotatable in either direction from off position, a controller-drum carried thereby, stationary contacts adapted to be engaged by said drum, two stationary commutators concentric with said shaft, resistances connected to said commutators, and a bridging member carried by said shaft and engaging said commutators, the segments of each commutator symmetrically disposed with reference to the off position of said bridging member being cross-connected.

3. In a controlling-switch for electric circuits, a rotatable shaft, a controller-drum carried thereby, stationary contacts adapted to be engaged by said drum, two stationary commutators concentric with said shaft, resistances connected to said commutators, and a bridging member carried by said shaft and engaging said commutators, the points of engagement of said member with said two commutators being relatively displaced with reference to the segments of the commutators.

4. In a controlling-switch for electric circuits, a rotatable shaft, a controller-drum carried thereby, stationary contacts adapted to be engaged by said drum, two stationary commutators concentric with said shaft, resistances connected to said commutators, a bridging member carried by said shaft, and spring-pressed brushes carried by said member and engaging said commutators, the points of engagement of said brushes with said two commutators being relatively displaced with reference to the segments of the commutators.

5. In a controlling-switch for electric circuits, a rotatable shaft, a controller-drum carried thereby, stationary contacts adapted to be engaged by said drum, two stationary commutators concentric with said shaft and having their segments staggered with respect to each other, resistances connected to said commutator, a bridging member carried by said shaft, and spring-pressed brushes carried by said member and engaging said commutators.

6. In a controlling-switch for electric circuits, a shaft rotatable in either direction from its off position, a controller-drum carried thereby, stationary contacts adapted to be engaged by said drum, two stationary commutators concentric with said shaft and having their segments staggered with respect to each other, resistances connected to said commutators, and a bridging member carried by said shaft and engaging said commutators, the segments of each commutator symmetrically disposed with reference to the off position of said bridging member being cross-connected.

7. In combination with a generator and motor, a controlling-switch comprising a drum rotatable in either direction from its off position and stationary contacts adapted to be engaged thereby, said contacts and drum being connected and arranged to connect the armature of said motor to said generator for either

direction of rotation of said motor upon the movement of said drum in either direction from its off position, a movable member rotatable with said drum, two stationary commutators adapted to be engaged by said member, and two resistances connected respectively to said commutators, said commutators and member being arranged and connected to cut out alternately sections of said two resistances from the circuit of the generator-field when said drum is moved in either direction from its off position.

In witness whereof I have hereunto set my hand this 6th day of May, 1904.

MAXWELL W. DAY.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.