

(No Model.)

J. J. WOOD.
RHEOSTAT.

4 Sheets—Sheet 1.

No. 502,340

Patented Aug. 1, 1893.

FIG. 1.

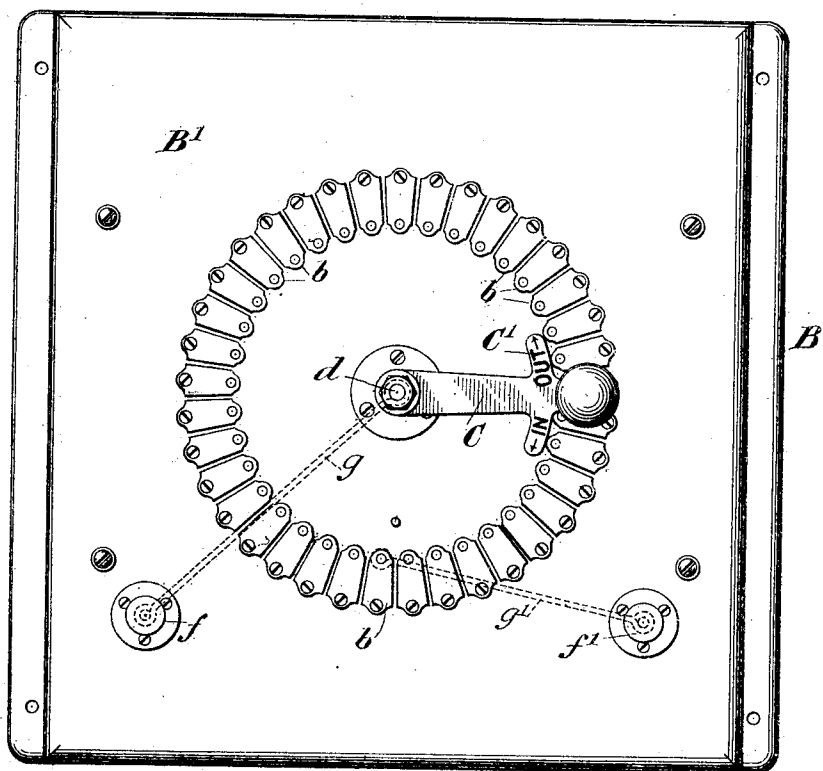
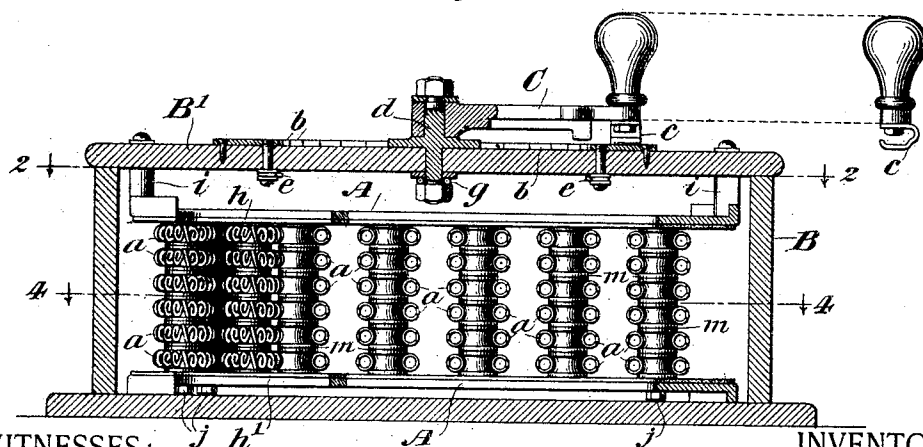


FIG. 3.



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FIG. 2.

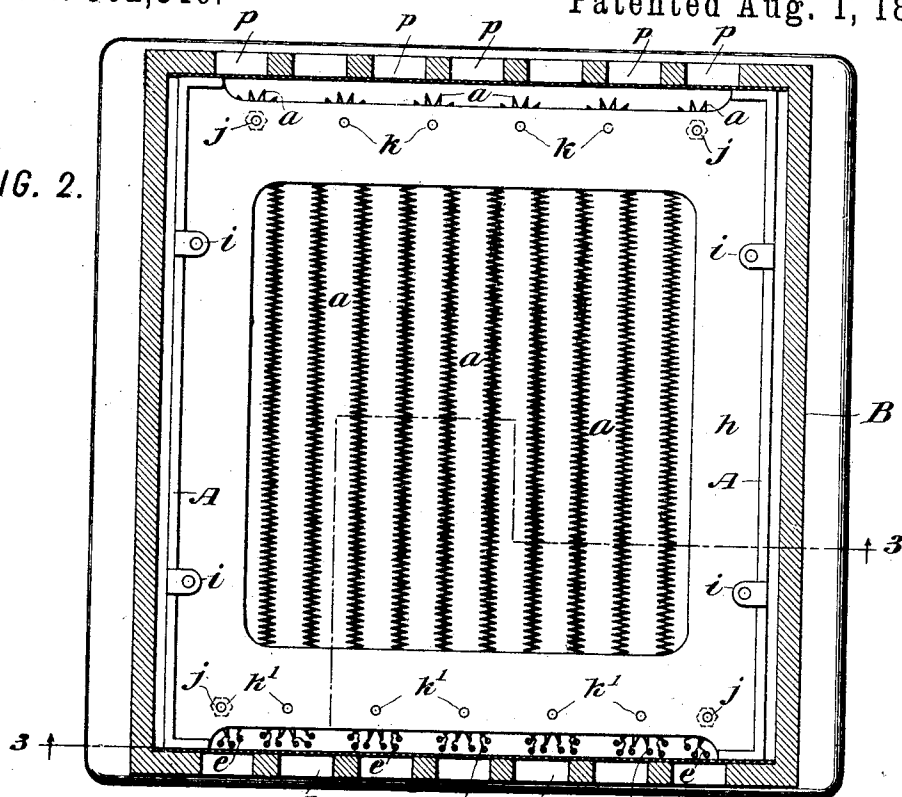
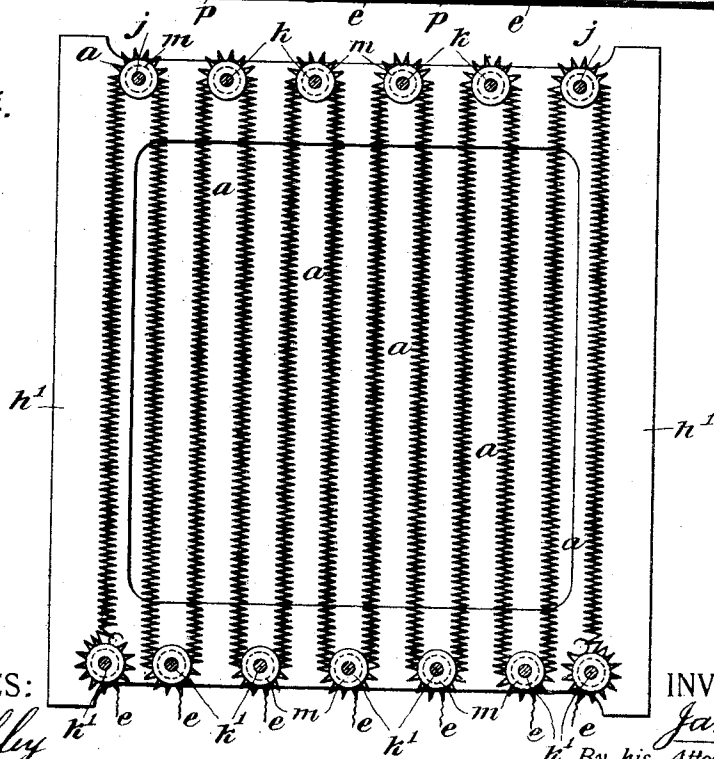


FIG. 4.



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FIG. 5.

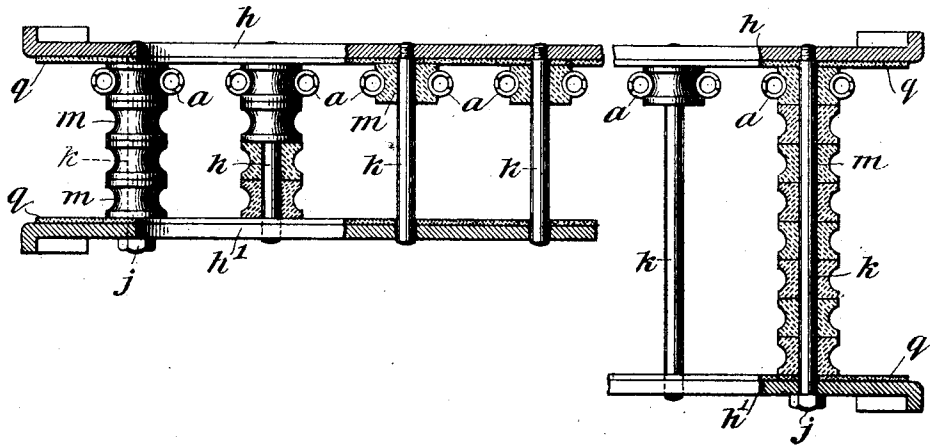
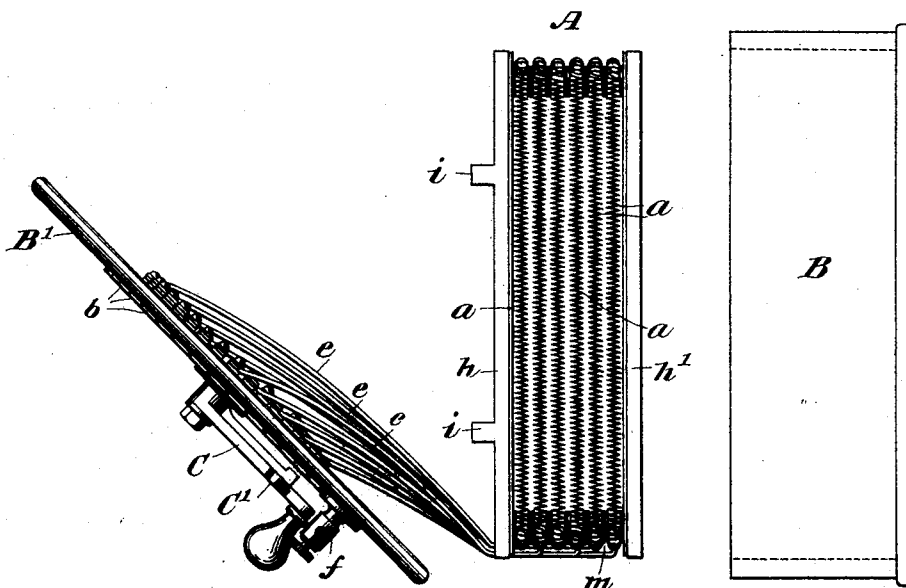


FIG. 6.



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FIG. 7.

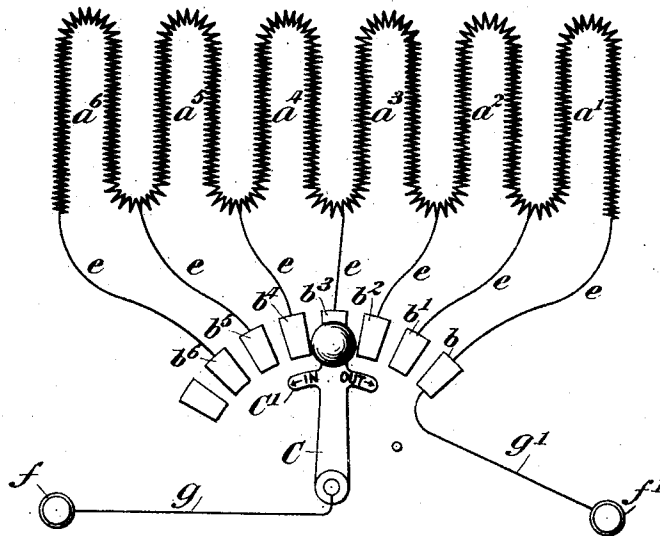
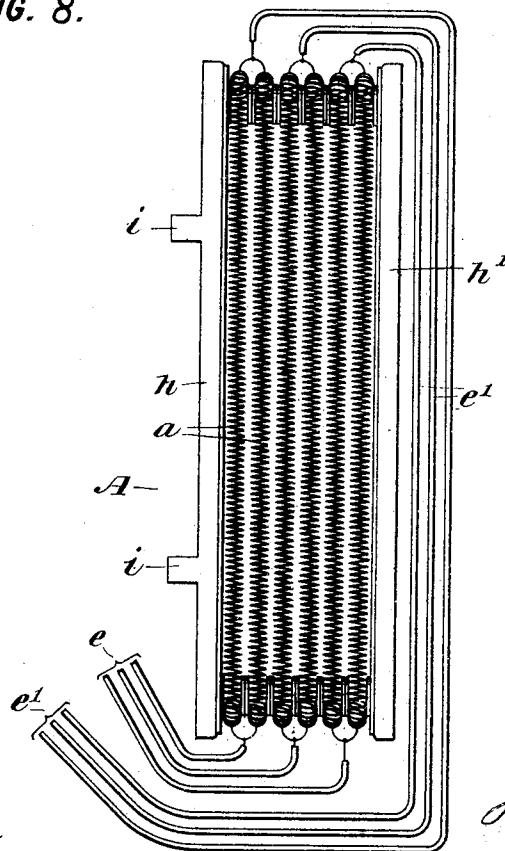


FIG. 8.



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UNITED STATES PATENT OFFICE.

JAMES J. WOOD, OF FORT WAYNE, INDIANA.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 502,340, dated August 1, 1893.

Application filed July 15, 1892. Serial No. 440,114. (No model.)

To all whom it may concern:

Be it known that I, JAMES J. WOOD, a citizen of the United States, residing in Fort Wayne, in the county of Allen and State of Indiana, have invented certain new and useful Improvements in Rheostats, of which the following is a specification.

This invention relates to rheostats or resistance boxes adapted for throwing a graduated resistance into an electric circuit under the control of the operator. The invention provides an improved and simplified construction of such instruments.

Figure 1 of the accompanying drawings is a front elevation of my improved rheostat. Fig. 2 is a front view in vertical section on the line 2—2 in Fig. 3. Fig. 3 is a horizontal section cut in the planes of the line 3—3 in Fig. 2, and looking upwardly. Fig. 4 is a vertical section of the resistance coils and frame removed, cut on the line 4—4 in Fig. 3. Fig. 5 is a horizontal section of Fig. 4 partly dissected and showing the adaptation of the invention to resistance boxes of different sizes. Fig. 6 is a side elevation showing the resistance box opened and illustrating the manner of connecting the wires leading from the resistance coils to the segments. Fig. 7 is a circuit diagram. Fig. 8 is a diagrammatic side view.

In my improved rheostat the resistant element consists of wire, preferably German silver wire, coiled in close coils the convolutions of which are barely out of contact with each other. These coils have their helical portions carried without interruption over insulating bars or rollers at top and bottom, so that between these supports the coils are extended vertically parallel with one another.

In the drawings, let A indicate a frame carrying the resistance coils *a a*, inclosed in a case or box B having a removable front board or cover B'. On the front of this cover are fastened the segments *b b*, which are swept by a contact spring *c* mounted on an operating lever or arm C, which is pivoted on a stud *d* at the middle of the cover. The several segments *b b* correspond in number with the resistance coils *a a*, and are connected to the respective coils by connection wires *e e* at the back of the cover. On the cover are two binding posts *f* and *f'*, the former of which is con-

nected by a wire *g* (Fig. 1) with the pivot *d* of the conducting lever C, while the other binding post is connected by a wire *g'* with the initial segment *b*, all as clearly indicated in Fig. 7.

The frame A is constructed of a front plate *h* and a back plate *h'*, which may be of cast iron. The front plate has lugs *i* by which it is fastened to the front board or cover B', so that by disconnecting this cover from the box B, the removal of the cover will carry with it the entire frame A and resistance coils, thereby removing the latter from the box and rendering them readily accessible. The plates *h h'* are fastened together at the corners by means of four bolts *j j*. Extending between the plates is a row of pins *k k* at the top, and a similar row *k' k'* at the bottom. Preferably the two upper bolts *j j* constitute the end pins *k k*, and the two lower bolts constitute the end pins *k' k'*. On these pins are supported a succession of insulating rollers *m m*, best shown in Fig. 5. These are preferably made of porcelain, each having a hole forming a free fit with the pin, and having a circumferential groove in its exterior large enough to receive the resistance coil. The lower roll *k'* contains one more pin than the upper row *k*, six pins being shown in the upper row and seven in the lower row, in order to support six resistance coils for each series. A suitable length of the coiled resistance wire *a* to give the combined resistance of the coils constituting one series (six in the construction shown) is cut off, and one end thereof is bent around the first roller *m* on one of the end pins or bolts of the lower row, the coil being then carried upward over the first roller *m* on the end pin of the upper row, thence downward again around the corresponding roller on the second pin of the lower row, thence upward again and so on back and forth until it has been carried over all of the first series of rollers on all of the pins, its final end being bent around the roller on the last of the lower pins, all as shown in Fig. 4. The wire coil is made somewhat shorter than the length of its zigzag path, in order that it shall be somewhat stretched so as to distend it and keep its convolutions out of contact. Its distension is rendered uniform by the turning of the rollers on the pins, since all the rollers are loosely mounted on the pins

during the operation of applying the resistance coils. The coils of the first series having been thus applied to the first series of rollers, the same operation is repeated for the
 5 coils of the second, third, fourth, &c., series. Fig. 5 shows the coils of only the first series thus far applied. When all the coils have been applied in this manner, the bolts *jj* are
 10 tightened in order to draw the plates *h h'* together. It is important to introduce cushioning layers or washers between the porcelain rollers and the respective front and back plates of the frame, in order to avoid the liability of cracking the porcelain upon the
 15 screwing together of the plates. To accomplish this, and at the same time provide an insulating covering for the inner surface of the plates, I apply against the inner side of each plate a layer of a suitable fireproof cushioning or insulating substance, asbestos being
 20 preferable. These layers are shown at *q q* in Fig. 5. In the preferred construction, the pins *k k'* intermediate of the end pins or bolts are screwed tightly into one of the plates, and
 25 their ends enter freely into holes formed in the other plate so as to be guided thereby, as shown in Fig. 5. All of the resistance coils having been thus mounted in the frame, they are ready for the attachment of the connection wires *e e*, which are twisted onto and soldered to the portions of the resistance coils
 30 where they pass under the lower rollers, as shown in Fig. 4. The frames *h h'* are cut out on the under side to permit of these wires being passed thence forward, as shown in cross-section in Fig. 2. The wires are carried forward beyond the front frame *h*, and pass up in the space between this frame and the cover
 35 *B'*, extending to the respective screws by which connection is made with the contact segments.

The inclosing case *B* is provided with holes *p p* through its top and bottom, as shown in Fig. 2, which permit of an upward circulation
 45 of air through and between the resistance coils, whereby they are kept cool. These holes have a shield of wire gauze fastened across them on the inside of the case to prevent any injurious thing from entering the
 50 box.

My improved resistance box is thoroughly fireproof for a current of more than double that for which it is designed, since the resistance coils are carried wholly by an iron frame,
 55 and come in contact only with porcelain or other fireproof rollers or equivalent grooved supports. By carrying the same coil of wire continuously over and under the supports, its connection therewith is rendered very simple
 60 and is made entirely independent of the joining of the connection wires *e e*. By supporting all the coils from the cover, which also carries the binding posts, and to which all the electrical connections are made, the coils and
 65 connections are rendered readily accessible by simply detaching the cover and removing it from the box, whereupon the frame carry-

ing the coils comes out with it. The wires *e e* connecting with the several coils are then all accessible on the under side, so that their
 70 junction with the resistance coils may be inspected. If it is required to get access to the portions of these wires connecting with the segments, it is only necessary to remove the
 75 screws by which the cover is fastened to the lugs *ii* of the front plate, whereupon the cover may be turned down in the manner shown in Fig. 6, so that any of the wires may be traced and their connections examined.

An important advantage of my invention is
 80 found in the facility it affords for the construction of resistance boxes of varying sizes or having varying numbers of coils. To vary the number of coils it is only necessary to change the length of the interposed pins *k k'*
 85 so that they shall hold a greater or less number of the rollers *m m*. Thus the construction shown in Figs. 1 to 4 has six rollers on each pin, thus accommodating six series of resistance coils; but in Fig. 5 are shown two ar-
 90 rangements, that at the left hand having only four rollers on each pin, while that at the right has eight rollers. Thus within the limitations of practicability any number of coils may be provided by simply varying the depth
 95 of the frame that supports them, and supplying a deeper or shallower box *B*. The number of segments *b b* may be varied proportionally to the number of coils used, in the manner well understood.

The contact lever *C* is in general of usual construction. It embodies, however, one practically important improvement, namely, the application to it of an indicator to denote the
 105 direction in which it should be turned to throw the resistance in or out. Ordinarily, in resistance boxes, if any indication whatever is afforded, the circle of segments is provided with an indicating mark to show which way the arm should be turned, but such marks are
 110 liable to be overlooked or misunderstood, and much inconvenience has resulted from the arm being turned in the wrong direction so as to cut resistance out instead of throwing it into circuit. To overcome these disadvantages, I provide the contact lever *C* with an
 115 indicator *C'* carried by it. This indicator consists of an arc-shaped projection from each side of the arm carrying the words "In" and "Out," or other suitable guiding marks with
 120 arrows pointing in opposite directions. It is obvious from this indicator that to throw resistance in, the arm should be turned in the direction of the arrow springing from the word "In," and to cut resistance out, it should
 125 be turned in the direction of the opposite arrow springing from the word "Out." This guide or indicator turns with the arm, so that in all positions of the latter it indicates the direction in which it should be turned to in-
 130 crease or decrease the resistance.

It is obvious that instead of porcelain rollers *m m* threaded on pins, a single insulating bar might be employed having suitably

spaced circumferential grooves equivalent to uniting the rollers integrally together end to end. The advantage of employing separate rollers is, that any number of series of coils may be readily applied by threading more or less rollers on the pins between the plates h and h' , the pins and bolts being made of the proper length to reach from plate to plate.

Of course the connecting wires ee might be extended over the top of the frame instead of under the bottom, which would be equivalent to turning the frame upside down, or their connections with the coils might be made at one side by extending the coils horizontally, which would be equivalent to turning the frame and coils on its side. But I prefer to connect the wires to the coils at the bottom because this is the coolest portion of the coils, the ascending air currents by which the coils are cooled becoming heated before reaching the upper ends of the coils.

It will be understood that the specific construction of my improved rheostat shown in the drawings is one wherein the coils are connected in series. It is often necessary or advisable, however, to connect two or more coils in multiple in order to increase the conductivity and reduce the resistance for certain purposes. In such case two or more of the upright resistance coils aa will be grouped together and connected to one connection wire, as will be well understood. In case a further subdivision of the coils is required, connections may be made with them at the upper rollers, as well as at the lower rollers, the connection wire from the upper rollers in such case extending rearwardly over the top of the frame, and passed down the rear side of the frame and under the bottom thereof, where they join the connection wires leading from the bottom of the coils. This is shown somewhat diagrammatically in Fig. 8, where e designates the wires connecting with the bottom ends of the coils, and e' designate those connecting with the upper ends, only six wires being shown; these wires being the end wires of three groups. The coils may be connected in any other ways according to the proportions desired or the purposes for which the rheostat is required.

My improved rheostat differs from all other resistance coils in the feature of carrying a continuous helix of wire back and forth over grooved insulating supports at opposite sides. In prior constructions having opposite supports with coils stretched between, the coils have been interrupted or discontinued at each support, the wire being straightened out or uncoiled where it passes over the supports.

I claim as my invention the following-defined novel features or improvements, substantially as hereinbefore specified, namely:

1. In a rheostat, the combination of a frame having opposite grooved insulating supports, with resistance coils carried by said supports and extended back and forth between them

with their helical portions carried uninterruptedly over the opposite supports.

2. In a rheostat, the combination of a supporting frame consisting of front and back plates, with intervening insulating supports, of resistance coils carried between the frames on said supports and extended back and forth over the opposite supports.

3. In a rheostat, the combination of a supporting frame consisting of front and back plates and two opposite rows of pins extending between said plates, of insulating supports carried on said pins, and resistance coils mounted in said frame on said supports, being extended back and forth over the opposite supports.

4. In a rheostat, the combination with a supporting frame consisting of front and back plates and two opposite rows of pins extending between them, of grooved insulating rollers mounted on said pins, and resistance coils supported on said rollers with their helical portions carried uninterruptedly around them in the grooves thereof, and extended back and forth between the opposite rollers.

5. In a rheostat, the combination with a supporting frame consisting of front and back plates and two opposite rows of pins extending between them, of grooved insulating rollers mounted on said pins, a resistance coil supported on said rollers by being extended back and forth over the opposite rollers, with its helical portion carried uninterruptedly around in the grooves thereof, fastened at its terminals and distended to separate its convolutions, whereby by the turning of the rollers its distension is equally distributed.

6. In a rheostat, the combination of a supporting frame having insulating supports and resistance coils carried on said supports, with a box inclosing said frame, the front board or cover of said box carrying the segments and contact arm, and the connecting wires for joining the segments to the resistance coils extending downwardly from the respective segments between said cover and frame, and passing underneath the frame, to the respective coils, whereby by turning down the cover all the connecting wires are exposed and accessible.

7. In a rheostat having a circular series of segments and a contact arm sweeping over them, the combination with this arm of an indicator carried by it and consisting of pointers pointed in opposite rotative directions, and directive words or marks in connection with the said pointers, whereby the arm carries with it an indication of the direction in which it should be turned to increase or decrease the resistance.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JAMES J. WOOD.

Witnesses:

ARTHUR C. FRASER,
GEORGE H. FRASER.