No. 650,196. Patented May 22, 1900.

G. A. SCHOELLER.

SWITCH FOR ELECTRIC MOTORS.

(Application filed Feb. 1, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

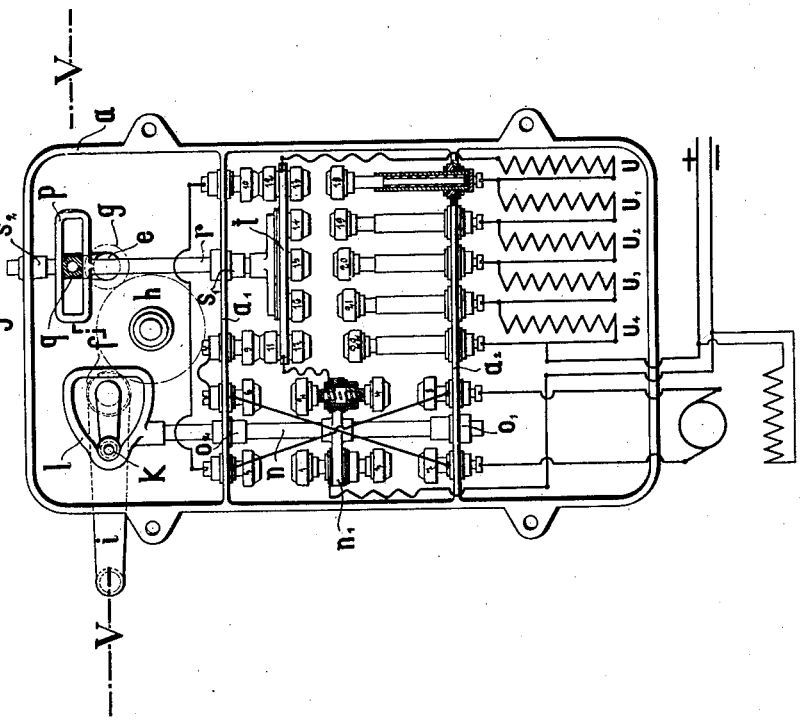
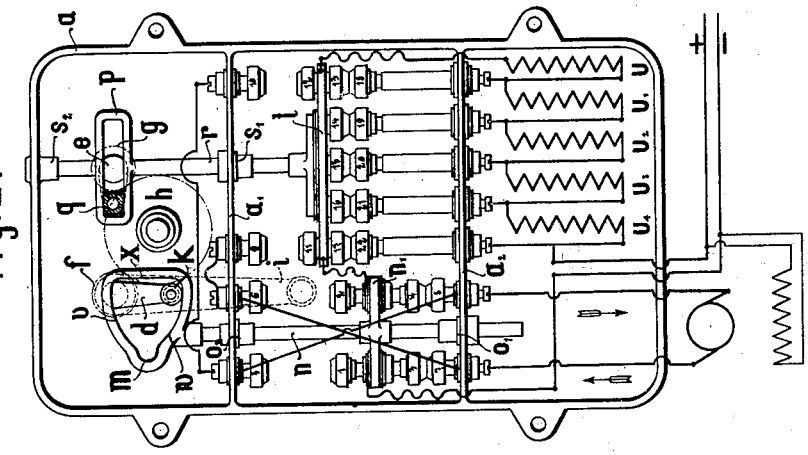


Fig. 2.



Witnesses:
Geo. W. Gissenbaum
C. P. Hendrickson

Inventor:
Gustav A. Schoeller,
by Albert Baumgarten
Atty.

No. 650,196. Patented May 22, 1900.

G. A. SCHOELLER.

SWITCH FOR ELECTRIC MOTORS.

(Application filed Feb. 1, 1900.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 4.

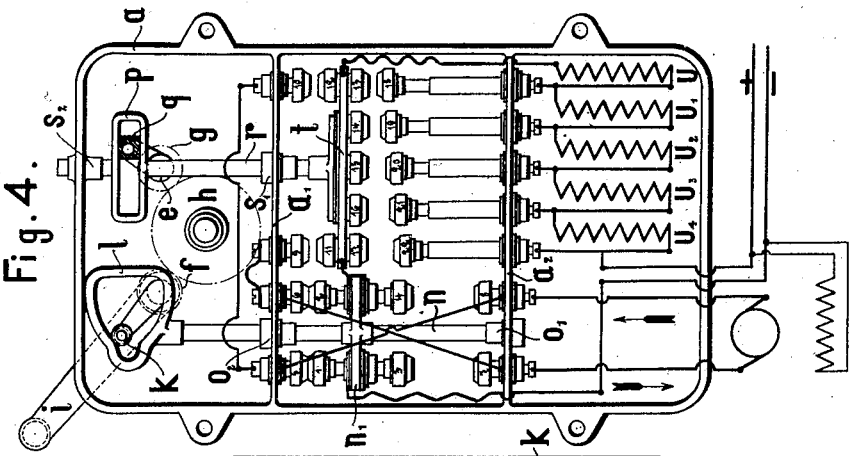


Fig. 5.

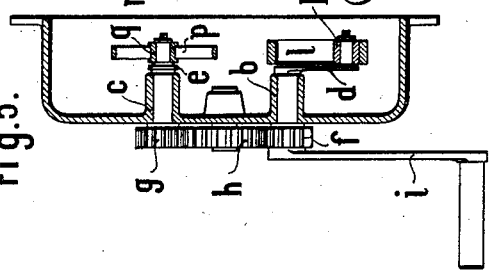
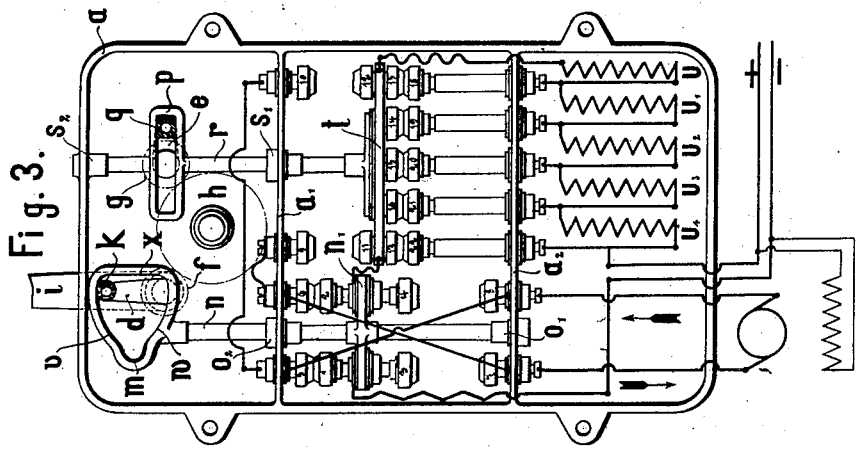


Fig. 3.



Witnesses:
Geo. Eisenbrandt
C. P. Hendrickson.

Inventor:
Gustav A. Schoeller,
by Wm. Aberdeen Jr.
Atty.

UNITED STATES PATENT OFFICE.

GUSTAV A. SCHOELLER, OF MÜLHEIM-ON-THE-RUHR, GERMANY, ASSIGNOR TO FRIED. KRUPP, OF ESSEN, GERMANY.

SWITCH FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 650,196, dated May 22, 1900.

Application filed February 1, 1900. Serial No. 3,571. (No model.)

To all whom it may concern:

Be it known that I, GUSTAV A. SCHOELLER, engineer, a citizen of the German Empire, residing at 2 Gustavstrasse, Mülheim-on-the-Ruhr, Germany, have invented certain new and useful Improvements in Switches for Electric Motors, of which the following is a specification.

My invention refers to improvements in switches for starting, stopping, and reversing electromotors and for regulating resistances.

The invention consists, essentially, in arranging all the movable contact-pieces to travel in parallel straight lines, the starting-contacts for forward or backward motion being actuated in opposite directions from the central or rest position, while the remaining contacts for regulating the resistances and for short-circuiting are actuated in one and the same direction from the position of rest. The contacts are actuated by two crank-gears, the cranks of which are placed at an angle of ninety degrees and are so connected as to run together. The reversing-gear is so arranged that after the circuit is closed for forward or backward motion of the motor the starting-crank may be turned farther, together with the other crank, without causing further motion of the starting-contacts.

My invention will be best understood by reference to the annexed drawings, illustrating an example of applying my invention to a shunt-motor.

In the drawings, Figure 1 is an elevation of the apparatus in the position of rest. Fig. 2 is a similar elevation with full current for forward motion. Fig. 3 is an elevation with full current for backward motion. Fig. 4 is an elevation showing the reversing-gear in the position giving full contact for forward motion while all of the resistances are still connected in series in the circuit. Fig. 5 is a section on the line V V, Fig. 1, showing the crank-gear in detail.

In the drawings, the letter a designates the casing divided into three compartments by two cross-pieces a' and a^2, between which cross-pieces the several circuit-closers are placed. The reversing apparatus consists of a sliding rod n, guided in fixed bearings o' o^2 of the cross-pieces a' and a^2 and carrying four contact-pieces 1, 2, 3, and 4. These contact-pieces are connected to a cross-head n', rigidly attached to the rod n, but electrically insulated from the cross-head n' in such a manner that by themselves 1 and 3 are electrically connected and in the same manner 2 and 4, and the several contacts are made yielding by springs, as shown in Fig. 1, (contacts 2 and 4.) Opposite the contact-pieces 1 and 2 and upon the cross-piece a' are secured the circuit-closing pieces 5 and 6, and upon the cross-piece a^2, opposite the contact-pieces 3 and 4, the circuit-closing contact-pieces 7 and 8, all of them electrically insulated from the cross-pieces a' or a^2, so that when the rod n is moved upward the contacts 1 5, as well as 2 6, are closed, while by a motion in opposite direction the contacts 3 7 and 4 8 are closed. The diagonally-opposite contact-pieces 5 and 8 are electrically connected in the usual manner and also the diagonally-opposite contact-pieces 6 and 7, as indicated in Figs. 1 to 4, where the connecting-wires are shown to cross each other.

The contact-pieces for the resistances are arranged in a manner similar to the reversing-contacts.

r is a sliding rod guided in fixed bearings s' s^2. To the lower end of this sliding bar r and electrically insulated therefrom is fixed the conducting cross-head t, which on its under side carries the contact-pieces 13 14 15 16 17, while opposite the latter spring contact-pieces 18, 19, 20, 21, and 22 are secured to the cross-piece a^2. The contact-pieces 18 to 22 are electrically connected each to one of the resistance-coils u u' u^2 u^3 u^4, which are connected in series. The contact-pieces 18 to 22 are stepped off in such a manner that when the rod r is moved down they do not all at the same time come into contact with the opposite pieces 13 14 15 16 17, but one after the other. On its upper side the carrier t is provided with two circuit-closing contact-pieces 11 and 12, opposite which there are placed on the cross-piece a' two insulated spring contact-pieces 9 and 10. These opposite contact-pieces 9 and 11, as well as 10 and 12, come in contact when the rod r is moved upward,

their object being to short-circuit the armature-circuit when it is open, so as to cause a quick stoppage of the motor.

The rods n and r, carrying the contact-pieces, are actuated by the two cranks d and e, the shafts of which are mounted in bearings b and c of the casing, the cranks being placed at an angle of ninety degrees. Pinions f and g are fixed on the outer ends of the crank-shafts and are both in engagement with an intermediate gear-wheel h, the actuating hand-lever i, as shown, being fixed on the shaft of the pinion f, although it may be fixed to the axle of g or of the gear-wheel h. Other means may be used for connecting the two cranks, so as to move together, such as a toothed bar, or a chain and sprocket wheels. Upon its pin the crank d carries a roller k, which engages a loop l, secured to the rod n of the reversing-switch. This loop consists of an open frame with a short slot m, engaged by the roller k of the crank d when the latter is in its horizontal position. To the slot m are joined faces v and w in the form of the arc of a circle, the radius of which is equal to the sum of the radii of the crank d and of the roller k. The frame or loop l, and consequently the rod n, is raised or lowered when the crank d is turned while the roller k is engaging the slot m. When the loop l and the rod n have reached their upper position, as in Figs. 3 and 4, the roller k, leaving the slot m, slides along the arc v without further action. Equally, when the loop l and the rod n have reached their lower position, as in Fig. 2, the roller k, leaving the slot m, slides along the arc w without further action. The vertical face x of the loop limits the range of motion of the crank d to one hundred and eighty degrees. The crank e is connected to the straight loop p, placed at right angles to the rod r, by a sliding piece q, pivoted to the crank-pin.

The operation of the apparatus is as follows: When the hand-lever i is turned from the position of rest, Fig. 1, into the position shown in Fig. 4, the roller k, engaging the slot m of the loop l, lifts the loop, and with it the rod n and the circuit-closing contact-pieces connected thereto, until the contact-pieces 1 and 5 and 2 and 6 come together. During this part of the motion of the circuit-closer caused by the crank d the crank e is turned the same angle as the crank d; but since the crank e at the commencement of the motion stood vertical (at an angle of ninety degrees to the crank d) the loop p, and with it the rod r, is moved but little vertically down, so that while the contacts 9 and 11, as well as 10 and 12, are broken the contacts of the resistance-coils are not closed. The current now passes in the well-known manner from the + wire in series through the resistances u^4, u^3, u^2, u', and u, through the contact-carrier t, the contact-pieces 2, 6, and 7, and in the direction of the black-winged arrows, Fig. 4, through the armature and over the contact-pieces 8 5 1 to the — wire. When the handle i is turned further up, Fig. 3, the roller k now rolls on the inner face v of the loop l, which is concentric with the center of the crank d, without causing a further motion of the loop and of the contact-pieces connected therewith. The rod n therefore stands still, while during this motion the crank e moves the loop p and through it the contact-carrier t farther down. During this downward motion, while the spring-contacts 18, 19, 20, and 21 yield, the coils u, u', u^2, u^3, and u^4 of the resistances are short-circuited in succession by the contacts 13 and 18, 14 and 19, 15 and 20, 16 and 21, 17 and 22 until finally the several parts take the positions shown in Fig. 3, where the motor is fully switched in and the current from the positive pole passes over the contact-pieces 22 17 2 6 7 and in the direction of the black-winged arrows through the armature over the contact-pieces 8 5 1 to the — wire. When the hand-lever i is turned back from the position of Fig. 3 to the position of rest, Fig. 1, the above-described changes take place in the opposite order—that is to say, the resistance-coils are first switched in successively—then the current is broken by the switch, and then the armature short-circuited by the contacts 9 11 and 10 12. When the hand-lever i is moved downward from the position of rest, Fig. 1, as in Fig. 2, both loops l and p move downward, and the contacts 3 7 and 4 8 are first closed. The current then passes from + through the resistances over the carrier t, the contact-pieces 4 8 in the direction of the white-winged arrows, Fig. 2, through the armature and over the contacts 7 3 back to the — wire—that is to say, the motor is reversed. During further downward movement of the hand-lever i successive short-circuiting of the resistance-coils takes place in the same manner described above in relation to Fig. 3.

It is evident that the above-described arrangements, instead of being applied to a shunt-motor, may also be used for starting and regulating a motor in the main circuit. In this latter case the contact-pieces for short-circuiting the armature above described may be conveniently used for starting an electric brake.

What I claim as new is—

1. In a switch for electric motors, a pair of double spring contact-pieces for starting, stopping and reversing, movable in a straight line in opposite directions from the position of rest; corresponding sets of fixed contact-pieces facing the former on opposite sides of the position of rest; electrical connections directing the current to the armature in one direction when the movable contact-pieces bear against one of the fixed sets, and in opposite direction when they bear against the other set, in combination with resistance and short-circuiting contacts movable parallel to the former against fixed contacts in one and the

same direction for either direction of the motion of the motor, substantially as shown and described.

2. In a switch for electric motors, a pair of double spring contact-pieces for starting, stopping and reversing, movable in a straight line in opposite directions from the position of rest; corresponding sets of fixed contact-pieces facing the former on opposite sides of the position of rest; electrical connections directing the current to the armature in one direction when the movable contact-pieces bear against one of the fixed sets, and in opposite direction when they bear against the other set, in combination with resistance and short-circuiting contacts movable parallel to the former against fixed contacts in one and the same direction for either direction of the motion of the motor, and cranks placed at right angles to each other and sharing their angular motion, one crank actuating the reversing-switch, the other actuating contacts for resistances and short-circuiting the armature-current, substantially as specified.

3. In a switch for electric motors, a pair of double spring contact-pieces for starting, stopping and reversing, movable in a straight line in opposite directions from the position of rest; corresponding sets of fixed contact-pieces facing the former on opposite sides of the position of rest; electrical connections directing the current to the armature in one direction when the movable contact-pieces bear against one of the fixed sets, and in opposite direction when they bear against the other set, in combination with resistance and short-circuiting contacts movable parallel to the former against fixed contacts in one and the same direction for either direction of the motion of the motor, a crank d, a shaft-rod n to which the movable double spring-contacts are attached by means of a cross-head n', and a loop l provided with a slot m engaged by the crank d and with upper and lower faces concentric to the crank-shaft, and a crank e geared to the crank d and placed at right angles to the same, said crank e actuating the contacts for short-circuiting the armature-current and the resistance-coils, substantially as specified.

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

GUSTAV A. SCHOELLER.

Witnesses:
WILLIAM ESSENWEIN,
P. LIEBER.