(No Model.) 2 Sheets—Sheet 1.

M. MOSKOWITZ.

POLARIZED COMPOUND SWITCH.

No. 542,773. Patented July 16, 1895.

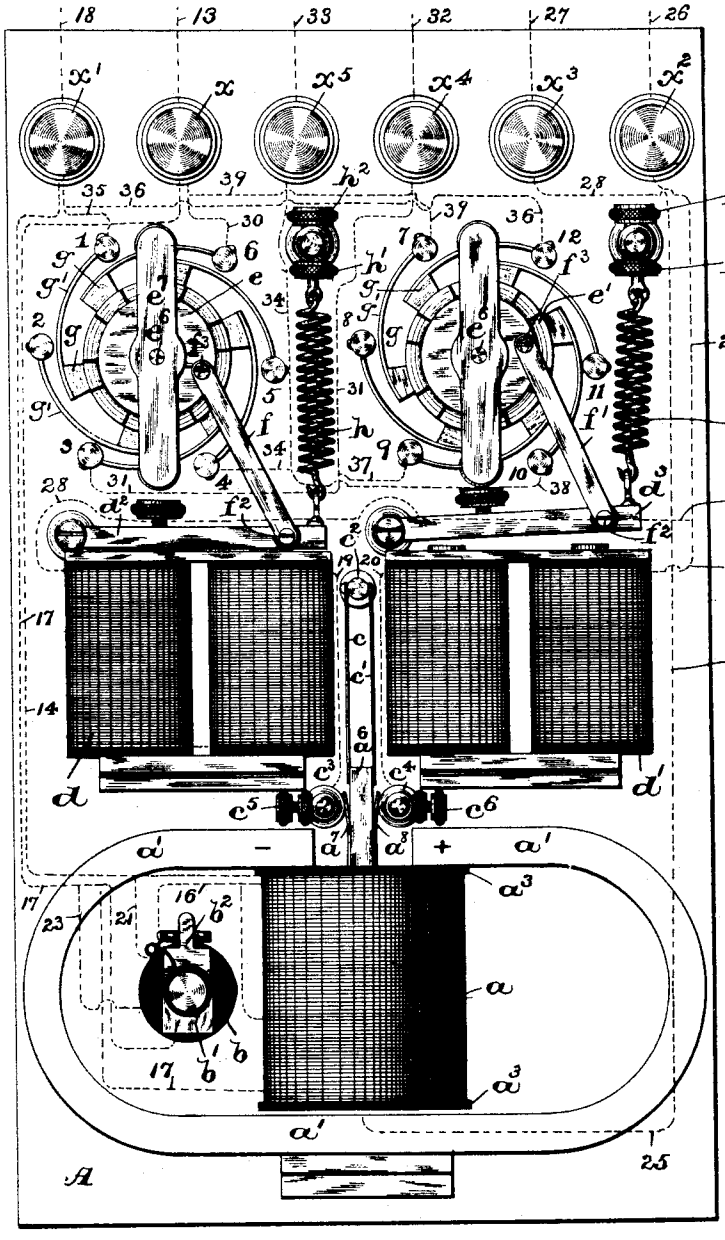

FIG. 1

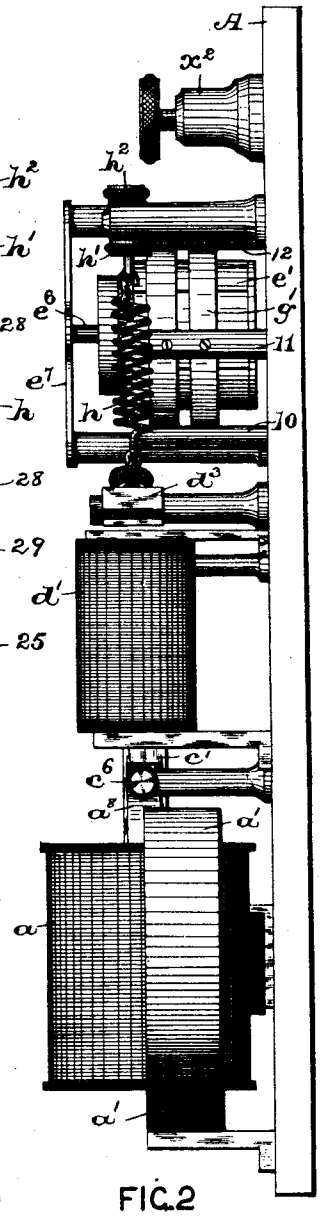

FIG. 2

WITNESSES:

Mary J. Drusdell

Wm. H. Campfield, Jr.

INVENTOR:

MORRIS MOSKOWITZ.

BY

Fred'k C. Fraentzel,

ATTORNEY

(No Model.) 2 Sheets—Sheet 2.

M. MOSKOWITZ.

POLARIZED COMPOUND SWITCH.

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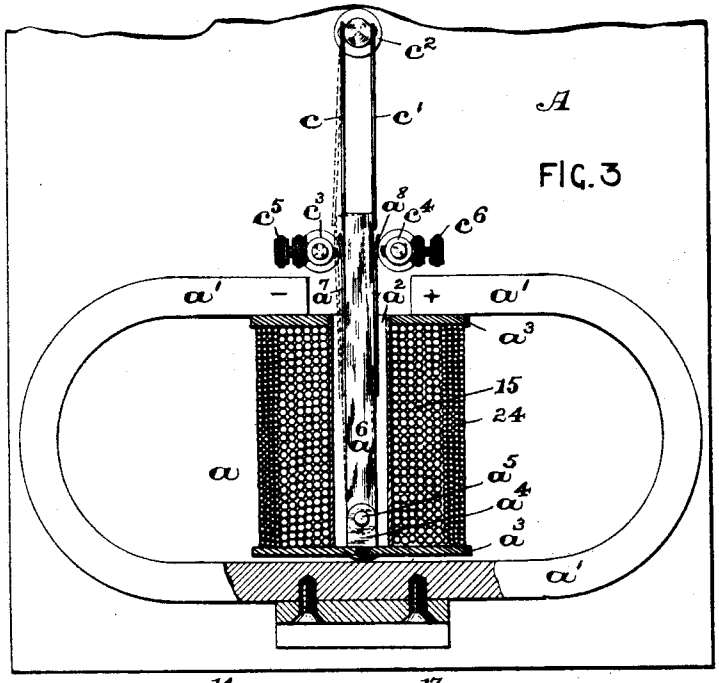

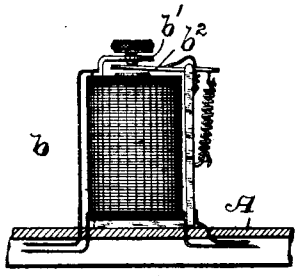

FIG. 4

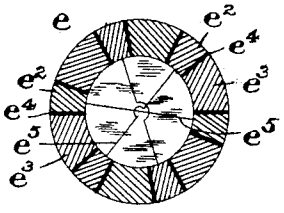

FIG. 5

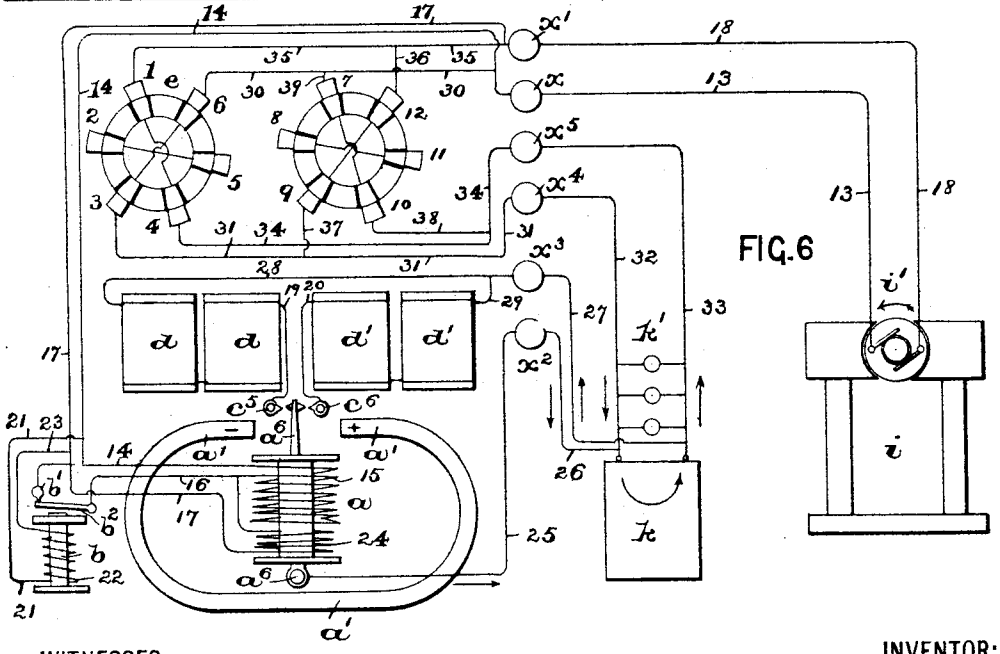

FIG. 6

WITNESSES:

Marcy J. Brusdell

Wm. H Canfield. Jr.

INVENTOR:

MORRIS MOSKOWITZ.

BY

Fred C. Fraentzel,

ATTORNEY

UNITED STATES PATENT OFFICE.

MORRIS MOSKOWITZ, OF NEWARK, NEW JERSEY, ASSIGNOR TO THE NATIONAL ELECTRIC CAR LIGHTING COMPANY, OF WEST VIRGINIA.

POLARIZED COMPOUND SWITCH.

SPECIFICATION forming part of Letters Patent No. 542,773, dated July 16, 1895.

Application filed May 2, 1895. Serial No. 547,837. (No model.)

To all whom it may concern:

Be it known that I, MORRIS MOSKOWITZ, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Polarized Compound Switches; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters and figures of reference marked thereon, which form a part of this specification.

My present invention has reference to improvements in pole-changers to be used in connection with dynamo-electric machines subject to armature reversal; and my present invention has for its primary object to provide a novel form of pole-changer, having for its purpose to properly direct the current through the secondary or storage battery or batteries employed in an electric system in which my novel form of pole-changer is employed.

In my previous application for Letters Patent, filed February 27, 1895, Serial No. 539,865, I have clearly illustrated and described one form of polarized compound switch or pole-changer to be used in systems of car lighting, heating, &c., where the source of electrical energy is derived from a dynamo arranged on a car-wheel axle forming the armature-shaft, and which is consequently subject to reversal of rotation. The purpose of the pole-changer is sufficiently brought out in the specification of my said above-mentioned application, and therefore need not be described in detail herein.

In my present invention I have devised a form of construction of polarized compound switch in which the use of the ordinary mercury-cups and copper contacts are entirely dispensed with, and in which the mechanical action to operate the switch is entirely due to an electromagnetic pull.

My present invention therefore consists in the novel form of pole changer herein shown, and also in the novel arrangements and combinations of parts, such as will be fully described in the accompanying specification and finally embodied in the clauses of the claims appended thereto.

The invention is illustrated in the accompanying sheets of drawings, in which—

Figure 1 is a face view of the pole-changer embodying the principles of my present invention, and Fig. 2 is a side view of the same. Fig. 3 is a detail view of an electromagnet and a permanent magnet, partly illustrated in section to clearly show the arrangement of its pivoted magnetic armature; and Fig. 4 is a side view of an electromagnet for controlling the flow of the electric current through said electromagnet, illustrated in Fig. 3. Fig. 5 is a cross-section of one of a pair of small commutators employed in connection with this form of polarized compound switch. Fig. 6 is a diagrammatic representation of the circuit-connection between the polarized compound switch and the dynamo and secondary battery.

Similar letters and figures of reference are employed in each of the above-described views to indicate like parts.

I will first describe the construction of the pole-changer and then, in a general way, I will describe its operation in connection with the dynamo and the storage-battery illustrated in said Fig. 6.

In Figs. 1 and 2, A indicates the base of the polarized compound switch. The switch itself is made with a compound-wound electromagnet a, which is in circuit with the main circuit and also with a small controlling-magnet b, said electromagnet a being arranged in a permanent magnet a', preferably of the horse-shoe type, as clearly shown in Fig. 3.

The electromagnet a is made in the manner of a solenoid, having a brass or other suitable tube a^2 arranged between the two ends a^3, which are of a non-conducting material. Said lower end a^3 is provided within said tube a^2 with a suitable bearing a^4, to which is pivotally secured on a pin a^5 the armature a^6, which is preferably of iron or steel, and which by induction is subject to variable polarization. In operative contact with the opposite sides of the upper end of said armature a^6 are the free ends of suitable springs c and c', which are fastened or secured to a post c^2 on the base A, said springs being employed for the

purpose of normally holding the upper end of said armature a^6 directly between two suitable posts c^3 and c^4 and the spring-contacts a^7 and a^8 on the sides of said armature a^6 away from the points of the adjustable contact-screws c^5 and c^6, as clearly indicated in Figs. 1 and 3.

As will be seen from said Fig. 1, d and d' are a pair of electromagnets, being respectively provided with the spring-actuated armature-bars d^2 and d^3, which are mechanically connected by means of a pair of links f and f', respectively, with suitable commutators e and e'. Said links f and f' are pivotally secured to said armature-bars d^2 and d^3 by means of suitable pins or screws f^2, and the opposite ends of said links are pivotally connected by means of screws or pins f^3 to said commutators e and e', substantially as shown. Thus it will be seen that when either one of said armature-bars d^2 or d^3 is attracted by its electromagnet d or d' either one of said commutators e or e' is partially rotated to establish a complete circuit, as will be understood.

Each commutator comprises therein certain commutator-sections e^3 and e^3, insulated from each other by a suitable insulating material e^4, substantially as shown in Fig. 5, said sections e^2 being suitably connected by a suitable connection e^5, while the sections e^3 are open-circuited, there being no electrical connection between them. Said sections or segments e^2 and e^3 are suitably secured between suitable end plates having a pivotal support e^6, arranged to partially rotate in a suitable bearing-bar e^7 and a suitable bearing in the base A, as will be clearly evident from an inspection of Fig. 2. In sliding contact with the outer surfaces of said sections e^2 and e^3 of each commutator e and e' are suitable brushes g, arranged on spring-arms g', secured to suitable binding-posts 1, 2, 3, 4, 5, 6, and 7, 8, 9, 10, 11, and 12, connected with the different circuits, for the purposes to be fully stated hereinafter.

As has been stated, the armature-bars d^2 and d^3 of the electromagnets d and d' are spring-actuated, being connected with suitable tension-springs h, connected with the adjusting-screws h' and h^2 in the usual manner.

I will now describe the operation of the parts comprising my novel form of polarized compound switch and the electrical circuits connecting the same with a suitable dynamo i and a storage-battery k and lamps k' or other electric translating devices in the circuits. It is briefly as follows: As will be seen more especially from an inspection of Fig. 6, a closed circuit is maintained through the armature-commutator of the dynamo, and by means of the circuit-wire 13, through binding-post x, wire 14, to low-resistance coil 15 of the electromagnet a, thence through wire 16 and the armature-bar b^2 of the electromagnet b, making contact at b' with the wire 17, to binding-post x' and wire 18, to the dynamo i, so that there will be a current developed through said circuits and the electromagnet a by the residual magnetism of the fields of the dynamo at the time of the starting of the same. Thus it will be understood that a low pressure of, say, about two volts, is sufficient to energize the pivoted armature-magnet a^6 and polarize the same according to the direction of rotation of the dynamo-armature. The upper and variable pole portion of said pivoted armature having been arranged in the field of the powerful permanent magnet a', the poles of which are permanent north and south poles, will, respectively, attract or repel said armature a^6 according to its polarization, due to the direction of the dynamo-armature, causing its contacts a^7 or a^8 to make contact at c^5 or c^6, and by either of the circuit-wires 19 or 20 energizing either of said electromagnets d or d', according to which side the armature-magnet a^6 has been caused to make the contact. By this time, however, the speed of the dynamo-armature having increased, the current coming through the wires 13 and 14 will pass through the wire 21 and the coil 22 of the electromagnet b, and out through the wire 23 into the wire 17, whereby said magnet b becomes sufficiently energized to attract the armature-bar b^2 and break the contact at b', and the circuit is now completed through the wire 14, the coil 15, and the high-resistance coil 24, with the wire 17, back to the dynamo i, as will be clearly understood from Fig. 6.

I have described the current coming from the dynamo i when its armature is rotating in the direction of the arrow i'. Of course, if the direction of rotation of the dynamo-armature is reversed, then the current will come through the wire 18, and in at the binding-post x', passing in opposite direction through the circuits just described, as can be readily traced from Fig. 6. In this manner the free end of the armature-magnet a^6 is made either positive or negative according to the direction of the armature rotation of the dynamo. Said pivoted armature-magnet a^6 is connected by the wire 25 with the binding-post x^2, and wire 26 with the battery or batteries k, from which extends the wire 27 to the binding-post x^3, which in turn connects the electromagnets d or d', by the respective wires 28 and 29 and the wires 19 and 20, with either one of said contacts c^5 or c^6. As soon as contact has been made by the pivoted armature-magnet at either c^5 or c^6, the circuit is completed through either of said electromagnets d or d', the current, when contact is made at c^5, coming from the battery k through the wire 27, binding-post x^3, wire 28 into the electromagnet d, out into wire 19, the armature-magnet a^6, and wire 25 into the binding-post x^2; or, if contact has been made at c^6, throwing the magnet d out of circuit, then the current passes from the battery through wire 27 and wire 29 to the electromagnet d', wire 20, into the armature-magnet a^6, out into wire 25, binding-post x^2, and wire

23 into the battery. Thereby a complete circuit has been established through the battery, the current passing in one and the same direction through the same, irrespective of the direction of the armature rotation of the dynamo, for the purpose of energizing the electromagnets d and d' and controlling the operation of the commutators e and e'. When either one of the electromagnets d or d' has become energized in this manner, the respective armature-bar d^2 or d^3, attracted by the energized electromagnet, will cause a partial rotation of either one of the commutators e or e', operated by the links f and f' connected with the respective commutators, thereby bringing the brushes g in sliding contact with the open-circuited sections e^3 of the operated commutator in contact with the electrically-connected commutator-sections e^2, as will be clearly evident.

Thus it will be seen that the same current generated by the dynamo i, which polarizes the pivoted armature-magnet a^6 in the manner and for the purposes stated, will also feed the battery k or the lights k' by being caused to pass through the battery in one direction, irrespective of the direction of rotation of the dynamo-armature. It is as follows: Suppose the dynamo-armature to be rotating in the direction of arrow i', then the current from the dynamo in passing through the wire 13 to the binding-post x, contact, of course, having been made by the magnet d and its armature-bar d^2, will branch off from the wire 14 into wire 30 into post 6 of the commutator e, through the brush-arm g' and brush g through the electrically-connected commutator-sections e^2 into the oppositely-placed brush g and its arm g' to the post 3. The current next passes through the wire 31 to binding-post x^4 and wire 32 into the battery, through the same, and out into wire 33 to binding-post x^5, thence by wire 34 to post 4 of the commutator e, through the brushes g and their arms g', making contact at 4. The current then passes through the electrically-connected sections e^2 into the brush g and brush-arm g' at the post 1, and thence by wire 35 to binding-post x' and wire 18 back to the dynamo.

When the direction of rotation of the armature of the dynamo is reversed, the armature-magnet a^6 breaks this circuit by making contact at c^6, causing the electromagnet d', by means of its armature-bar d^3 and the link f', to partially rotate the commutator e' to establish an electric circuit through the same, while the electromagnet d is cut out of circuit. The current from the dynamo now passes through the wire 18 to the binding-post x', wires 35 36 to the post 12, the brush g and its arm g' through the commutator e' and out through the opposite brush g and arm g' into the post 9. Then the current passes through the wires 37 31 to binding-post x^4, into wire 32 through the battery k, out therefrom into wire 33 to the binding-post x^5, thence by wires 34 38 into post 10, and the brush g and its arm g' connected therewith through the commutator e' into the opposite brush g and its arm g' at the post 7, and then by wires 39 30 to binding-post x, and finally through the wire 13 back to the dynamo.

By my invention it will be seen that I have devised a sensitive and delicately-operating pole-changer for the main purpose of controlling the direction of flow of current from a dynamo-armature subject to reversal of rotation and variation of speed through a storage-battery or lamps or other translating devices in one and the same direction irrespective of such changes in the dynamo-armature.

From an inspection of Fig. 6 it will be seen that when the dynamo is not in operation and the armature-magnet a^6 is neutral between the contacts c^5 and c^6 the lights k' or other devices can be fed directly from the battery k.

The posts 2 and 5 of the commutator e and the posts 8 and 11 of the commutator e' may be connected with other circuits in which I can arrange other electrical devices and apparatus to be connected in circuit with the storage-battery or with the dynamo.

Having thus described my invention, what I claim is—

1. In a polarized compound switch, the combination, with an electro-magnet subject to variable polarity, of a pair of electro-magnets adapted to be brought in circuit by the action of said electro-magnet of variable polarity, and a pair of commutators controlled by said pair of electro-magnets, said commutators comprising therein, commutator sections e^3 which are open-circuited, and commutator-sections e^2 which are electrically connected, and means connecting said commutators with armature bars of said pair of electro-magnets, substantially as and for the purposes set forth.

2. In a polarized compound switch, the combination, with an electro-magnet subject to variable polarity, of a pair of electro-magnets d and d', having armature bars, a pair of commutators, and link connections between said armature bars and commutators to control said commutators and establish a complete circuit, when said electro-magnet of variable polarity has brought either of said magnets d or d' in circuit, substantially as and for the purposes set forth.

3. In a polarized compound switch, the combination, with an electro-magnet subject to variable polarity, of a pair of electro-magnets d and d', having armature bars, a pair of commutators, and link connections between said armature bars and commutators to control said commutators and establish a complete working circuit, when said electro-magnet of variable polarity has brought either of said magnets d or d' in circuit, said commutators comprising therein, commutator sections e^3 which are open circuited, and commutators e^2 which are electrically connected, substantially as and for the purposes set forth.

4. A polarized compound switch, consisting essentially of an electro-magnet a, a piv-

oted armature magnet a^6 subject to variable polarity, a permanent magnet a', a pair of electro-magnets d and d', adapted to be brought in circuit by the action of said magnet a^6, and a pair of commutators controlled by said electro-magnets d and d'; said commutators comprising therein, commutator sections e^3 which are open-circuited, and commutator sections e^2 which are electrically connected and means connecting said commutators with the armature bars of said magnets d and d', substantially as and for the purposes set forth.

5. A polarized compound switch, consisting essentially, of an electro-magnet a, a pivoted and spring-actuated armature magnet a^6, subject to variable polarity, spring-contacts a^7 and a^8 on said magnet, contacts c^5 and $c,^6$ a permanent magnet a', a pair of electro-magnets d and d', adapted to be brought in circuit by the action of said magnet a^6, and a pair of commutators controlled by said electro-magnets d and d', substantially as and for the purposes set forth.

6. A polarized compound switch, consisting essentially, of an electro-magnet a, a pivoted spring-actuated armature magnet a^6, subject to variable polarity, spring contacts a^7 and a^8 on said magnet, contacts c^5 and c^6, a permanent magnet a', a pair of electro-magnets d and d', adapted to be brought in circuit by the action of said magnet a^6, and a pair of commutators controlled by said electro-magnets d and d', said commutators comprising therein, commutator sections e^3 which are open-circuited, and commutator sections e^2 which are electrically connected, and means connecting said magnets d and d', substantially as and for the purposes set forth.

7. In a polarized compound switch, the combination, with a pair of electro-magnets d and d', having the respective armature bars d^2 and d^3, of a pair of commutators e and e', and links f and f', for operatively connecting said armature bars d^2 and d^3 with said commutators e and e' to control the same, substantially as and for the purposes set forth.

In testimony that I claim the invention set forth above I have hereunto set my hand this 25th day of April, 1895.

MORRIS MOSKOWITZ.

Witnesses:
FREDK. C. FRAENTZEL,
LEON D. ADLER.