(No Model.)

2 Sheets—Sheet 1.

# J. DOYLE.

## RHEOSTAT.

No. 441,293. Patented Nov. 25, 1890.

Fig. 1.

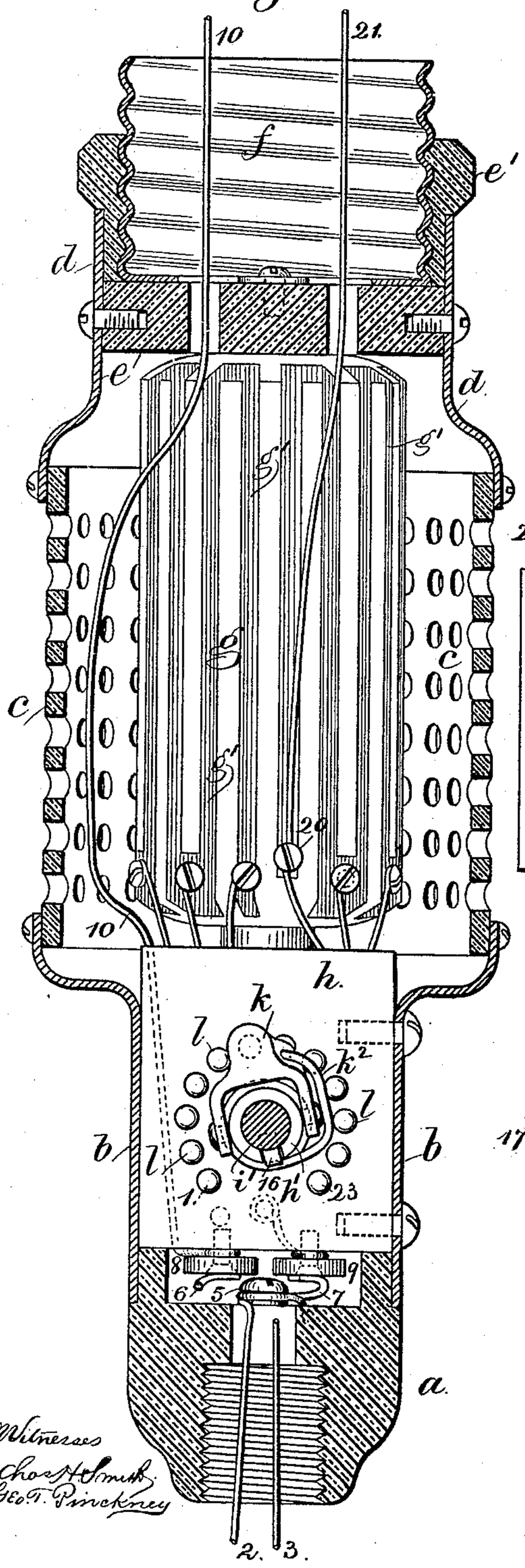



Fig. 3.

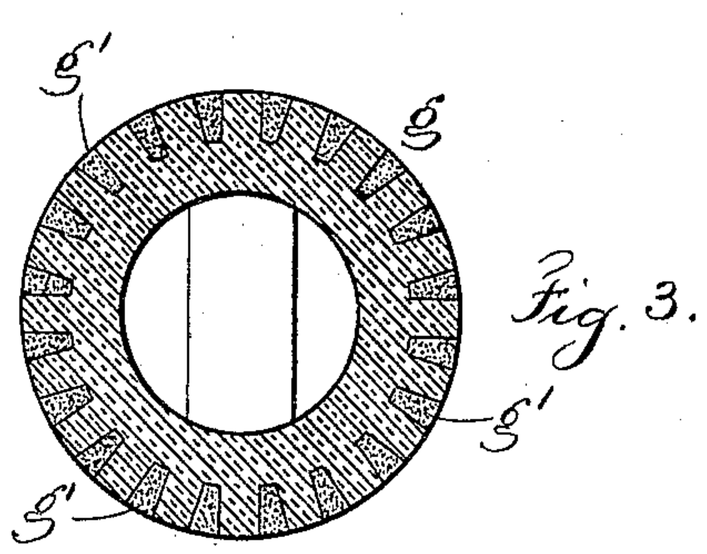



Fig. 4

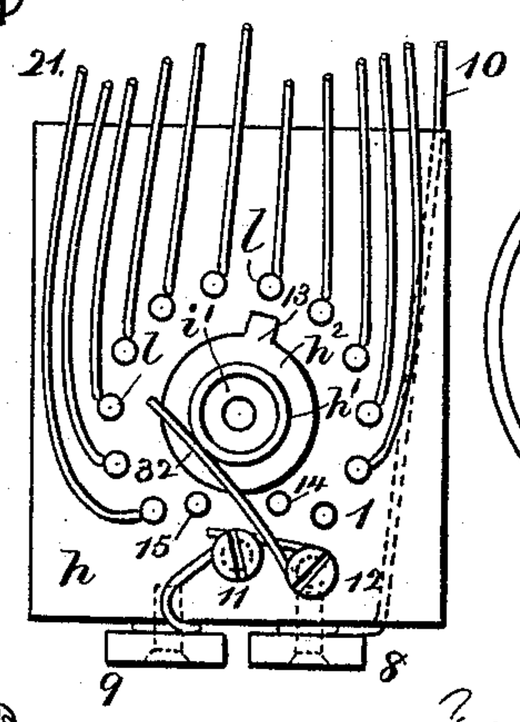



Fig. 5

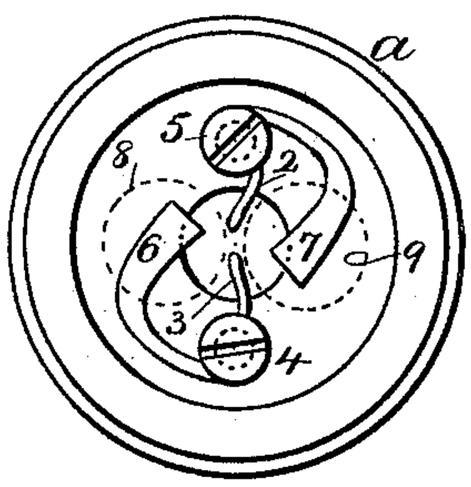
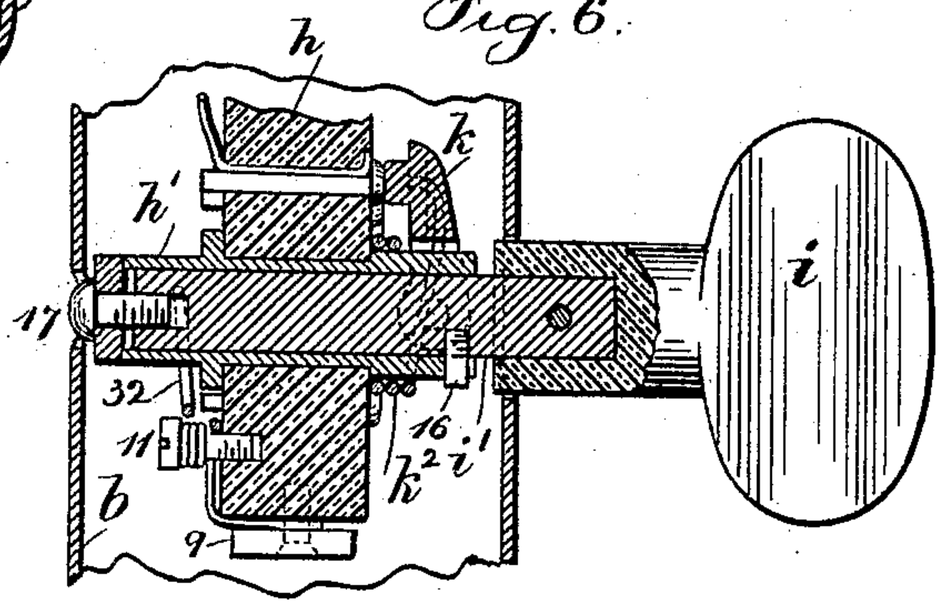



Fig. 6.




Witnesses
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Geo. T. Pinckney

Inventor
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per Lemuel W. Serrell
atty

(No Model.)

2 Sheets—Sheet 2.

# J. DOYLE.

## RHEOSTAT.

No. 441,293. Patented Nov. 25, 1890.

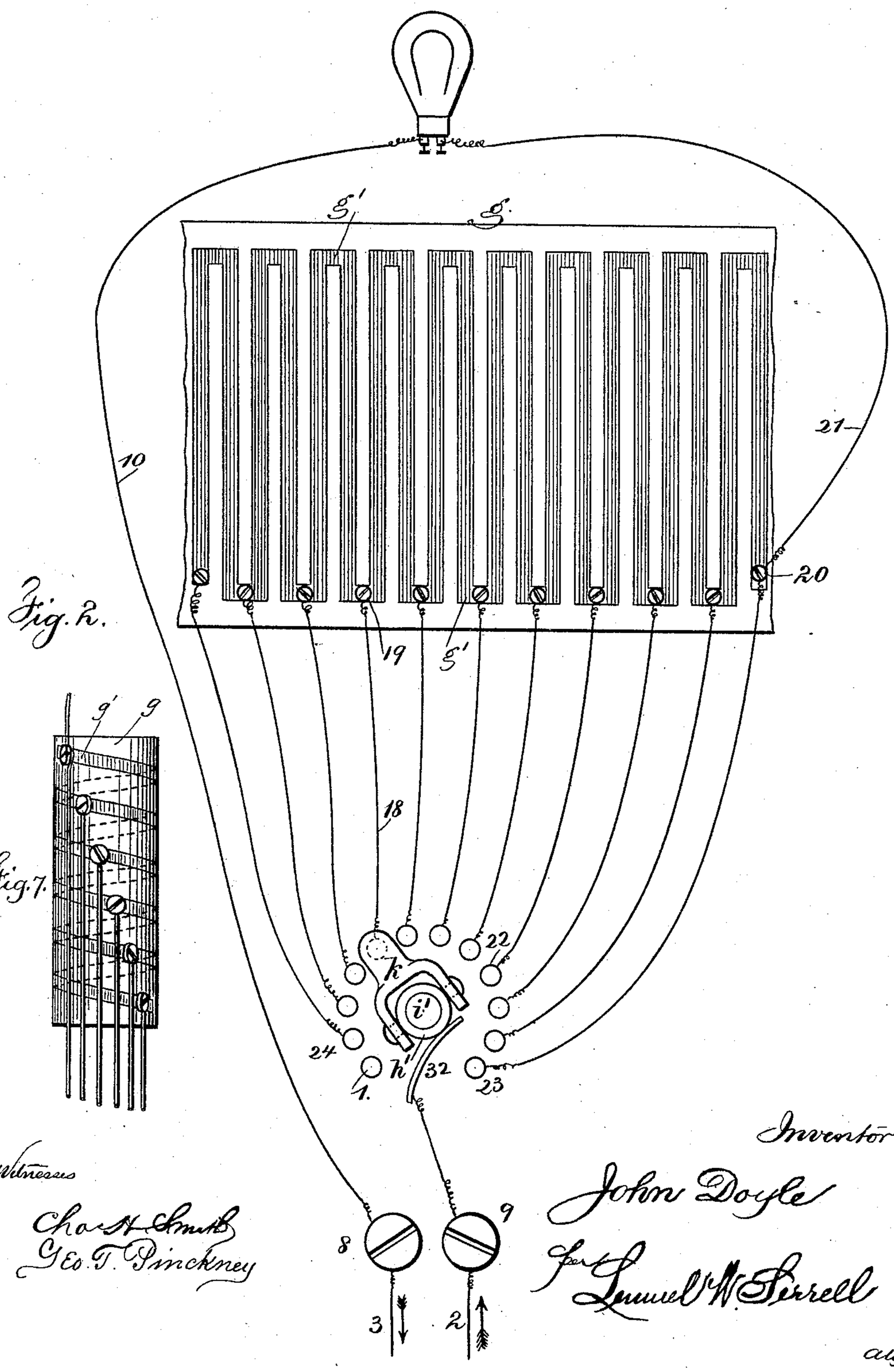


Fig. 2.




Fig. 7.

Witnesses

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# UNITED STATES PATENT OFFICE.

JOHN DOYLE, OF HOBOKEN, NEW JERSEY, ASSIGNOR TO THE NORTH AMERICAN ELECTRIC COMPANY, OF NEW YORK, N. Y.

## RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 441,293, dated November 25, 1890.

Application filed August 1, 1890. Serial No. 360,609. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN DOYLE, a citizen of the United States, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented an Improvement in Rheostats, of which the following is a specification.

Rheostats for electric currents have heretofore been made with a sliding contact by the movement of which more or less of resistance has been placed in the electric circuit, and rotary switches have also been employed as well as the sliding contact. In some of these rheostats the resistance has been of uniform character throughout, the variation therein resulting from a greater or less length of the resisting medium in the circuit, and it has been desirable in rheostats employed in connection with electric lamps that the rheostats should be small and not occupy much space, and at the same time be so constructed that the resistance offered to the electric current should be large.

My present invention is designed as an improvement upon the devices set forth in Letters Patent No. 311,820, granted to me February 3, 1885, and No. 321,285, granted to me June 30, 1885, and I have shown and herein describe my present invention with special reference to an incandescent electric lamp and its fixtures.

In my present invention the rheostat occupies but a small space and the resistance is uniform throughout, the variation in the resistance being produced by a greater or less length of the resisting medium, and I employ a rotary switch the movement of which by a key directs the current passing through the lamp and the rheostat through more or less of the resisting medium, according to the degree of resistance desired in the lamp.

The mechanism employed in the construction of my improved rheostat is not only compact, but is simple in construction, and is surrounded by an envelope or inclosure that is a poor and imperfect conductor of heat, so that any heat generated by the resistance of the rheostat will not become a source of danger.

My improved rheostat is not only adapted for use in connection with incandescent electric lamps and their fixtures, but the same can be adapted for use in any electric circuit.

In my patent, No. 311,820, herein referred to, the resisting or inferior conducting medium was composed of plumbago and borax or its equivalent, mixed together, and the resistance varied in proportion to the borax or its equivalent combined with the plumbago; but the form in which this was put up or inclosed was liable to be injured by breakage, and one of the objects of my present invention is to overcome this difficulty.

In the drawings, Figure 1 is a vertical section of a case and an elevation showing the features of my improvement. Fig. 2 is a diagrammatic view of the switch, the resisting medium, and the lines of wire; and Figs. 3, 4, 5, 6, and 7 are detail views of parts of the apparatus, hereinafter more fully described. These figures are drawn on a large scale for greater clearness.

*a* represents the base or socket adapted to be secured to a bracket or other fixture.

*b* is a flanged tube secured to the socket *a*, and one end of the perforated cylinder *c* is connected to the flanged tube *b*, and the other end of said cylinder *c* is connected to the flanged tube *d*, which in its turn carries the disk *e* and the lamp-socket *f*, around which socket is the ring *e'*.

The perforated cylinder *c*, disk *e*, and ring *e'*, together with the socket *a*, are all made of hard rubber or other insulating material, and when connected together, as shown, form the case for the rheostat and the holder for the incandescent lamp, and the means of attaching the same to the bracket or other fixture.

The resistance-cylinder *g* and the insulating switch-block are connected together in any desired manner and are within the aforesaid case, the switch-block *h* being alone connected to the tube *b* of the case by screws, as shown, and the axis of the cylinder and switch-block coincides with the axis of the case. The resistance-cylinder *g* is composed of a non-conducting material, preferably pipe-clay and retort-cement, mixed in any desired proportions in the form of a paste, and molded, preferably, in cylindrical form and baked or otherwise hardened, with longitudinal grooves

in its outer surface, which grooves are connected at alternate ends. The resisting material $g'$, which consists of plumbago and borax or their equivalent, are mixed together and inserted in the longitudinal grooves and the end grooves that connect the longitudinal ones at alternate ends, whereby the zigzag line of resisting material is formed circumferentially on the surface of the cylinder $g$, which cylinder is a non-conductor. The resisting material $g'$ is shown in Figs. 1 and 2 by fine parallel lines, to distinguish it from the insulating material of the holder $g$.

The rotary switch is composed of the insulated head or key $i$ and stem $i'$, which stem passes through the tube $b$ and block $h$, and through a sleeve $h'$, connected to the block, and upon the sleeve $h'$ is a forked spring switch-point $k$, pivotally connected thereto, and provided with a wire or other spring $k^2$, adapted to press the switch-point toward the block $h$. The switch-point $k$ might be pivoted to the stem $i'$, and the spring $k^2$ also secured thereto. Passing through the block $h$ and arranged in the form of a circle are pins $l$, with their heads adjacent to the switch-point $k$ and upon which the switch-point bears, and the conducting-wires that pass from these pins are in electric contact with said pins and are safely secured with them to the block $h$ by passing through the same holes as the pins and lying parallel therewith. I have shown in the drawings, Figs. 1 and 4, twelve of these pins, and a wire passes from each pin, with the exception of the pin $l$, which is the place of rest for the switch-point. The conducting-wires that pass from these pins are connected to screws or posts in the resisting material of the cylinder $g$, these screws being inserted around the lower portion of the cylinder in the groove connecting the alternate ends of the longitudinal grooves. These grooves, as shown in Fig. 3, have sides formed on radial lines from the center of the cylinder, and are, in other words, V-shaped; but the same may be slightly undercut, if desired, and I would remark that the grooves in the cylinder $g$ for holding the resisting material may be circumferential, with connected alternate ends instead of longitudinal, as the effect in either case and the manner of connecting up the wires would be practically the same.

The conducting-wires 2 3, leading into the case, go to the posts 4 5 in the socket $a$, and from said posts metal strips 6 7 make electric contact to the binding-posts 8 9, upon the lower end of the switch-block $h$. From the post 8 the wire 10 passes directly to the lamp. From the post 9 a wire passes to the posts 11 12, and a spring 32 from the post 12 forms electric contact with the surface of the sleeve $h'$, and this sleeve $h'$ is made with a flange $h^2$, having a projecting point 13, and said point 13, with the turning of the rotary switch, comes against either of the stops 14 or 15 to arrest its movement.

The pin 16 is in the stem $i'$, and is received in a notch in the end of the sleeve $h'$, whereby the two turn together, and a screw 17 passes through a washer into the end of the stem $i'$, whereby the stem and sleeve are connected rigidly together, and as the key $i$ and stem $i'$ are turned in either direction the sleeve $h'$ and the spring switch-point $k$ are rotated also, so that the switch-point is caused to pass from one pin-head to the next in the circular form employed and in the plane of the axial line of the case to increase or decrease by the resistance the amount of current passing to the lamp.

In the diagrammatic view, Fig. 2, the cylinder $g$, of pipe-clay and retort-cement, having the longitudinal grooves connected at alternate ends and forming a continuous line of resisting material of plumbago and borax or its equivalent, is represented as laid out flat, so that the grooves are shown on the same plane. In this view the electric current is shown as coming to the lamp by the conductor 2 to the post 9 and wires to the sleeve $h'$ and the spring switch-point $k$, from which the current passes by the wire 18 to the screw or pin 19, secured in the material that forms the resistance. From this screw 19 the current passes through the zigzag series of longitudinal grooves to the screw or post 20 by wire 21 to the lamp, returning from the lamp by the wire 10 to the post 8, and away by the wire 3. It will be noticed from the view Fig. 2 that if the switch-point $k$ is turned around to the pin 22 the current will be caused to travel through less of the resisting medium in its passage to the lamp, and if said switch-point is turned to the pin 23 the current will pass through direct to the lamp, and if the switch-point $k$ is turned back to the pin 24, adjacent to the pin $l$, the current will be compelled to travel through the entire continuous length of the resisting medium in the grooves of the cylinder before it reaches the pin 20 to pass to the lamp.

When the switch-point $k$ is upon the pin $l$, no current passes to the lamp, and when the point $k$ is rotated to the pin 24 the greatest resistance is offered to the current, and as the switch-point is moved around the circular form of pins less resistance is offered to the current at every pin, so that it is apparent that the current passing to the lamp is under perfect control and there is no danger of burning out the carbon by too great a current passing suddenly to the lamp, and no risk can come to the carbon filament of the lamp by shutting off the current too suddenly.

In the drawings, Fig. 7 illustrates a cylinder $g$, of non-conducting material, in which the resisting material is contained in a continuous circumferential groove wound spirally, and the screws for the wires to the rotary switch are placed at intervals along said groove.

The receptacle or holder for the resisting

material can be made in other forms than the cylinder herein described, the same being governed by the uses to which the resistance or rheostat is put, as the same may be made flat or otherwise, the essential feature being that the grooves or openings therein to hold the resisting material be of one continuous length, so that the electric current can be caused to pass through the entire length of the resisting material, or any desired proportion thereof.

I find that pipe-clay mixed with retort-cement that contains asbestus and fire-clay are well adapted to the cylinder or holder; but any character of earthenware or mineral substance that is substantially a non-conductor and is not injured by heat may be made use of; nor do I herein limit myself to the use of plumbago and borax as a resisting material to be inserted in the grooves of the cylinder *g*, as other inferior conducting materials may be employed.

I claim as my invention—

1. A rheostat or resistance formed of a cylinder of earthenware, having a grooved surface and resisting material in such grooves, and connections for the electric conductors, substantially as specified.

2. The combination, in a rheostat or resistance, with resisting material composed of plumbago and borax, of a receptacle or holder of earthenware with grooves in a zigzag form, with alternate connected ends, the grooves containing said resisting material, substantially as set forth.

3. The combination, with the switch-block of non-conducting material and the circular range of contact-pins, of a stem central to the contact-pins, a switch-point and a pivotal connection between the stem and switch-point, and a spring to press the switch-point to the contact-pins, substantially as specified.

4. The combination, with the rotary switch and switch-point and the circular range of pins, of a switch-block *h*, of insulating material, and a resistance-cylinder *g*, of earthenware, rigidly connected to the switch-block, a resisting material in zigzag grooves in the surface of the cylinder, and wires from the pins of the switch to progressive points in the resisting material, whereby more or less resistance can be brought to bear to the passage of the electric current, substantially as set forth.

5. The combination, with the socket *a* and tube *b* of the fixture, of the insulating switch block *h*, connected to the tube *b*, the resistance-cylinder *g*, secured to the switch-block *h*, the perforated cylinder *c*, of insulating material, connected to the tube *b* and surrounding the resistance-cylinder *g*, the socket for the lamp connected to the cylinder *c*, and a switch and the conducting-wires of the rheostat, substantially as set forth.

6. The combination, with the inclosing-case and a switch, of the grooved cylinder of insulating material and the switch-block connected together and to the inclosing-case at the switch-block only, the axis of said cylinder and switch-block coinciding with that of the inclosing-case, and a resisting material in the grooves of said cylinder, substantially as specified.

7. The combination, in a rheostat or resistance, with a resisting material, of a receptacle or holder for such resisting material having a continuous groove adapted to receive and retain the resisting material, and binding posts or connections inserted in said resisting material at varying or progressive distances from the ends thereof, substantially as set forth.

8. The combination, in a rheostat or resistance, with the inclosing-case, of the grooved cylinder of insulating material containing resisting material in the grooves and the switch-block, the cylinder and block being connected together and to the case at the switch-block only, a rotary switch having a stem passing through the case and switch-block at right angles to the axial line, and a spring-point and a circular range of contacts and connections to regulate the passing current, substantially as set forth.

Signed by me this 29th day of July, 1890.

JOHN DOYLE.

Witnesses:
GEO. T. PINCKNEY,
HAROLD SERRELL.