(No Model.)

C. WILLMS.

RHEOSTAT.

No. 467,338. Patented Jan. 19, 1892.

Fig. 1.

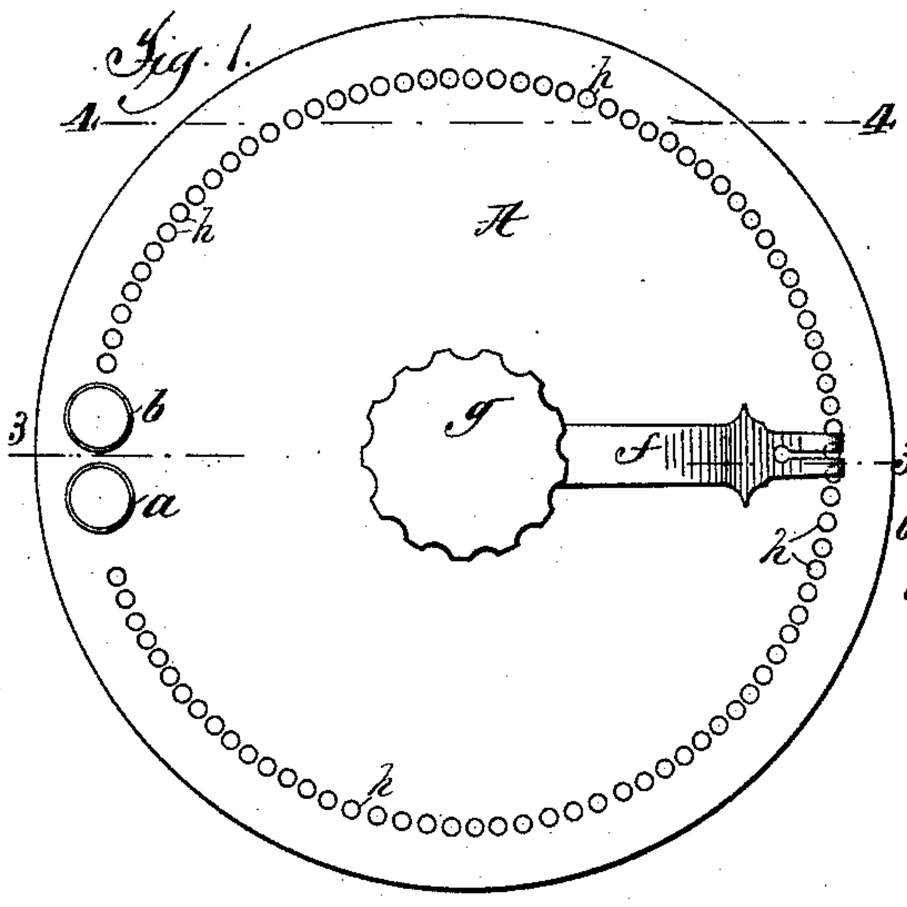


Fig. 2.

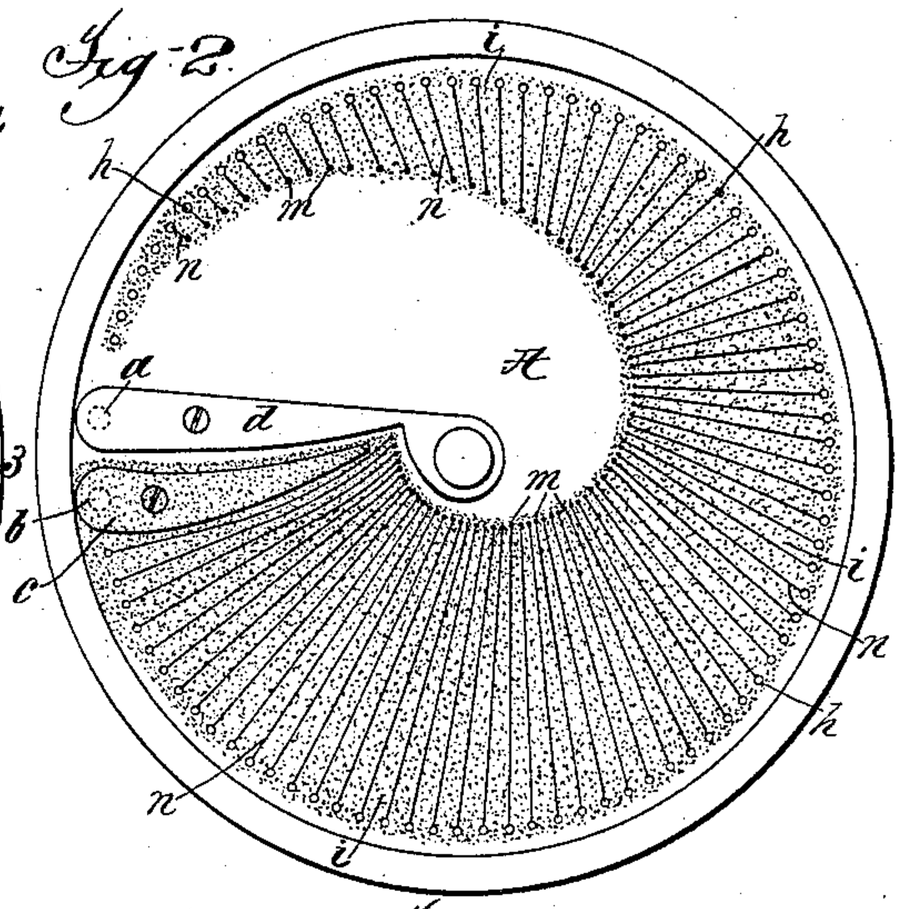


Fig. 3.

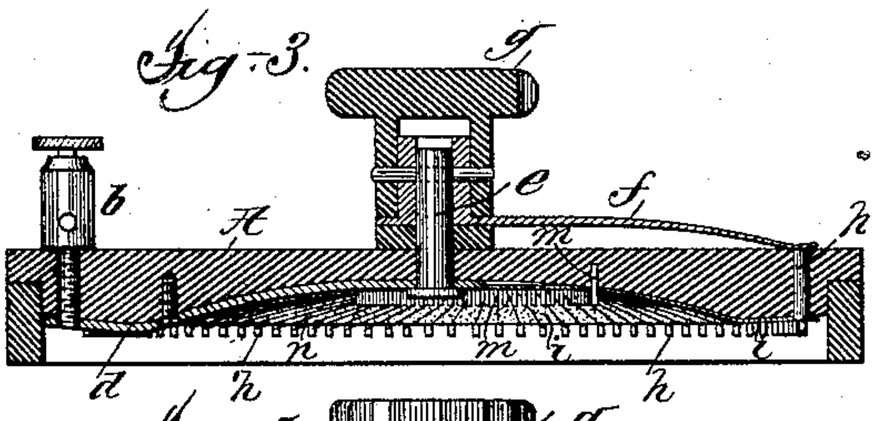


Fig. 4.

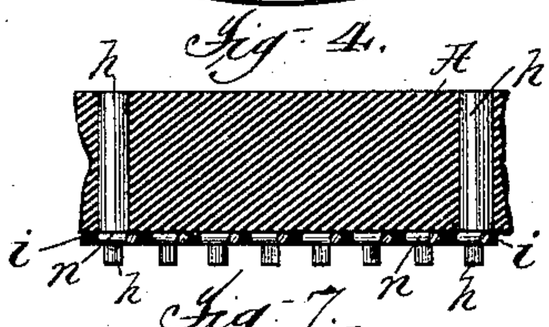


Fig. 5.

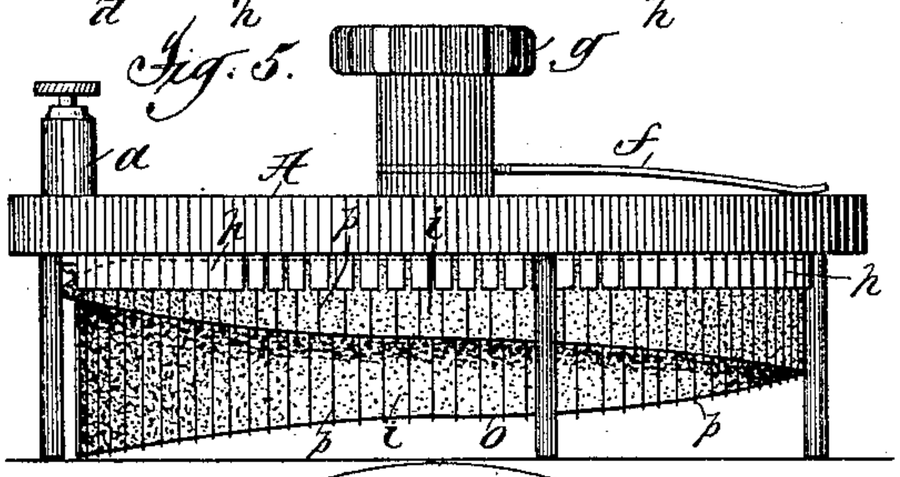


Fig. 7.

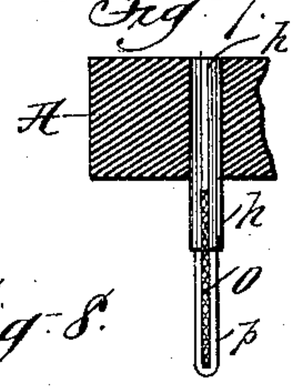
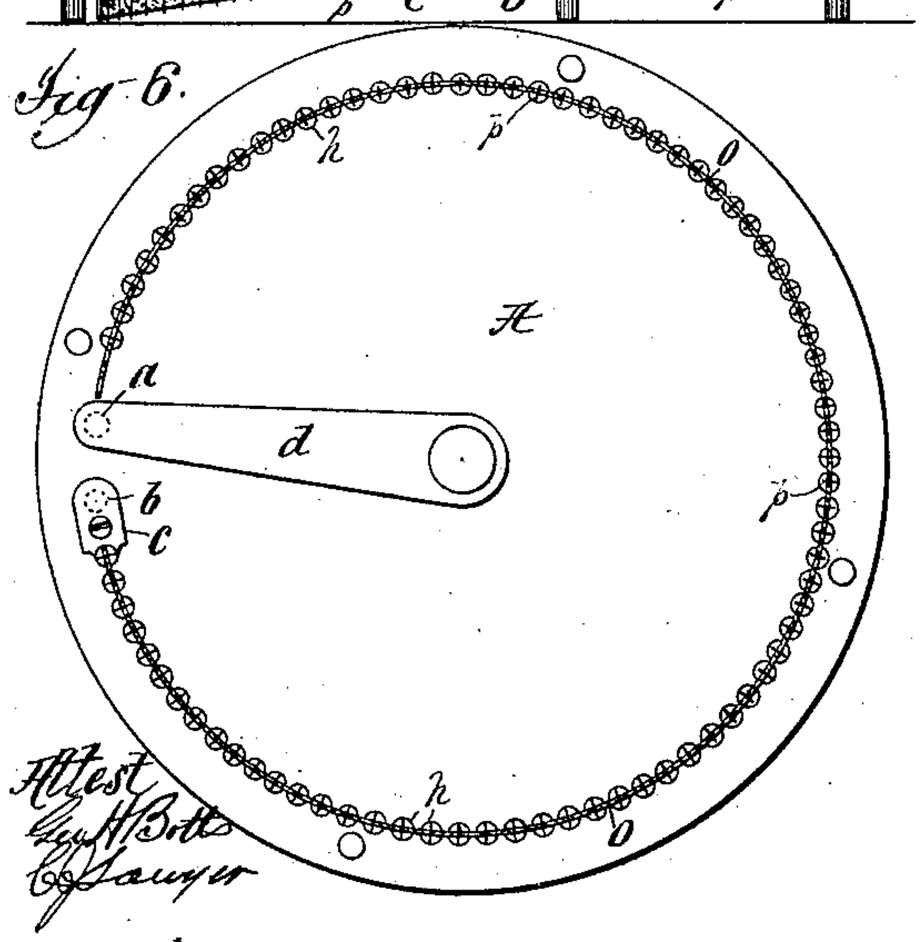


Fig. 8.

Fig. 6.



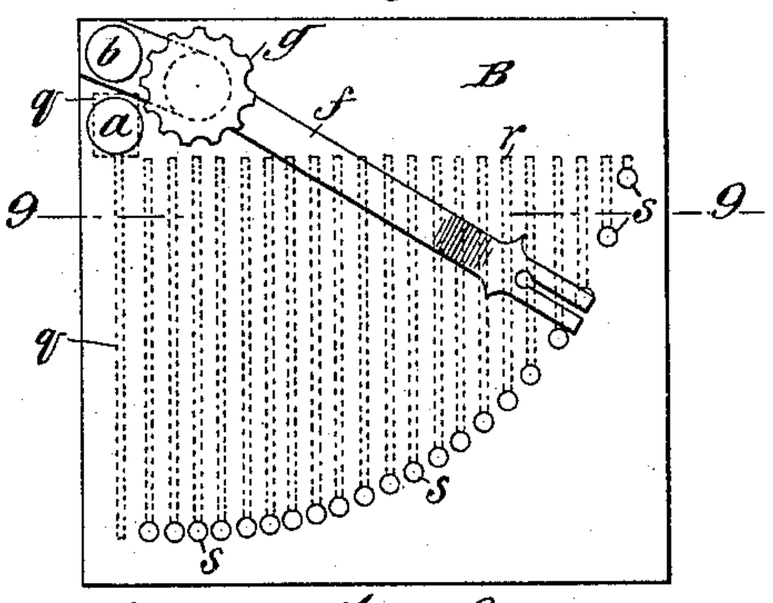
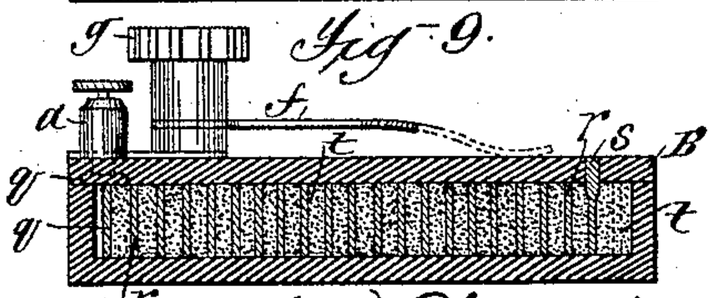


Fig. 9.



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RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 467,338, dated January 19, 1892.

Application filed September 30, 1891. Serial No. 407,574. (No model.)

To all whom it may concern:

Be it known that I, CHARLES WILLMS, a citizen of the United States, residing at Baltimore, Maryland, have invented certain new and useful Improvements in Rheostats, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

In rheostats or current-regulators employing a contact-plate forming or electrically connected with one terminal and a movable contact-piece connected with the other terminal and engaging one of a series of conductors separated from the first contact-plate by resistance material the path of the current through the insulating material tapers from a width equal to the length of the contact-plate to the small conductor with which the movable contact-piece makes contact. The result is that the path of the current is the full width of the resistance material only at the contact-plate. A large part of the resistance material between the contact-piece and conductor is not utilized in any single position of the movable contact-piece, and it is difficult and in some cases impossible to accurately graduate the variation in resistance introduced by the change in position of the movable contact-arm. I provide an improved construction in which the resistance material is divided into sections by collecting sectors, so that the full width of the resistance material forms the path between the contact-plate and movable contact-piece, the current being transmitted through the resistance material from the contact-plate to the collectors and thence through the conductors to the contact-piece.

For a full understanding of my invention a detailed description of rheostats embodying my invention in some of its preferred forms will now be given, and the improvements forming the invention specifically pointed out in the claims.

In the accompanying drawings, forming a part of this specification, Figure 1 is a plan view of a convenient form of rheostat embodying my invention. Fig. 2 is a reversed plan of the same. Fig. 3 is a section on the line 3 of Fig. 1. Fig. 4 is an enlarged detail section on the line 4 of Fig. 1. Fig. 5 is a side view of a modified form of rheostat. Fig. 6 is a bottom view of the same. Fig. 7 is an enlarged detail section showing one of the conductors and collectors. Fig. 8 is a plan view of a rheostat adapted for use with a large quantity of current, and Fig. 9 is a section on the line 9 of Fig. 8.

Referring now to Figs. 1 to 4, A is a block of insulating material, preferably of rubber; *a b*, the binding-posts mounted therein and forming the terminals. The binding-posts *a b* pass through the block A and connect, respectively, with metallic conducting-plates, *c d*, secured to the under side of the block. The plate *c* forms the contact-plate from which the current passes through the insulating material, and the plate *d* connects by means of a stud *e*, extending through the block, with a contact-arm *f*, moving in the arc of a circle over the top of the block and actuated by means of an insulating thumb-piece *g*, connected to the stud *e* and arm *f* by a cross-pin, as shown, or in any other suitable manner. The contact-arm *f* at its outer end moves over and makes contact with a series of conducting-pins *h*, preferably level with the top of the block and extending through the same and projecting from the under side of the block, being preferably of considerable size on top of the block to form extended contact-surfaces and of small size below to give as great a distance as possible between the pins to be traversed by the current through the resistance material. The contact-plate *c* and the under side of the block about the conducting-pins and between them and the center of the block are covered to the desired thickness with resistance material. I prefer to use as the resistance material a mixture of plumbago, glue, and suitable insulating material; but any other suitable compound or material of high specific resistance may be used. As shown, the resistance material forms only a thin layer upon the under side of the block, as the rheostat now being described is designed to be used with a small current; but it will be understood that the thickness of the resistance material may be varied as desired. The layer of resistance material is preferably formed as shown, so that the width of the material decreases from the contact-plate *c* about the

block, the width of the path for the current decreasing regularly, this narrowing of the path having the same effect as varying the resistance material to increase the resistance.

The construction thus far described is old and is subject to the objections above pointed out.

Referring now to the parts embodying my invention, a series of pins *m* are secured on the under side of the block A at the inner line of the resistance material *i* and corresponding to the conducting-pins *h* on the outer line of the same. Wires *n* extend between the pins *h m*, being secured to the pins and drawn tightly in any suitable manner. These wires are embedded in the resistance material and form collecting-sectors by which the current is collected from the resistance material and transmitted to the conducting-pins *h*, thus dividing the resistance material into sections, the full width of the section forming the path of the current. As will be seen from Fig. 4, the wires or collecting-sectors are substantially equal in diameter to the thickness of the resistance material, so as to make contact with approximately the full cross-section of the resistance material.

The operation of the device is the same as that of rheostats of this class now in use and will be understood without further description. By my invention the full width of the resistance material at every point is utilized, and the graduation of the current depends simply upon the width of the material, which it will be seen does not vary with the position of the contact-arm *f*, except as it is intentionally varied by decreasing the width of the resistance material in making the rheostat.

It is evident my invention may be embodied in rheostats of other forms than that above described, and that the principle of my invention is applicable generally in rheostats.

In Figs. 5 to 7 I have shown a modified construction. In the rheostat shown in these figures the general construction and arrangement are the same except in respect to the resistance material and its support, and the same references will be used for similar parts so far as they correspond in the two constructions. In the modified construction the resistance material is not placed upon the under surface of the block; but the conducting-pins *h* are split upon the under side of the block, and the edge of a sheet of mica or other suitable insulating material is thus secured in the pins. This sheet of insulating material extends downward from the under side of the block and is so shaped as to diminish in width from the contact-plate about the block. The insulating material *i* is spread upon the opposite sides of the mica, which thus forms a support for the resistance material, the width of the resistance material and path of the current therefore diminishing, as in the construction shown in Figs. 1 to 4. The collecting-sectors by which the resistance material is divided into sections consist of wires *p*, which pass from one side of the conducting-pins *h* over the edge of the sheet of mica *o*, and being secured to the other fork of the same split on the opposite side of the mica. These wires are embedded in the resistance material, as in the construction shown in Figs. 1 to 4, and it is evident that the construction with the resistance material upon the mica and diminished in width from the contact-plate *c* and with collecting-sectors *p* operates in substantially the same manner as that construction. As above stated, the thickness of the resistance material will vary with the quantity of current to be used, and it is evident, also, that the increased resistance by which the current is regulated may be produced either by diminishing the conducting path of the current through the resistance material, as in the constructions previously described, or in any other suitable manner, as by varying the composition of the resistance material at different parts of the path, by varying the thickness of resistance material between different conductors, or otherwise by any of the well-known methods.

In Figs. 8 and 9 I have shown a simple construction of rheostat for large currents, in which thick bodies of resistance material are used, and the collectors consist of conducting-plates the width of which is equal to the thickness of the resistance material. In this construction B is a box, upon the top of which are mounted the binding-posts *a b*, the contact-arm *f* and thumb-piece *g*. Within the box the binding-post *a* connects with a contact-plate *q*, and a series of conducting-plates *r* are mounted at suitable distances from each other and provided with conducting-pins *s*, which extend through the top of the box, and with which the contact-arm *f* makes contact. The conducting-plates *r* form collecting-sectors, as the wires in the constructions previously described, and the spaces between the plates in the box are filled with bodies of resistance material *t*, through which the current passes from plate to plate and from the contact-plate to the conducting-pin *s*, with which the contact-arm *f* is then in contact. The resistance is graduated in this construction by making the resistance-bodies *t* of different material, the resistance increasing from the contact-plate *q*. The resistance may be graduated, however, in any other suitable manner, or, of course, may be uniform.

It will be understood that in a construction similar to that shown in Figs. 8 and 9 a collecting-sector of small lateral area may be used with a thick body of resistance material; but in such case the excess of resistance material is practically useless, and approximately the same amount of current would be conveyed by a less thickness of resistance material. It will be understood, therefore, that such a construction is within my invention, as all the functions of the col-

lecting-sectors are subserved by a collector which makes contact with substantially the full cross-area of the resistance material required on the plane of the collector for the quantity of current designed to be used.

While I have shown and described only the preferred forms of construction in which my invention may be embodied, it is evident that many other forms of rheostats may be devised employing the principle of my invention; and my invention is not to be limited to any of the special constructions shown.

What I claim is—

1. A rheostat having a body of resistance material forming a path for the current and divided into sections by a series of collecting-sectors, each of substantially the same area as the cross-section of the resistance material required at the plane of the sector, substantially as described.

2. A rheostat having a body of resistance material forming a path for the current in which the resistance varies from one point to another and divided into sections by a series of collecting-sectors, each of substantially the same area as the cross-section of the resistance material required at the plane of the sector, substantially as described.

3. A rheostat having a body of resistance material forming a path for the current of gradually-decreasing width and divided into sections by a series of collecting-sectors, each extending the width of the resistance material at the plane of the sector, substantially as described.

4. In a rheostat, the combination, with a contact-plate with which one conductor of the circuit connects, of a series of conductors, a movable contact-piece with which the other conductor of the circuit connects and which is adapted to form contact with any one of the series of conductors, a body of resistance material forming a path for the current between the contact-plate and successive conductors, and a series of collecting-sectors in which the resistance varies from one point to another and connected with the conductors and each of substantially the same area as the cross-section of the resistance material required at the plane of the sector, substantially as described.

5. In a rheostat, the combination, with a contact-plate with which one conductor of the circuit connects, of a series of conductors, a movable contact-piece with which the other conductor of the circuit connects and which is adapted to form contact with any one of the series of conductors, a body of resistance material forming a path of gradually-decreasing width for the current between the contact-plate and successive conductors, and a series of collecting-sectors dividing the resistance material into sections and connected with the conductors and each of substantially the same area as the cross-section of the resistance material required at the plane of the sector, substantially as described.

6. In a rheostat, the combination, with a non-conducting surface coated with a resistance material, of a series of conductors between which the resistance material forms a path for the current, a movable contact-piece adapted to complete the circuit by forming contact with any one of the series of conductors, and a series of collecting-sectors embedded in the resistance material and connected with the conductors and each extending the width of the path of resistance material at the plane of the sector, substantially as described.

7. The combination, with the insulating-block A, of contact-plate *c* on one side of the block, with which one conductor of the circuit connects, contact-piece *f* on the other side of the block, mounted to move in the arc of a circle, and with which the other conductor of the circuit connects, a series of conducting-pins *h*, extending through the block and arranged on the circle traversed by the contact-arm *f* and forming contact therewith, resistance material on the same side of the block as contact-piece *c* and forming a path for the current, and collecting-sectors embedded in the resistance material and connected with the conductors and each extending the width of the path of resistance material at the plane of the sector, substantially as described.

8. The combination, with the insulating-block A, of contact-plate *c* on one side of the block, with which one conductor of the circuit connects, contact-piece *f* on the other side of the block, mounted to move in the arc of a circle, and with which the other conductor of the circuit connects, a series of conducting-pins *h*, extending through the block and arranged on the circle traversed by the contact-arm *f* and forming contact therewith, resistance material on the same side of the block as contact-piece *c* and forming a path for the current of gradually-decreasing width, pins *m*, corresponding to conducting-pins *h* and on the opposite side of the path of resistance material, and wires *n*, connecting pins *h* and *m* and embedded in the resistance material, substantially as described.

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

CHARLES WILLMS.

Witnesses:
H. G. ENSOR,
WM. H. JONES.