No. 670,278, Patented Mar. 19, 1901.

R. J. HUGHES & A. B. SHAW.

REVERSING APPARATUS FOR ELECTRICAL DEVICES.

(Application filed Oct. 13, 1900.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 2,

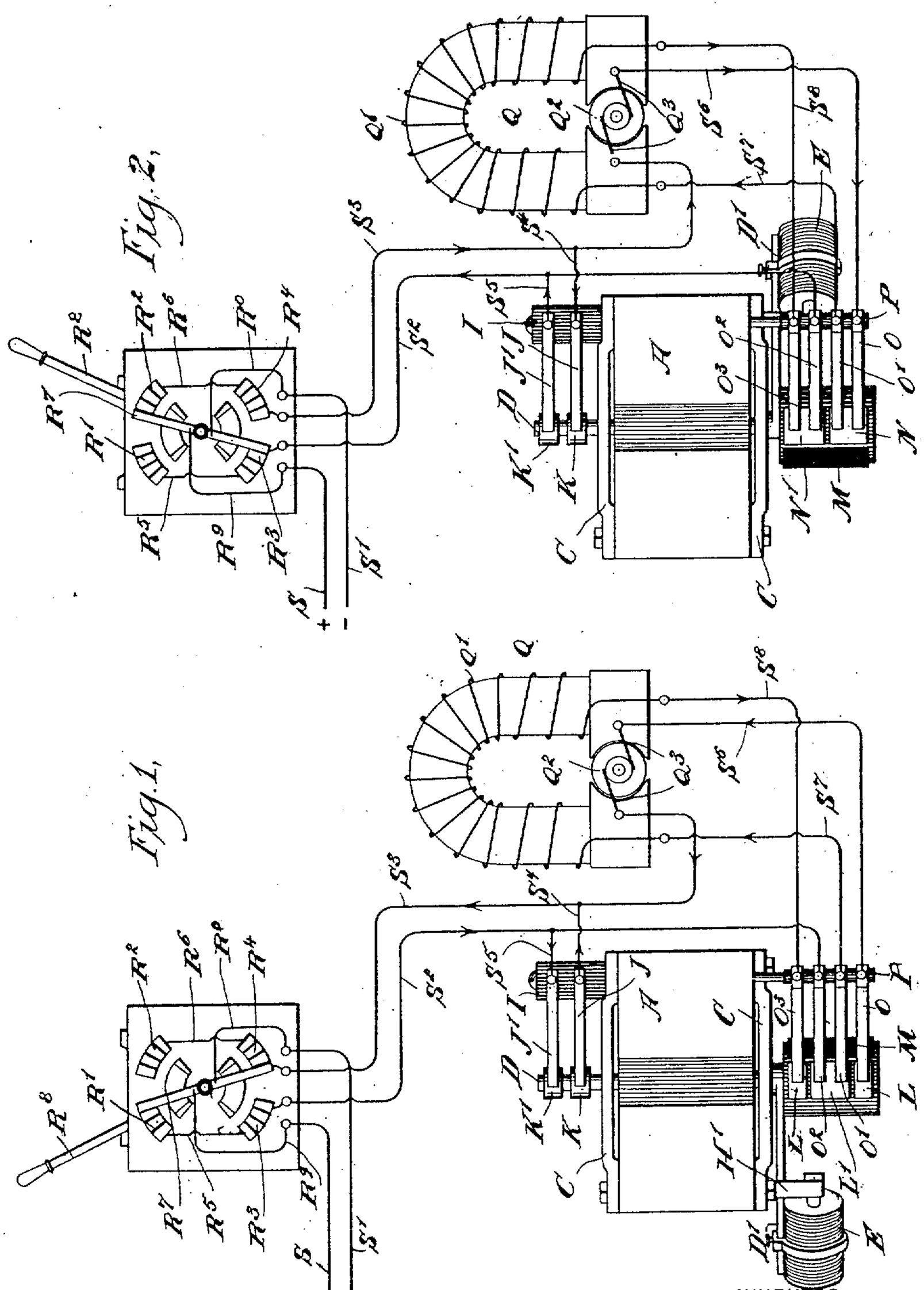

Fig. 1,

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Fig. 3,

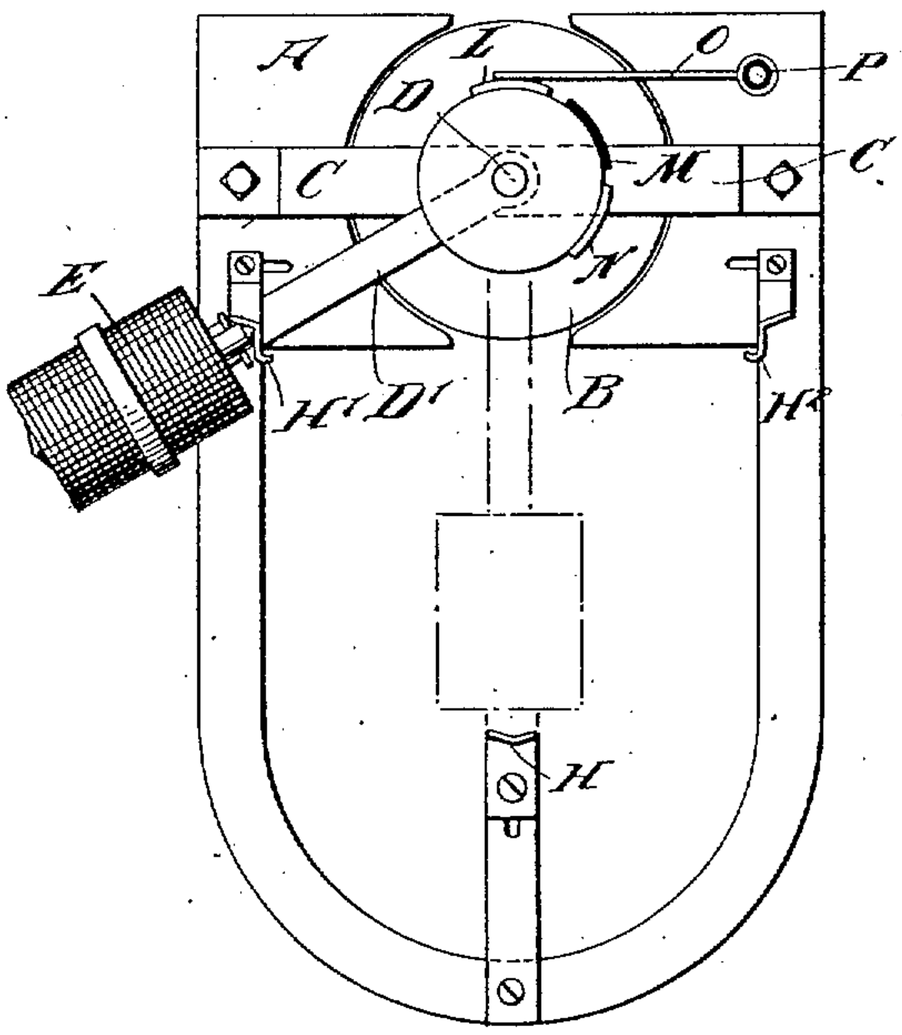

Fig. 4,

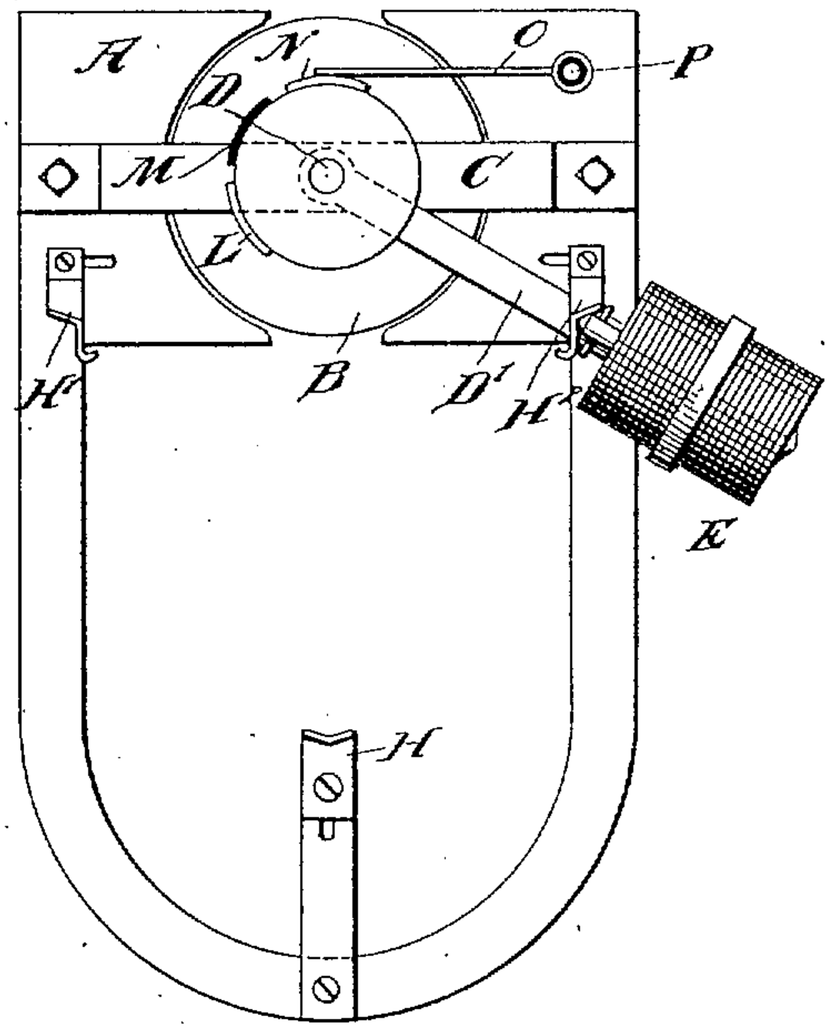

Fig. 5.

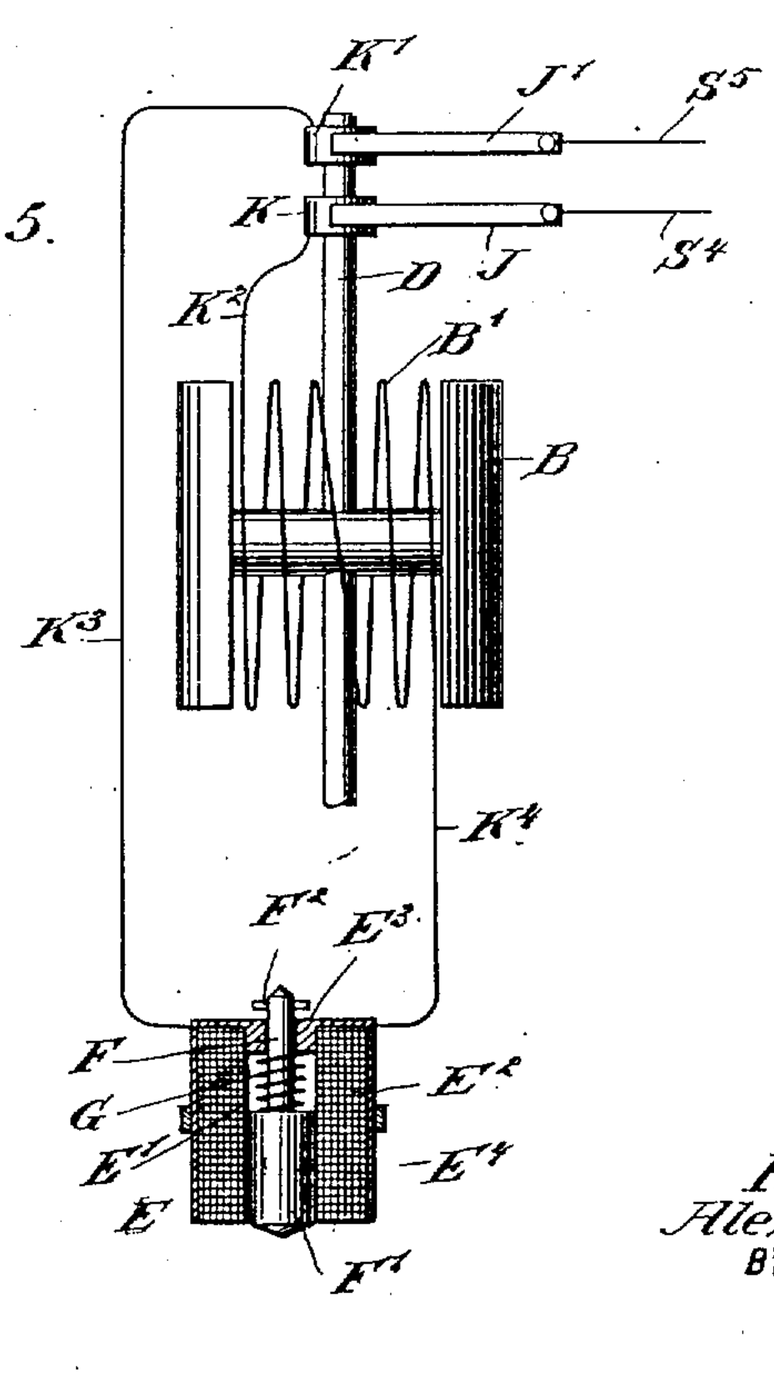

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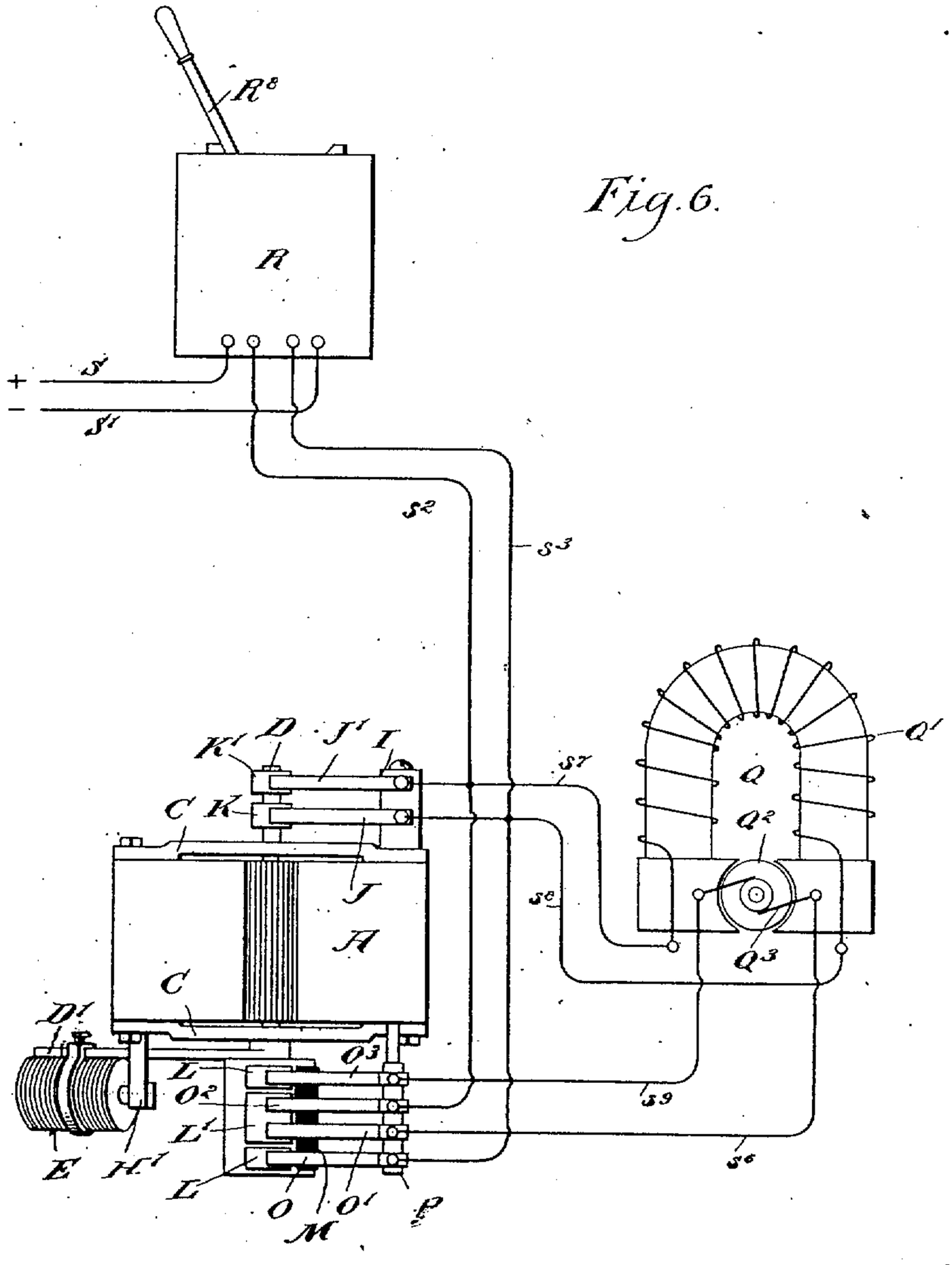
Fig. 6.



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ROBERT JOSEPH HUGHES AND ALEXANDER BRUCE SHAW, OF DUQUESNE, PENNSYLVANIA.

REVERSING APPARATUS FOR ELECTRICAL DEVICES.

SPECIFICATION forming part of Letters Patent No. 670,278, dated March 19, 1901.

Application filed October 13, 1900. Serial No. 32,969. (No model.)

To all whom it may concern:

Be it known that we, ROBERT JOSEPH HUGHES and ALEXANDER BRUCE SHAW, citizens of the United States, and residents of Duquesne, in the county of Allegheny and State of Pennsylvania, have invented a new and Improved Reversing Apparatus for Electrical Devices, of which the following is a full, clear, and exact description.

Our invention relates to electrical reversing devices, and has for its object to provide a simple and sensitive device of this class which will be applicable to two-wire electrical systems, which will change its position automatically, and which may be readily adjusted.

The invention will be fully described hereinafter and the features of novelty pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a diagrammatic view of a reversing apparatus constructed according to our invention and applied to a motor. Fig. 2 shows the same apparatus in the reversed position. Figs. 3 and 4 are elevations of the reversing device proper in two different positions. Fig. 5 is a diagram of the circuit of the reversing-coils, and Fig. 6 is a diagram showing the arrangement of circuits for a shunt-motor.

The apparatus comprises a permanent magnet A, between the curved pole-pieces of which an armature B is mounted to turn in supports C, which when secured to the magnet, as shown, should be of a non-magnetic material. The armature B is mounted upon a shaft D, carrying an arm D', upon which is adjustable lengthwise an electromagnet E. This electromagnet comprises a spool E', with a magnetizing-coil E^2, a core E^3, and preferably a shell E^4 in magnetic connection with the core E^3. The latter is apertured for the passage of the narrow non-magnetic portion F of a magnetic plunger F', a spring G being interposed between the core E^3 and the wide portion F' of the plunger to force the latter outwardly in the electromagnet E. A cross-pin F^2 of the plunger limits its outward movement. The shaft D should be horizontal, or approximately so, so that the electromagnet E will have a tendency to gravitate into the central position. (Shown by dotted lines in Fig. 3.) The magnet E is adapted to be locked in this position by a stationary latch H engaging the beveled outer end of the plunger portion F'. The beveled inner end of the plunger portion F is adapted to be engaged by latches H' H^2, located at the sides of the permanent magnet A. Each of the latches H H' H^2 is adjustable inward and outward to correspond to the adjustment of the electromagnet E on the arm D'.

An insulating-block I, secured to the magnet A or to any other suitable stationary support, carries two brushes J J', engaging collectors K K', secured on the shaft D, but insulated therefrom. One of these—the collector K—is connected by a wire K^2 with the armature-coil B', while the other collector, K', is connected by a wire K^3 with the coil E^2, the latter being connected with the armature-coil by a wire K^4, so that the coils E^2 and B' are connected in series. The other end of the shaft D carries a reversing-switch having three contact-plates L L', of which the outer plates L are in electrical connection with each other, but insulated from the central plate L'. Adjacent to these plates is a plate M of a length about equal to the aggregate length of the plates L L'. On the other side of the plate M are located two plates N N', insulated from each other. All these plates are adapted to be engaged by four contact arms or brushes O O' O^2 O^3, secured to a support P and insulated therefrom. The plate M is made of fiber or other insulating material and has for its purpose to provide a smooth and almost continuous path for the brushes O O' O^2 O^3 in their passage from the set of contact-plates L L' to the set of contact-plates N N'.

Q is a motor of any suitable type having field-coils Q', an armature Q^2, and brushes Q^3 for carrying the current to the armature.

R is a reversing-controller of suitable construction, comprising, for instance, resistance-sections R' R^2 R^3 R^4, two sets of which are connected by wires R^5 R^6, and a reversing-switch R^7, operated by a lever R^8 and having its opposite ends insulated from each

other and connected by wires R^9 R^0 with binding-posts connected by wires S S' with the terminals of a dynamo or other electric generator.

The other electrical connections are as follows: From the resistance-sections R^3 R^4 wires S^2 S^3 lead, respectively, to the brush O^2 and to one of the brushes Q^3. Each of these wires has a branch S^4 S^5 leading to the brushes J J', so as to form a shunt-circuit S^4 J K K^2 B' K^1 E^2 K^3 K' J' S^5. The other brush Q^3 is connected by a wire S^6 with the brush O. The ends of the field-coils Q' are connected by wires S^7 S^8 with the brushes O' O^3, respectively.

The operation is as follows: Assuming the controller to be in the position shown in Fig. 1, the current passes to the line and to the motor as follows: wires S and R^9, switch R^7, resistance-section R', wire R^5, resistance-section R^3, wire S^2, brush O^2, plate L', brush O', wire S^7, coils Q', wire S^8, brush O^3, the two plates L, (since these two are always electrically connected,) brush O, wire S^6, brushes Q^3, and armature Q^2, wire S^3, resistance-section R^4, switch R^7, and wires R^0 S'. At the same time a portion of the current is shunted from the wires S^2 S^3 to pass through the wire S^5, brush J', collector K', wire K^3, coil E^2, wire K^4, coil B', wire K^2, collector-ring K, brush J, and wire S^4. It will be seen that the field-coils and the armature-coils of the motor are connected in series. The current in the shunt-circuit energizes the armature B and the magnet E. The magnetization of the armature B produces a torque sufficient to hold the arm D' in equilibrium, or about so, in the position shown. The energizing of the magnet E causes the plunger F F' to be drawn into the coil E^2, so that the beveled end of the section F is held against the latch H'. The arm D' therefore remains locked so long as the current passes through the circuit. Should the circuit be opened, the spring G will force the plunger F F' out of engagement with the latch H' and release the arm D', which will then drop to the central position. (Illustrated by dotted lines in Fig. 3.) The plunger will first yield and then snap into the latch H, thus locking the arm D' in the central position. In this position the four brushes O O' O^2 O^3 engage the insulating-plate M and are therefore disconnected from each other electrically. Should the circuit then be closed again, the current will pass through the shunt-circuit previously described, which includes the armature-coils B and reversing switch-coils E^2, and the torque produced by the mutual action of the armature B and permanent magnet A will turn the shaft D in one direction or the other, according to the direction of the current, to be locked, as before described, by the engagement of the inner end of the plunger F F' with either of the latches H' H^2. It will be understood that as soon as the magnet E is energized the plunger is withdrawn from the latch H, so that the arm D' is free to swing. The magnet E serves not only to unlock the arm D' from the central position, but acts as a weight governing the angular motion of the shaft D. By a proper adjustment of the magnet on the arm D' and of the latches H H' H^2 a very sensitive action can be obtained. Should the controller be brought into the position shown in Fig. 2, the arm D', with the magnet E, will swing to the right, as shown in Fig. 4, bringing the brushes O O' on the plate N and the brushes O^2 O^3 on the plate N'. The circuit will then be as follows: wires S and R^3, switch R^7, resistance-section R^2, wire R^6, resistance-section R^4, wire S^3, brushes Q^3 and armature Q^2, wire S^6, brush O, plate N, brush O', wire S^7, coils Q', wire S^8, brush O^3, plate N', brush O^2, wire S^2, resistance-section R^3, switch R^7, wire R^9, and wire S'. The current passes through the field-coils in the same direction as before, but in the opposite direction through the armature-coils, thereby reversing the motor. In the shunt-circuit containing the armature-coils B' and the electromagnet-coils E^2 the current flows in the opposite direction to that described with reference to Fig. 1. The action of the magnet E is the same as before—viz., to keep the plunger F F' against the latch, (H^2 in this case,) while the armature B, being now of opposite polarity, turns in the opposite direction to that before described.

To illustrate an application of our invention, we may mention its use upon electrically-operated travelers. These are generally operated with four conducting-wires where reversibility is desired. With our invention two wires (S^2 S^3) will suffice. The controller is stationary—that is, it is not mounted upon the traveler which carries the motor Q—and is located at any suitable place—that is, the traveler carries the motor Q, which drives it and the reversing device consisting of the magnet A and the parts connected therewith. The traveler, with the reversing-device, runs on a suitable track, as usual, and receives its current from the stationary wires S^2 S^3, which extend along the track, or the track-rails themselves may be used as conductors. The current is taken off the said wires by brushes or trolley-wheels, as usual. The controller R is stationary, as above stated, and located at a place where it is readily accessible, so that the direction in which the traveler moves, as well as the starting of the traveler, may be controlled at a distance. It will be understood that the motor is readily started and reversed and that the operation of the reversing-switch constituted by the brushes O O' O^2 O^3 and the plates L L' N N' on the shaft D is entirely automatic upon the manual or other operation of the controller.

We desire it to be understood that various modifications may be made without departing from the nature of our invention. Thus the rocking armature B may control a reversing-switch of a different type from that shown

in the drawings. While we have shown our invention in connection with a series-wound motor, we wish to state it can be applied as well to operate and reverse shunt-motors with the change in connections illustrated by Fig. 6. Here the wires s^2 s^3 lead from the terminals of the controller R to the brushes O^2 and O, respectively, while wires s^7 s^8 connect the ends of the field-coil Q' with the brushes J' and J, respectively, and the brushes O' and O^3 are connected by wires s^6 and s^9, respectively, with the brushes Q^3. We also wish it to be understood that the magnet A might be an electromagnet having its coil in series with the coil B' of the armature B, or a permanent magnet might be substituted for the electromagnetic armature B. This reversal obviously would not affect the operation and is covered in the claims as an equivalent.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, a translating device connected with said wires, a magnet, a rocking armature in the field of said magnet, a shunt-circuit including the coils of said armature, contact-plates held to turn in unison with the armature, brushes arranged to engage said plates, and connections from the said brushes to the line and to the translating device, so arranged as to reverse the translating device when the armature swings from one side to the other.

2. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, an electric motor having field-coils and armature-coils, four contact-brushes, two of which are connected with the ends of the field-coils, the third with one terminal of the armature-coils, and the fourth with one of the line-wires, while the other terminal of the armature-coils is connected with the other line-wire, a magnet, an armature mounted to turn in the field of said magnet, a shunt-circuit from the line-wires to the coils of this armature, and contact-plates held to turn in unison with the armature and arranged to be engaged by said brushes, the plates being disposed in two sets one or the other of which is adapted to engage said brushes according to the position of the armature, one set being constructed to establish the following connections: from the brush connected with the line-wire to one of the brushes connected with the field-coils of the motor, and from the other brush connected with the field-coils of the motor, to the brush connected with the armature-coils of the motor; while the other set of contact-plates is adapted to establish the following connections: from the brush connected with the line-wire to that brush connected with the field-coils which by the first-mentioned set of contact-plates is connected with the armature-coils, and from the other brush connected with the field-coils to the brush connected with the armature-coils.

3. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, an electric motor having field-coils and armature-coils, four contact-brushes two of which are connected with the ends of the field-coils, the third with one terminal of the armature-coils, and the fourth with one of the line-wires, while the other terminal of the armature-coils is connected with the other line-wire, a magnet, an armature mounted to turn in the field of said magnet, a shunt-circuit from the line-wires to the coils of this armature, contact-plates held to turn in unison with the armature and arranged to be engaged by said brushes, the plates being disposed in two sets adapted to engage said brushes according to the position of the armature, and an insulating-plate arranged between said sets of contact-plates and adapted to engage all the brushes simultaneously, one of the sets of contact-plates being constructed to establish the following connections; from the brush connected with the line-wire to one of the brushes connected with the field-coils of the motor, and from the other brush connected with the field-coils of the motor, to the brush connected with the armature-coils of the motor, while the other set of contact-plates is adapted to establish the following connections: from the brush connected with the line-wire to that brush connected with the field-coils which by the first-mentioned set of contact-plates is connected with the armature-coils, and from the other brush connected with the field-coils to the brush connected with the armature-coils.

4. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, a translating device connected with said wires, a magnet, a rocking armature in the field of said magnet, a shunt-circuit including the coils of said armature, latches arranged to hold the armature in its several positions, circuit-changing plates held to turn with the armature, brushes arranged to engage said plates, and connections from the said brushes to the line and to the translating device, so arranged as to reverse the translating device when the armature swings from one side to the other.

5. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, a translating device connected with said wires, a magnet, a rocking armature in the field of said magnet, a shunt-circuit including the coils of said armature, latches arranged to hold the armature in its several positions, electrically-operated latch-controlling devices included in

said shunt-circuit, circuit-changing plates held to turn with the armature, brushes arranged to engage said plates, and connections from the said brushes to the line and to the translating device, so arranged as to reverse the translating device when the armature swings from one side to the other.

6. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, a translating device connected with said wires, a magnet, a rocking armature in the field of said magnet, a shunt-circuit including the coils of said armature, an arm extending from the armature-shaft, an electromagnet mounted on said arm and having its coils in said shunt-circuit, a movable magnetic plunger controlled by said electromagnet, a latch arranged to be engaged by said plunger when not attracted by the electromagnet, additional latches arranged to be engaged by the plunger when the electromagnet is energized, circuit-changing plates held to turn with the armature, brushes arranged to engage said plates, and connections from the said brushes to the line and to the translating device, so arranged as to reverse the translating device when the armature swings from one side to the other.

7. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, a translating device connected with said wires, a magnet, a rocking armature in the field of said magnet, a shunt-circuit including the coils of said armature, an arm extending from the armature-shaft, an electromagnet mounted on said arm and having its coils in said shunt-circuit, a movable magnetic plunger controlled by said electromagnet, a latch arranged to be engaged by said plunger when not attracted by the electromagnet, additional latches arranged to be engaged by the plunger when the electromagnet is energized, the latches as well as the electromagnet being adjustable inward and outward, circuit-changing plates held to turn with the armature, brushes arranged to engage said plates, and connections from the said brushes to the line and to the translating device, so arranged as to reverse the translating device when the armature swings from one side to the other.

8. An electric apparatus, comprising a two-wire line, a reversing-controller for connecting the terminals of an electric generator interchangeably with said wires, a translating device connected with said wires, a magnet, a rocking armature in the field of said magnet, a shunt-circuit including the coils of said armature, an arm extending from the armature-shaft, an electromagnet mounted on said arm and having its coils in said shunt-circuit, a spring-controlled magnetic plunger in the field of said electromagnet, a latch arranged to be engaged by one end of the plunger when the arm is in its central position and no current passes through the electromagnet, additional latches arranged to be engaged by the other end of the plunger when the same is attracted by the energized electromagnet and the latter has swung into a lateral position, circuit-changing plates held to turn with the armature, brushes arranged to engage said plates, and connections from the said brushes to the line and to the translating device, so arranged as to reverse the translating device when the armature swings from one side to the other.

In testimony whereof we have signed our names to this specification in the presence of subscribing witnesses.

ROBERT JOSEPH HUGHES.
ALEXANDER BRUCE SHAW.

Witnesses:
JOHN LONG,
MAUDE FULLER,
GEORGE F. PITTS.