No. 649,972. Patented May 22, 1900.

T. S. WATSON.

ELECTRIC MOTOR CONTROLLING DEVICE.

(Application filed Oct. 4, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

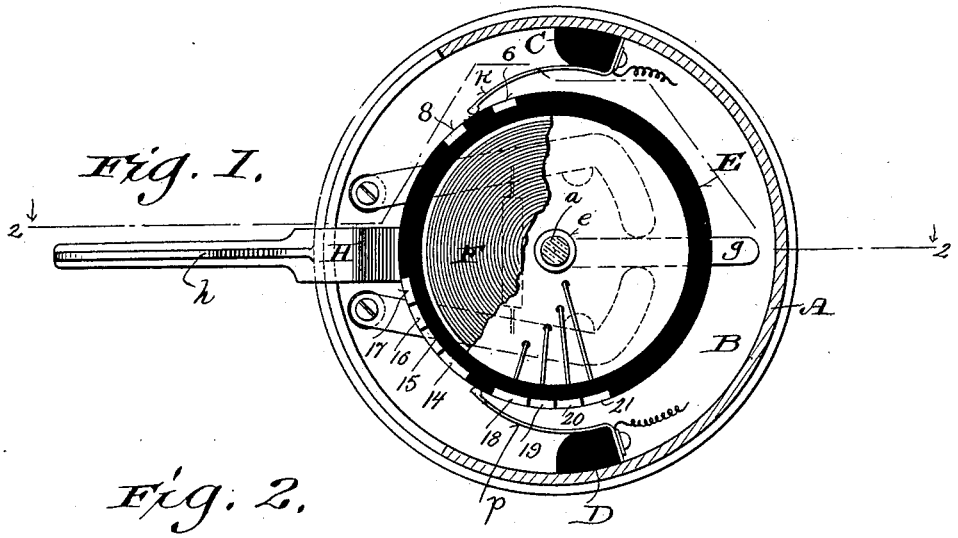


Fig. 2.

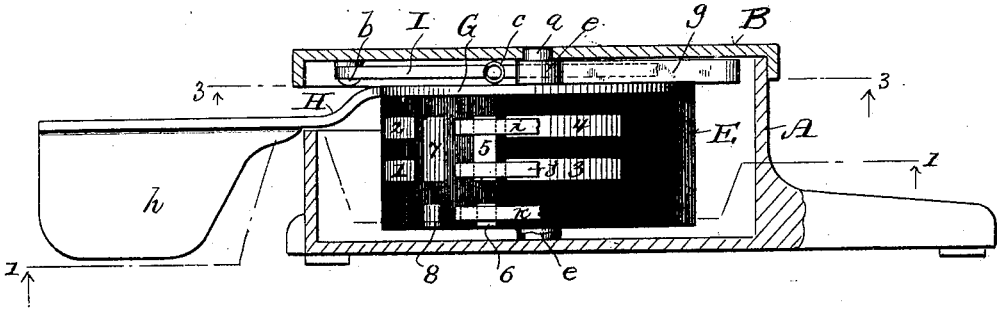
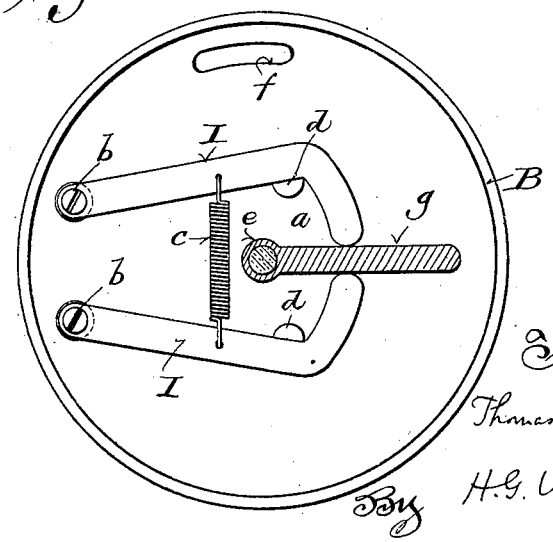


Fig. 3.



Witnesses:
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B. C. Roloff.

Inventor
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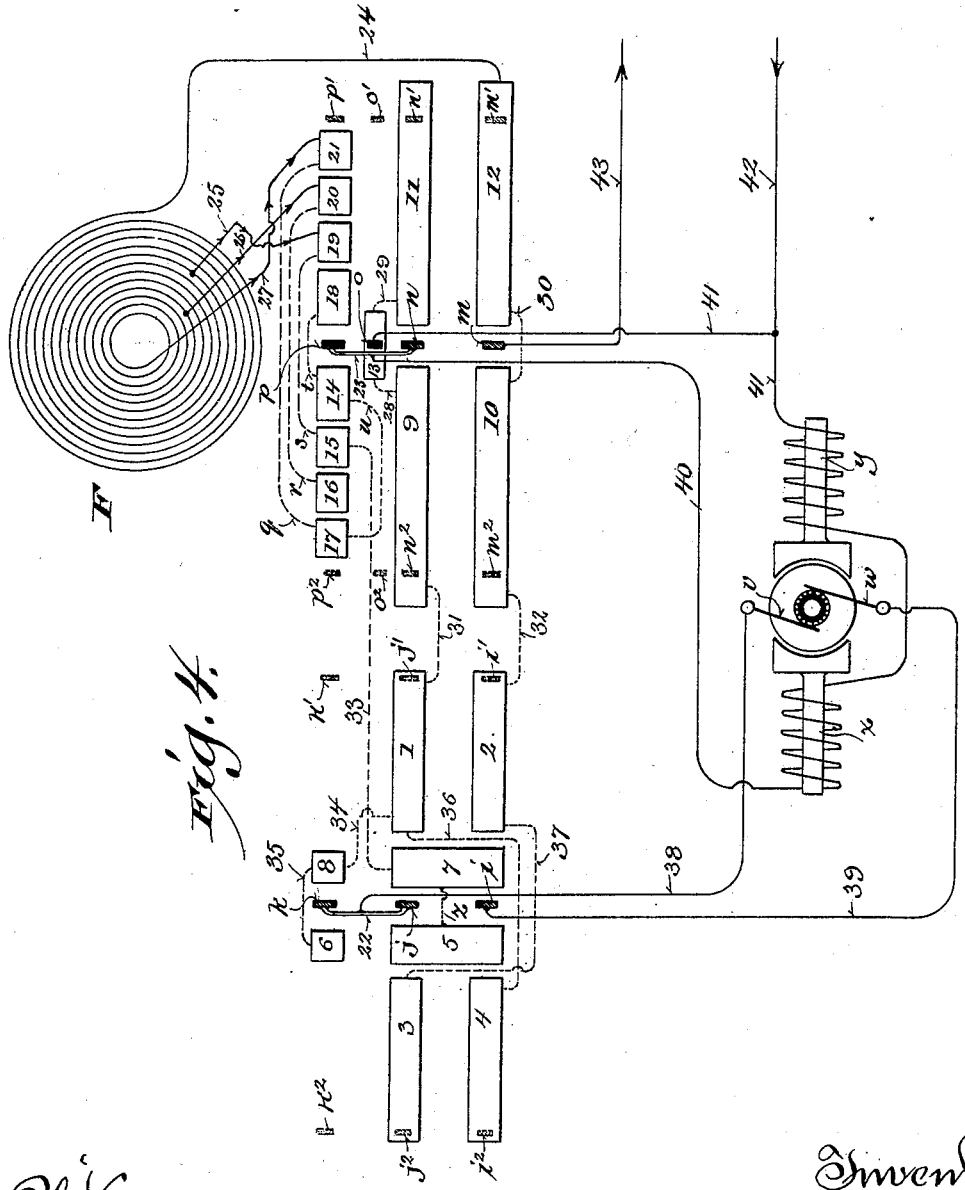

Fig. 4.

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UNITED STATES PATENT OFFICE.

THOMAS S. WATSON, OF MILWAUKEE, WISCONSIN, ASSIGNOR TO THE BROWNING MANUFACTURING COMPANY, OF SAME PLACE.

ELECTRIC-MOTOR-CONTROLLING DEVICE.

SPECIFICATION forming part of Letters Patent No. 649,972, dated May 22, 1900.

Application filed October 4, 1899. Serial No. 732,443. (No model.)

To all whom it may concern:

Be it known that I, THOMAS S. WATSON, a citizen of the United States, and a resident of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Electric-Motor-Controlling Devices; and I do hereby declare that the following is a full, clear, and exact description thereof.

My invention relates to devices for controlling electric motors, having especial reference to those employed in the operation of rotary dental tools, though not necessarily confined thereto; and it consists in certain peculiarities of construction and combination of parts, as will be fully set forth hereinafter and subsequently claimed.

In the drawings, Figure 1 is a horizontal sectional view of a controlling device embodying my present invention, taken on line 1 1 of Fig. 2. Fig. 2 is a vertical sectional view of the same, taken on the line 2 2 of Fig. 1. Fig. 3 is an under side plan view of the cover and its connections, partly in section, on the line 3 3 of Fig. 2. Fig. 4 is a diagrammatic view representing the electrical connections between my said controlling device and an electric motor controlled thereby.

Referring to the drawings, A represents the annular supporting-frame or containing-case of my device, having a central stationary spindle *a* and two vertical columns of suitable insulating material C D, arranged against the inner periphery of the case A, opposite to each other, and to which the hereinafter-described brushes and wires are attached.

E represents an annular shell composed of fiber or other insulating material. B indicates the cover of the containing-case, and F the resistance-coils within the shell E.

G is an annular plate secured to the top of the shell E, and from the center of this plate there depends a sleeve *e*, rigid therewith, fitting upon the described spindle *a*.

H represents a lever rigid with and projecting from said plate G and passing out through an opening in the wall of the case A and having a toe-piece *h* to enable said lever (which is preferably cast integrally with the plate G) to be readily moved by the foot of the operator. A guide *g* is also cast with or rigidly secured to the plate G in line with the lever H, and when the device is assembled this guide *g* is normally in contact with the opposing free ends of the jaws I I, whose other ends are pivoted, as shown at *b b*, to the under side of the cover B, said jaws being connected by a retractile spring *c* and limited in their movement toward each other by stop-pins *d d* on said cover B, so that after the lever H has been moved by the operator and released it will be instantly brought back to its normal position by the means just described. The cover B may be further provided with an aperture *f* for the passage therethrough of the conducting-wires, or said wire may have passage through the walls of the case A at any convenient point.

The periphery of the shell E is provided with strips of metal forming contact-plates, insulated from each other by the material of the said shell and electrically connected together and to the resistance-coils, as hereinafter described, there being on one side of the lever the horizontal plates 1 2, vertical plates 7 5, and below the plates 7 5 (which I term the "short-circuiting contact-plates") the smaller plates 8 6 (there being a greater insulated space between the plates 8 6 than between the plates 7 5) and horizontal plates 3 4. On the other side of the lever H the face of the shell E has the horizontal plates 9 10 and 11 12, below the plates 9 11 (and across the vertical line of insulated space between said plates) the smaller horizontal plate 13, and on a plane below the plate 13 there are eight small plates, comprising plates 14, 15, 16, and 17 below plate 9 and plates 18, 19, 20, and 21 below plate 11.

From the vertical column C there project three brushes (marked, respectively, *i j k*) and from the column D there project four brushes, (respectively marked *m n o p*,) the brushes *j k* being connected by the wires 22 and the brushes *n p* being connected by the wires 23.

From the described resistance-coils F a wire 24 runs to plate 12, a wire 25 runs to plate 19, a wire 26 runs to plate 20, and a wire 27 runs to plate 21. Plates 17 and 21 are cross-connected by wire *q*, plates 16 and 20 by wire *r*, plates 15 and 19 by wire *s*, plates 14 and 18 by

wire t, and plates 17 and 14 by wire u. It will be further observed plates 9 and 11 are connected to plate 13 by the wires 28 and 29 and plates 10 and 12 are connected by the wire 30; also, that wire 31 connects plates 9 and 1, wire 32 connects plates 10 and 2, wire 33 connects plates 15 and 7, wire 34 connects plates 1 and 8, wire 35 connects plates 8 and 6, wire 36 connects plates 1 and 4, wire 37 connects plates 2 and 3, and wire z connects plates 5 and 7.

In said Fig. 4 I further represent, by diagram, an electric motor, and from the armature-brush v thereof a wire 38 runs to wire 22, which connects the controller-brushes j k, and from the armature-brush w a wire 39 runs to the controller-brush i, while from the field-coil x of the motor a wire 40 runs to the wire 23, which connects the controller-brushes n p, and from the field-coil y a wire 41 runs to the controller-brush o. Wires 42 and 43 connect the motor and controller, respectively, with the mains or sources of electrical power, wire 42 being shown connected to wire 41 and wire 43 leading to the controller-brush m.

The diagram view, Fig. 4, shows the relative positions of the controller-brushes and contact-plates when the lever H is at its normal or neutral position with no current flowing through any part of the controller or motor; but if the lever H is swung to one extreme position the shell E is partly rotated thereby, so as to bring the controller-brushes to the points indicated by i' j' k' m' n' o' p', with the brushes n and m resting on the plates 11 and 12 and the brushes j and i on the plates 1 and 2 and the other brushes on the insulated portions of said shell. The current comes in from one of the mains on wire 42, and as brush o is now resting on the fiber of the shell the current cannot pass thereto, but will pass through the field-coils y x of the motor and thence by wires 40 and 23 to brush n (brush p being on the fiber) and plate 11, thence by wire 29, plate 13, and wire 28 to plate 9, wire 31, and plate 1 to brush j, then from this point through wires 22 and 38 to the armature-brush v, and through the armature to brush w, and through wire 39 to brush i and plate 2, thence through wire 32, plate 10, wire 30, and plate 12 to brush m, and thence through wire 43 to the other main, thus completing the circuit. When the lever H has been turned to bring the controller-brushes into the positions just described, the armature will run at its highest speed. By moving the lever H slightly in the reverse direction the brush p will rest upon plate 21, there being no change in the relative positions of the other brushes and plates over that just described, and by this contact between brush p and plate 21 the full resistance from the coils F will be shunted around the armature, thereby increasing the amount of current which flows through the field-coils, and consequently lowering the speed of the armature. If the lever H is still further moved in the same direction, so that brush p will rest upon plate 20, this will cut out a part of the resistance and increase the current through the field-coils, decreasing thereby the speed of the armature, and, similarly, when the lever is moved so that brush p rests on plate 19 still more resistance is cut out, the flow of the current through the field-coils still further increased, and the speed of the armature still further decreased. A still further movement of the lever H in the same direction will cause brush p to rest upon plate 18 and brush k on plate 8, with brushes j i resting on and short-circuited by plate 7, which results in stopping the revolution of the armature. The circuit is now traced as follows: from one main through wires 42 41, field-coils y x, wires 40 and 23, brush n, plate 11, wire 29, plate 13, wire 28, plate 9, wire 31, plate 1, wire 34, plate 8, brush k, wire 22, brush j, plate 7, wire 33, plate 15, wire s, plate 19, wire 25 to the outer coils of the resistance F to wire 24, and plate 12, brush m, and wire 43 to the other main. As the lever H is still further advanced toward the neutral point the brush o comes into contact with the plate 13 just as the brush k leaves the plate 8, and just as said brush o strikes plate 13 the field-coils y x are short-circuited, thus eliminating the inductive spark which is caused by opening any field-circuit. When the brush k leaves plate 8, brush p still remains on plate 18, which cuts in all of the resistance F, and thereby reduces the current and diminishes the sparking which will occur when the brush p leaves plate 18 as the lever reaches the neutral point. When the lever H is carried to the opposite extreme position, so as to have the controller-brushes at the points indicated at i^2 j^2 k^2 m^2 n^2 o^2 p^2, the current passes through the field-coils in the same direction as before, but the current through the armature is reversed, thereby reversing the direction of rotation of the armature.

While in the diagram view, Fig. 4, I have indicated a series-wound motor, it will be understood that my controlling device is designed to be used in connection with a shunt-wound or a compound-wound motor and that the mechanical construction of my device herein illustrated may be varied within the scope of my claims without departing from my invention.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric-motor-controlling device, the combination with a supporting frame or case, having series of brushes secured thereto, but insulated therefrom, and a stationary spindle projecting therefrom, of an annular shell of insulating material, adapted for partial rotation upon said spindle, resistance-coils contained within and carried by said annular shell, series of contact-plates disposed upon the outer periphery of said shell,

electrical connections between said contact-plates, and said resistance-coils, and a lever for rotating said shell in either direction.

2. In an electric-motor-controlling device, the combination with an annular-walled case, having a central stationary spindle projecting therefrom, of a pair of columns of insulating material secured, at opposite points to and within the annular wall of said case; series of brushes secured to and projecting from said columns, a plate carrying a sleeve rotatable upon said spindle, and a guide and projecting lever in line with each other; an annular shell of insulating material secured to said plate; resistance-coils contained within and carried by said shell; series of contact-plates disposed upon the outer periphery of said shell; electrical connections between said contact-plates and said resistance-coils, and a cover for said case having spring-controlled jaws for engagement with said guide.

3. In an electric-motor-controlling device, the combination with a supporting-frame carrying insulated stationary brushes, and a stationary spindle, an annular shell of insulating material rotatable with said spindle and having series of contact-plates disposed on its outer periphery, resistance-coils contained within and carried by said annular shell, electrical connections between said contact-plates and said resistance-coils, and a lever for rotating said shell in either direction, of contact-plate 18 for cutting in a high resistance, and contact-plate 13 for short-circuiting the field-coils of the motor just before the brushes engage with the neutral point on said annular shell, whereby the inductive spark ordinarily caused by opening a circuit through the field is eliminated.

4. In an electric-motor-controlling device, the combination with the resistance-coils, of the contact-plate 18 electrically connected to one end of said resistance-coils; plate 12 electrically connected to the other end of resistance-coils; plates 11 and 13 electrically connected together; brushes p and n electrically connected together, and to one end of the field-coils of the motor; brush m electrically connected to one of the mains; and brush o electrically connected to the other main, and to the other end of the field-coils of the motor, whereby the engagement between the said brushes and contact-plates will cut in a high resistance, and short-circuit the field-coils of the motor, for the purpose set forth.

In testimony that I claim the foregoing I have hereunto set my hand, at Milwaukee, in the county of Milwaukee and State of Wisconsin, in the presence of two witnesses.

THOMAS S. WATSON.

Witnesses:
H. G. UNDERWOOD,
B. C. ROLOFF.