(No Model.) 2 Sheets—Sheet 1.

# R. H. MATHER.

## SWITCH FOR ELECTRIC MOTORS.

No. 382,714. Patented May 15, 1888.

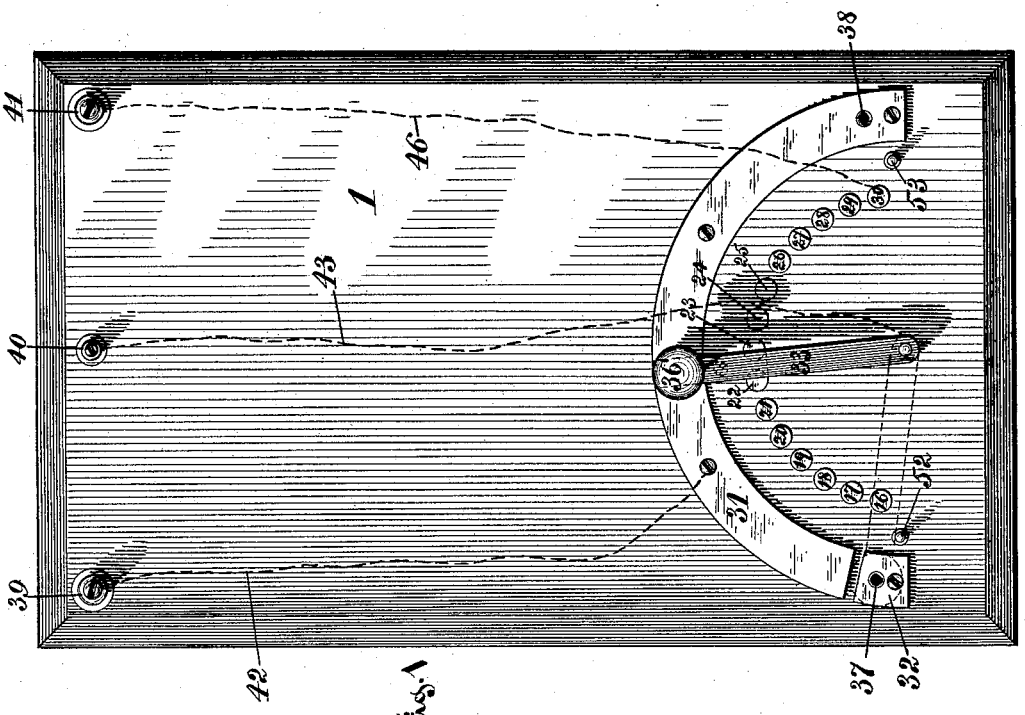


Fig. 1.

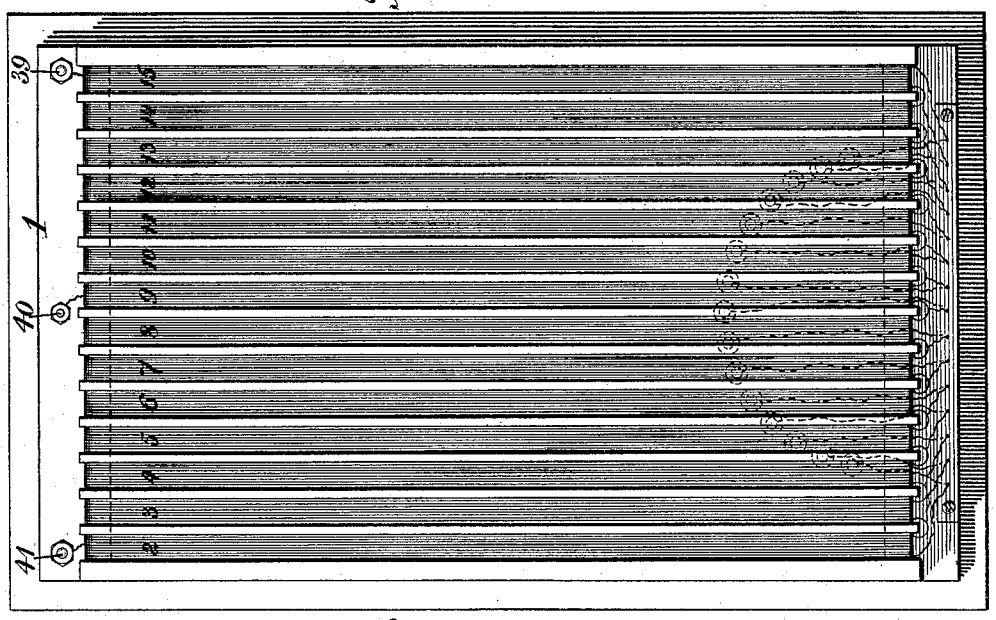


Fig. 2.

Witnesses:
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Henry L. Pickard

Inventor:
Richard H. Mather,
By Willard Eddy,
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(No Model.) 2 Sheets—Sheet 2.

# R. H. MATHER.

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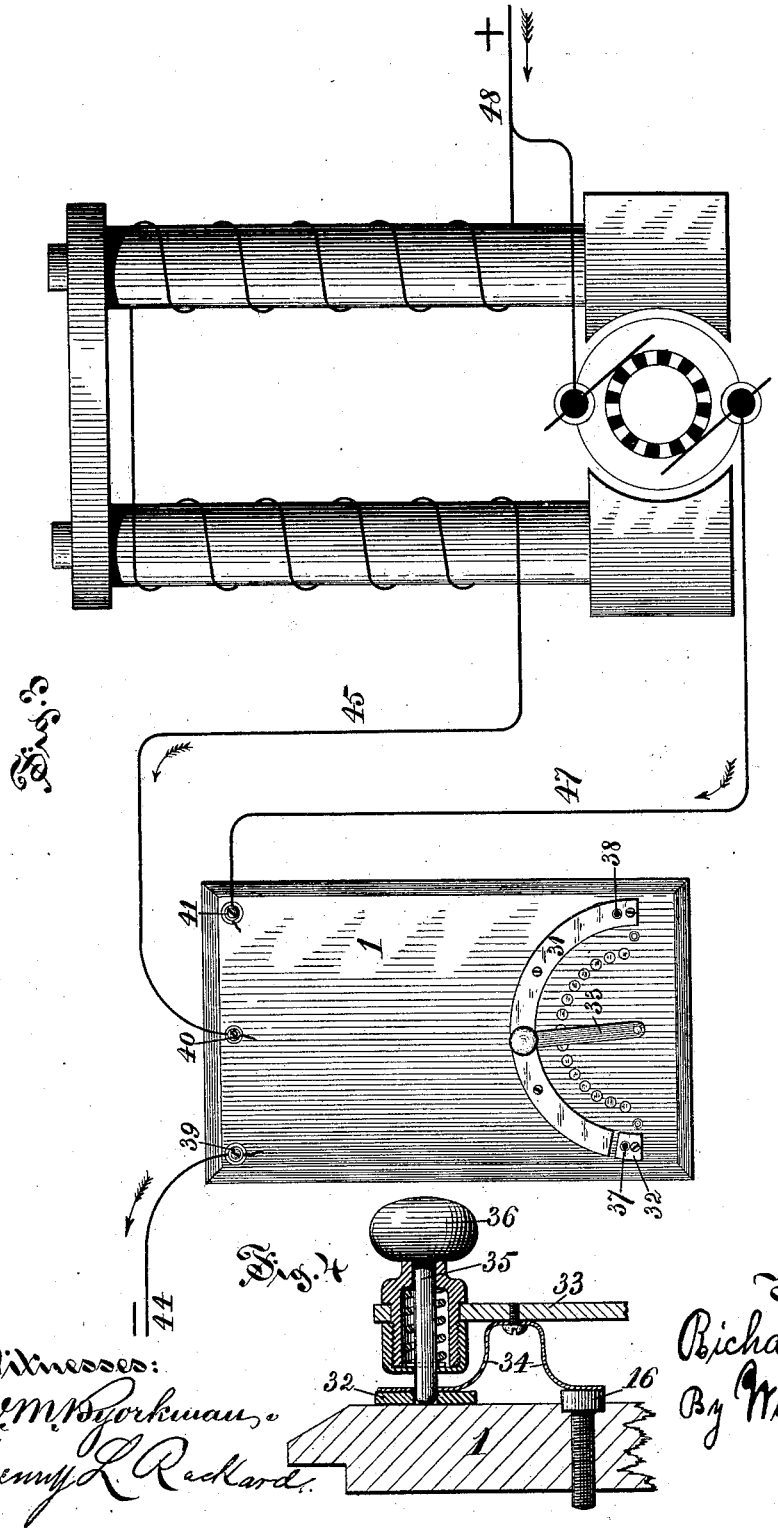


Fig. 3.

Fig. 4.

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# UNITED STATES PATENT OFFICE.

RICHARD H. MATHER, OF WINDSOR, CONNECTICUT.

## SWITCH FOR ELECTRIC MOTORS.

SPECIFICATION forming part of Letters Patent No. 382,714, dated May 15, 1888.

Application filed January 20, 1887. Serial No. 225,887. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD H. MATHER, of Windsor, in Hartford county, Connecticut, have invented certain new and useful Improvements in Switches for Electric Motors, which are described in the following specification and illustrated by the accompanying drawings.

My improved switch is designed to be used in connection with an electric motor, particularly a shunt-wound motor, and with an electric circuit of constant electro-motive force, for the purpose of introducing such motor into such circuit gradually and without danger of burning out the armature of said motor, and for the purpose of cutting such motor out of such circuit without producing a spark or other inconvenience. These objects I accomplish by means of a rheostat, which is connected with the armature-circuit of the motor and is gradually cut out of that circuit when the current is being turned on, and by means of certain contacts and connections whereby the main and shunt circuits of the motor are connected when the current is turned off.

The best manner in which I have contemplated applying the principle of my invention is shown in said drawings, in which—

Figure 1 is a front view of my improved switch mounted upon the front side or cap of a resistance-box. Fig. 2 is a back view of said cap with rheostat thereon. Fig. 3 is a front view of said resistance-box and switch connected with a shunt-wound electric motor, and Fig. 4 is a detail.

In the views, the numeral 1 denotes the front side or cap of a wooden box containing resistances.

The numerals 2 to 15, inclusive, indicate in Fig. 2 the several resistance-coils of a rheostat arranged in any convenient position, fastened to the back side of cap 1, and connected in the usual manner, as seen in Fig. 2, with each other and with a number of brass studs or other contacts, 16 to 30, inclusive, which pass through cap 1 and are arranged in the arc of a circle, as seen in Fig. 1. The aggregate resistance of these coils is such as is involved in the operation of the invention, as hereinafter explained. Upon the face of cap 1, adjacent to said studs, but not in contact therewith, is a curved contact-plate, 31, having the form of a segment of a flat ring which is concentric with said arc. Plate 31 has a detached segment, 32, lying adjacent to stud 16. Within reach of said plates and studs a contact-arm, 33, is pivoted upon cap 1 at the common center of said arc and ring. This arm is provided with a brush, 34, one end of which is adapted to pass over all of said contact-studs successively, and is wider than the distance between any two of said studs which are adjacent to each other, while the other end of said brush is constantly in contact with plate 31. This brush is seen in Fig. 4, which is a partial longitudinal section through arm 33 and adjacent parts, in the position indicated by dotted lines in Fig. 1. Stop-pins 52 and 53 prevent arm 33 from passing beyond said studs in either direction. Holes 37 and 38 pass through said plate, as seen in Figs. 1 and 3. Said arm is also provided with a spring-seated terminal pin, 35, one end of which is provided with a finger-piece, 36, while the other end of the same is adapted to enter holes 37 and 38 whenever arm 33 is carried to its extreme position in either direction. Binding-posts 39, 40, and 41 are the terminals of the instrument. The signs + and — in Fig. 3 may be regarded as the positive and negative terminals, respectively, of an electric generator, which is not otherwise shown in the drawings.

Such being the elements of my invention, the appropriate electrical connections not already indicated are as follows: Terminal 39 is connected with plate 31 by wire 42 and with the negative terminal of a generator by wire 44. Terminal 40 is connected with arm 33 by wire 43 and with the field-magnet helix of the motor by wire 45. Terminal 41 is connected with stud 30 by wire 46 and with the armature by wire 47. The motor is connected with the positive terminal of said generator by wire 48.

Such being the construction and the appropriate electrical connections of my invention, its mode of operation is now to be explained. The normal position of arm 33 when the switch is open is indicated by dotted lines in Fig. 1. When arm 33 is in the extreme position which is there indicated, the point of the spring-seated pin 35 is held in hole 37, and thus said arm is locked in that position. One end of brush 34 then rests upon segment 32, while the other end of the same rests upon stud 16, as shown in Fig. 4. In this position of affairs no current can pass through the motor; but the field-magnet helix and the armature of the motor are connected through wires 45 and 47, 43 and 46, arm 33, and said brush and resistances.

If, now, it be desired to introduce said motor into the generator-circuit, said arm is unlocked from its last-mentioned position by manipulation of pin 35, and is slowly turned away from stop-pin 52 toward stop-pin 53. Said arm is shown in Figs. 1 and 3 in an intermediate position. As soon as brush 34 touches plate 31, current passes from the field-magnet helix by wires 45 and 43 to arm 33, and from the armature of the motor by wires 47 and 46, all said resistances, stud 17, and brush 34 to the same point. From said point the current passes by brush 34, plate 31, and wire 42 to terminal 39. The resistances in the armature-circuit prevent the armature from receiving more current than it can safely receive, while the described distribution of current causes the field-magnet to be fully energized and causes the armature to revolve in the usual manner. As the described motion of arm 33 continues, a gradually-increasing number of said resistances are cut out of circuit, and the speed of the motor increases until all said resistances are cut out and the normal speed is attained. During this operation the resistance which is produced by the increasing counter electromotive force of the armature varies approximately as the resistance which is cut out by the described motion of arm 33, and hence the armature is not exposed to the danger of being burned out by excessive current. When arm 33 encounters pin 53, the rheostat is cut out of circuit, and pin 35, entering hole 38, locks the switch. By unlocking the switch and carrying arm 33 back to the position first above mentioned the switch is opened, while the armature and field-magnet circuits remain connected, as above described. This connection allows the latter circuit to discharge through the former, and so prevents the sparking which might otherwise result from the sudden opening of the switch.

I claim as my invention—

1. An electric circuit a portion of which is divided into two branches forming a constantly-closed loop, and a shunt-wound electrodynamic motor having its armature in one of said branches and its field-magnet helices in the other of said branches, in combination with a rheostat and a switch which is adapted to introduce, operate, and cut out said rheostat as a portion of said first-mentioned branch, and also to open and close an electrical connection between said loop and the remaining portion of said circuit, substantially as and for the purpose specified.

2. An electric circuit a portion of which is divided into two branches forming a closed loop, and an electric motor having its armature in one of said branches, and having field-magnet helices in the other of said branches, in combination with a rheostat and a switch which is adapted to manipulate said rheostat and to open and close the circuit-connection of said loop, substantially as and for the purpose specified.

3. An electric circuit having two branches, an electric motor having an armature in one of said branches and field-magnet helices in the other of said branches, and a rheostat which is connected with said armature-branch and is provided with a number of contact-points, in combination with an electric switch having a contact-plate which is connected with said circuit, and a movable conductor which is connected with said field-magnet branch, and is adapted to make sliding contacts with said contact-points and contact-plate, substantially as and for the purpose specified.

4. An electric switch having three terminals, in combination with a rheostat which is connected with one of said terminals, and a movable conductor which is connected with another of said terminals and is adapted to operate said rheostat, and also to make and break an electrical connection with the remaining terminal of said switch, substantially as and for the purpose specified.

5. An electric generator, a shunt-wound electric motor, and a rheostat which is connected with the armature-circuit of said motor, in combination with a movable conductor which is connected with the field-magnet circuit of said motor, and is adapted to operate said rheostat and to open and close an electrical connection between said movable conductor and said generator, substantially as and for the purpose specified.

6. An electric circuit having two branches, and an electric motor having an armature in one of said branches and field-magnet helices in the other of said branches, in combination with a rheostat which is connected with the armature-branch of said motor, a movable conductor which is connected with the field-magnet branch of said motor, and is adapted to connect said branches as a constantly-closed loop through a variable portion of said rheostat, and also to connect and disconnect said loop with the main circuit at a point between said branches, substantially as and for the purpose specified.

7. An electric circuit having two branches, a shunt-wound electric motor having its armature and field-magnet helices arranged in said branches, respectively, a rheostat which has a constant connection with the armature-branch of said motor, in combination with an electric switch which is provided with an insulated rest, a contact-plate, and a movable conductor connecting said branches through a variable portion of said rheostat and making and breaking contact with said plate, substantially as and for the purpose specified.

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

RICHARD H. MATHER.

Witnesses:
WILLARD EDDY,
L. M. BENEDICT.