(No Model.) 4 Sheets—Sheet 1.

C. W. TOBEY.

RHEOSTAT.

No. 480,151. Patented Aug. 2, 1892.

Fig. 1.

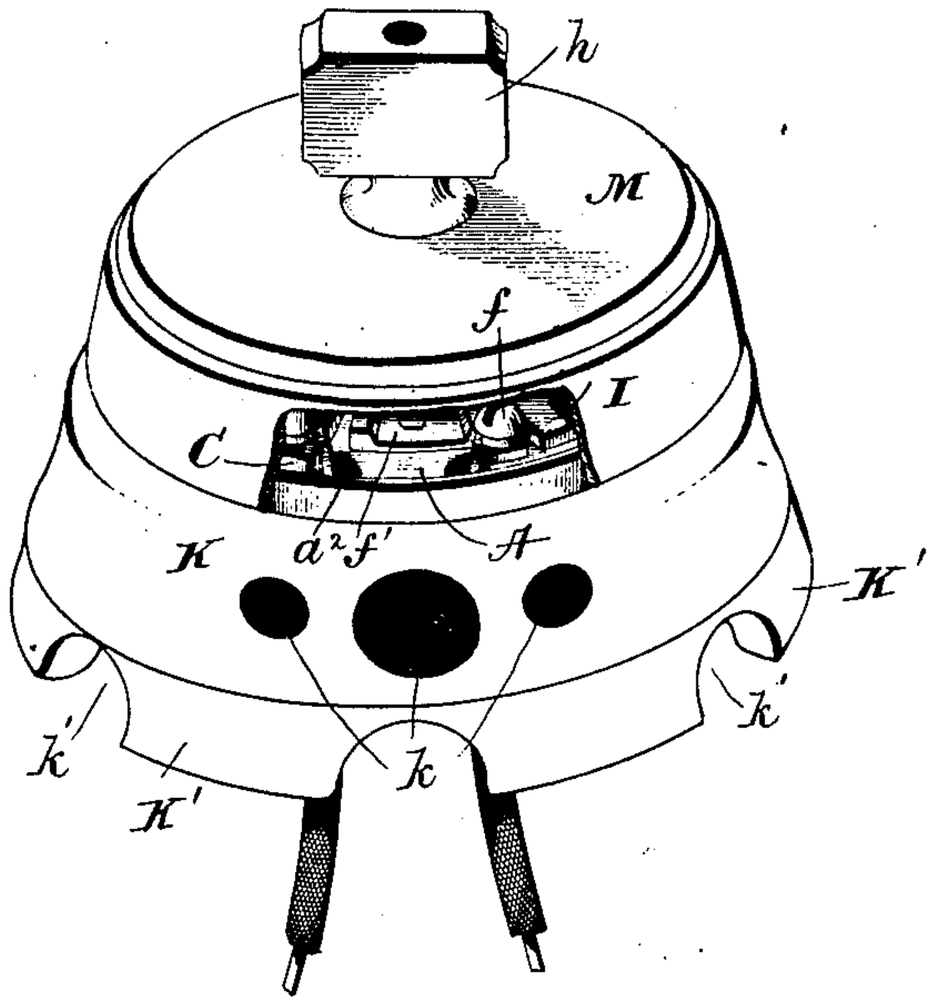


Fig. 2.

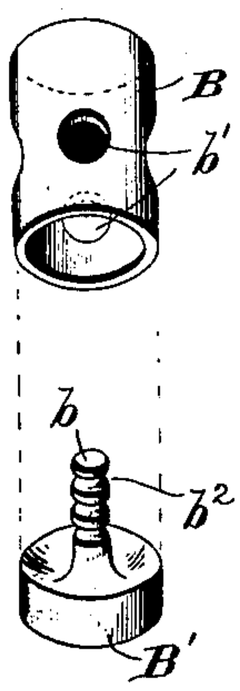


Fig. 3.

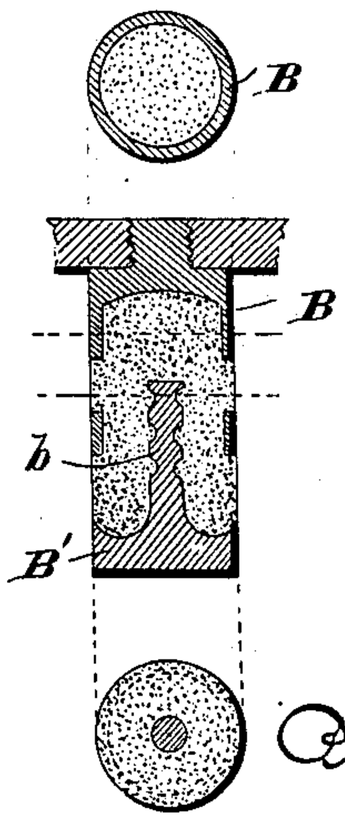
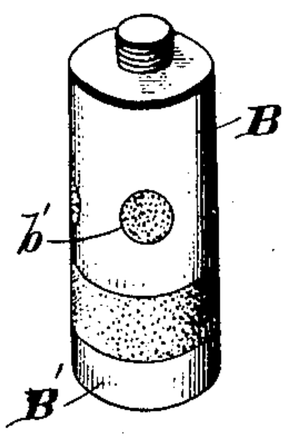


Fig. 4.



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Prindle and Russell his Attys.

(No Model.) 4 Sheets—Sheet 2.

C. W. TOBEY.

RHEOSTAT.

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Fig. 5.

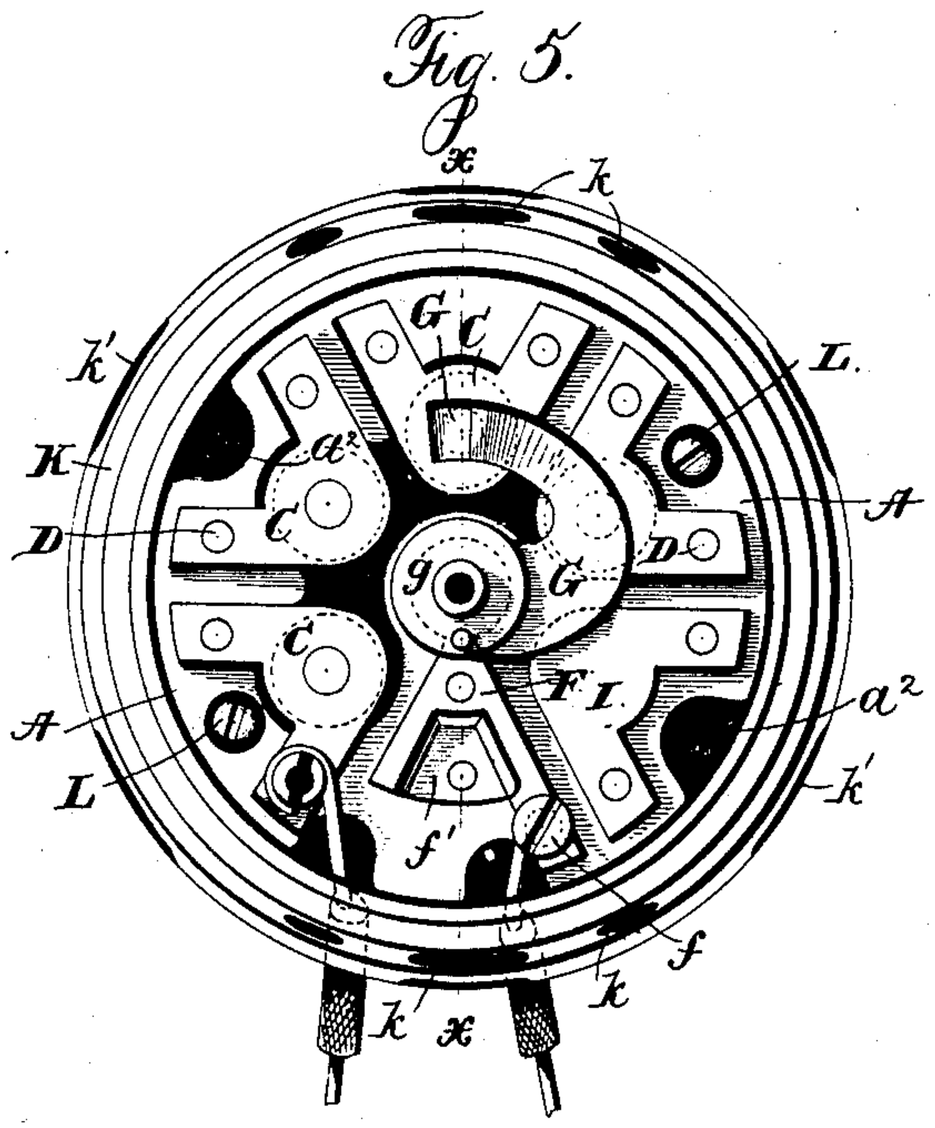

Fig. 6.

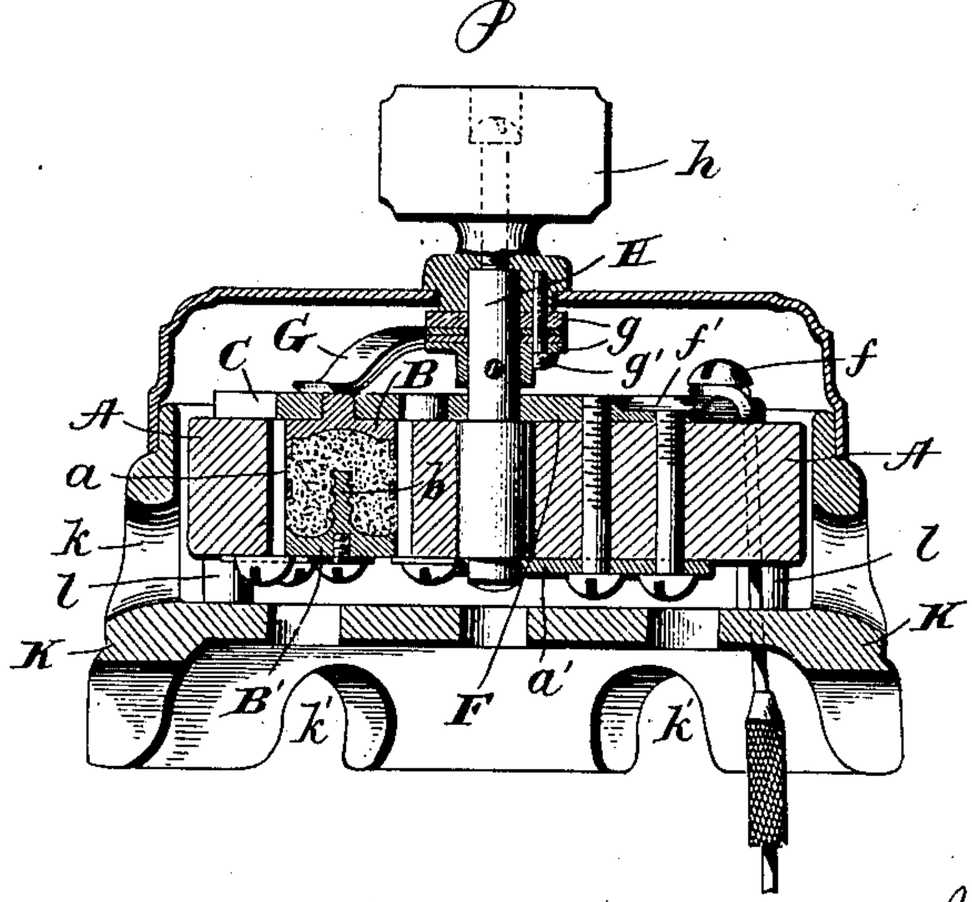

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Fig. 7.

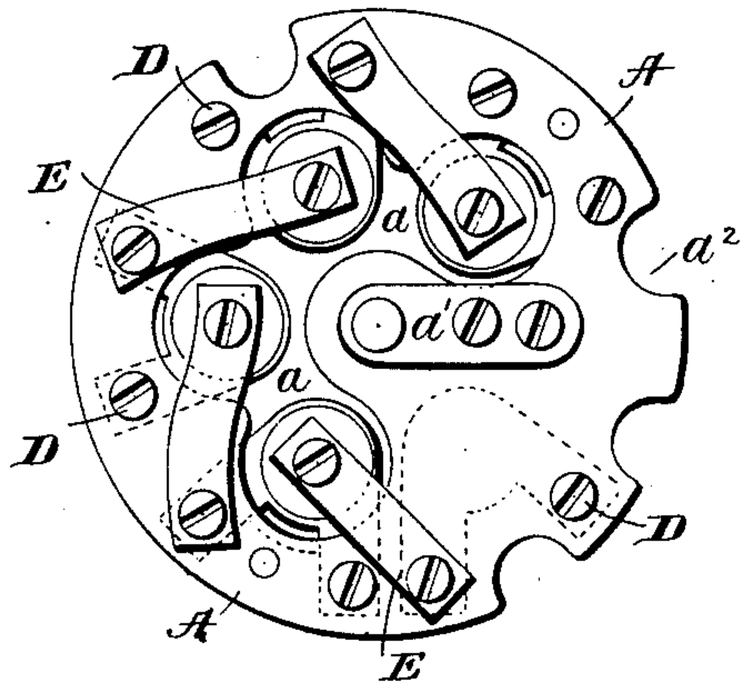

Fig. 8.

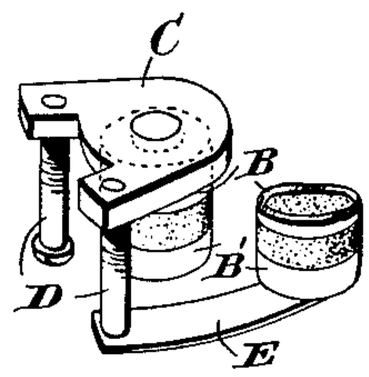

Fig. 12.

Fig. 9.

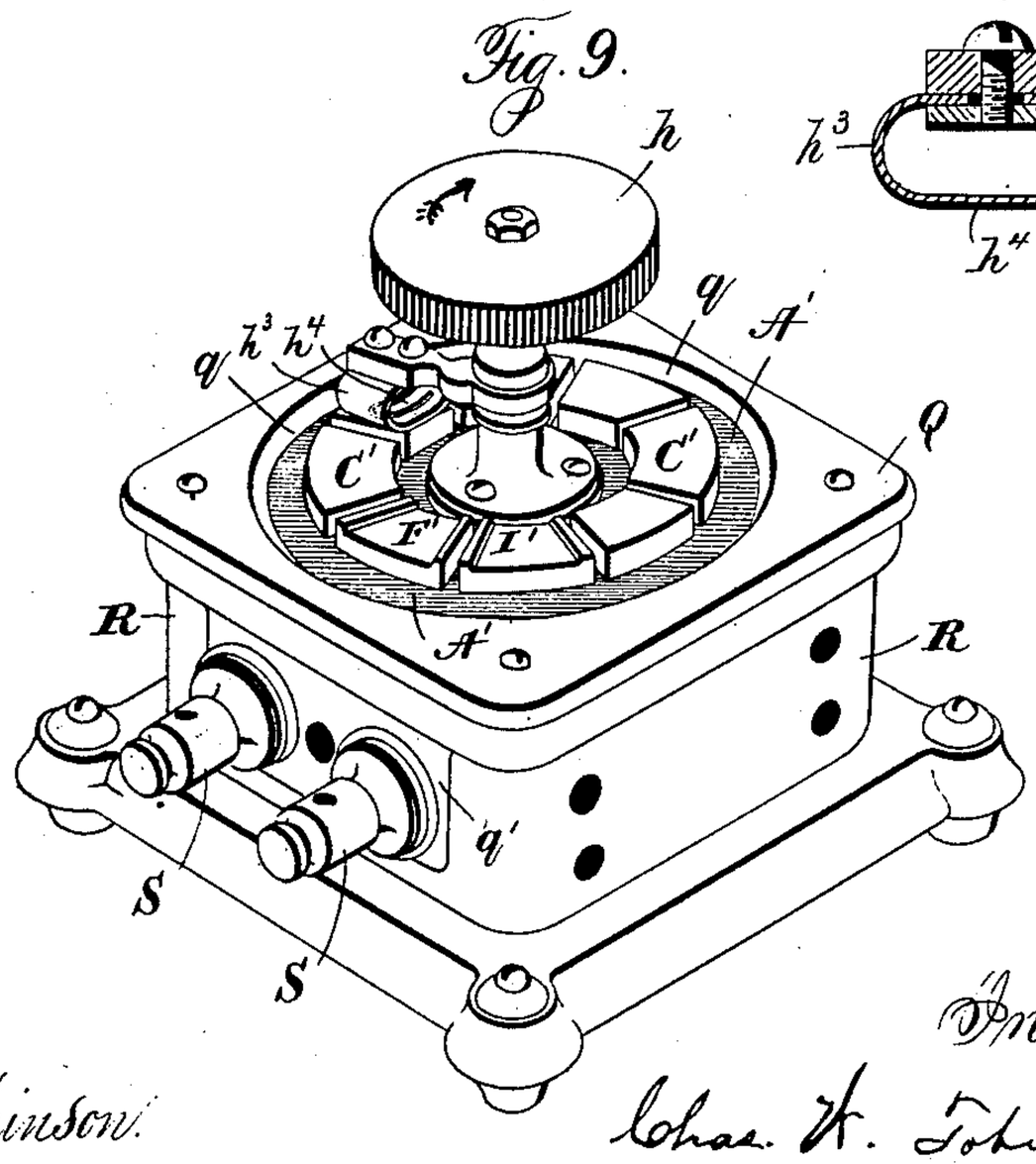

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Fig. 10.

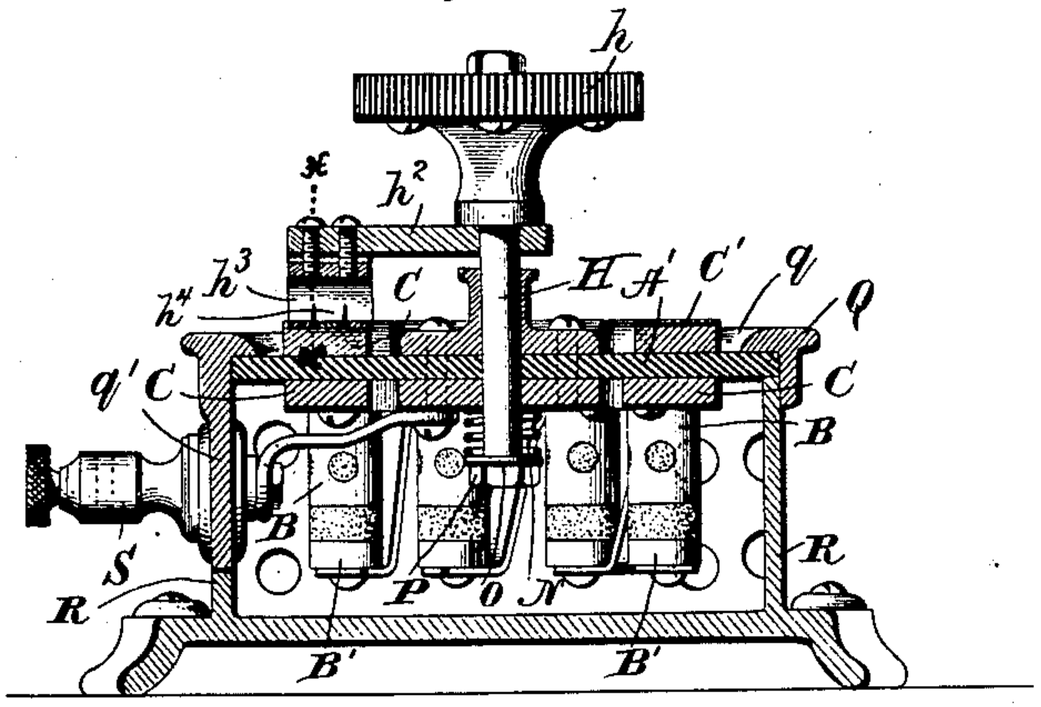
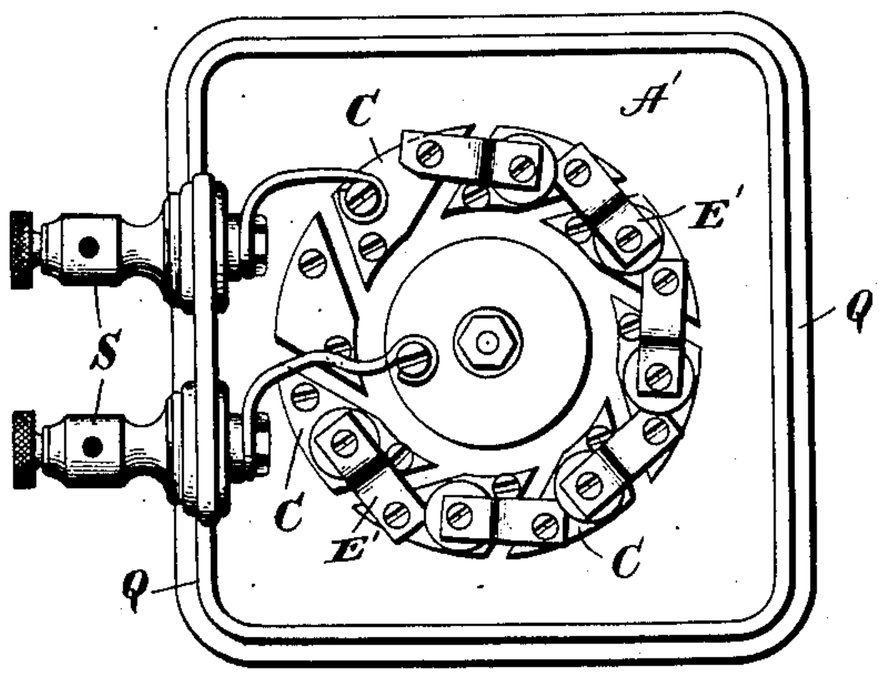


Fig. 11.



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UNITED STATES PATENT OFFICE.

CHARLES W. TOBEY, OF NEW BEDFORD, MASSACHUSETTS, ASSIGNOR TO BURT & TOBEY, OF SAME PLACE.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 480,151, dated August 2, 1892.

Application filed July 11, 1891. Serial No. 399,230. (No model.)

201-F8

To all whom it may concern:

Be it known that I, CHARLES W. TOBEY, of New Bedford, in the county of Bristol, and in the State of Massachusetts, have invented certain new and useful Improvements in Rheostats; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of a rheostat adapted for use with an electric light, portions of the casing being shown as broken away to disclose the interior arrangement of parts. Figs. 2 to 4, inclusive, are detail views of the resistance device I employ. Fig. 5 is a plan view of the rheostat with the casing-cover removed; Fig. 6, a section on the line *x x* of Fig. 5. Fig. 7 is a plan of the side opposite that shown in Fig. 5, the casing being omitted; Fig. 8, a detail view in perspective showing the manner of connecting the several resistances; Fig. 9, a perspective view of a rheostat constructed in accordance with my invention for use with motors; Fig. 10, a section thereof; Fig. 11, a bottom view with the inclosing box or casing removed; and Fig. 12, a detail view in section on line *z z*, Fig. 10, showing the spring switch or brush employed with the motor form.

Letters of like name and kind refer to like parts throughout the several figures.

The object of my invention is to provide certain improvements in rheostats or current regulating and controlling devices for use in electric circuits whether in connection with electric lights, motors, or in other situations where it is desirable and necessary to control or vary the strength of a current as delivered to its destined place for utilization; and to this end said invention consists in the rheostat and the parts thereof constructed and arranged substantially as hereinafter specified.

In the drawings I show two forms of rheostats constructed in accordance with my invention as adapted for use with an electric light and with a motor, respectively, the former being illustrated in Figs. 1 to 8 and the latter in Figs. 9 to 11, inclusive.

In constructing a rheostat for the purpose of regulating and controlling lights I employ a disk A, of porcelain or other non-conducting material, and mount thereon in a circular line a series of resistances adapted from one to the whole series to be put into the circuit by means of a switch device hereinafter described, as well as means, also operating in conjunction with said switch, whereby the circuit may be opened or closed and the current in the latter event not be modified by the presence of the resistance devices. The several resistances are constructed alike, each being in the form of a cylindrical body consisting of a composition of inferior conductivity and a holder or casing for the same. This composition is made of powdered graphite, (which is the conductor,) cement, and asbestus in such proportions as the degree of resistance desired may dictate, which are thoroughly mixed with water and then combined with the holder or casing under pressure. If desired, however, clay or some other suitable non-conducting material may be used instead of the cement and asbestus, although these latter are preferable, and also said substances may be combined under pressure without being moistened by water. The asbestus is valuable not only because of its electrical non-conductivity and because of being a non-conductor of and refractory to heat, but also because, being fibrous, it serves to bind or hold the other elements together, much as does hair in plaster.

The holder consists of a cylindrical hollow metal body or shell B, open at one end, in which the composition is placed, and a metal disk B, on which is a shank *b*, having the arrangement presently described. Only a portion of the composition is contained in the shell B, as such a quantity thereof is used as to entirely fill and extend beyond the same. Upon the projecting portion the disk B′ is superimposed with its shank extended into and thoroughly embedded therein. To key or lock the composition in the shell, its wall is provided with several perforations *b′*, into which portions of the composition extend, and for securing the same and the disk *b′* firmly together the shank *b* of the latter has a number of annular depressions b^2. The shell and disk are necessary to be used, because the composition has not such coherence as to enable its

shape to be preserved without some such assistance. The shank *b* extends into the portion of the composition contained in the shell and at the center of the latter, but does not touch the same, and the shell and disk are not in contact, but separated by the composition. The current is thus compelled to pass through the resistance before reaching the metallic conductors.

Each resistance is attached to and supported from the disk A by means of a metal conducting-plate C, to which it is secured, as by a screw-threaded projection on the closed end of the shell B, which enters a threaded opening in the plate, said plate being held to the disk by means of two screws D and D, which pass through openings in the disk from the under side thereof, whose screw-threaded ends enter threaded openings in two outwardly-exended arms on the plate. The heads of the screws abut against the under face of the disk. For the accommodation of the series of resistances the disk has a slot *a* extending therethrough, in which they are located, and its size is such that a space is left between the adjacent portions of the disk and the resistances, through which there can be a circulation of air to prevent excessive heating of parts when the resistances are put in the circuit.

Electrical connection between the resistances is made by means of a metallic conducting-strip E, which is secured at one of its ends to the disk B′ of the resistance-holder and at its other end has passed through it the nearest screw D for securing the next adjacent resistance-supporting plate to the disk A. Said screw thus not only performs this mechanical function of connecting the parts, but also is a part of the electrical connection between them.

The device is placed in the circuit whose current is to be controlled by having one conducting-wire thereof connected by a binding-post *f* to a metal plate F, which is secured to the disk A and is in electrical connection with a switch device capable of having contact with any one of the resistance-supporting plates and the other wire thereof connected by a binding-post to the first resistance-supporting plate in the series. The switch device consists of a switch arm or brush G, constructed of two thin pieces of spring-brass superimposed one upon the other, attached to a shaft or arbor A, journaled at the center of the disk and extending therefrom in a spiral curve with their free ends bearing yieldingly upon the contact-plates. The two pieces are secured to the shaft by being placed between two collars *g* and *g*, one of which is pinned to the shaft and through both of which and the confined pieces between a pin *g′* is passed. The shaft H passes through an opening in an extension of the contact-plate F, being thus in electrical connection therewith, and is journaled at its end at the other side of the disk A by having such end reduced and contained in a plate *a′*, secured to the disk. To a portion of the shaft that extends beyond the point where the arm is attached thereto is fastened a key or button *h*, by means of which the switch-arm may be turned or moved from one contact-plate to another. When the switch-arm is in contact with the plate F, the circuit is open, and to apprise the manipulator of the rheostat of the fact of their contact said plate has a depression *f′*, into which the free end of the switch-arm springs or seats itself.

Owing to the manner of connecting the several resistances, it will be seen that the first resistance will not be put into the circuit until the switch-arm rests on the second resistance-supporting plate, and so on throughout the series a resistance does not come into the circuit until the next adjacent supporting-plate is in contact with the switch-arm. Thus should the switch-arm be in contact with the second plate C the course of the current will be through the first plate, the first resistance, the metal plate E, attached to the disk B′ thereon, the securing-screw D, then through the second plate to the switch-arm, but not through the second resistance. This arrangement renders it necessary to provide after the last resistance a contact-plate I, in order that the latter may be thrown into the circuit. Such plate, preferably, is shaped similarly to the resistance-supporting plates C and is attached to the disk A in the same way and by one of its fastening-screws and a strip E, connected electrically with said last resistance; also, as a consequence of such arrangement the current will be turned full on when the switch-arm rests upon the first resistance-supporting plate, as the resistance supported thereby is not thrown in until contact is made with the second plate, as above described. The arrangement of the resistances being in a circular line, the contact-plates are given the shape of segments of a circle, and in consequence of this arrangement the device is most compact, requiring but little room, and thus specially adapted for use with lamps.

The mechanism constructed as thus far described is contained in a circular casing K, of porcelain or other insulating material, to whose bottom the disk A is attached by means of headed screws L and L, which pass through such bottom and said disk, and nuts on portions of the screws that project through the bottom. The disk A does not rest on the bottom; but they are kept apart, so that a space is left between them for the free circulation of air to reduce the temperature when the resistances are in circuit by the use of tubular distance-pieces *l* and *l*, through which the screws pass, and, too, for the formation of air-spaces the disk is of less diameter than the interior of the casing and has at various places in its periphery grooves or notches a^2. The wall of the casing K is perforated, as at *k*, at diametrically-opposite sides to admit the free passage of air into and through the same,

and to provide an air-space between the device and the object to which it may be attached the casing-wall K′ is extended beyond the bottom thereof, so that the edges of this wall and not the bottom will rest against such object. Said wall at numerous points is provided with openings or notches k' to admit the circulation of air between said bottom and the object to which the device may be attached.

A cylindrical cap M, seated on an annular shoulder on the casing K, covers the mechanism not inclosed by said casing, being provided at its center with an opening for the passage of the switch-operating key and held in place by a flange on said key of greater diameter than such opening which engages the cap-plate adjacent thereto.

It will be seen that by the provision of numerous air-spaces heat due to the use of the resistances is largely modified; but as a further precaution against danger likely to ensue from excessive heat the strips E, which connect the resistances, are made of some fusible metal which when a predetermined temperature is reached will melt, and so break the circuit. The melting of the strip occurs not from an excess of electricity passing through it, but by an overheating of the resistance and communication of heat from it to said strip. This of course, when it occurs, until remedied, will prevent further use of the device as a rheostat; but it does not prevent its use as an ordinary switch, inasmuch as the circuit could still be made through the first resistance-supporting and contact plate C and the switch-arm.

In applying my ideas to the construction of a rheostat for use with motors I employ resistances constructed precisely as those for use with the lamp device and arrange them also in a circular line. The plates C, to which said resistances are connected, however, do not constitute the contact-plates for engagement by the switch; but said plates are secured to the under side of a flat piece of slate A′ or other insulating material by screws passing therethrough and through the slate into a series of segmental plates C′ upon the upper side of said piece of slate. For each resistance-supporting plate there is a plate C′. The resistances are connected electrically by means of fusible metal strips E′, which at one end are attached to the disk B′ of the resistance-holder and at the other to the resistance-supporting plate C by one of the attaching-screws thereof, which constitutes the electrical connection with the contact-plate C′. There is also the provision of a segmental cut-out plate F′, corresponding to the similar plate F of the lamp rheostat and a plate I′ for placing the last resistance in circuit. Both the last-named plate I′ and the cut-out plate F′, which, as in the lamp form, are adjacent, have depressions in their faces, and in the present instance these are bounded by abruptly-rising ribs, whose function will presently be stated. The switch consists of a centrally-located shaft H′, from which extends a radial arm h^2, that at its outer end has attached a bowed-spring contact plate or brush h^3 for contacting with the series of segmental contact-plates C′. Said brush on its plate-engaging face has a spring-tongue h^4, which is adapted to engage with the above-referred-to ribs on certain of the contact-plates to prevent backward movement of the switch from off said plates to the plates immediately preceding them. As the series of resistances are so arranged and connected that the first contact made after a forward movement from the cutting-out plate F′, which improvement is in the direction of the arrow shown in Fig. 9, is to throw all of the resistances in the circuit, and not, as in the case of the lamp form, to utilize the whole capacity of the current, the object of this will be understood, as it renders it impossible to throw the full current at once to the motor, which, of course, is undesirable. Continued movement of the switch successively cuts out the resistances until the current is allowed to pass through the instrument without unusual impediment.

To assist the contact between the switch or brush h^3 and the contact-plates, the switch-shaft is projected beyond the inner face of the piece of slate whereon is placed a coiled spring N, having one end bearing against a collar O, held on the shaft by a nut P, with a tendency to force the shaft longitudinally in the direction necessary to accomplish this object. On the shaft is a hand-wheel h for rotating the same to move the switch. The piece of slate is preferably square in shape and is placed in a square cast-iron frame Q, through a circular opening q in which the mechanism on the upper side of the slate projects, which frame is screwed to a square cast-iron box or casing R, that incloses all of the mechanism on the under side of the piece of slate, except on one side, where a portion of one of the walls of the box is removed. The opening thus formed is closed by a piece q', depending from the frame Q, to which are secured in a properly-insulated manner two binding-posts S and S. One of these binding-posts is connected to the switch and the other to the last resistance, and to them are also attached the conductors from the motor and the source of energy. All of the mechanism is thus carried by the frame Q and can be removed therewith from the box or casing.

The walls or sides of the box R are perforated at various points to admit a free passage of air thereto for cooling purposes. At its corners the box is provided with feet to hold it out of close contact with the object to which it may be attached.

Having thus described my invention, what I claim is—

1. A resistance-conductor for electric currents, composed of powdered graphite and asbestus compressed into a cohering compact

body, substantially as and for the purpose specified.

2. A resistance-conductor for electric currents, consisting of a composition of proportionate parts of powdered graphite, asbestus, and cement compressed into a cohering compact body, substantially as and for the purpose shown.

3. A resistance-conductor for electric currents, consisting of a composition of proportionate parts of powdered graphite, asbestus, and cement mixed with water and compressed into a cohering compact body, substantially as and for the purpose set forth.

4. A resistance for electric currents, consisting of powdered graphite and a non-conductor compressed into a coherent body, to whose opposite ends are secured metallic pieces, substantially as and for the purpose described.

5. A resistance for electric currents, consisting of powdered graphite compressed into a metal holder in a cohering body, which holder but partially incloses the same and constitutes means for its attachment to a support, substantially as and for the purpose specified.

6. In combination with the resistance composition, the holder therefor, consisting of a shell or casing partly inclosing the same, and the disk or piece affixed to such composition, substantially as and for the purpose shown.

7. In combination, the resistance composition and the holder therefor, consisting of a shell or casing partly inclosing the same and the disk with a shank affixed thereto, united to such composition by having such shank embedded therein, substantially as and for the surpose set forth.

8. A resistance for electric currents, consisting of powdered graphite, asbestus, and cement compressed and united with a holder consisting of a shell partly inclosing the same and the disk or piece superimposed upon a portion thereof not contained in said shell, substantially as and for the purpose described.

9. In combination, the several resistances composed each of powdered graphite, asbestus, and cement compressed into a cohering body connected in series, and the switch for placing any number from one to the whole series in the circuit, substantially as and for the purpose specified.

10. In combination with several resistances, the fusible conductor connecting them, substantially as and for the purpose set forth.

11. In combination with the resistance device of a rheostat forming part of a circuit, a fusible conductor connected directly to said resistance and also forming a part of the circuit, substantially as and for the purpose specified.

12. In combination, the several resistances, the supporting-plate for each resistance, acting as a contact, the body to which said plates are attached, the attaching-screws, and the fusible conducting-strip extending from one resistance to one of the attaching-screws of the next adjacent resistance, substantially as and for the purpose set forth.

13. In combination, the supporting-body of insulating material having a slot or opening, the series of resistances in the latter, the contact-plates for said resistances, from which the same are supported, and the switch, substantially as and for the purpose shown.

14. In combination, the series of resistances, their contacts, the circuit-closing contact, the cut-out contact, said contacts being arranged in a circle with the last-named two adjacent to each other, and the spring-switch, said cut-out contact having a depression to seat said switch, substantially as and for the purpose described.

15. In a switch, in combination with the spring movable brush or contact device, the circuit-closing contact and the cut-out contact having a depression for seating said brush, substantially as and for the purpose specified.

In testimony that I claim the foregoing I have hereunto set my hand this 22d day of June, A. D. 1891.

CHARLES W. TOBEY.

Witnesses:
WM. F. CASWELL,
EMMA D. CASWELL.