J. H. SANDIDGE.

SYSTEM OF MOTOR CONTROL.

APPLICATION FILED NOV. 22, 1911.

1,054,144. Patented Feb. 25, 1913.

Fig. 2

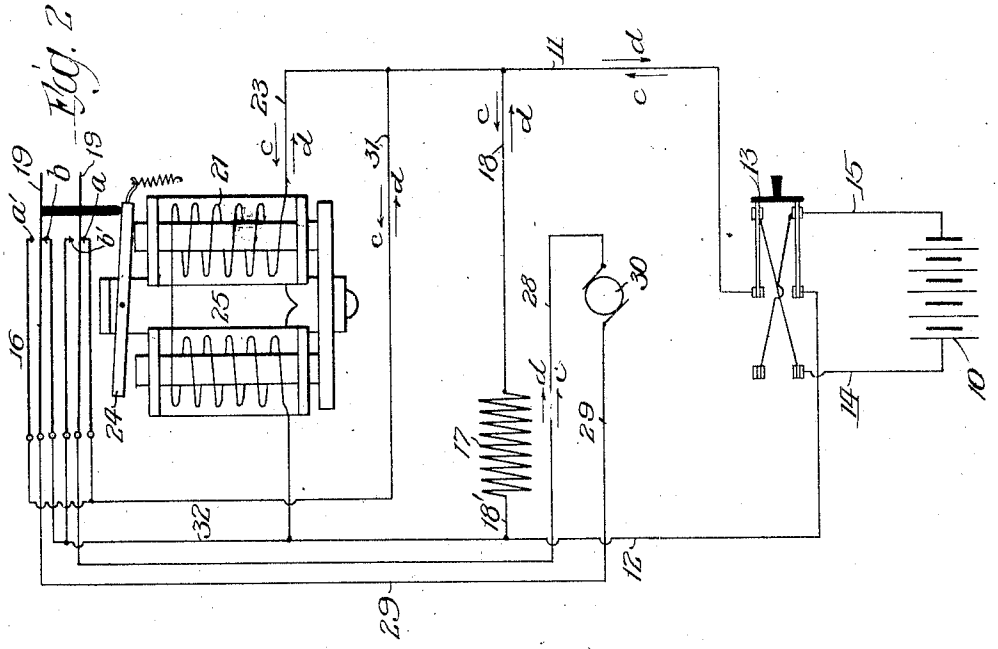
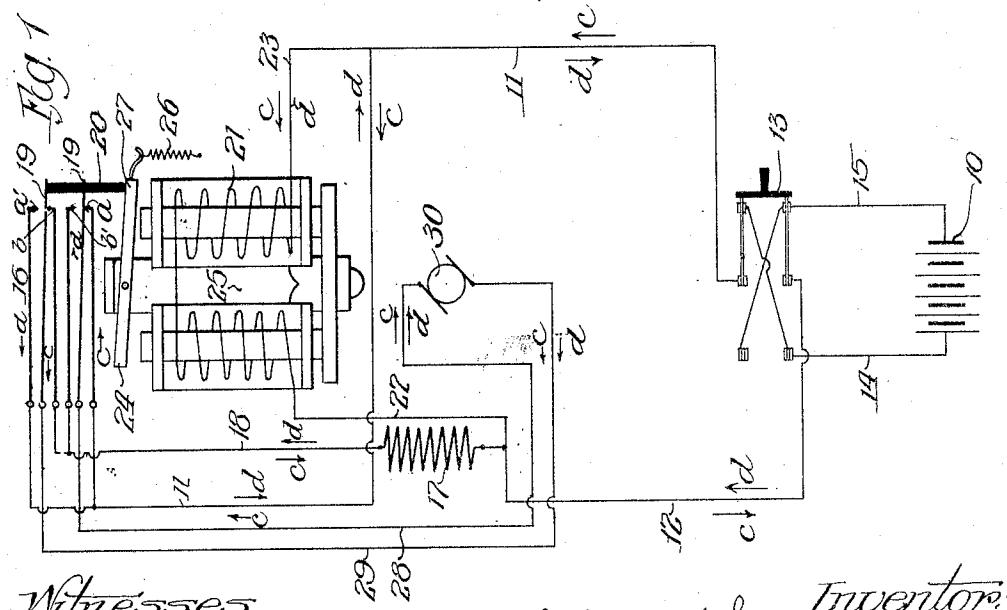


Fig. 1



Witnesses
F. E. Darion
J. C. Carpenter

Inventor:
J. Howard Sandidge
by Luthrum Belt & Fuller
Attys.

UNITED STATES PATENT OFFICE.

JOHN HOWARD SANDIDGE, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO R. K. WINANS, OF CHICAGO, ILLINOIS.

SYSTEM OF MOTOR CONTROL.

1,054,144. Specification of Letters Patent. **Patented Feb. 25, 1913.**

Application filed November 22, 1911. Serial No. 661,794.

To all whom it may concern:

Be it known that I, JOHN HOWARD SANDIDGE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Systems of Motor Control, of which the following is a specification.

My invention relates to a system for the control and reversal of the direction of rotation of D. C. electric motors in general, and particularly the smaller types of motors for which no separate external starting means is required.

One of the principal aims of my invention is to produce a system of wiring of the fewest possible connections, which, coöperating with a polarized relay, will, when the current is reversed in the main or lead lines, cause the motor to rotate in the opposite direction.

Further aims and advantages will appear as the invention is better understood from the following description, which, taken in connection with the accompanying drawing, illustrates one embodiment thereof.

Referring to the drawings:—Figure 1. illustrates diagrammatically my invention as applied to a series wound motor. Fig. 2. illustrates diagrammatically a modification thereof as applied to shunt-wound motors.

On the drawings, a generating source 10 is connected to the main lines 11 and 12 through the throw-over switch 13, which may be of any preferred type, by means of the wires 14 and 15. From the throw-over switch 13 the line wire 11 leads to the automatically controlled throw-over switch 16, and is connected to the terminals *a* and *a'*. The line wire 12 is connected directly to the field of the motor 17, from which the wire 18 leads to the terminals *b* and *b'* of the said switch 16. The switch 16 is provided with the flexible leaves 19, which are adapted to be either in contact with the terminals *a*—*b* or *a' b'*. To the ends of the flexible leaves 19 is attached an upright member 20 of any non-conducting material. A polarized relay 21 is connected between the line of lead wires 11 and 12 in parallel therewith by means of the wire 22 and 23. This polarized relay may be of any desired type. A soft iron bar 24 is pivoted to the upright 25, and is adapted to be rotated by means of the magnetic properties of the relay against the spring 26. To one end of the bar 24 is pivotally connected the non-conducting upright 20 at the point 27. The flexible leaves 19 are connected by means of the wires 28 and 29 to the armature 30 of the motor.

To show the direction of the flow of current throughout the various parts of the system embodying my invention, when the same is in operation, I have provided the series of arrows *c* which indicate the direction of flow when the throw-over switch 13 is positioned as shown in Fig. 1, and the series of arrows *d* which show the direction of flow when the said switch is thrown over to reverse the direction of the current in the wires 11 and 12.

The current flowing from the generator 10 passes through the throw-over switch 13 along the line wire 11 following the path of the arrow *c* to the terminal *a* of the automatic throw-over switch 16, through the lower flexible leaf 19, through the wire 28 to the armature 30, leaving said armature by means of the wire 29, it passes to the upper flexible leaf 19 through the terminal *b*, and by means of the wire 18 to the field 17, from which it passes along the wire 12 through the throw-over switch 13 and wire 15 back to the generator 10. With the current flowing as just indicated, the polarized relay is inoperative due to its polarized properties, and the spring 26 holds the leaves 19 in contact with the points *a* and *b*. When the throw-over switch 13 is operated to reverse the direction of the current throughout the system, the polarized relay being connected by means of the wires 22 and 23, in parallel with the line wires, becomes operative, causing the free end of the iron bar 24 to be attracted downwardly, lifting thereby the ends of the flexible leaves 19 against the force of the spring 26 out of contact with the terminals *a* and *b*, and into

contact with the terminals a' and b'. With the current flowing as indicated by the arrows d it passes now through the field of the motor in the opposite direction. Leaving the field it goes to the terminal b, which being in contact with the lower flexible leaf 19, will direct the current through the wire 28 to the armature 30, from which it will leave through the wire 29 to the upper flexible leaf 19, which now being in contact with the terminal a' will direct it back through the wire 11, throw-over switch 13 and wire 15 to the generator 10. Thus the current is reversed by means of the polarized relay in the field of the motor while the direction of its flow remains unchanged in the armature.

It is obvious that the armature and the field may be interchanged by merely attaching the field terminal 18 to the flexible leaves 19 and the motor wires 28 and 29 to the points b—b', in which case the current will be reversed in the armature, and will remain the same in the field when the current in the system is reversed.

A modification of the system is shown in Fig. 2, wherein a shunt-wound motor replaces the series motor in the system disclosed in Fig. 1. In this case the field 17 is permanently placed in parallel with the line wires 11 and 12 by means of the wires 18 and 18'. The armature 30 is as before connected to the flexible leaves 19; the points a and a' are connected together and to the line wire 11 by means of the wire 31, and the points b and b' are connected to the line wire 12 by means of the wire 32.

The operation of the system as applied to shunt-wound motors is substantially the same as when it is applied to series wound motors, the series of arrows c and d being employed to show the direction of the flow of current when the switch 13 is in its direct and reversing positions respectively. The current leaves the generator 10, passes through the throw-over switch 13, through the line wire 11 to the terminal a, through the flexible lower leaf 19, thence through the armature 30, and back through the upper leaf 19 to the terminal b, and back to the generating source through the wires 32, 13 and 14. When the switch 13 is thrown over to reverse the current through the field and the polarized relay, it will flow as indicated by the arrows d, and will pass up the line wire 12 along the wire 32 to the terminal b', and as the current flowing in this direction renders the polarized relay operative, the flexible leaves 19 move out of contact automatically through the agency of the polarized relay, with the terminals a—b into contact with the terminals a'—b'. The current having arrived at the point b' then passes along the lower leaf 19 through the wire 28 as before into the armature 30, and back to the upper leaf 19 from whence it reaches the terminal a', and returns to the generator through the wires 31, 11 and 15.

It is obvious that to reverse the direction of rotation of a motor equipped with this system of wiring, it is only necessary to reverse the current to the system by means of the throw-over switch 13. The polarized relay which in all cases is connected in parallel is inoperative when the current enters through the wire 11, and the spring 26 holds the flexible leaves 19 in contact with the points a and b. When, however, the current enters by means of the line wire 12 the polarized relay becomes operative, and exerts a pull upon the end of the bar 24, moving it about its pivot to reverse the current in either the field or the armature as the position of the field or the armature may require.

It is obvious that minor changes and arrangement of parts may be resorted to without departing from the spirit or scope of my invention, or sacrificing any of the benefits thereof.

I claim:

1. A system of motor control comprising a motor, main wires delivering electricity to the motor, a throw-over switch located between the main wires, a permanent magnet having an oscillatory pole, a pair of electro-magnets oppositely wound connected in parallel with the said main wires and in series with each other, said electro-magnets being adapted to coöperate with the oscillatory pole of the permanent magnet to oscillate the same, a switch actuated by said oscillatory pole, connections between the said switch and the field and armature of the motor whereby current flowing through the main wires in one direction will flow through the field and armature in opposite directions and through the field and armature in the same direction when the current in the main wires is reversed.

2. A system of motor control comprising a motor, main wires delivering electricity to the motor and connected to the field of the motor, a throw-over switch located between said main wires, a permanent magnet having an oscillatory pole, a pair of electro-magnets oppositely wound connected in parallel with the said main wires and in series with each other, said electro-magnets being adapted to oscillate the oscillatory pole of the permanent magnet, two pairs of contact points, one member of each pair being connected with each main wire, a double-leaf switch connected to said armature, means connecting the oscillatory pole of the permanent magnet with the said leaves of the switch whereby current flowing through the system in one direction will move the oscillatory pole to bring the leaves

of the switch into engagement with one pair of contact points and the reversal of the current will move the oscillatory pole of the permanent magnet to bring the leaves of the switch into engagement with the other pair of contact points, thereby directing the current through the field and armature in the same direction when the current flows in one direction and through the field and armature in opposite directions when the current is reversed.

J. HOWARD SANDIDGE.

Witnesses:
J. C. CARPENTER,
T. D. BUTLER.