A. J. HORTON.

MOTOR CONTROLLER.

APPLICATION FILED MAY 28, 1914.

1,168,003. Patented Jan. 11, 1916.

Fig. 1.

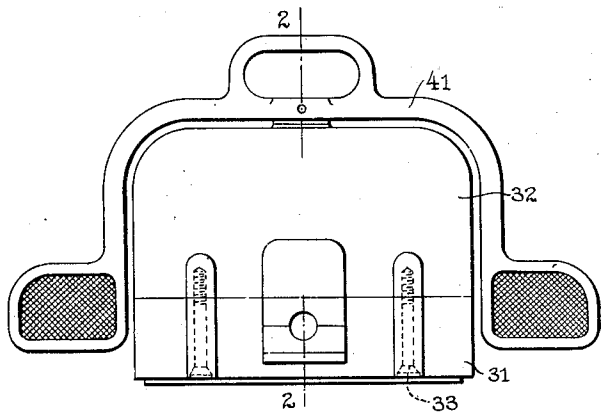


Fig. 2.

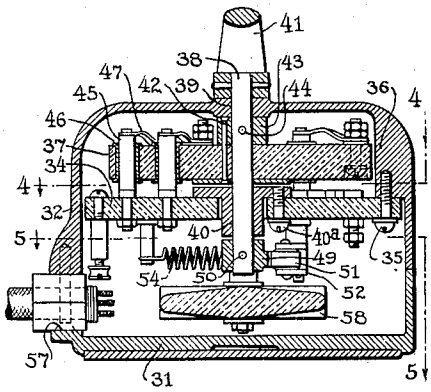


Fig. 3.

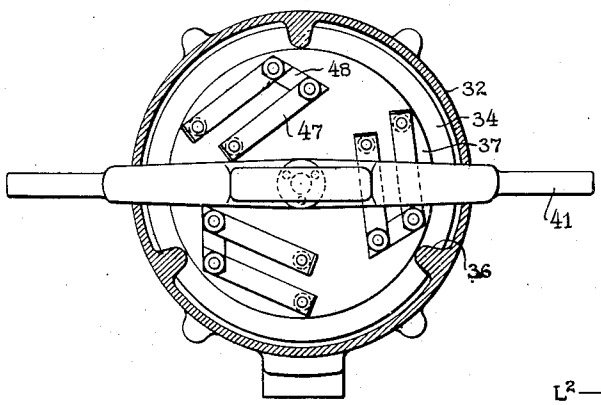


Fig. 4.

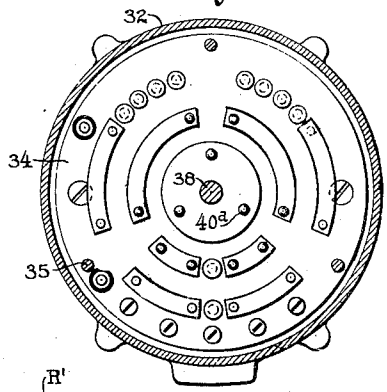


Fig. 5.

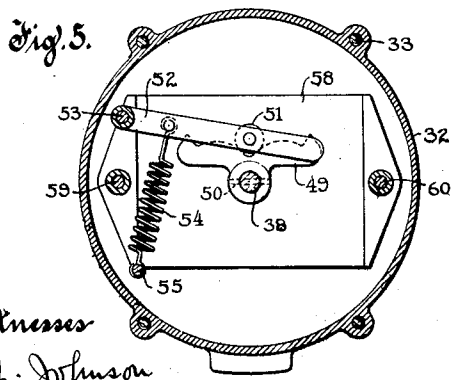
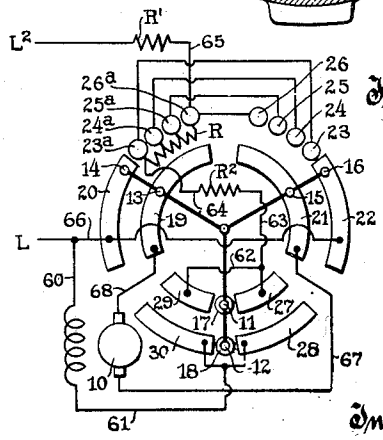


Fig. 6.



Witnesses

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MOTOR-CONTROLLER.

1,168,003. Specification of Letters Patent. Patented Jan. 11, 1916.

Application filed May 28, 1914. Serial No. 841,610.

To all whom it may concern:

Be it known that I, ALBERT J. HORTON, a citizen of the United States, residing at White Plains, in the county of Westchester and State of New York, have invented new and useful Improvements in Motor-Controllers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

This invention relates to improvements in motor controllers.

The invention, while not limited thereto, is particularly applicable to dental motors and especially those of the shunt type in which the field takes a relatively large current and the armature a relatively small current.

The various objects and advantages of the invention will appear from the embodiment thereof illustrated in the accompanying drawing and now to be described.

In the drawing, Figure 1 is a side elevation of the controller; Fig. 2 is a vertical section on line 2—2 of Fig. 1; Fig. 3 is a top plan view of Fig. 2 with the top of the inclosing casing removed; Fig. 4 is a horizontal sectional view on line 4—4, Fig. 2, but at right angles thereto; Fig. 5 is a sectional view on line 5—5, Fig. 2, but at right angles thereto; and, Fig. 6 is a diagrammatic view showing the controller electrically connected to an electric motor.

Referring first to Fig. 6, the controller is used to control the direction of operation and speed of a shunt motor 10. The controller effects speed regulation of the motor through a variable resistance R and more specifically by varying the amount of said resistance included in the armature circuit of the motor.

As schematically illustrated the controller comprises a revoluble contact member and a plurality of stationary contact buttons and segments. The revoluble contact member has three pairs of contact brushes 11—12, 13—14, and 15—16. These pairs of brushes are arranged approximately 120° apart and are electrically independent of one another. The contact member is movable in opposite directions from the position shown in Fig. 6, which constitutes its normal position. In such position the brushes 11 and 12 rest on dead contact buttons 17 and 18, while the brushes 13 and 14 rest upon and bridge contact segments 19 and 20 respectively and brushes 15 and 16 rest upon and bridge contact segments 21 and 22.

The brushes 13 and 15 always remain in engagement with their respective segments while the brush 14 remains in engagement with its segment 20 throughout the entire counter-clockwise movement of the controller and the brush 16 in engagement with its segment 22 throughout the entire clockwise movement of the controller. During the counter-clockwise movement of the controller the brush 16 sweeps over a series of contact buttons 23, 24, 25 and 26, while upon clockwise movement of the controller the brush 14 sweeps over a corresponding series of contacts 23^a, 24^a, 25^a and 26^a. These series of contact buttons are cross connected and are connected to the resistance R whereby movement of the controller in either direction affords regulation of said resistance. Returning to the brushes 11 and 12, the same engage and bridge segments 27 and 28 when the controller is moved in a counter-clockwise direction and engage and bridge segments 29 and 30 when the controller is moved in a clockwise direction.

The brushes 13, 14, 15 and 16, as will hereinafter appear, in addition to regulating the resistance R, control the continuity of the armature circuit of the motor and also a dynamic braking circuit for the motor armature. The brushes 11 and 12, on the other hand, control the continuity of the field circuit.

The mechanical embodiment of the controller, as illustrated in the remaining views, is as follows: The aforesaid contacts are all housed in a box or casing comprising a base section 31, and a cover section 32. These sections are adapted to be secured together by suitable means, such as screws 33. The stationary contacts are all suitably mounted upon an insulating base plate 34 of circular form secured by screws 35 against lugs 36 provided on the interior of the cover section 32 of the casing. One of these points of attachment is shown in Fig. 2 and as shown in Fig. 3 the base 34 is similarly supported at three points approximately 120° apart. The contact brushes are all mounted upon a circular insulating member 37 arranged above the base 34 and said member 37 is

fixed to a vertical spindle 38 having a bearing 39 in the casing cover and another bearing 40 in the stationary base 34. The spindle constitutes the operating medium for the revoluble contact member and has fixed to its upper end a suitable operating lever 41 which, as illustrated, is of a character common in dental controllers. The lever 41 provides means whereby the revoluble member 37 may be moved in either a clockwise or counter-clockwise direction.

More specifically describing the details of construction, the bearing 40 of the spindle 38 comprises a flanged sleeve set into the base 34 and secured thereto by screws 40^a. The revoluble insulating member 37 has secured thereto, as by rivets 42, a collar 43 surrounding the spindle 38 and fixed thereto by a pin 44. The pin 44 supports the member 37 in a slightly spaced relation with respect to the flange of the bearing 40 to prevent wear between said parts.

The brushes 11 to 16 inclusive, as illustrated in Fig. 2, each comprise a pencil 45 of suitable material sheathed in a member 46 reciprocably mounted in the insulating member 37 and placed under pressure by a spring 47. The pressure springs 47 of the several brushes are illustrated in Fig. 3 and as shown in this figure, said springs are electrically connected in pairs by cross connecting strips 48.

Referring to Figs. 2 and 5, means are provided to center the controller in the position indicated in Fig. 6 and to limit the movement of the controller in opposite directions. This means comprises a double-cam member 49 fixed to the lower end of the spindle 38 by a pin 50 and an engaging roller 51 carried by a pivoted arm 52. The arm 52 is pivoted upon a pin 53 projecting downwardly from the supporting base 34 and has associated therewith a spring 54, tensioning the same in a direction to press the roller against the cam 49. The spring 54 is connected at one end to said arm and at its opposite end to a second downwardly projecting pin 55 on the base 34. The surface formation of the cam 49 is such that the pressure of roller 51 thereagainst tends to center the controller while the end formation of the cam 49 is such as to limit the range of movement of the controller.

For admitting the leads to and from the various contacts the base portion of the casing is provided with a suitable aperture 57 and for enabling connection of the leads to the several contacts suitable binding posts are provided. However, as the connections may obviously be made in numerous different ways, the particular arrangement of binding posts will not be described.

Again referring to Fig. 6, the controller has associated therewith additional resistances R′ and R^2, for a purpose hereinafter set forth. These resistances, together with the variable resistance R, may, of course, be located as desired. However, as illustrated in Figs. 2 and 5, they may be combined in a single element 58 and mounted within the casing. As shown, the resistance element 58 is supported at opposite ends by bolts 59 and 60 depending from the fixed insulating base 34.

The operation and functions of the controller will now be more specifically described in connection with Fig. 6. With the controller in the position illustrated, both the motor armature and field winding are disconnected from circuit. When the controller is moved in a clockwise direction circuit is established through the motor field winding from line L, by conductor 60 through said winding, by conductor 61 to segment 30 through brushes 12 and 11 to segment 29, by conductors 62 and 63 through resistance R^2, by conductor 64 through all of the resistance R, by conductor 65 through resistance R′ to line L^2. Also, the armature circuit is completed from line L by conductor 66 to segment 22, thence through brushes 16 and 15 to segment 21, by conductor 67 through the motor armature, by conductor 68 to segment 19 through brushes 13 and 14 to contact 23^a through resistance R, by conductor 65 and resistance R′ to line L^2. Thus the motor armature and field winding are connected in parallel between line L and resistance R so that both resistances R and R′ are common to armature and field branches of the motor circuit. Also, it will be observed that the resistance R^2 is included in the field branch of the motor circuit and as will be understood, this resistance is provided to give the desired relative drops in voltage across the motor armature and field. After the motor has thus been started the movement of the controller may be continued whereupon the brushes 13 and 14 will gradually exclude the resistance R from the armature circuit but leaving the full amount of said resistance in the field circuit. This provides for acceleration of the motor to the desired speed and likewise a reduction in the speed of the motor by reverse movement of the controller. The resistance R′ is fixed and always remains in circuit with both the armature and field branches of the motor. When the controller is returned to the position illustrated the motor is disconnected from the supply circuit and a dynamic braking circuit is established across the terminals of the motor armature. This circuit extends from the upper terminal of the motor armature by conductor 68 to segment 19 across brushes 13 and 14 to segment 20, by conductor 66 to segment 22 and across brushes 16 and 15 to segment 21, and thence by conductor 67 to the lower terminal of the motor armature. Accordingly when the

controller is returned to initial position the residual magnetism of the field will cause the motor to act as a dynamic brake and thereby quickly come to rest.

Operation of the controller in the counter-clockwise direction from the position illustrated completes the field circuit of the motor as previously traced to conductor 61, thence to segment 28 across brushes 12 and 11 to segment 27 and through the resistances R^2, R and R′, as already traced, to line L^2. At the same time it completes the armature circuit from line L by conductor 66 to segment 20, across brushes 14 and 13 to segment 19, by conductor 68 through the motor armature in an opposite direction to that previously described, by conductor 67 to segment 21 and thence across brushes 15 and 16 to contact 23, by its cross connection to contact 23^a and thence through resistances R and R′, as already traced. It will thus be seen that with the exception of reversing the flow of current through the motor armature the controller functions in the same manner as when operated in a clockwise direction and its continued movement regulates the resistance R in the same manner as that previously described. Also, the controller upon return movement reëstablishes the dynamic braking circuit, as described.

Provision is thus made for starting the motor in either direction with its armature shunted by its field winding and a fixed resistance and with a common variable resistance and fixed resistance in series with both branches of its circuit. Further provision is made for thereafter adjusting the variable resistance with respect to the armature but maintaining the same constant with respect to the field. In consequence the adaptability of the controller to special motors will be readily apparent and, moreover, it will be apparent that the shunting of the armature through the field materially decreases the effect of load variations on the speed of the motor.

What I claim as new and desire to secure by Letters Patent is:—

1. The combination with a motor having an armature taking a relatively low current and a shunt field taking a relatively high current, of a variable resistance and means for connecting the motor armature and shunt field through said resistance to a source of supply for starting said motor in either direction, said resistance being adjustable to regulate the motor speed but being variable only with respect to the armature branch.

2. The combination with a shunt motor, of power connections for the armature and field branches of said motor including a resistance common to both branches and means controlling the continuity of both branches, said means in off position establishing a closed loop across the terminals of the motor armature.

3. The combination with a shunt motor, of a common series resistance for the armature and shunt field winding of said motor and means operable to reverse the flow of current in one branch of the motor circuit for varying the direction of operation of said motor and also operable to vary said resistance with respect to the armature branch for regulating the speed of the motor, but leaving said resistance constant with respect to the field branch.

4. The combination with a shunt motor, of a plurality of resistances and means controlling the continuity of both the armature and field branches of said motor, said means, upon completing said branches, including certain of said resistances in series with both and another of said resistances in the field branch.

5. The combination with a shunt motor, a resistance, stationary contacts and three sets of electrically independent contacts simultaneously adjustable with respect to said stationary contacts to complete the armature and field branches of the motor and to include said resistance in series with both branches and thereafter vary said resistance with respect to the armature branch leaving the same constant with respect to the field branch.

6. The combination with a shunt motor, a resistance, stationary contacts and three sets of electrically independent contacts simultaneously adjustable with respect to said stationary contacts to complete the armature and field branches of the motor and to include said resistance in series with both branches and thereafter vary said resistance with respect to the armature branch leaving the same constant with respect to the field branch, said contacts being movable in opposite directions to determine the direction of operation of the motor.

7. In a motor controller, in combination, a cylindrical casing having an open end, an insulating base removably secured midway of said casing, stationary contacts mounted on the inner face of said base, an operating spindle having bearings in said base and the closed end of said casing, a rotatable insulating base fixed to said spindle intermediate said first mentioned base and the closed end of said casing, and brushes carried by said rotatable base to coöperate with said stationary contacts.

8. In a motor controller, in combination, an insulating base, stationary contacts mounted on one face thereof, a movable member supported above said contacts in a spaced relation with said base, contacts carried by said movable member, a resistance element supported on the other side of said base, and a one piece casing having a closed

end and an open end, said base and parts supported thereby being insertible through the open end of said casing.

9. In a motor controller, in combination, a cylindrical casing having a closed end and an open end, an insulating base, fixed and movable contacts supported thereby, an operating member for said movable contacts and means biasing said operating member to a predetermined position, said base, contacts, operating member and means constituting a unit insertible and removable through the open end of said casing.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

ALBERT J. HORTON.

Witnesses:
WM. C. WINTERROTH,
W. L. CULLY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."