UNITED STATES PATENT OFFICE.

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SPEED-REGULATOR FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 442,208, dated December 9, 1890.

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To all whom it may concern:

Be it known that I, WILLIAM W. SCHIFFMANN, a citizen of the United States, residing at St. Paul, in the county of Ramsey and State of Minnesota, have invented certain new and useful Improvements in Electrical-Motor Speed-Regulators, of which the following is a specification.

This invention relates to speed-regulators for apparatus operated by electrical motors; and it consists in the construction and adaptation of parts, as hereinafter shown and described, and specifically pointed out in the claims.

This invention may be applied to many different forms of apparatus driven by electrical motors wherein a variable speed is required; but for the purpose of illustration I have shown it applied to the hand-piece of a dental engine, to which form of apparatus the invention is peculiarly applicable.

In the drawings, Figure 1 represents the hand-piece of a dental engine with my improved regulating device arranged therein. Fig. 2 is a cross-section on the line X X of Fig. 1. Fig. 3 is a cross-section on the line Y Y of Fig. 1. Fig. 4 is a longitudinal section of a portion of the hand-piece, showing the arrangement and location of the contact-plates therein. Fig. 5 is a similar view showing the location and arrangement of the reversing mechanism or switch. Fig. 6 is a cross-section, enlarged, of the flexible shaft connecting the hand-piece with the driving mechanism of the motor, showing the manner of arranging the conducting-wires therein. Fig. 7 is a detail diagram view of the different parts, illustrating the wiring system and connections. Fig. 8 is a detail diagram view similar to Fig. 7, but on a smaller scale, illustrating more completely the manner of arranging the wiring and connecting the motor and the hand-piece.

A′ represents the casing of the hand-piece of a dental engine, A^2 the "burr," and A^3 a section of the flexible shafting by which the burr or other implement is driven, all these parts being of the usual construction. The "grip" part A^4 of the hand-piece is formed hollow and with a "core" a, and has partially embedded in its core a number of contact-plates of regularly-graduated lengths. These plates will correspond in number with the different speeds at which the motor is desired to be run, with one plate additional as a "dead" or negative wire. For the purpose of illustration I have shown four of these contact-plates b' b^2 b^3 b^4, the first one b' being the longest and representing the dead or negative wire, and b^4 the shortest and representing the greatest speed, while the contact-plates b^2 and b^3 represent the intermediate speeds.

B represents a "rheostat" or assembly of resistance-coils, and D an electric motor placed at any convenient point with reference to the dental engine. The motor is adapted to drive the shaft journaled in the hand-piece A′ by means of a flexible shaft and a system of pulleys in any suitable manner, and for the purpose of illustration I have shown the outline of such a system in Fig. 8, in which d' represents a cord belt running from the motor D over pulleys d^2 to the flexible shaft A^3, while the conducting-wires between the hand-piece and the rheostat and motor are placed inside the envelope of this flexible shaft, as hereinafter more fully described. The contact-plates b' b^2 b^3 b^4 are connected by conducting-wires to the rheostat. The plate b' is connected to conducting-wires b^5, which pass through the binding-post t' on the rheostat and thence to the "field-magnet" F′ of the motor, while the plate b^2 is connected by conducting-wire b^6 to the plate e' on the rheostat, which is connected into the longest series of coils and represents the greatest "resistance," while the next plate b^3 is connected by conducting-wire b^7 to the next plate e^2 on the rheostat, which is connected into a shorter system of resistance-coils and represents a less resistance than the plate e', while the next plate b^4 is connected by conducting-wire b^8 to the next plate e^3 on the rheostat, which is connected directly to the main negative-current wire N, so that there is no resistance whatever to the current passing through the plate b^4 and wire b^8. The rheostat shown is of the ordinary construction, such as are in common use, but without a switch or speed-controlling arm, as with my invention this part of the instrument is not used. These wires b^5 b^6 b^7 b^8 are conducted from the hand-piece A′ inside the

covering A^3, surrounding the flexible shaft, as shown in Figs. 1, 6, and 8, and from thence within a suitably-insulated covering to the rheostat, so that none of the wires are exposed in their transit.

In Fig. 7 I have shown a diagram illustrating more fully the course of the different wires and the connections, P representing the positive wire, which passes through the field-magnet F^2.

H′ represents a circuit-closing plate adapted to rest across the contact-plates b' b^2 b^3 b^4, and provided with an insulated knob H^2, by which it may be moved, the knob projecting through a slot m' in the shell of the grip part A^4 of the hand-piece, so as to be readily actuated by the person using the implement.

Along the edge of the slot m' are a series of lines m^2, corresponding to the lengths of the plates b' b^2 b^3 b^4, to denote the position of the plate H′. Thus when the knob H^2 is opposite the mark m^2 nearest the burr A^2 the plate H′ will be resting across all the plates b' b^2 b^3 b^4 and forming an electrical connection with the wire b^5, leading directly from one magnet of the motor, with the wire b^8 leading directly to the negative wire N, using the full current and causing the motor to run at full speed, and then if the knob H^2 be placed as shown in Figs. 1 and 7 the plate b^2 will be connected to the plate b', and the wire b^5, leading from one of the magnets of the motor, will be connected with the wire b^6, leading through the longest series of the resistance-coils in the rheostat, before passing into the main negative wire N, and thus checking the motor and causing it to run at its slowest speed. Then if the knob H^2 be placed opposite the mark m^2 farthest from the burr the motor will be stopped entirely, as the plate H′ will rest only in contact with the plate b' and break the current between the wires b^5 and b^6 or b^7 or b^8. It will thus be readily seen that any desired speed may be maintained by increasing the number of the contact-plates connected to the rheostat and increasing the scope of the resistance-coils therein.

It is frequently necessary to reverse the motion of the burr or other implement which is being used in the hand-piece, and to do this quickly and effectively I arrange within the grip A^4 a reversing-switch, as shown. This consists of four contact points or plates i' i^2 i^3 i^4, the points i' i^4 connected by a loop i^5 and the points i^2 i^3 connected by a loop i^6. The point i' is connected by conducting-wire i^7 to one of the field-magnets F^2 of the motor, while the point i^2 is connected by conducting-wire i^8 to the other field-magnet F′ of the motor.

G′ G^2 represent two pivoted bars connected together by an insulated cross-bar having a knob G^3 and adapted to rest by their ends upon the points i' i^3 or upon the points i^2 or i^4, according as the bars are moved to the right or left. The bar G′ is connected by conducting-wire i^9 to one brush F^3 of the commutator of the motor, while the other bar G^2 is likewise connected by conducting-wire i^{10} to the other brush F^4 of the commutator. When the bars G′ G^2 are placed as shown in Figs. 5 or 7, the current passes through the motor in one direction, causing it to run in one direction, and when the position of the bars G′ G^2 is reversed the current passes through the motor in the opposite direction and reverses it. This is a very important feature of this invention, as it is frequently necessary to reverse the motion of the burrs in dental work, many burrs being made to cut in both directions. This reversing feature is especially advantageous when arranged as herein shown, so that it can be easily accomplished by one of the fingers or the thumb of the hand holding the implement and without the necessity for releasing the hand from the implement or changing its relation thereto. The knob G^3 passes upward through a slot in the shell of the grip part A^4 of the hand-piece in a similar way to the knob H^2. By this simple construction the motor can be perfectly controlled by merely adjusting the two small knobs H^2 G^3 on the bridging-plate H′ and upon the switch-bars G′ G^2, and when placed within the hand-piece of a dental engine the operator is enabled to easily manipulate it by the fingers of the same hand which holds the hand-piece, so that there is no necessity for him to remove the implement from its work or release the hand engaged with the patient.

Another important feature of this invention is in passing all the conducting-wires between the hand-piece and the motor and rheostat within the casing or envelope of the flexible shaft, as the wires are thereby concealed from sight and are not exposed to the danger of loss by leakage or from other sources.

Having thus described my invention, what I claim as new is—

1. In a dental-engine hand-piece, a series of graduated contact-plates embedded therein and in electrical connection with a rheostat, a motor in electrical connection with said rheostat and adapted to actuate the shaft of said hand-piece, a commutator adapted to be moved over said contact-plates, said graduated contact-plates and commutator being placed near the outer or burr end of said hand-piece, so that said commutator may be actuated by the fingers or thumb of the hand which holds the hand-piece and without releasing its hold therefrom or changing its relation thereto.

2. In a dental-engine hand-piece, a series of graduated contact-plates embedded in the hand-piece near its burr end in electrical connection with a rheostat, a motor in electrical connection with said rheostat and adapted to actuate the shaft of said hand-piece, a commutator adapted to be moved over said contact-plates, a reversing-switch embedded in said hand-piece near said contact-plates and connected into the circuit of said motor,

whereby said commutator and switch may be actuated by the fingers or thumb of the hand which holds the hand-piece, and the speed and motion of the burr controlled without releasing the hand or changing the relation to the hand-piece, substantially as and for the purpose set forth.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM W. SCHIFFMANN.

Witnesses:

C. N. WOODWARD,

H. S. WEBSTER.