(No Model.) 2 Sheets—Sheet 1.

# A. J. SHAW.

## RHEOSTAT.

No. 517,770. Patented Apr. 3, 1894.

*Fig. 1.*

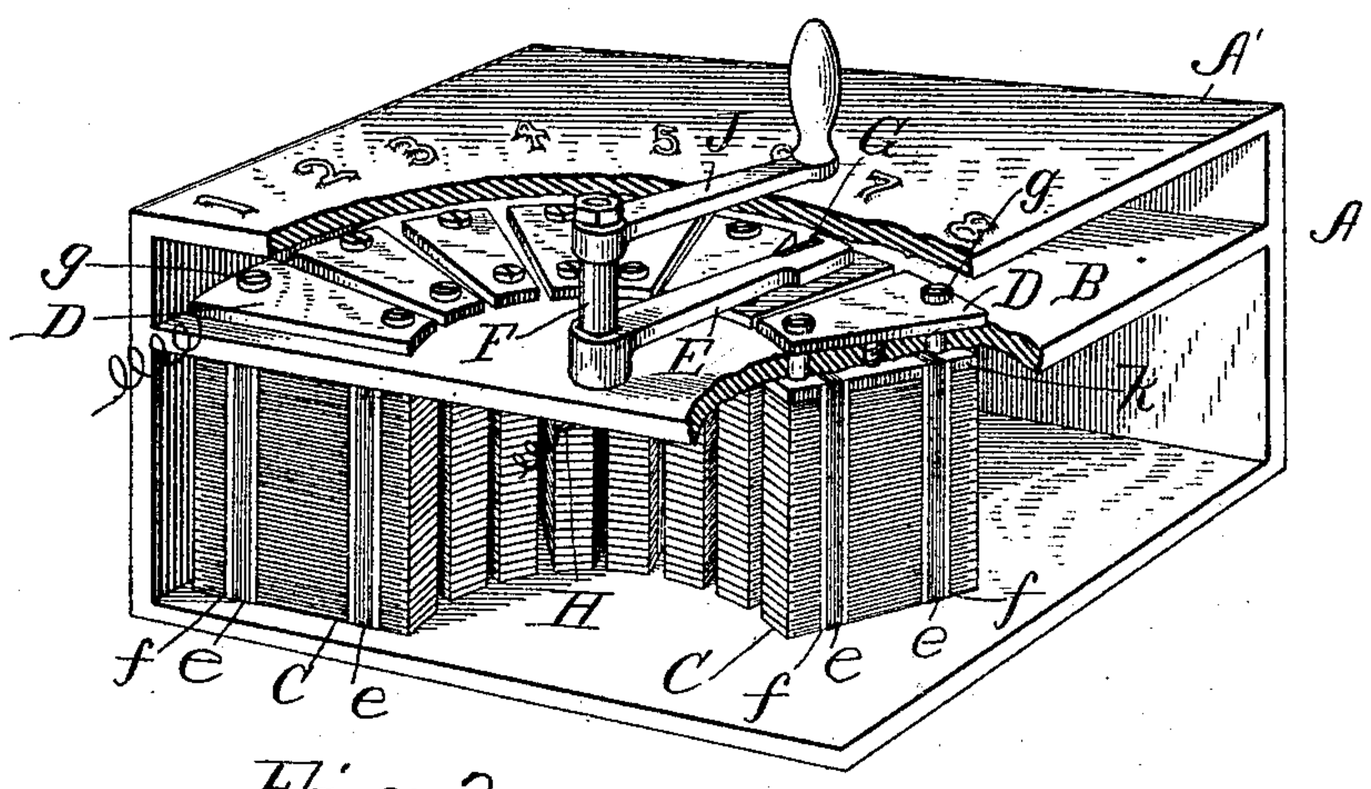
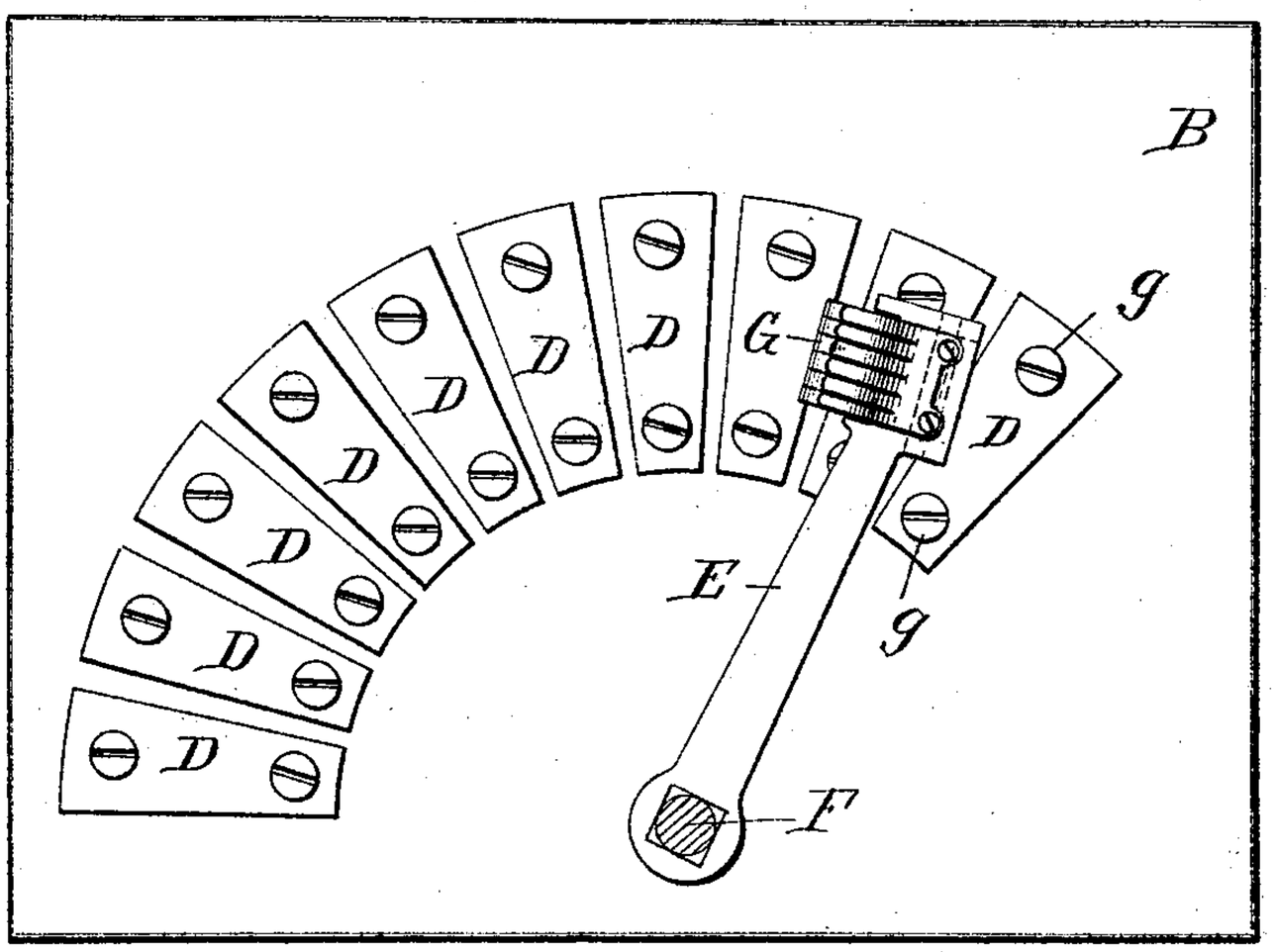



*Fig. 2.*

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(No Model.) 2 Sheets—Sheet 2.

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*Fig. 3.*

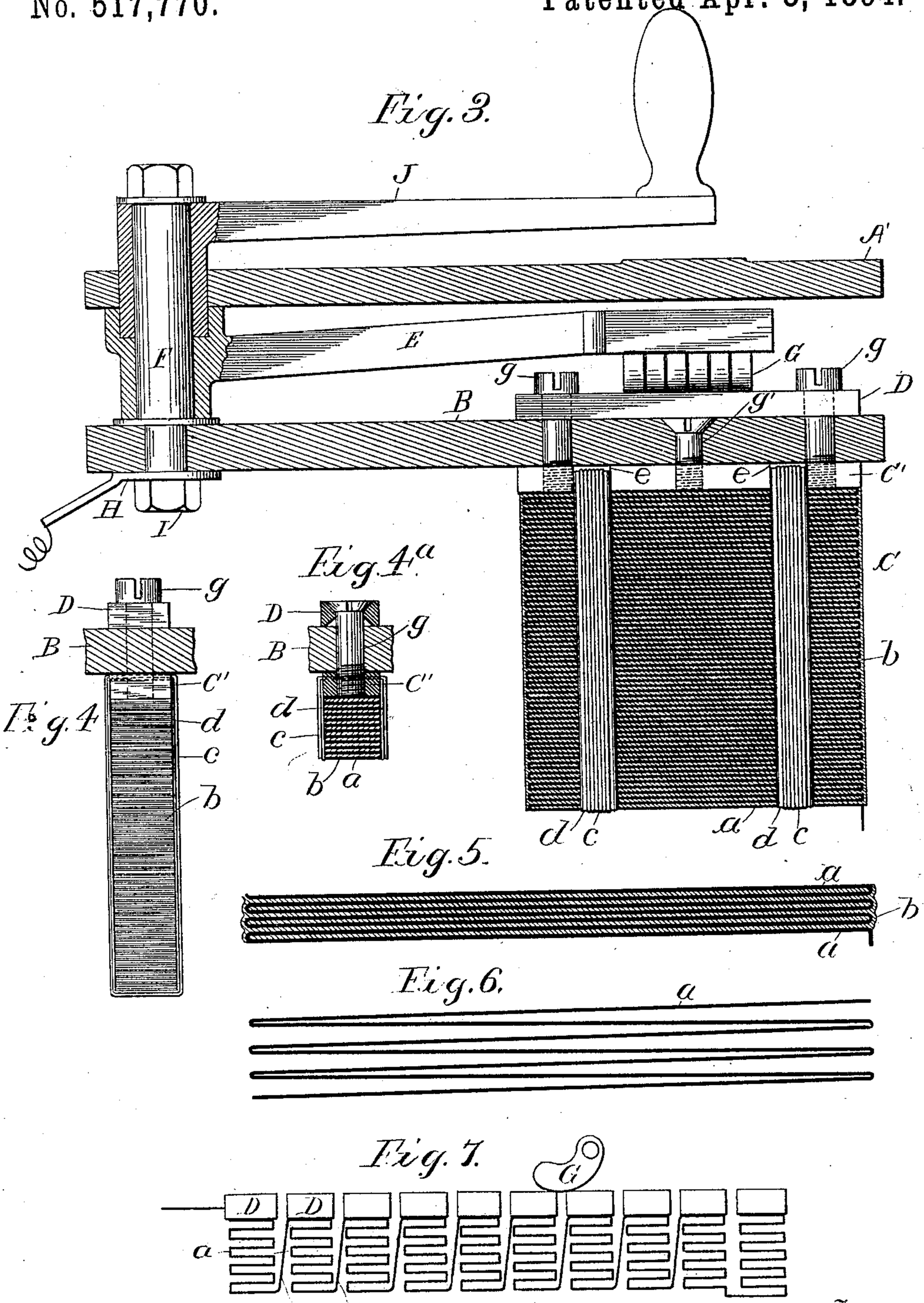


*Fig. 4.*




*Fig. 4a.*




*Fig. 5.*




*Fig. 6.*




*Fig. 7.*




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# UNITED STATES PATENT OFFICE.

ALTON J. SHAW, OF MUSKEGON, MICHIGAN.

## RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 517,770, dated April 3, 1894.

Application filed October 12, 1893. Serial No. 487,926. (No model.)

*To all whom it may concern:*

Be it known that I, ALTON J. SHAW, a citizen of the United States, residing at Muskegon, in the county of Muskegon and State of Michigan, have invented certain new and useful Improvements in Rheostats, of which the following is a specification.

My invention relates to rheostats, and is designed to produce a simple, cheap and efficient instrument, suitable for use with powerful currents, and capable of ready renewal or repair.

The invention consists in various novel features, combinations and details hereinafter set forth and claimed.

Figure 1 is a perspective view of a rheostat embodying my invention in a convenient form for general use; Fig. 2, a top plan view, showing the contact blocks and arm; Fig. 3, a sectional view, illustrating the preferred manner of attaching the resistance cards or blocks to a supporting plate or board; Figs. 4 and 4ª, edge elevations of one of the cards or sections, the latter showing the contact block in section; Fig. 5, a sectional view of a portion of a card, block, or section, showing the manner of binding and insulating the metallic tape or band; Fig. 6, a view of the band prior to insulation; Fig. 7, a diagrammatic view, showing the manner of connecting the cards or sections in building up a rheostat.

In designing my rheostat, I have aimed to produce an instrument suited to the conditions of actual and general use; that is to say, to provide a compact device, capable of carrying and controlling powerful currents without danger of being destroyed or injured; cheap and durable in construction; and convenient to repair or renew if necessary.

Briefly stated, the construction involves the use of a series of cards, blocks, or sections of metallic tape or ribbon, (light strap iron being preferred,) folded upon itself, the layers insulated one from another,—and a movable contact for bringing into circuit a greater or a less number of the cards or sections, as required.

The precise manner of folding the band and connecting the cards or sections, as also the grouping of the cards, may be varied, and in the drawings I have represented what I deem an advantageous embodiment of the invention.

In said drawings, A indicates a box or casing, provided with a board or diaphragm B, which may be of slate, vulcanized fiber, or other suitable non-conducting material. The board B, which is here represented in a horizontal position, constitutes a support for the resistance cards or sections, and may be arranged in any desired position, according to the working conditions.

C indicates a resistance card, block or section, formed of a metallic tape, ribbon, or band, *a*, folded back and forth upon itself, the several folds being insulated one from another, to compel the current entering at one end to pass through the entire length of the band before passing to anything beyond. The folding of the tape, ribbon, or band *a* may vary somewhat as to order and direction, though I prefer the zigzag or back-and-forth folding shown.

In every case I find it advantageous to fold the metal in comparatively short lengths, because I thereby lessen the "drop" or decrease of potential at any point between the folds, and consequently lessen the tendency of the current to short circuit or jump across from fold to fold without traversing the entire length of each. This in turn enables me to employ with safety, lighter insulation than would otherwise be required.

In Figs. 1 to 5 inclusive, I have represented the cards as consisting each of a single strip *a*, folded directly back and forth upon itself,—or upon the intervening insulation,—Fig. 7 showing a series of such cards suitably connected to form a rheostat.

In Figs. 3, 4 and 5, I have represented the folds of the metal strip as separated and insulated one from another by a thin layer or body *b*, of enamel, which also serves to bind the folds together.

By the employment of any insulating enamel or cement capable of firmly uniting with the metal and of resisting heat, the whole card can be made into one firm and compact body; but in practice I find it expedient to employ in connection with such enamel, binding wires *c*, separated from the card C and from its supporting or carrying bar C′, by in-

sulating strips *d*, Figs. 3 and 4. The wires *c*, which may be covered or not, serve not only to firmly bind the folded metal band *a* into a compact and solid card or body, but they also firmly secure said card to the supporting bar C′. The upper side of each supporting bar C′ is provided with recesses or seats *e* to receive the binding wires and their insulating strips, and to prevent these from projecting above the face of the bar. The enamel proposed is such as is commonly used upon culinary vessels,—care being taken in this case as in that of such vessels, to select a composition having the same ratio of expansion and contraction as the metal or alloy employed. These being common and well known, and having long been employed for electrical insulation, need not be further specified, though it may be stated that the enamel used upon so-called "granite-ware," is well suited to the purpose, as are also the white and blue enamels of German sheet metal ware, now extensively sold. It is of course important that the enamel enter and pass between all portions of the proximate folds, and to insure such result, it is found advantageous to make the folds somewhat open, or to separate them more or less in the first instance in the manner illustrated in Fig. 6. While the folds are thus separated, the entire strip, with the exception of the top or first fold, is immersed in the fluid enamel, which is thus caused completely to envelop the metal. This accomplished, the folded band is removed from the enamel bath, and the layers or folds are firmly pressed together, in which condition they are held until the enamel is hardened by baking or otherwise. The compression of the card to render it compact, may be effected by a suitable press or clamp, or by the binding wires, which latter will be insulated from the band *a* by the enamel, or by strips *d*, as above indicated. Better to insure a perfect union of the enamel and the metal or alloy used, it will be found advisable to roughen the latter slightly, which may be done mechanically, or by corrosion.

Enamel is preferred to other insulating materials because of the ease with which it can be applied, its excellent insulating properties, and its action as a binder for the folded strip. It is also unaffected by the development of even great heat in the band *a*.

Whatever be the form or arrangement of the folding, the card or body C will be secured to a supporting bar C′, as above mentioned. Each bar C′ is tapped to receive screws or tap bolts *g*, which pass through a metallic contact block D, then through the supporting board B, and finally screw into the bar C′, as shown in Figs. 3 and 4. The screws thus serve not only to support and fasten the cards or sections C in place, but they also serve as conductors to convey the current from the bar C′ to the contact block or plate D, on the opposite side of the board B, or vice versa. The contact blocks D wear away or grow rough and uneven with use, owing to the rubbing of the contact brushes upon them, and to an almost inevitable amount of sparking between the brushes and contact blocks. In order to prolong the usefulness of the blocks without necessitating redressing, I make them reversible, so that when one face becomes worn, the opposite face may be brought beneath the brushes. When the tap bolts or screws have the form shown in Figs. 1, 3 and 4, that is to say, are made with a cylindrical head, the lower face or shoulder of which is perpendicular to the axis of the screw, no special adaptation of the holes in blocks D is necessary to permit such reversal; but when the bolts or screws are of the form of "stove-bolts," or have the beveled form of head common to wood screws, the holes are counter-sunk, in both faces of bar D, to receive the bolt-heads, as illustrated in Fig. 4ª. In order to reverse or to renew a contact block D, it is of course necessary to remove the screws *g* which hold it, and such removal would, in the absence of other fastening device, permit the card or section belonging to such block to fall from the support B. To prevent this, and to permit each block to be removed and replaced at will, without necessitating access to or interference with the cards or sections, I employ for each card an additional supporting or fastening screw *g′*, which passes through the supporting board or body B, and enters a properly threaded seat in the bar C′, as shown in Fig. 3.

It is apparent that the blocks D may be made of different forms in cross section, and that holes may pass through them in different directions, either intersecting one another or offset slightly, so that more than two faces may be utilized. A square bar or block will be found very serviceable. So, too, any equivalent and well known fastening device may be substituted for the screws. It will of course be understood that the supporting board or body A must in all cases be of insulating material, or that the contact blocks D, bars C′ and screws *g* and *g′* must be carefully insulated from said support.

For the purpose of quickly introducing or cutting out any desired number of the resistance cards or sections C, I provide an arm E, of brass or other good conductor, which arm is swiveled or loosely mounted upon a stem or pin F, at the center from which the cards or sections radiate. The arm E carries a brush G, consisting of a series of hinged or pivoted plates, the lower edges of which are curved so as to ride freely over the contact blocks D and from one to another, the space between the blocks being such that the plates of brush G will readily reach across and make contact with one block before leaving another. In practice it will be advisable to employ a spring or springs to force the plates down and maintain firm and close contact

with the blocks D. Such a spring is shown at G′ in Fig. 2. The stem or pin F is formed with a screw-threaded tang or reduced portion which passes through plate B and also through a metallic connecting strip H, and is furnished with a nut I, by which the stem is held firmly in place. The arm E may be furnished with a knob or hand piece of insulating material, by which to move it, and this may be applied in any convenient manner. In order to prevent accidental contact with the blocks D, or accumulation of dust, grease, or other foreign matter thereon, a second operating arm or lever J may be employed, as shown in Figs. 1 and 3, in which case the arm J will be above and the arm E below the cover or top A′ of the box or casing A.

To permit the application and removal of the crank arm without removal of the top A′, or any portion thereof, the said arm is made separate from arm E, and its lower end is made polygonal, to enter a socket of like form in the hub of arm E, as shown in Figs. 1 and 3.

The order or manner of coupling the cards or sections may be varied as circumstances suggust or require, a convenient arrangement being that illustrated in Fig. 5. As there shown, a line wire *h* connects with the first card C at the left of the series, and the last fold or coil of each card or section is connected with the first or upper fold of the next card to the right throughout the series until the last card or section is reached, at which point the order is changed and the bottom folds of the last two cards are connected direct. Under this arrangement it will be seen that when the brush G rests upon the first block D to the left, the current will pass from said block through the brush and through arm E to connecting strip H and thus to line without introducing any of the card C into the circuit; but as the brush is moved toward the right, one resistance card will be added or introduced for each block passed, until the last one to the right is reached, when two will be introduced. This is found a very convenient arrangement for many uses, but is merely suggestive and not essential. It is also apparent that the cards may be arranged in a straight line or series instead of radial to a common center, the contact brush being arranged to correspond. It will be seen that in the event of injury to any one of the cards or sections, it may be removed and replaced by merely unscrewing three screws and screwing them back into the block C′ of a new section. It will also be seen that the construction is simple, cheap, and durable.

Numerals or other characters may be placed upon the top A′ of casing A to indicate the resistance introduced.

Any equivalent device may be substituted for the screws *g* and *g′*.

Having thus described my invention, what I claim is—

1. A rheostat comprising a series of connected cards or sections of folded metallic tape, a supporting plate for said cards or sections, contact blocks carried by said supporting plate and electrically connected with the respective sections, and a brush movable over the contact blocks substantially as set forth.

2. A resistance card or body consisting of a folded metallic tape or band, having a layer of enamel interposed between the folds and serving both to insulate and mechanically to bind together the several folds or layers.

3. A resistance card or body comprising the following elements in combination; a folded metallic tape or band, a metallic block resting upon one fold of said band, and a binding passing about the folded body and the block and serving to unite the same and hold them in compact condition.

4. In combination with a supporting board or plate, a resistance card C provided with a metallic block C′, a contact block D, and screws or fastenings *g* passing through the contact block and the supporting plate and engaging with the block C′, substantially as shown and described.

5. In combination with a suitable supporting board or plate, a resistance card or body provided with a metallic block C′, a fastening securing the block C′ to the supporting plate, a contact block on the opposite side of said plate, and fastenings extending from the contact block to the block C′, substantially as and for the purpose set forth.

6. A resistance card consisting of two or more insulated sections, each section comprising a metallic band folded back and forth in zig-zag form, the folds being electrically insulated but mechanically united by enamel, substantially as described.

In witness whereof I hereunto set my hand in the presence of two witnesses.

ALTON J. SHAW.

Witnesses:
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T. C. AKIN.