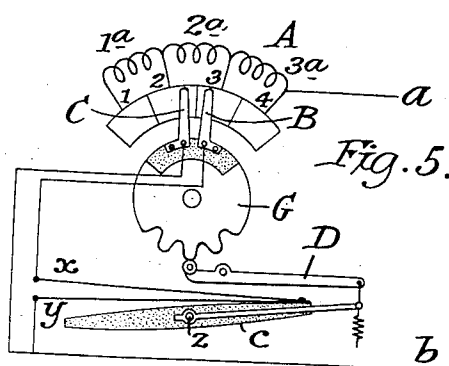
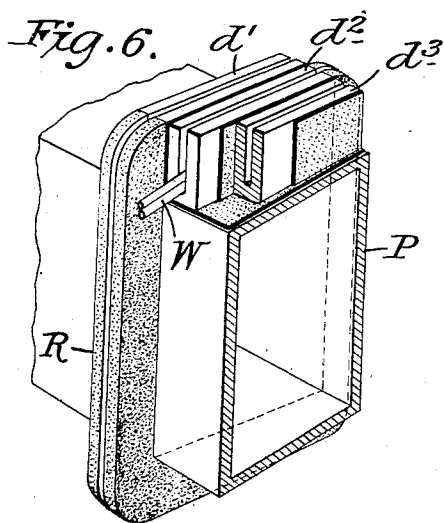
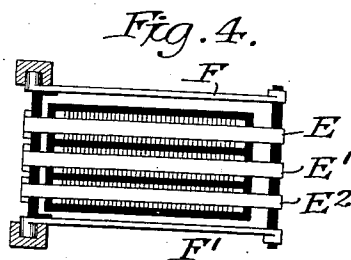
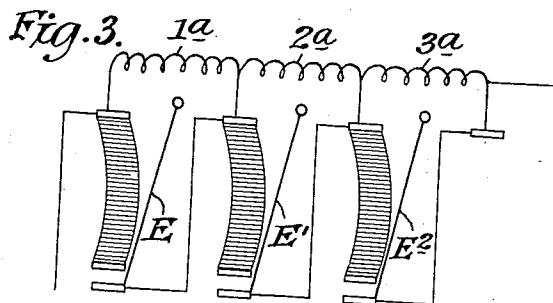
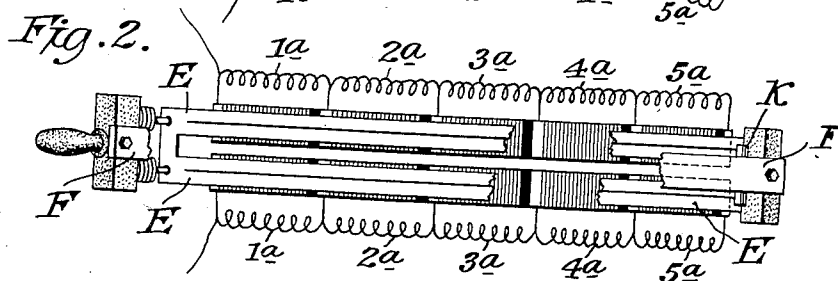
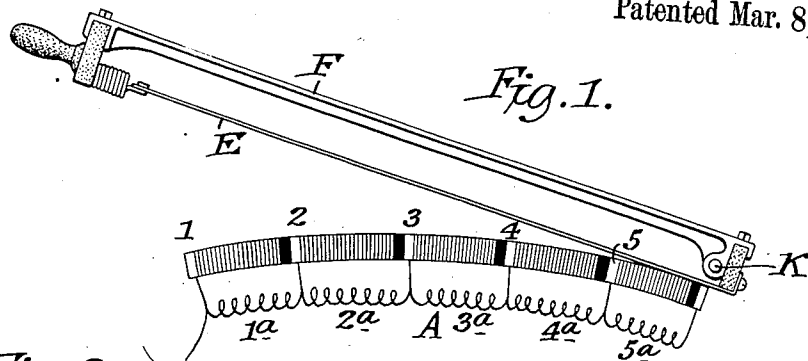




Inventor
 Edward M. Bentley

UNITED STATES PATENT OFFICE.

EDWARD M. BENTLEY, OF LAWRENCE, NEW YORK.

RHEOSTAT.

1,371,192.

Specification of Letters Patent.

Patented Mar. 8, 1921.

Application filed August 7, 1919. Serial No. 315,856.

To all whom it may concern:

Be it known that I, EDWARD M. BENTLEY, a citizen of the United States, residing at Lawrence, county of Nassau, and State of New York, have invented certain new and useful Improvements in Rheostats, the following being a full, clear, and exact disclosure of the one form of my invention which I at present deem preferable.

10 For a detailed description of the present form of my invention, reference may be had to the following specification and to the accompanying drawing, which illustrates my invention, wherein—

15 Figure 1 shows a side elevation, and Fig. 2 a plan of my device;

Figs. 3, 4 and 5 show alternative forms, and

Fig. 6 gives the constructive details.

20 In prior applications Serial Nos. 311524 and 311525, filed July 17, 1919, and in Letters Patent 1,313,853 of August 19, 1919, I have shown rheostats of a novel type in which progressive contact with an extended
25 resisting conductor is effected by means of a flexible metallic ribbon bending over a contact surface which is curved or arched on a long radius and constitutes the extended resisting conductor, being formed either by a
30 second ribbon lying on a curved base or by a pile of resistance elements.

My present invention involves certain improvements in rheostats of that type. In particular I employ such a rheostat in connection with an ordinary rheostat wherein
35 the resistance is in large units or sections connected between succeeding contact blocks. Together with such a rheostat my rheostat is used as a secondary one to bridge the blocks
40 of the ordinary, or primary, rheostat and to then be temporarily increased to a high value so that a section of the primary rheostat can be put into circuit with no material arcing. I have also devised improved constructive details in rheostats of my type.

Referring to Fig. 5 of the drawing, A represents three sections of resistance wire connected between the contact blocks 1, 2, 3 and 4 of an ordinary rheostat herein referred to
50 as the primary rheostat. The said sections are marked individually 1^a, 2^a, 3^a. B and C are the two branches of a split contact brush or finger, the branch B being a trailer connected to the line wire *b* through a rheostat
55 of my peculiar type composed of diverging metallic ribbons *x* and *y* secured to one edge

of an oscillating presser board *c* of insulating material having curved or arched surfaces. As the presser is oscillated clockwise around its center *z* the two ribbons are bent 60 or warped together over the surface of the presser and their resistance thereby short circuited. This is herein designated as the secondary rheostat. The presser is worked periodically by a lever D which engages 65 teeth on a disk G which rotates with the split contact brush.

In operation a counter clockwise rotation of the split brush will bring the sections of primary resistance into the circuit leading 70 from line wire *a*. The branch C of the brush will first cross the break between two succeeding blocks, going—say, from block 3 to block 2. That will leave the trailer B on block 3, putting the section 2^a in parallel 75 with the secondary resistance which is now raised to its highest value by the opening up of ribbons *x* and *y* through the action of lever D. This secondary resistance, being of my arcless type, can be made so high that 80 when the trailer subsequently moves from 3 to 2 it will break with 3 without any appreciable arc, it being remembered that the difference of potential between 3 and 2 is limited by the resistance 2^a which is perma- 85 nently connected therewith. Both C and B will then be on block 2 and the secondary resistance will again be short circuited. That removal of secondary resistance will permit C to make the next move from 2 to 1 90 without an arc since the short-circuited secondary rheostat prevents the existence of potential difference between C and 2. Thereupon the secondary resistance is again thrown in and the trailer B also passes onto 95 block 1 without appreciable arc, as above described.

In the arrangement of Fig. 5 there is but one secondary rheostat which is operated repeatedly, but in Fig. 1 I have shown 100 an arrangement wherein there is a secondary rheostat for each one of the several sections of primary resistance and the same contact ribbon serves for both secondary and primary rheostats. The contact blocks 105 1, 2, 3, 4, 5, are interpolated in the contact curve at intervals, while between each pair of blocks is the extended resistance of the secondary rheostat, which in this case is that form of my arcless type which employs a 110 pile of carbon plates or of metal plates joined by minute lengths of resistance mate-

rial. Each pile is in contact with the block on one side but insulated from the block on the other side. E is the flexible conductor which in this case is stretched like the threads of a violin bow between the opposite ends of a bow F pivoted at K. This expedient removes the tension on the ribbon E from the pivot joint of the bow so that the latter can be moved freely with little friction, the only pressure on the joint being that due to the small increment of tension required to bend the ribbon over the arched surface of the pile. The pivot K is also so located as to give a slight drag of the ribbon longitudinally along the contact surface to keep it rubbed free of dust and corrosion. Manifestly, as the bow swings anti-clockwise, the primary sections 5^a, 4^a, etc., are gradually short-circuited in succession, while it is the clockwise movement that throws the resistance into circuit with a consequent tendency to arcing. Starting at the left the blocks 1 and 2 will be assumed to be covered by ribbon E and the section 1^a completely short circuited just as in Fig. 5 aforesaid each section is short circuited prior to the introduction of the secondary rheostat. Then as the bow begins its clockwise movement the first secondary resistance section will be gradually introduced between ribbon E and block 1 until it is so great that no appreciable arc is produced when the ribbon passes onto the insulation between said resistance section and block 2. In like manner the short circuit will be gradually removed from each section of the primary rheostat. In the plan of this arrangement shown in Fig. 2 the bow F is broken away showing the ribbon E beneath it acting on two parallel sets of primary resistance blocks and intermediate secondary rheostats.

Figs. 3 and 4 show a similar arrangement, but here the several secondary rheostats are operated simultaneously, there being separate ribbons therefor as shown at E, E¹, E². In this case a short and easy movement of bow F F¹ simultaneously applies or removes the short circuit at each of the several sections of the primary rheostat through a secondary rheostat.

In Fig. 6 I have shown on an enlarged scale a special form of my metallic resistance pile wherein the short resistance between the consecutive elements of the pile is formed of wire, instead of a flat sheet of ribbon. The several elements of the pile are shown at d¹, d², and d³, each being formed by a flat sheet bent into a U which is seated on the top side of a metal tube P but insulated therefrom and from its neighboring elements. Around the tube P are placed a series of U-shaped washers R of insulating material with grooves around their

peripheries corresponding to the grooves in the U-shaped elements d¹, d², d³. The two legs of each washer are slightly twisted so that the top of one leg stands in line with element d¹ and the top of the other leg stands in line with the opposite side of element d². This arrangement is repeated until the pile is complete. Then resistance wire is wound in the grooves and by virtue of the offset relation of the legs of the washers, the wire will follow a generally helical course around the tube making contact connection with one of the elements at each succeeding turn. The elements will form points of reinforced conductivity along the length of the wire. At the beginning of the pile several strands of wire will be used, and the strands then terminated at successive points along the pile to give a tapering effect to the resistance which becomes very high toward the end when only a single strand is left. The tube will be slightly curved in length so that the contact surface formed by the elements will have the arched form desired for progressive contact by the tangent ribbon E. The pile will also be mounted in any suitable holder, and the wire sealed in, if preferred, with cement, leaving only the contact surface and, if desired, some of the side surface of the elements exposed to the air.

For service as a secondary conductor in the arrangements of Figs. 1, 2, 3, 4 and 5 I do not restrict myself to the use of a metallic resistance pile, in the event of a pile being used, but may employ a carbon pile in lieu thereof.

I may finally leave the high resistance in circuit in the arrangement of Fig. 3.

What I claim as new and desire to secure by Letters Patent is:

1. A rheostat comprising a pile of elements forming a contact surface along the outside of the pile, and a resistance of wire form wound in contact with the succeeding elements, said elements being so positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

2. A rheostat formed of a pile of resistance elements comprising a series of plates forming a contact surface along the outside of the pile connected by minute resistances in wire form, said plates being so relatively positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

3. A rheostat formed of a pile of resistance elements comprising a series of plates forming a contact surface extended along the outside of the pile and a continuous resistance wire wound in contact with succeeding plates, said plates being so relatively positioned that all or any lesser number there-

of may be simultaneously engaged by a contact member.

4. A rheostat formed of a pile of conducting elements forming a contact surface along the pile and strands of resistance wire wound in contact with succeeding elements, said elements being so relatively positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

5. A rheostat formed of a pile of conducting elements forming a contact surface along the pile and strands of resistance wire wound in contact with succeeding elements, the strands terminating at definite points along the pile, said elements being so relatively positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

6. A rheostat formed of a tubular base, a pile of insulated elements thereon forming a contact surface extending along the tube, and resistance wire wound on the tube in contact with the succeeding elements, said elements being so relatively positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

7. A rheostat formed of a tubular base, a pile of insulated elements thereon forming a contact surface, grooved washers extending around the tube and offset between succeeding elements, and resistance wire wound in said grooved washers and in contact with said elements, said elements being so relatively positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

8. A rheostat comprising a base, a pile of elements constituting a contact surface extending along the base, and resistance wire wound around said base and around said elements to connect therewith in succession, said elements being so relatively positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

9. A rheostat comprising a base, a pile of conducting elements thereon forming a curved contact surface and a continuous resistance wire wound in contact with said elements, said elements being so relatively positioned that all or any lesser number thereof may be simultaneously engaged by a contact member.

10. A rheostat comprising a base, a pile of conducting elements thereon forming a contact surface and a resistance wire of less conducting capacity than said elements wound on the same base in contact with said elements successively.

11. The method of putting a section of rheostat resistance into a circuit which consists in bridging its terminals by a secondary rheostat in its lower-resistance condition, shifting the contact member of the

rheostat to its final contact, and subsequently raising the resistance of the secondary rheostat.

12. The method of putting a section of rheostat resistance into circuit which consists in bridging its terminals by a secondary rheostat in its low-resistance condition, shifting the contact member of the rheostat to the final terminal, raising the resistance of the secondary rheostat and breaking its circuit.

13. The method of putting a section of rheostat resistance into circuit which consists in bridging its terminals by a short-circuited secondary rheostat, shifting the contact member of the rheostat to the final terminal of the section and gradually removing the short circuit from the secondary rheostat.

14. The method of putting a section of rheostat resistance in circuit which consists in bridging its terminals by a short-circuited secondary rheostat, shifting the contact member to the final terminal, gradually removing the short circuit from the secondary rheostat, and breaking the secondary rheostat circuit.

15. The method of putting a section of rheostat resistance into circuit which consists in bridging its terminals by the contact member of the rheostat and also by a short-circuited secondary rheostat, shifting said contact member to the final terminal, and removing the short circuit from the secondary rheostat.

16. A rheostat comprising a primary resistance, contacts at intervals therein, a contact member engaging said contacts in succession, a short-circuited secondary resistance between two adjacent contacts, and means for gradually removing the short circuit from said secondary resistance to bring into circuit the section of primary resistance that is connected between said adjacent contacts.

17. A rheostat comprising a primary resistance, contacts connected thereto at intervals, a contact member engaging said contacts in succession, a short-circuited secondary resistance between two of said contacts, and automatic devices for gradually removing the short circuit from the secondary resistance rheostat by operating the primary resistance.

18. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance and arranged in a curve, together with a contact member engaging said contacts in succession and consisting of a flexible conductor bending over the curved series of contacts.

19. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance, a secondary rheostat, and a contact member connecting with said contacts

in succession and operating the secondary rheostat in passing from one contact to the next.

20. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance and a secondary rheostat operating between successive contacts in parallel with the section of primary rheostat which is permanently connected between the said contacts, to first reduce and then increase the potential difference between said contacts.
21. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance, a contact member engaging said contacts in succession, and a secondary rheostat operating to first reduce and then increase the potential between successive contacts and engaged by the said contact member.
22. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance, a series of secondary rheostats between adjacent contacts, and a contact member acting on both the primary and secondary rheostats.
23. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance, a series of secondary rheostats of pile form between adjacent contacts, and a contact member acting on both the primary and secondary rheostats.
24. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance, a series of secondary rheostats

between adjacent contacts respectively, and an operating device acting on said secondary rheostats simultaneously.

25. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance, a secondary resistance between each pair of adjacent contacts, a short-circuiting device for each secondary rheostat, and means for operating said devices simultaneously.

26. A rheostat comprising a series of contacts connected at intervals to the rheostat resistance, a secondary rheostat having a curved contact surface between each pair of adjacent contacts, and a flexible conductor bending over said surfaces to short circuit the secondary resistances and the contacts of the primary rheostat.

27. A rheostat comprising a resistance element having a curved contact surface, a flexible conductor bending over said surface to contact therewith progressively, and a rocking carrier for said conductor upon which the conductor is extended.

28. A rheostat comprising a resistance element having a curved contact surface, a rocking carrier, and a plurality of flexible parallel conductors mounted on said carrier under tension and bending over said surface to contact therewith progressively.

Signed at New York city, county and State of New York, this fifth day of August, 1919.

EDWARD M. BENTLEY.