No. 641,157. Patented Jan. 9, 1900.

O. F. SHEPARD, JR.

SWITCH FOR ELECTRIC MOTORS.

(Application filed May 19, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.

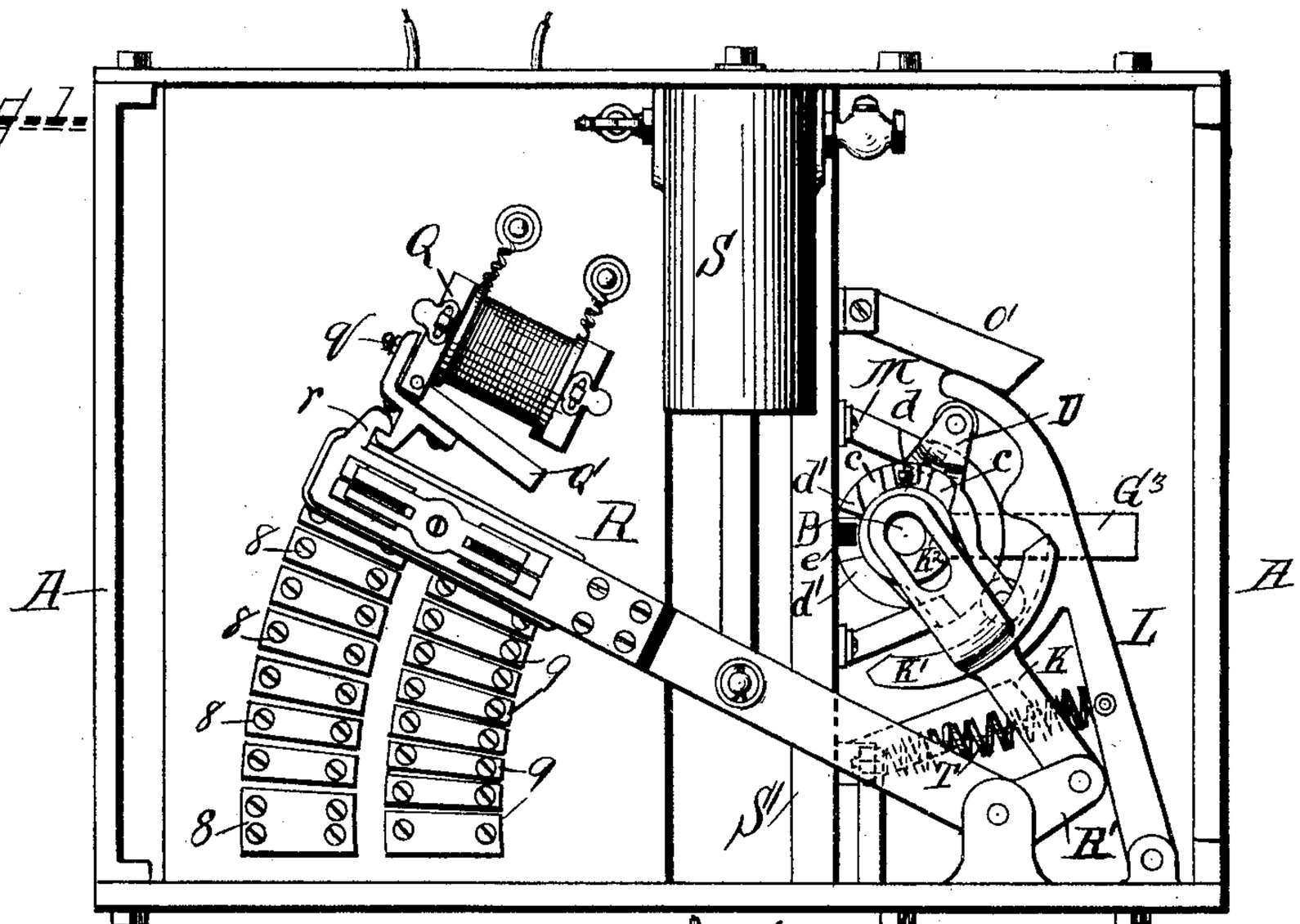
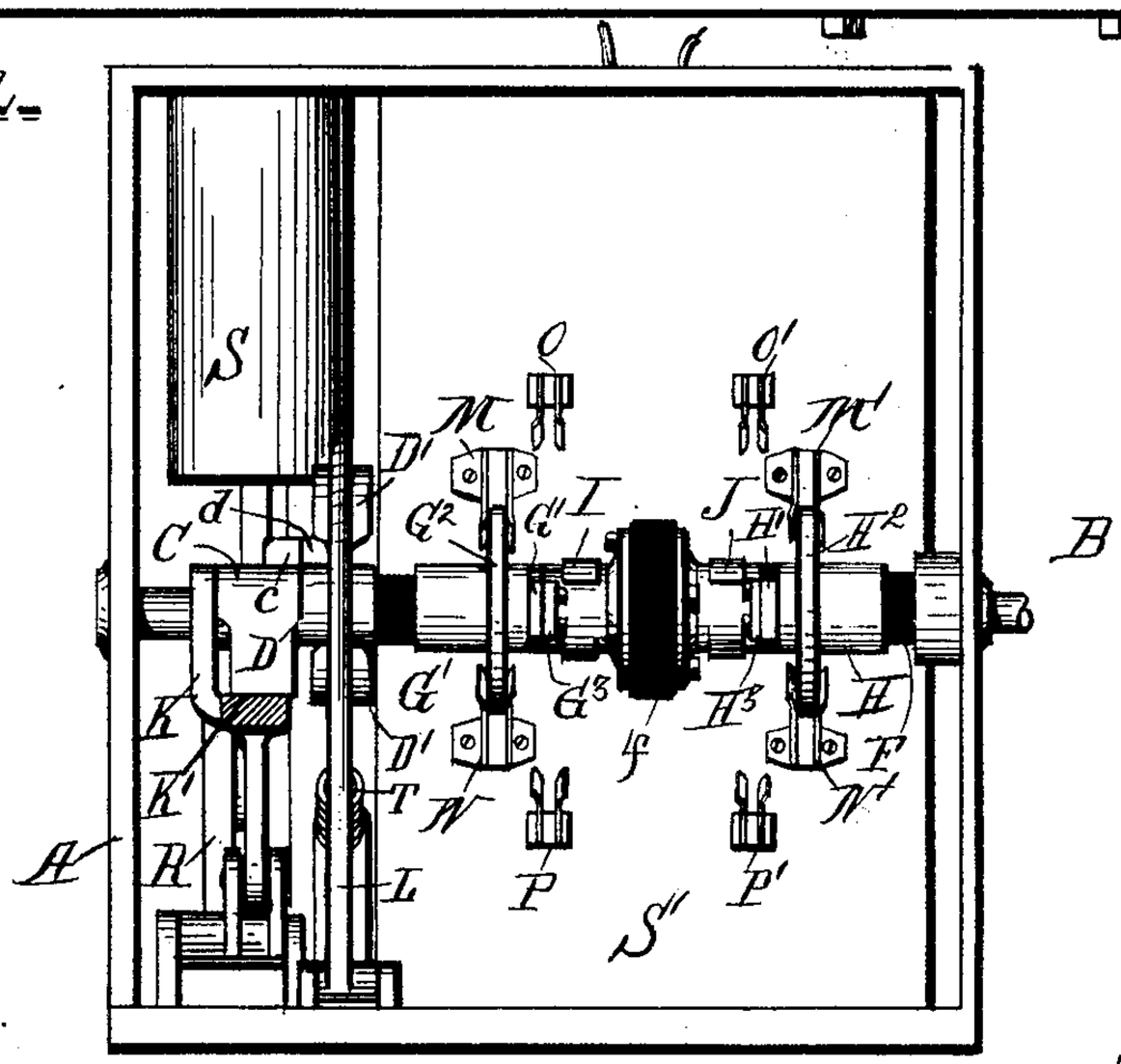


Fig. 2.



WITNESS

Wm. J. Peck.

Claude Procunier

INVENTOR

Oscar F. Shepard Jr.

BY

Chamberlain

his ATTORNEY

No. 641,157. Patented Jan. 9, 1900.

O. F. SHEPARD, JR.

SWITCH FOR ELECTRIC MOTORS.

(Application filed May 19, 1899.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 3.

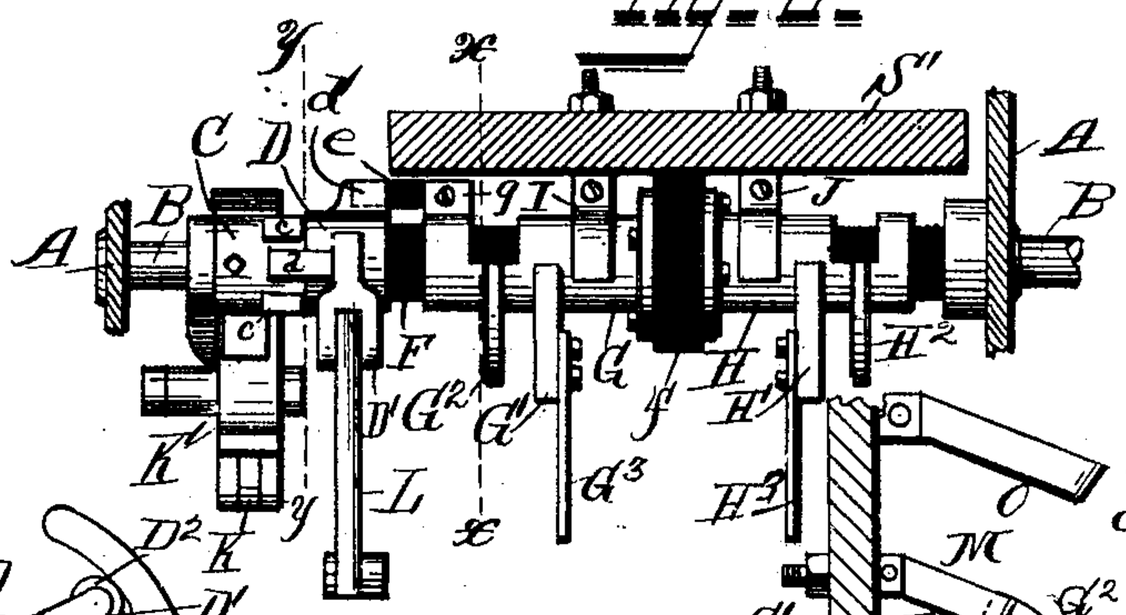


Fig. 7.

Fig. 6.

Fig. 5.

Fig. 8.

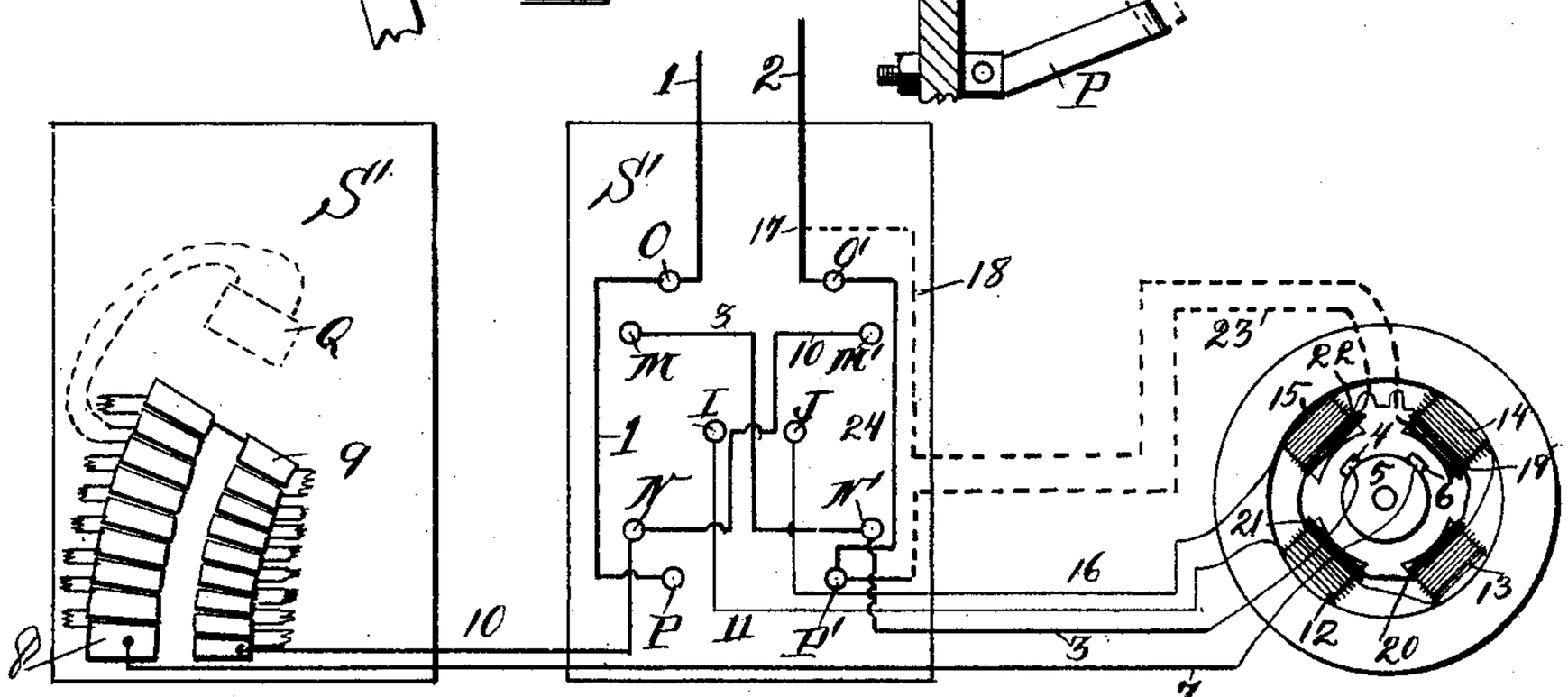


Fig. 4.

WITNESS

Wm. J. Beck.

Claude Procumier

INVENTOR

Oscar F. Shepard Jr.

BY

Chas. Beck

his ATTORNEY

No. 641,157. Patented Jan. 9, 1900.

O. F. SHEPARD, JR.

SWITCH FOR ELECTRIC MOTORS.

(Application filed May 19, 1899.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 9.

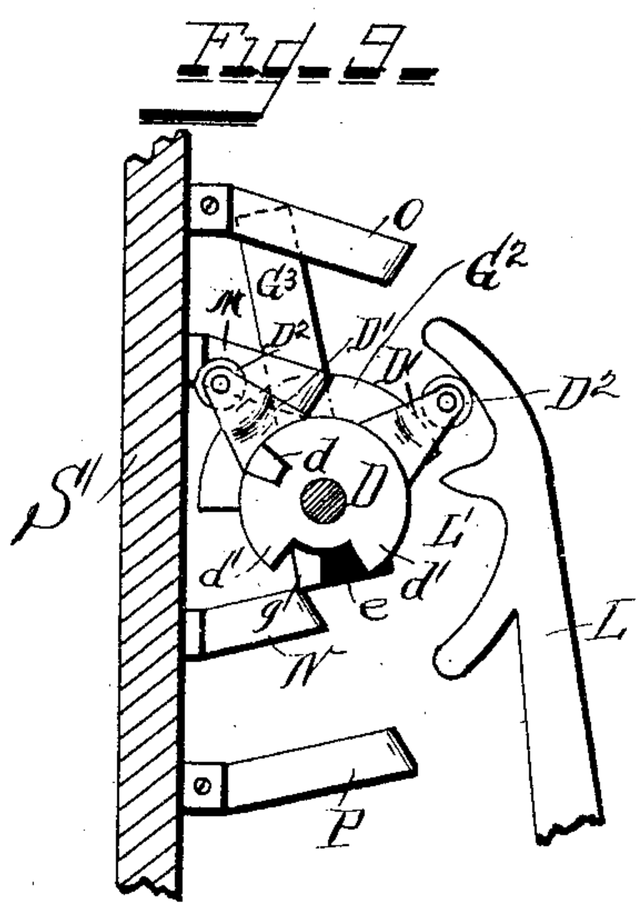


Fig. 10.

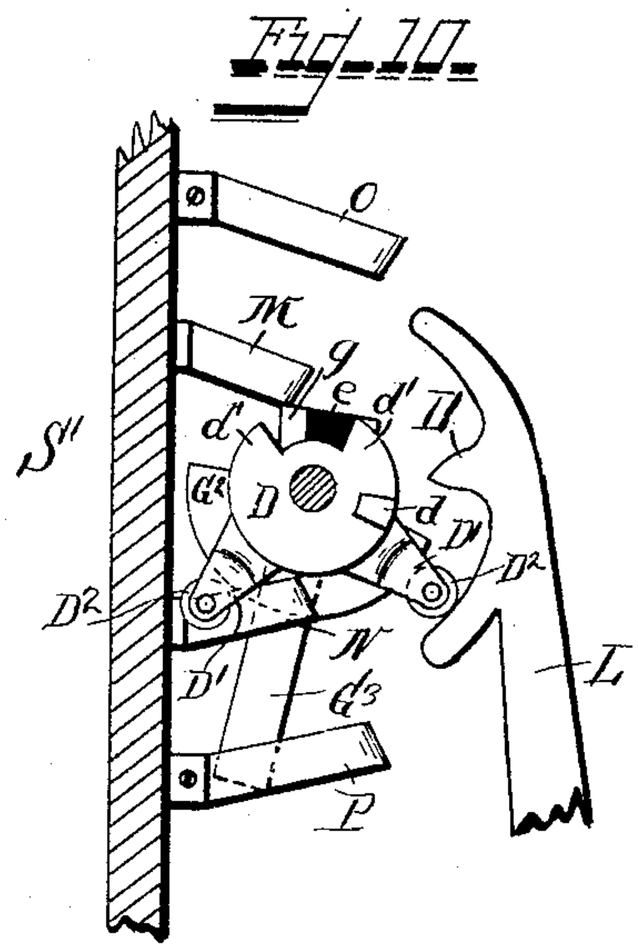


Fig. 11.

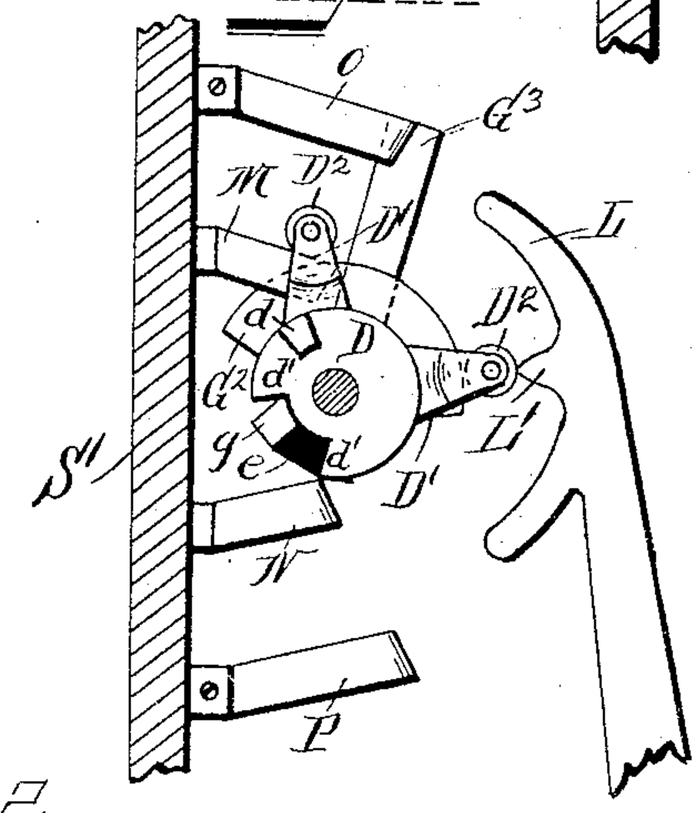


Fig. 12.

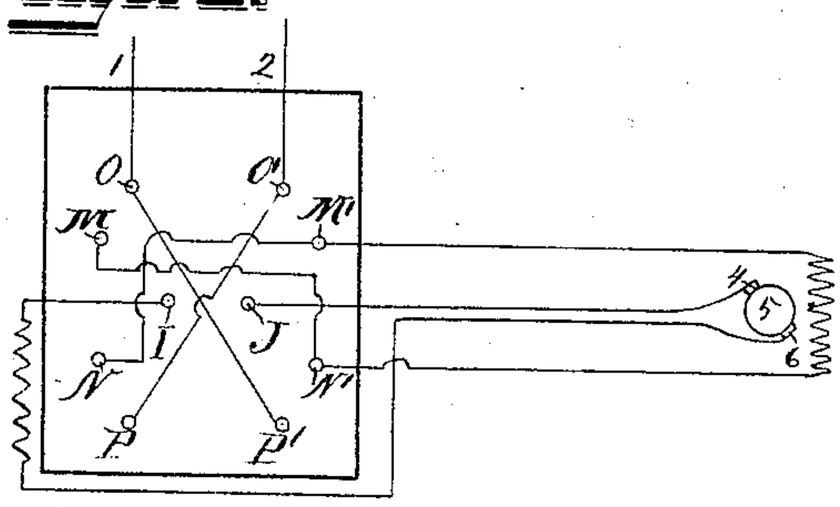
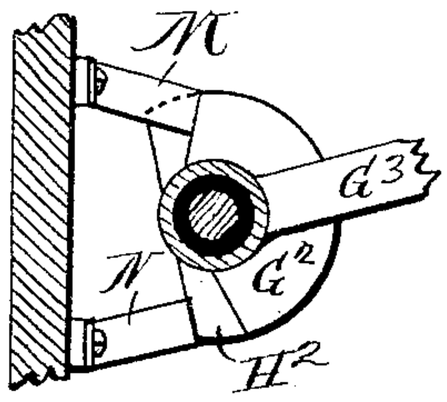


Fig. 13.



WITNESS

Wm. J. Peck.

Claude Procunier.

INVENTOR

Oscar F. Shepard Jr.

BY

Chas. J. Peck

his ATTORNEY

UNITED STATES PATENT OFFICE.

OSCAR F. SHEPARD, JR., OF MADEIRA, OHIO.

SWITCH FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 641,157, dated January 9, 1900.

Application filed May 19, 1899. Serial No. 717,449. (No model.)

To all whom it may concern:

Be it known that I, OSCAR F. SHEPARD, Jr., a citizen of the United States, residing at Madeira, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Switches for Electric Motors, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification.

The object of my invention is to provide a reversing-switch for an electric motor which will prevent sparking both of the fields and also in the opening of the outside circuit; also, to provide a switch with automatic mechanism for snapping it open as well as closed.

In carrying out my invention I provide a switch in which when the connection is made with the source of current-supply the field and armature of the motor are both in circuit with said source of current-supply and in which when the switch is operated to cut off connection with the source of current-supply a closed circuit is maintained which always includes the field.

My invention also consists in the construction and combination of the parts, all as will be hereinafter set forth, and more specifically pointed out in the claims.

In the accompanying drawings, Figure 1, Sheet 1, is a side elevation of switch mechanism embodying my invention. Fig. 2, Sheet 1, is an end elevation looking to the left of Fig. 1. Fig. 3, Sheet 2, is a plan view of the contact-fingers and connected parts, partly in section. Fig. 4, Sheet 2, is a longitudinal sectional view of the operating-shaft and the parts carried thereby, showing the position of the insulation. Fig. 5, Sheet 2, is a transverse end elevation on the dotted line x x of Fig. 3 looking to the right. Fig. 6, Sheet 2, is a detail end elevation of the cam mechanism for operating the resistance-lever as seen looking toward the right of Fig. 3. Fig. 7, Sheet 2, is a detail end elevation of the snapping mechanism, taken on the dotted line y y of Fig. 3 looking to the right. Fig. 8, Sheet 2, is a diagram of the electrical connections. Fig. 9, Sheet 3, is a view corresponding to Fig. 7, but including the contact-fingers and contacts in rear thereof in one position. Fig. 10, Sheet 3, is a corresponding view with the parts in the opposite position. Fig. 11, Sheet 3, is a corresponding view with the parts in position just before the snap takes place to break the circuit. Fig. 12, Sheet 3, is a diagram of a modified form of connection. Fig. 13, Sheet 3, is a detail view of a modified form of contacts.

The same letters and numerals of reference are used to indicate identical parts in all the figures.

A represents any suitable rheostat-box, through which is journaled a shaft B, which is operated by any suitable means. Fast upon the shaft B is a cam C, (which I will more fully describe hereinafter,) which has upon its upper surface a pair of projections or lugs c, forming one part of a lost motion. Projecting between said lugs c is a lug d, Fig. 3, integral with the snapper D, which forms the other part of the lost motion, the purpose of which will be described later.

The snapper D, loose upon the shaft B, has in its side a cut-out portion forming a pair of lugs d', similar to those on the cam C, between which projects an insulating-piece e, forming a second lost motion between the snapper D and switch proper. Loosely mounted on the shaft B is an insulating-tube F, which carries a pair of brass collars G H, which are insulated from each other by the insulating-washer f, as shown in Figs. 2, 3, and 4, said washer also answering to mechanically unite the parts G and H. At one end of the brass collar or sleeve G is a projection g, which carries the insulating-piece e, Figs. 3 and 4.

Integral with the sleeves G and H are contact-fingers G′ and H′ and contact-segments G^2 and H^2. Suitable blades G^3 and H^3, Figs. 2 and 3, are fastened to the fingers G′ and H′, respectively, so that they may be renewed when they become worn or burned from any cause.

Continuously bearing against the sleeves G and H are a pair of contact-brushes I and J, respectively, Figs. 2, 3, and 5, the purpose of which will be hereinafter explained.

The operation of the device is as follows: When it is desired to start the motor in either direction, the operator rotates the shaft B in

the required direction, carrying with it the cam C, which is fast thereon; but the other parts remain stationary until either of the jaws *c* of the cam C comes against the lug *d* of the snapper D, which takes up the first lost motion and rotates the snapper D. One of the lugs *d'* then takes up the lost motion until it strikes the insulating-lug *e*, which rotates the sleeves G and H. In the meanwhile the snapper, which has a pair of projecting arms D', carrying rollers D^2, has been traveling around, one of the rollers D^2 bearing against the curved surfaces of the snapper-arm L until it gets to a position on the point L' of the projection on the inner face of the snapper-arm L, when the spring T causes the roller to slip off of the point L' and be accelerated forward, snapping the switch into contact—that is, the blades G^3 and H^3 are brought into connection with the contacts O or P, thereby making an electrical connection with the source of current-supply.

The cam C, in addition to its function of transmitting motion to the switch mechanism, also serves to control the action of the starting or regulating rheostat. In the operation of closing the switch the cam C travels along the curved surface K' of the cam-link K, the curved surface being of sufficient length that no movement is permitted the link K until the instant that the switch snaps closed, at which instant the cam C leaves the curved surface K', and any further motion of the cam C now permits the link K to follow it up, and hence allows the rheostat-arm to descend by gravity and cut out the starting resistance. Now upon reversing the action in order to cut off the current-supply, the cam C being in a position as shown in Fig. 6, Sheet 2, first forces the link K downward, thereby through its action upon the bell-crank lever R', Fig. 1, raising the rheostat-arm R and inserting the starting-resistance in the armature-circuit. A further movement of the shaft B, and hence the cam C, takes up the lost motions in the opposite direction, and the switch is snapped open the same as it was snapped into contact. It will be noted that in this way the rheostat-arm is always fully raised before the outside circuit is opened. Hence the operator, while maintaining the outside circuit fully closed, is enabled to hold the rheostat-arm at any position and permit or cause it to move to any new position in its arc of action for the purpose of regulating the speed of the motor. While thus under the control of the operator the rheostat-arm R is also regulated by the dash-pot S, whereby it is prevented from descending at more than a certain fixed speed, governed by the admission of the regulating fluid through a suitable stop-cock. Said dash-pot is also provided with a check-valve to admit of its free action in the operation of raising the arm. There is also provided a small retaining or catch magnet Q, in circuit with the starting-resistance, (or other circuit of the motor,) as shown in Fig. 8, Sheet 2. The function of this magnet is by its action upon its armature Q' to release the catch holding the rheostat-arm R. This is provided so that the arm R cannot descend should the current-supply be lacking. This enables the operator to throw in his switch and wait for the current-supply to be turned upon the line, at which instant the magnet Q releases the arm R and it descends, and the motor starts normally. Were this provision not made and the switch thrown in with the supply-current lacking, the arm R would descend and cut out all the starting-resistance, and then should the current-supply be turned on there would be a short circuit through the armature of the motor, which might result disastrously.

The electrical connections of the device are as follows: From any suitable source of current-supply is connected a wire 1, which passes to the contacts O and P, referring to Fig. 8. From the other pole of the current-supply is connected a wire 2, which passes to the contacts O' and P'. Supposing the switch to be moved to its upward position, the blades G^3 and H^3 engage the contacts O and O', respectively, and the current, starting from wire 1, passes through the contact O to the blade G^3, thence to the finger G' and sleeve G, thence through the segment G^2, contact M, wire 3, commutator-brush 4, armature 5, commutator-brush 6, wire 7, resistances 8 and 9, wire 10, contact M', segment H^2, sleeve H, finger H', blade H^3, contact O', and wire 2, thereby completing the circuit for the armature.

The connection for the field, the switch being in the same position, is through wire 1, contact O, blade G^3, finger G', sleeve G, brush I, wire 11, through the fields 12, 13, 14, and 15, wire 16, brush J, sleeve H, finger H', blade H^2, contact O', and wire 2, thereby completing the circuit for the field.

The reversed connections are as follows: The switch being down, starting with wire 1 the current passes to contact P, to blade G^3, to finger G', sleeve G, segment G^2, contact N, wire 10, resistances 9 and 8, wire 7, commutator-brush 6, armature 5, commutator-brush 4, wire 3, contact N, segment H^2, sleeve H, finger H', blade H^3, contact P', wire 24, contact O', and wire 2, thereby completing the armature-circuit. The field-circuit connections are, starting with wire to contact P, blade G^3, finger G', sleeve G, brush I, wire 11, fields 12, 13, 14, and 15, wire 16, brush J, sleeve H, finger H', blade H^3, contact P', wire 24, through contact O', and wire 2, thereby completing the field-circuit. It is hereby noted that the current while being in the same direction in the field-winding as in the previous case is reversed in direction in the armature-winding, thereby reversing the direction of rotation of the motor.

When the motor has a series winding, the

wire 2 is omitted between point 17 and contact O′, and a wire (shown in dotted lines 18) is connected with the wire 2 and runs to the series of windings 19, 20, 21, and 22 to wire 23, to contact P′, and from thence the current goes to the contact O′ through the wire 24. The connections for the electromagnet Q are preferably made from one of the coils in the resistance, as shown by dotted lines in Fig. 8, although this magnet could be included in the field-circuit or an independent shunt-circuit as well.

The segments G^2 and H^2 are of such length that they are never out of connection with one set or the other of the armature-contacts M and M′ and N and N′, respectively, from which it will be seen that there is always a closed circuit including the shunt-field. Therefore the segments G^2 and H^2 short-circuit the armature when the switch is upon center; but as the operating-shaft approaches center the cam C has caused through its action upon the link K the rheostat-arm R to be raised, thus inserting all or part of the starting resistance in the armature-circuit. Hence no injury can be done to the armature or machinery, as there is no sudden stopping like a dead short circuit would cause. Furthermore, this short-circuiting of the armature with resistance inserted acts as a brake tending to stop the motor.

It is by making the segments G^2 and H^2 of sufficient length to bridge over the armature-contacts M and N and M′ and N′, respectively, as shown in Fig. 5, and by providing means for inserting resistance in the armature-circuit when the switch is upon center that I am enabled to accomplish the results herein described.

In a switch intended for reversing the connections between the armature and field of a motor it is necessary in order to always maintain the field in a closed circuit to short-circuit the armature and field terminals when the switch is brought to center—that is, at the instant of reversal. I have described one way in which this may be done, and an alternative form is shown in the connections of Fig. 12, Sheet 3. Here instead of crossing the connections of the armature the main current-supply terminals and the field connections are crossed. Since each armature-terminal is thus always maintained in connection with its respective sleeve G or H, better connection can be made with the armature for mechanical reasons. In this form one of the segments G^2 or H^2, as the case may be, need not necessarily bridge over its respective contact-blades, but one segment must bridge the shunt-contact and the other segment must be sufficiently long to maintain contact with the blades that it is leaving until the longer segment begins to bridge over, when the field-contacts are short-circuited through H^2, for instance, as shown in the drawings.

The above-described mechanism will be found very desirable in the electric-motor mechanism of elevators, although it is capable of use wherever it is desired to operate and control an electric motor for any purpose whatever.

Having thus fully described my invention, I claim—

1. The combination with a source of current-supply and an electric motor, of a reversing-switch composed of two simultaneously-moving contact portions interposed between the source of current-supply and the motor, said switch being adapted to make electrical connection with the source of current-supply and with both the armature and field circuits of the motor, the parts making contact with the field and armature circuits being adapted to maintain said field and armature circuits always in connection with the main body of the switch, and means whereby the starting-resistance is always inserted in the armature-circuit immediately before the switch breaks connection with the source of current-supply.

2. The combination with a source of current-supply and an electric motor, of a reversing-switch composed of two simultaneously-moving contact portions interposed between the source of current-supply and the motor, said switch being adapted to make electrical connection with the source of current-supply and with both the armature and field circuits of the motor, the parts making contact with the field and armature circuits being adapted to maintain said field and armature circuits always in connection with the main body of the switch, and thereby always including the field of the motor in a closed circuit, means whereby the starting-resistance is always inserted in the armature-circuit immediately before the switch breaks connection with the source of current-supply and means for automatically snapping said contact portions into and out of connection with said source of current-supply.

3. The combination with a source of current-supply and an electric motor of a reversing-switch interposed between the source of current-supply and the motor, a portion of said switch being adapted to make electrical connection with the source of current-supply, other portions being adapted to make electrical connection with the armature and field circuits and always maintaining said circuits in electrical connection with the main body of the switch, whereby during the instant of reversal the armature and field terminals are temporarily short-circuited, and means whereby resistance is inserted in the armature-circuit whenever the switch is brought to said central or short-circuiting position, thus always keeping the field in a closed circuit, thereby preventing sparking and strain upon the field insulation.

4. The combination with a source of current-supply and an electric motor of a revers-

ing- switch interposed between the source of current-supply and the motor, a portion of said switch being adapted to make electrical connection with the source of current-supply, other portions being adapted to make electrical connection with the armature-circuit, and the field-circuit being in continuous electrical contact with the main body of the switch; said armature and field portions being adapted to short-circuit the armature-terminals during the instant when the switch is upon center, and means whereby resistance is inserted in the armature-circuit whenever the switch is brought to said central or short-circuiting position, thus always keeping the field in a closed circuit, thereby preventing sparking and strain upon the field insulation.

5. The combination with a source of current-supply and an electric motor of a reversing-switch interposed between the source of current-supply and the motor, a portion of said switch being adapted to make electrical connection with the source of current-supply, other portions being adapted to make electrical connection with the armature and field circuits and always maintaining said circuits in electrical connection with the main body of the switch, whereby during the instant of reversal the armature and field terminals are temporarily short-circuited, thus always keeping the field in a closed circuit, thereby preventing sparking and strain upon the field insulation, and means for automatically snapping the contact portions of the switch into and out of connection with the source of current-supply.

6. The combination with a source of current-supply and an electric motor of a reversing-switch interposed between the source of current-supply and the motor, a portion of said switch being adapted to make electrical connection with the source of current-supply, other portions being adapted to make electrical connection with the armature-circuit, and the field-circuit being in continuous electrical contact with the main body of the switch; said armature portions being adapted to short-circuit the armature-terminals when the switch is upon center, means whereby resistance is inserted in the armature-circuit whenever the switch is brought to said central or short-circuiting position, thus always keeping the field in a closed circuit, thereby preventing sparking and strain upon the field insulation, and means for automatically snapping the contact portions of the switch into and out of connection with the source of current-supply.

7. The combination with a source of current-supply and an electric motor, of a reversing-switch interposed between the source of current-supply and the motor, a portion of said switch being adapted to make electrical connection with the source of current-supply, other portions being adapted to make electrical connection with the armature-circuit, and the field-circuit being in continuous electrical contact with the main body of the switch; said armature portions being adapted to short-circuit the armature-terminals when the switch is upon center, means whereby resistance is inserted in the armature-circuit whenever the switch is brought to said central or short-circuiting position, snapping mechanism consisting of a spring-tension arm with high and low points thereon, and a collar loose on the switch-operating shaft and having lost-motion connection therewith and provided with arms coöperating with said spring-tension arm and having lost-motion connection with the contact portions of the switch whereby the latter are thrown quickly into and out of electrical connection to prevent sparking.

8. The combination with a source of current-supply and an electric motor, of a reversing-switch interposed between the source of current-supply and the motor, a portion of said switch being adapted to make electrical connection with the source of current-supply, other portions being adapted to make electrical connection with the armature-circuit, and the field-circuit being in continuous electrical contact with the main body of the switch; said armature portions being adapted to short-circuit the armature-terminals when the switch is upon center, means whereby resistance is inserted into the armature-circuit whenever the switch is brought to said central or short-circuiting position, snapping mechanism consisting of a spring-tension arm with high and low points thereon, and a collar loose on the switch-operating shaft and having lost-motion connection therewith and provided with arms carrying rollers coöperating with said spring-tension arm and having lost-motion connection with the contact portions of the switch whereby the latter are thrown quickly into and out of electrical connection to prevent sparking.

9. In the electric-motor switch mechanism, the combination of a switch-operating shaft, electrical contact portions carried thereby, a starting-resistance, an arm therefor controlled by the operating-shaft, a magnet included in a circuit controlled by the switch, and an armature for said magnet provided with a catch engaging the resistance-arm, substantially as described.

10. In the electric-motor switch mechanism, the combination of a switch-operating shaft, electrical contact portions carried thereby, a starting-resistance, an arm therefor connected by link mechanism and a cam with the operating-shaft, a magnet included in a circuit controlled by the switch, an armature for said magnet provided with a catch engaging the resistance-arm, and a dash-pot connected to said resistance-arm, and means for regulating the movement of said resistance-arm, substantially as described.

11. In the electric-motor switch mechanism,

the combination of a switch-operating shaft, electrical contact portions carried thereby, a starting-resistance, an arm therefor connected by link mechanism and a cam with the operating-shaft, a magnet included in a circuit controlled by the switch, an armature for said magnet provided with a catch engaging the resistance-arm, and means for regulating the movement of said resistance-arm, substantially as described.

OSCAR F. SHEPARD, JR.

Witnesses:
GEORGE S. BAILY,
CLAUDE PROCUNIAR.