(No Model.) 2 Sheets—Sheet 1.

F. H. BERRY.

SWITCH FOR OPERATING SHUNT WOUND ELECTRIC MOTORS.

No. 492,456. Patented Feb. 28, 1893.

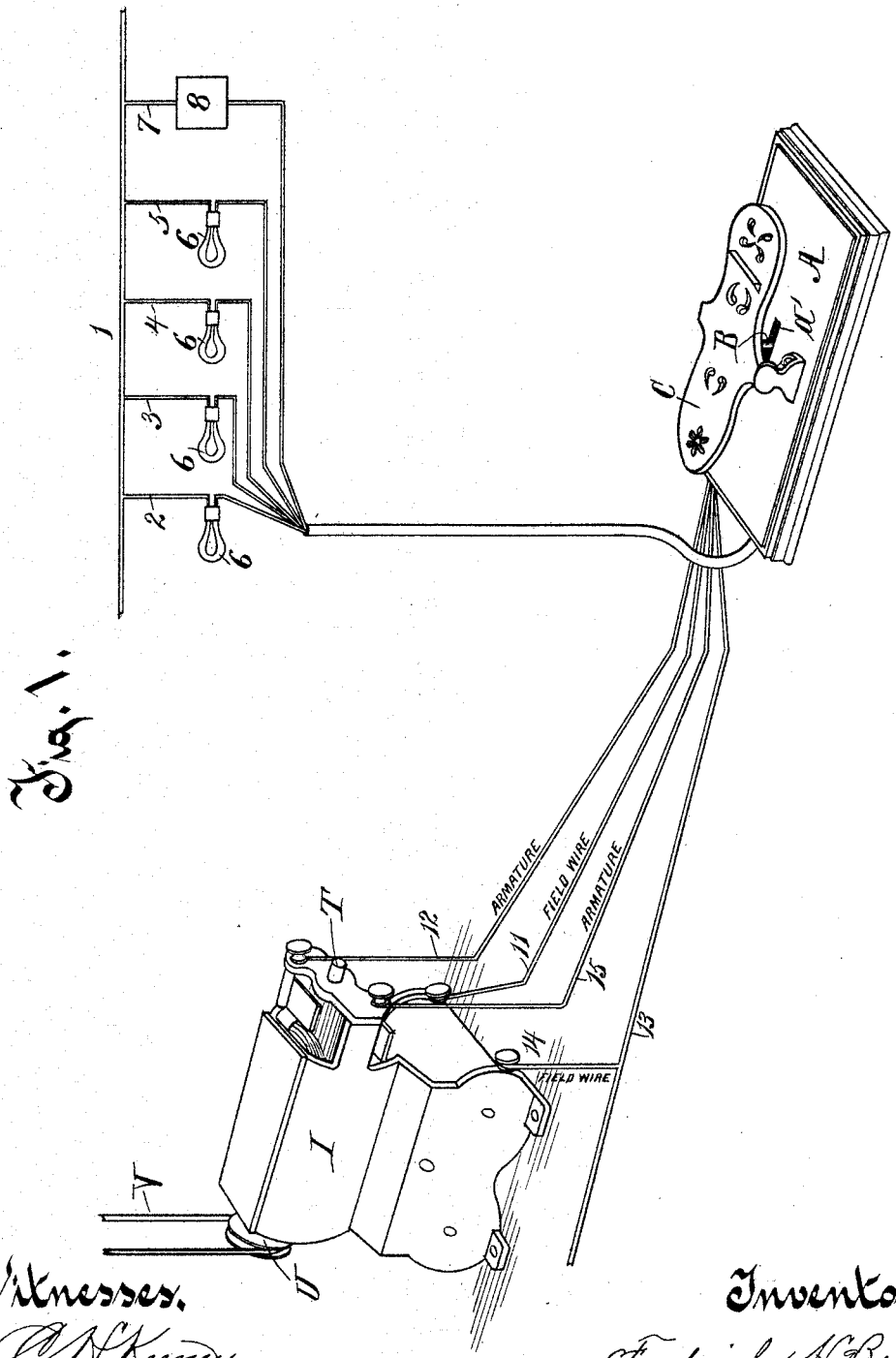

Fig. 1.

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Fig. 2.

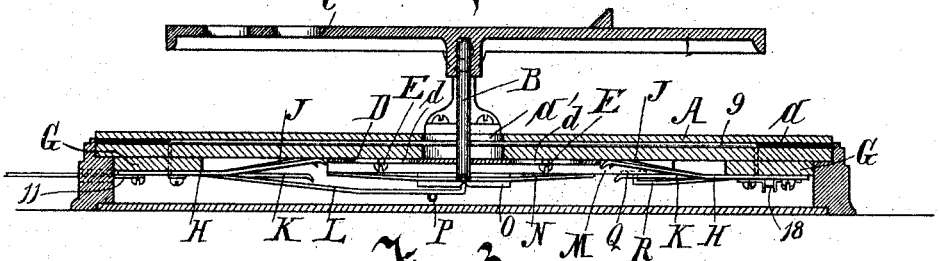


Fig. 3.

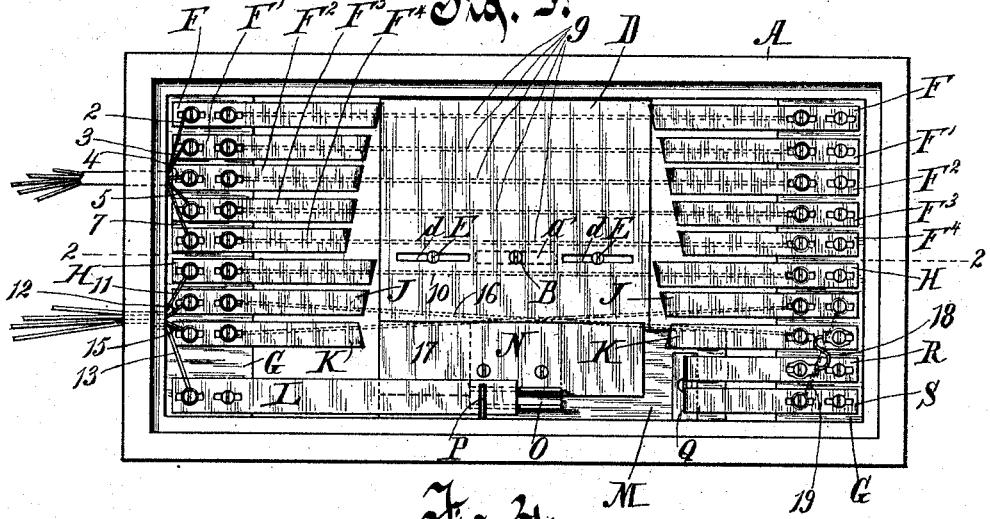
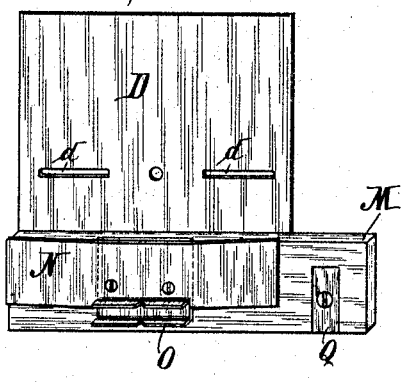


Fig. 4.



Witnesses.

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UNITED STATES PATENT OFFICE.

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SWITCH FOR OPERATING SHUNT-WOUND ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 492,456, dated February 28, 1893.

Application filed March 3, 1892. Serial No. 423,629. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK H. BERRY, of Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a new and useful Improvement in Switches for Operating Shunt-Wound Electric Motors, of which the following is a description, reference being had to the accompanying drawings, which are a part of this specification.

My invention has relation to a switch for operating small electric shunt-wound motors, one fourth horse power or under, more particularly adapted for running a dental engine, such for instance, as that shown and described in my application for Letters Patent, filed January 2, 1892, Serial No. 416,795, being designed to supplant the switch and clutch mechanism, covered by said application.

The primary objects had in view are to provide for operating the motor in two directions, forward or backward at variable speeds and power, and provision for instantaneously stopping, starting or reversing the motor without endangering or overheating the armature.

With the above and other objects in view the invention consists in the improved construction and combination of parts as hereinafter more fully set forth.

In the accompanying drawings, Figure 1, is perspective view of the motor, switch, resistance medium and fuse plug, also illustrating the course taken by the wires upon leaving the switch. Fig. 2, is a longitudinal vertical section through the line 2—2 of Fig. 3. Fig. 3, is an inverted plan view of the switch, illustrating clearly the different contact strips, the sliding contact plate, the wires leading from a series of the contact bars to the resistances and fuse plug and to the motor, respectively, the connections between the opposite contact strips shown in dotted lines, and Fig. 4, is a detail view of the sliding plate and the insulating block secured thereto, showing the contacts carried by the latter.

Like letters and numerals indicate corresponding parts throughout the several views.

Referring to the drawings, the letter A indicates the casing of the switch, said casing having its top formed of two layers of insulating material, with a space, *a*, therebetween. These layers are provided with central registering elongated slots, *a' a'*, through which a lever B, passes, the upper end of said lever being rigidly attached to the underside of a foot treadle C and its lower end passing through a sliding contact plate D. This latter is provided with elongated slots, *d d*, which receive guide pins, E E, extending from the underlayer of the top of the casing.

In the present illustration of my invention, the switch is shown as resting upon the floor, this being the preferable arrangement. In case it is used in any other position, however, as for instance, on a side wall, it is desirable to substitute a lever handle for the foot treadle.

Upon opposite sides of the sliding contact plate are shown series of five contact strips, said strips being lettered, respectively, F F' F^2 F^3 and F^4.

The numeral 1 indicates a main or feed wire. From this extends branch wires 2, 3, 4 and 5, having resistance mediums 6 (shown in the drawings as electric lights) in their circuits, and connected at their lower ends respectively to the outer binding screws of the strips F F' F^2 and F^3 on the left of Fig. 3.

In case my invention is operated on a continuous current incandescent system, I prefer to use the incandescent lamps wired in multiple arc, as resistance mediums. In case of use on a battery system, however, bobbins of German silver wire may be employed wound to a suitable resistance, in multiple arc, each bobbin allowing a portion of the whole current or ampère to pass. Another wire, 7, extends down from the main line 1 and connects with the outer binding screw of contact bar F^4 on the left of Fig. 3. This wire is provided with a fusible or safety plug, 8, of the ordinary and well known type, in its circuit. This in case of accidental short circuiting anywhere in the motor, or other connections, will melt and save further accidents to the parts. A series of wires, 9, connect the contact bars upon the opposite sides of the sliding plate, said wires being located in the space, *a*, formed between the top layers of the casing, and having their ends bent down and passing through the lower layer, thence through insulating blocks, G, to which the contact bars are secured, and finally attached to the inner binding screws of the bars. This

arrangement is shown clearly in Figs. 2 and 3, the latter figure illustrating the connecting wires by dotted lines. Next to the bars just described are other contact bars, H H, located on opposite sides of the sliding plate. These bars are connected by means of a wire, 10, running lengthwise in the space *a* and having its ends attached to the inner binding screws of said bars. The bar H on the left of Fig. 3, has a wire 11 connected to the outer binding screw thereof, said wire leading to the field of a motor I. Next to the contact bars just mentioned are bars, J J, the one on the left connected with the armature of the motor by a wire, 12, leading from the outer binding screw thereof. Bars K K follow bars J.

It will be seen that a main wire, 13, has a branch 14 extending to the field, and that said main wire carries the current to a plate N secured rigidly to an insulating block M, through a long contact bar L. From said plate N it is conducted through strip K when the latter is in contact therewith to the other pole of the armature by a second armature wire 15. A wire 16 connects the inner binding screw of bar J on the left with the corresponding screw of bar K on the right, while bar K on the left is connected to bar J on the right by a wire 17, attached to the inner binding screws also of these strips. The insulating block M is rigidly attached to plate D and consequently moves simultaneously therewith. The plate N carried by a block M is formed or provided with a medially notched supplemental portion, O, the notch adapted to be engaged by the upwardly bent end of the contact bar L, said bar being pressed upon by a laterally extending pin, P, so as to insure the engagement of the bent end with the notch at the proper time. This sliding block also carries a transverse contact plate Q.

Upon the right of insulating block, M, are two additional contact strips, R and S, the former connected with strip K by a fusible wire, 18, forming a circuit between bars R and K. This, in case the discharge is of high enough tension to endanger the armature, will melt and save said armature from overheating. Contact bar, J, on the right is connected with bar S by a wire, 19. It will be noticed that the binding screws of all the several contact bars work in elongated slots, whereby their adjustment longitudinally is provided for.

The letter T indicates the commutator shaft of the motor, said shaft carrying a pulley wheel, U, receiving a belt V, which operates the driving shaft (not shown) of a dental engine, or other machine to be driven.

The foregoing being a description of the several parts of my invention, I will now proceed to describe its operation. The ends of the several contact bars are turned down slightly, as clearly shown in Fig. 2, so that when sliding plate D is in the position illustrated in Fig. 3, with the upwardly turned end of contact, L, engaging the notch, said sliding plate is not in metallic contact with any of the bars except F. It will be understood, however, that bar L is always in metallic contact with N. We will now suppose that plate D, through the medium of the treadle, is slid toward the left so as to make contact with bars F F′ F^2 F^3 F^4 H and J, and to establish contact between K and N. Wire 7, which has plug 8 in its circuit, connects with bar F^4. When the adjustment just described is made, the full current of course passes over wire 7 to the bar F^4, and from said bar to plate D, being carried off the latter by bars H and J, the former leading to the field of the motor through the wire 11, and the latter leading to the armature of the motor through the wire 12. The current from wire 13 to plate N through bar L, is taken off the latter by bar K, and carried over wire 15 to the other pole of the armature. When the current is passing in the manner just described, the motor is running at full speed. If it is now desired to gradually decrease the speed and the power, the treadle is manipulated so as to shift sliding plate D out of contact with strip F^4, and the current then passes through wires 2, 3, 4 and 5 in multiple, containing the resistance mediums, and said current is distributed by the several contact bars F F′ F^2 and F^3 upon plate D, after which it takes exactly the same course as before explained. If now the sliding plate is shifted so as to engage only contact bars F F′ and F^2, one of the resistance mediums is cut out and, as before, after distribution of the current upon plate D, said current takes the course already pointed out. Shifting the plate so as to contact only with bars F and F′ cuts out two of the resistance mediums. When the plate contacts with only strip F all the resistances are cut out but one. It is to be understood that when plate D is so adjusted as to contact merely with bar F and before it has quite reached its normal position shown in Fig. 3, the only other contact it makes is with strip H. At the same time, however, bar L contacts with plate N, said contact being always established as previously pointed out. Bar H connects with the field of the motor through wire 11. The current, therefore, is conducted from plate D through bar H and over wire 11 to the field. This adjustment also shifts insulating block M so as to throw plate Q into engagement with strips R and S, thus establishing a short circuit between the poles of the armature, that is to say, a circuit is formed from bar K on the left through wire 17 to bar J on the right, from said last named bar through the wire 19 to bar S, from the latter over plate Q to bar R, and from the latter through fusible wire 18 to bar K on the right, finally passing from this bar through wire 16 to bar J on the left. When plate D was contacting with a greater number of the bars than F and H, the machine I was operating as a motor.

In its adjustment just described, however, its action becomes that of a dynamo, carrying one lamp or resistance medium to magnetize the field through bars F and H, bars J and K leading to the armature being short circuited through plate Q as just described. The armature, therefore, revolves merely of its own momentum. The dynamo thus operating under a load without any outside force to continue it as a generator instantaneously comes to a stop. As the armature is now at a standstill there being no counter electro-motive force generating therein, it is in a safe condition to reverse the direction of the current through the armature, which is accomplished by pressing down upon the toe or heel in the reverse direction so as to throw plate D to the right, causing it first to contact with bars F and H. The field is now in the same condition as it was when the last contact on the left was made, viz., the field being magnetized through bars F and H and armature on short circuit through plate Q. The sliding plate D is now moved farther to the right so as to contact with bar F′, contact still remaining between bar H and the plate and an additional contact established between said plate and bar J, and between plate N and bar K. At this time bars R and S are out of contact with Q, and rest upon the insulating block M. The current now feeds through resistance mediums in the circuits of wires 2 and 3 onto plate D and distributes through bars H and J, the J current going across to bar K on the left through wire 17. The current feeds through bar L to plate N and from the latter to bar K on the right thence crossing on wire 16 to J on the left, resulting in the reversing of polarity in the armature, and finally resulting in changing the direction of rotation of the armature shaft. It will be noticed that the armature is thus short circuited at a point where the amprage supplied to the field is the smallest, or in other words, at a point when sliding plate D is only in contact with bars F and H. It is also short circuited again at first contact before the reverse current is thrown on the armature. As the connections with full current, is through wire 7, it is impossible to reverse the current from such point, and it therefore becomes necessary to go back through the series of contacts, and across short circuit plate Q and thus cut out the supply gradually, and again cut in the supply gradually, thus relieving the armature of the shock of a full current before it is under motion, and generating its own counter electromotive force. The short circuit of armature being through fusible wire 18 in case the discharge is of high enough tension to endanger the armature, said wire will melt and save the armature from overheating. The object of diagonal ends of contact is that any sparking, due to break of contact, will be made at the point of the contact bar, thus not corroding the whole surface but only the extreme points.

While I have described the adaptation of my improved switch to dental engines, I do not wish to be understood as limiting myself to that particular use, inasmuch as it is obvious that it may be employed in various other ways, wherein a motor for transmitting power is utilized.

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

1. The combination, of a motor, a movable contact consisting of plates separated from each other by insulating material, contacting surfaces which one plate of the sliding contact is adapted to engage, one or more of said surfaces electrically connected with a source of supply and the other consisting of two branches separately connected to the field and the armature of the motor, a contacting surface which the other plate of the sliding contact is adapted to engage, said surface electrically connected with the opposite pole of the armature, and a contacting surface permanently engaged by this last named plate of the sliding contact, said contacting surface connected with the opposite pole of the field and main feed line, substantially as set forth.

2. The combination of a motor, a sliding contact consisting of plates separated from each other by insulating material, a series of nonmovable contacts adapted to be successively engaged by one plate of the sliding contact, wires connecting said nonmovable contacts with a source of supply, separate nonmovable contacts connected, respectively, with the field and armature of the motor, said contacts also engaged by the same plate of the sliding contact, a nonmovable contact connected with the opposite pole of the armature and adapted to be engaged by the other plate of the sliding contact, and a nonmovable contact surface permanently engaged by this last named plate, said contacting surface connected with the opposite pole of the field and main feed line, substantially as set forth.

3. The combination, of a motor, a sliding contact consisting of plates separated from each other by insulating material, a series of nonmovable contacts adapted to be successively engaged by one plate of the sliding contact, wires connecting said nonmovable contacts with a source of supply, a plurality of the wires having resistance mediums in their circuits, and one of said wires having a fusible plug in its circuit, separate nonmovable contacts connecting, respectively, with the field and the armature of the motor, said contacts also engaged by the same plate of the sliding contact, a nonmovable contact connected with the opposite pole of the armature and adapted to be engaged by the other plate of the sliding contact, a nonmovable contacting surface permanently engaged by this last named plate, said contacting surface con-

nected with the opposite pole of the field and main feed line, substantially as set forth.

4. The combination, of a motor, a sliding contact consisting of plates separated from each other by insulating material, a series of nonmovable contacts adapted to be successively engaged by one plate of the sliding contact, wires connecting said contacts with a source of supply, a plurality of said wires having resistance mediums in their circuits, and one of the wires having a fusible or safety plug in its circuit, separate nonmovable contacts connecting respectively, with the field and the armature of the motor, said contacts also engaged by the same plate of the sliding contact, a nonmovable contact connected with the opposite pole of the armature and adapted to be engaged by the other plate of the sliding contact, and a nonmovable contacting surface permanently engaged by this last named plate, said contact surface connected with the opposite pole of the field and main feed line, substantially as set forth.

5. The combination, of a motor, a movable contact consisting of two plates separated from each other by insulating material, one of said plates provided with a notch, contact surfaces which one or more plate is adapted to engage, one of said surfaces connected with the source of supply, and the other consisting of two members leading separately to the field and the armature of the motor, a contact surface which the other plate of the sliding contact is adapted to engage, said surface connecting with the opposite pole of the armature, and a contact strip permanently engaged by this last plate and connected with the feed line and provided with an upturned end adapted to engage the notch and hold the sliding contact in a normal inoperative position, substantially as set forth.

6. The combination, of a motor, a movable contact consisting of plates separated from each other by insulating material, contact surfaces upon opposite sides of said plate connected together by wires, one or more of said surfaces, upon one side, connected with a source of supply and the other consisting of two members leading separately to the field and the armature of the motor, opposite contact surfaces which the other plate of the sliding contact is adapted to engage, one of said contacts upon one side being electrically connected with the opposite pole of the armature, and a contacting surface permanently engaged by this last named plate of the sliding contact, said surface connected with the opposite pole of the field and main feed line, substantially as set forth.

7. The combination, of a motor, contact surfaces connected with a source of supply, a contact leading to one pole of the field of the motor, contacts leading to the poles of the armature, a short circuit between the poles of the armature, and a movable contact consisting of two plates insulated from each other, one of said plates constructed to engage the contacts leading to the source of supply and to also engage the contact leading to the field and one of the armature contacts, and the other plate having permanent connection with the opposite pole of the field and constructed to engage the other contact of the armature, the short circuit being established when this sliding contact is out of engagement with the armature contacts but in engagement with the field contacts, and the motor thus converted into a dynamo, substantially as set forth.

8. The combination, of a motor, a plurality of opposite contact surfaces connected together, those on one side connected with a source of supply, opposite contact surfaces consisting of two members, one of which connected with one pole of the field of the motor, and the other with one pole of the armature, opposite contact surfaces, one of which connected with the opposite pole of the armature, a wire connecting the lower armature contact upon one side with the opposite upper contact, a wire connecting the upper contact upon one side with the opposite lower contact, contacts upon one side, one of which connected with the upper armature contact upon the corresponding side and the other with the lower contact, and a movable contact composed of separate plates insulated from each other, one of said plates constructed to engage the contacts connected with the source of supply and also with the contacts leading to one pole of the field and one pole of the armature, and the other plate permanently connected with the opposite pole of the field, and adapted to engage the opposite pole of the armature, the insulating strip between the plates also carrying a contact adapted to engage the short circuit contacts upon one side, when contact is simultaneously made with the contact leading to the field of the motor, whereby a short circuit is formed and to break connection with said armature contacts when the sliding plate engages a plurality of the contacts leading to the source of supply, substantially as set forth.

9. The combination, of a resistance device consisting of a number of resistance coils, a switch comprising two sections insulated from each other, said resistance coils feeding upon one section, a shunt wound motor, one pole, respectively, of the field and armature thereof feeding from the plate of the switch which receives the feed of the resistance coil, and each of the remaining poles, of the field and armature respectively in circuit with the other plate, substantially as set forth.

10. The combination, of a motor, a plurality of opposite contacts connected together, those upon one side leading to a source of supply, contacts upon opposite sides also connected together, and one of said contacts leading to the field of the motor, contacts upon opposite sides consisting of two members each

leading to the armature poles, the lower member upon one side connected with the upper member upon the other by a wire, and the upper contact upon one side connected with the lower contact upon the opposite by a second wire, and a movable contact consisting of two plates insulated from each other, one of said plates having a permanent connection with the opposite pole of the field, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FREDERICK H. BERRY.

Witnesses:

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C. T. BENEDICT.