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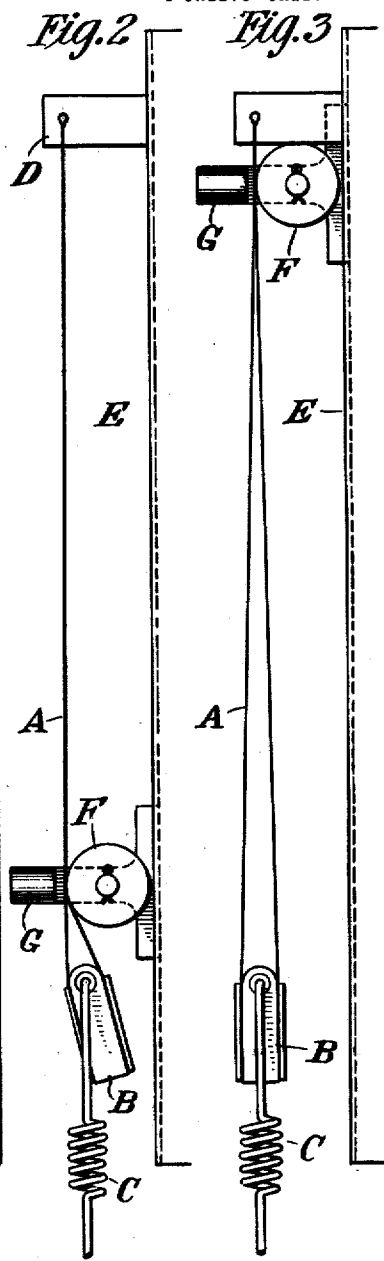
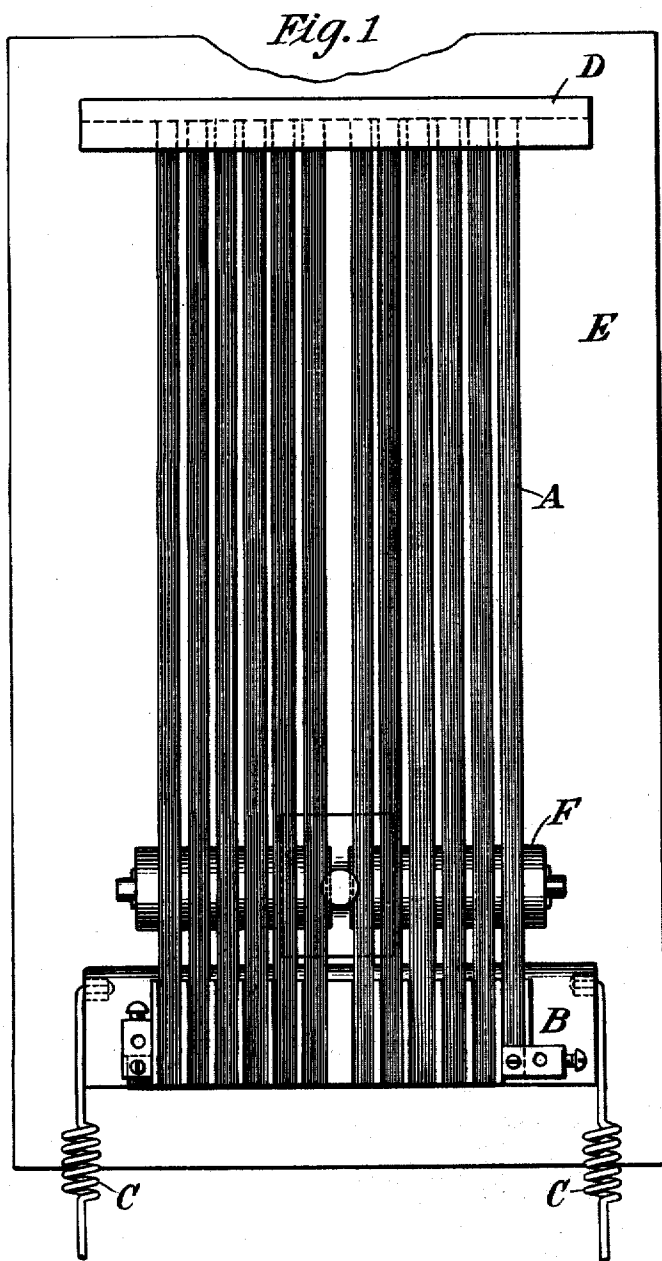
E. M. BENTLEY.

RHEOSTAT.

APPLICATION FILED MAY 9, 1919.

Patented Aug. 19, 1919.

3 SHEETS—SHEET 1.

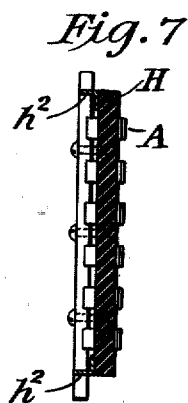
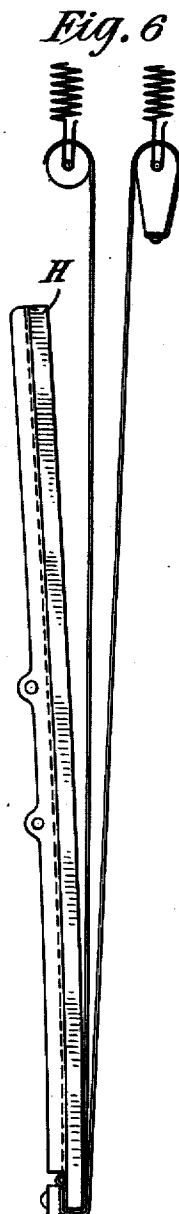
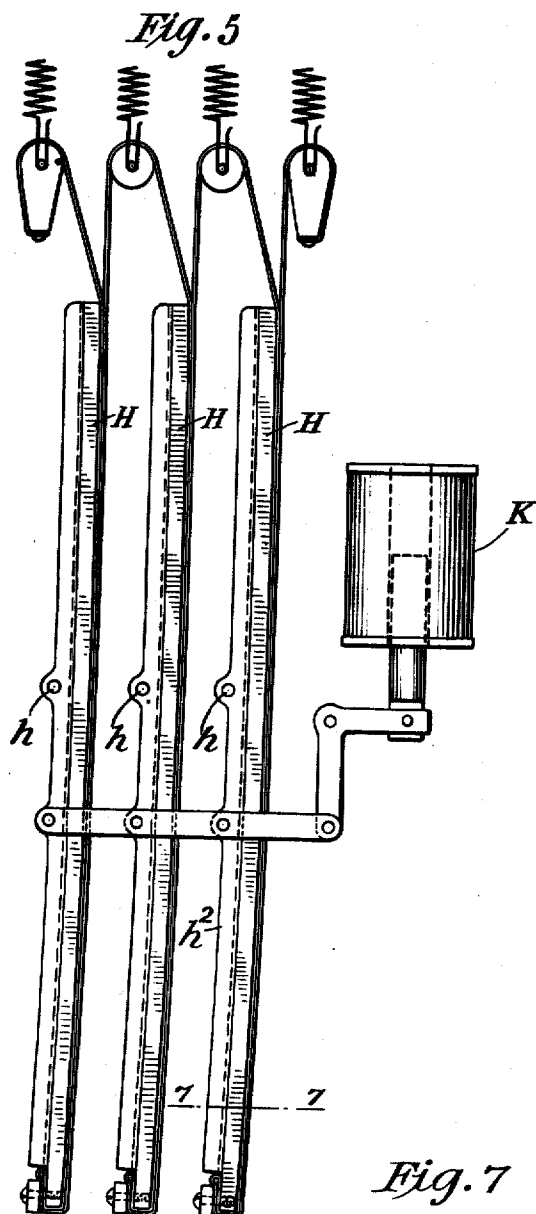


Inventor
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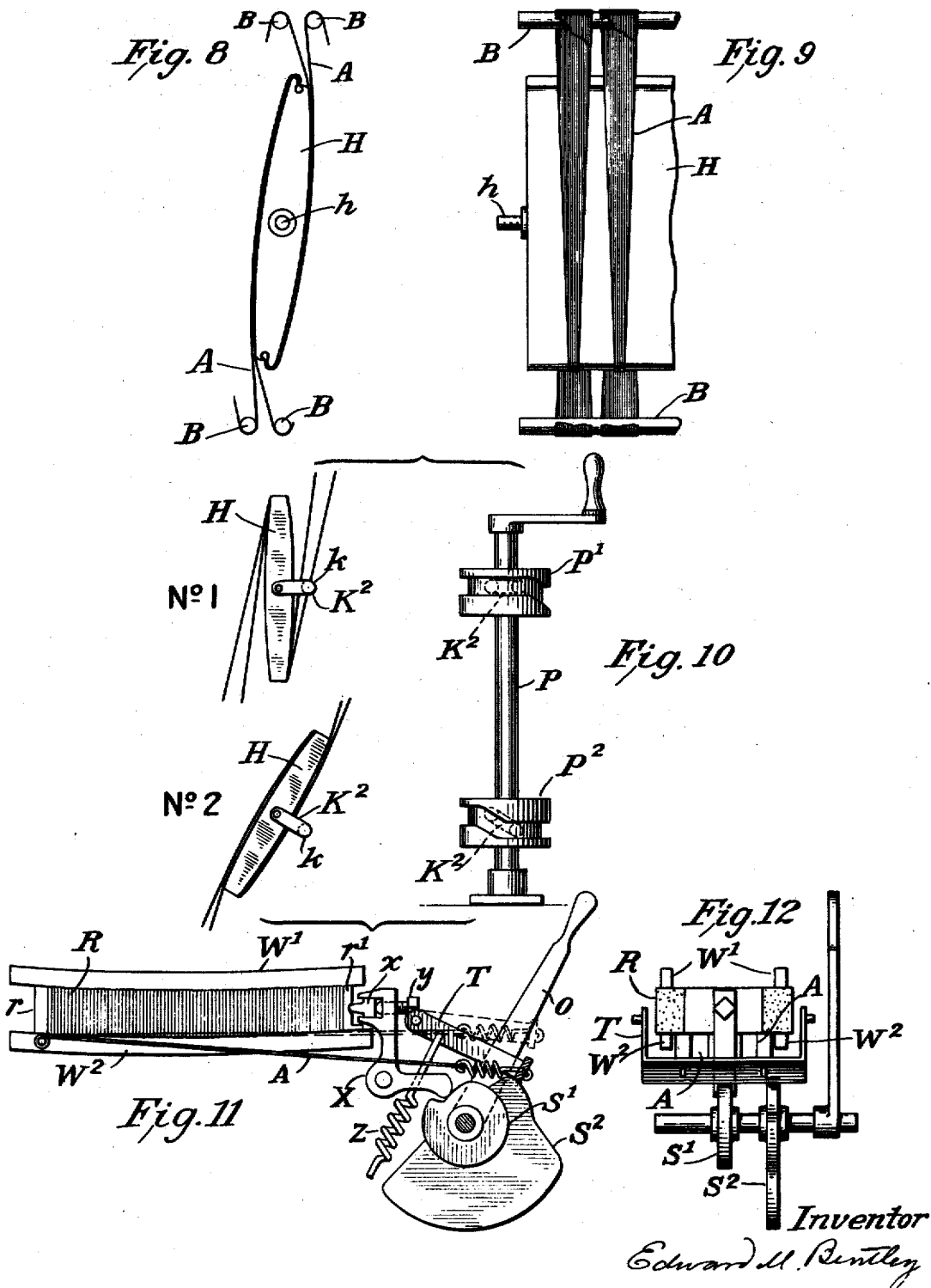
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3 SHEETS—SHEET 3.



UNITED STATES PATENT OFFICE.

EDWARD M. BENTLEY, OF LAWRENCE, NEW YORK.

RHEOSTAT.

1,313,853.

Specification of Letters Patent.

Patented Aug. 19, 1919.

Application filed May 9, 1919. Serial No. 295,945.

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.

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

Figure 1 is a plan,
Figs. 2 and 3 side elevations, and
Fig. 4 an end elevation of an elementary form of my invention;

Figs. 5, 6 and 7 show a form particularly designed for automatic operation;

Figs. 8 to 12 show modifications thereof.

My invention relates to a rheostat of the exposed type with a metallic conductor formed in a series of loops and means for progressively bringing into electrical connection the opposite sides of each loop to give a variable effective length and resistance thereto.

Referring to Figs. 1-5, A represents a metallic ribbon of suitable resisting material which is extended in a series of loops between the bar B near one end of the base E and a bar D near the opposite end. The extremities of the loops are, at the bar D, brought together and secured in a groove in the bar. At the opposite ends the loops are passed around a flat bar B which is pulled by the springs C C to put the loops under tension. Where each loop passes around bar B, it is folded over, as appears in Fig. 4 and started back in a new position to form the next succeeding loop. In this way the opposite sides of each loop lie face to face through their entire length and at a slight distance apart at one end though in contact at the opposite end. Extending across beneath the series of loops is a slide in the form of roller or bar F mounted on a traveler G which is free to slide longitudinally along the strips, being guided by a groove in the base. As appears in Fig. 3, which shows the slide at the extreme right hand end of its range, the roller F presses slightly upward against the overlying loops, but since it is at the tip of the loops, it does not affect the total resistance of the

looped ribbons. But, when the roller F reaches the opposite end of its route, as shown in Fig. 2, it has pressed the opposite sides of the loop into contact and thereby short circuited all of the loops, reducing their total resistance correspondingly. Between these two extreme positions of roller F are an infinite number of intermediate positions at each of which a greater or less portion of the loops is thus short circuited. Outside of those portions of the ribbon which are thus brought into contact, the ribbon itself may be electro-plated, with copper to eliminate resistance and heating at such points. By this means the ribbon will be entirely short circuited when the traveler G is in the position shown in Fig. 2.

In Fig. 5 several sets of such loops as appear in Fig. 1 are employed and the progressive closing up of the loops is effected by means of a rocker H which has a curved surface of long radius pressing against the loops of each set. In Fig. 6 the rocker is turned to open the loops, the tip of each loop being attached to one edge of the rocker and the rocker pivoted on an axis h . As shown in Fig. 7 the rocker is formed of a sheet of insulation with metal edge plates h^2 by which it is mounted. In Fig. 8 the rocker H is curved on both faces so that it may serve to open and close two sets of loops. In Fig. 9 the ribbons are made tapering toward the closed end or tip to provide greater current-carrying capacity as the resistance is decreased. The pendant rocker arrangement of Figs. 5-9 manifestly affords a wide variation of resistance for a small range of movement, requiring a small amount of force to execute. Therefore the arrangement lends itself to operation by a magnet as at K for regulative purposes. It will also be observed that the rocker H forms a presser for progressively bringing the two conductors upon which it acts into electrical connection, the same being true of the roller F of Figs. 1, 2 and 3. In the rocker form of presser a great advantage lies in the long radius of the arc in which the face of the rocker is curved and the extremely short radius on which it is pivoted. By this means a considerable swing of the rocker involves but a slight longitudinal movement of the flexible ribbon as it is wrapped and unwrapped on the face of the rocker, while a short range of movement serves to open and close a long

loop. Many rheostats require a long length of resisting conductor, and I am able, by this arrangement, to bring such a long length of conductor into a small compass, and by a very limited range of mechanical movement, requiring very little power, introduce or withdraw the resistance into or from the circuit without arcing or rupture of contact and by infinitesimal degrees.

In Figs. 8 and 9 I have shown, as heretofore stated, a two-faced rocker, by which its capacity is doubled. The two sets of loops have their tips secured to opposite ends of the rocker respectively and the flexible conductors of one set draw on the rocker in a direction opposite to the draft of the other set. Thus the same to-and-from movement of the rocker will either open or close both loops simultaneously, the pull on the pivot of the rocker being neutralized.

In Fig. 10 I have shown means for operating in successions two of the cards shown in Fig. 8, the term "card" meaning a rocker with its applied resistance strips, and the two cards in this figure being marked respectively No. 1 and No. 2. Each card is operated by a short lever-arm K^2 carrying at its outer end a roller k . P is a shaft on which are two cam-disks P^1 and P^2 , the cam being formed by peripheral grooves which run partly on an upper level and partly on a lower level, the two levels being joined by a diagonal groove. In these grooves travel the rollers k and k as shown by dotted lines. Since the diagonal grooves in the two disks P^1 and P^2 are offset, the rollers k will pass their diagonals in succession, the traverse of a roller through its diagonal from one slot level to the other serving to swing the corresponding card through its entire range from open to closed position. Card No. 2, for instance, may be of high resistance and will be swung first from its open to closed position by cam P^2 , as shown in Fig. 10, to remove its resistance from the circuit. Then card No. 1, which is of lower resistance and in series with card No. 2 in the same circuit, will be swung by cam P^1 to finally remove its resistance also from the circuit. The two cards will be operated in reverse order to bring them again into circuit. By such means any desired combinations of card movements may be produced, using two cards or more. The shaft P may for instance be a controller shaft carrying a series-multiple switch for two railway motors and the two cams so shaped and related as to give the rheostatic conditions required in connection with such a switch. This may be accomplished without resort to blow-out magnets and contactors such as are now employed in such an organization.

In Figs. 11 and 12 one side of the loop is formed by a pile of carbon plates R , the other side by two ribbons A, A of low re-

sistance. The carbon pile is so mounted in holders W^1, W^2 as to give one side of the pile the aforesaid curvature on a long-radius arc. In such a carbon pile it is feasible to vary its resistance through a certain range by varying the pressure thereon, but beyond that range a heavy pressure produces but slight reduction of resistance while finally the compressed pile still remains in the circuit and adds its resistance thereto. By my device it becomes possible to finally remove from circuit the resistance of a compressed carbon pile, or the pile may be given a fixed degree of pressure and the entire variation range secured by using my device to progressively short circuit it. In Figs. 11 and 12 the compression of the carbon pile is effected by means of a cam S^1 , on a shaft worked by lever O , acting on an angle-lever X , which at its upper end has an adjustable bearing block x controlled by a screw y . A second cam S^2 on the same shaft acts in succession to cam S^1 to swing the ribbons A, A and wrap them progressively around the curved face of the carbon pile. The ribbons are attached at one end to the metal plate r forming one terminal of the pile and at the other end to a tilting frame T , which is swung upward by cam S^2 and drawn downward by a spring Z . After the carbon has been compressed by cam S^1 to a degree determined by adjusting screw y , the ribbons A, A will, by means of cam S^2 , be wrapped progressively over the pile to short circuit it, coming finally into contact with metal plate r^1 forming the opposite terminal of the pile, as shown by dotted lines.

I have referred to the plating of the metallic resistance strip at non-variable points with copper to eliminate heating and permanent resistance. This is also of value at those points of the conductor which lie against the support rods and thereby lose a part of their radiating surface.

It will be manifest that various other modifications and applications of the above described rheostat will be apparent to those skilled in the art.

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

1. A rheostat comprising a bare flexible conductor extended longitudinally between separated points of support and a second conductor arranged to be pressed into contact therewith progressively.

2. A rheostat comprising two bare conductors extended adjacent to each other in the same direction but at an angle to each other, one of them being flexible, and a presser acting thereon progressively.

3. A rheostat comprising two bare conductors extended at an angle to each other, and a presser acting thereon progressively to put them in electrical connection from end to end.

4. A rheostat comprising a bare flexible conductor extended longitudinally under yielding tension between separated points of support, and a second extended conductor
5 arranged to be pressed into contact therewith progressively to vary the electrical resistance.
5. A rheostat comprising a bare flexible conductor of ribbon form extended longitudinally under yielding tension between separated points of support, and a second extended conductor arranged to be pressed into contact therewith progressively to vary the resistance.
- 10 6. A rheostat comprising a bare conductor extended longitudinally, a diverging bare conductor, and a presser acting to bring the two conductors into contact progressively along a curved surface.
- 20 7. A rheostat comprising a bare conductor of ribbon form extended longitudinally under yielding tension, a normally diverging conductor, and a presser acting to bring the two conductors into contact progressively
25 along a curved surface.
8. A rheostat comprising a bare conductor extended longitudinally under yielding tension, a second extended conductor and a presser having a curved surface bearing on
30 said conductors progressively to put them in contact progressively for varying their resistance.
9. A rheostat comprising a bare extended conductor, a second divergently extended
35 conductor, and a presser having a surface curved on a longer radius but oscillating on a shorter radius for putting said conductors into contact progressively.
10. A rheostat comprising a bare conductor extended in a series of loops, and a presser for progressively bringing the two sides of the loop into electrical connection.
11. A rheostat comprising a bare flexible conductor extended in a series of loops and a
45 presser for progressively bringing the two sides of the loop into electrical connection.
12. A rheostat comprising a bare conductor of ribbon form extended face to face in a series of loops and means for progressively
50 connecting electrically the opposite sides of the loops.
13. A rheostat comprising a bare conductor extended in a series of loops and means for progressively bringing into contact the
55 opposite sides of the loops.
14. A rheostat comprising a bare conductor of ribbon form extended in a series of loops and means for bringing the opposite sides of the loops into contact progressively.
- 60 15. A rheostat comprising a bare conductor of ribbon form extended in a flexible loop having its two sides face to face and means for progressively bringing into contact the opposite sides of the loop.
- 65 16. A rheostat comprising a bare conductor extended in a loop and a presser bearing on the loop progressively to connect electrically its opposite sides.
17. A rheostat comprising an extended flexible conductor under tension but capable
70 of yielding longitudinally, and a rocking presser bearing thereon to bring a second extended conductor into contact therewith progressively.
18. A rheostat comprising a presser, a
75 conductor extending along said presser and presenting a curved surface, and a taut flexible conductor arranged to bend progressively over said surface to vary the resistance.
- 80 19. A rheostat comprising a presser having a curved surface, and two conductors extending along said surface and brought into contact with each other progressively to vary their resistance by bending over said
85 surface.
20. A rheostat comprising a bare resisting conductor extending along a rigid curved surface, and a second flexible conductor making contact therewith progressively by bending over said surface.
21. A rheostat comprising a presser having a curved surface, a flexible bare conductor extending under yielding tension and secured at one end to said presser and
95 at its other end to a stationary point, and a second conductor with which the flexible conductor makes contact progressively by bending over said surface.
22. A rheostat comprising a presser having a curved surface, and a pair of flexible diverging conductors secured to one end of the presser and extended under yielding tension between said presser and a stationary point.
- 100 23. A rheostat comprising a presser having a curved surface on each side and flexible conductors extended oppositely from the opposite ends of said presser to stationary points.
- 110 24. A rheostat comprising a presser having a curved surface and a series of loops of flexible conductor extending under yielding tension from one end of said presser to a stationary point and brought into contact
115 progressively by bending over said curved surface.
25. A rheostat comprising a rocking presser with a curved surface and a flexible bare conductor extended from one end of
120 said presser to a stationary point and adapted to bend over the said curved surface as the presser is rocked to make contact progressively with a second conductor on said surface.
- 125 26. A rheostat comprising a presser of insulating material and two diverging bare conductors extended longitudinally and brought into contact progressively by said presser.
- 130

27. A rheostat comprising a bare conductor having different degrees of conductivity in different parts of its length and extended in a series of loops with a presser
5 for progressively cutting out the resistance of the conductor beginning at points of lesser conductivity.

28. A rheostat comprising a bare conductor ribbon of progressively increased cross
10 section extending in a series of loops, and a presser for short circuiting the loops progressively beginning at points of smaller cross section.

29. A rheostat comprising a tapering bare
15 conductor ribbon extended in a series of loops having their two sides face to face and a presser for short circuiting the loops progressively beginning at the tapered end.

30. A rheostat comprising sets of bare
20 conductor loops arranged to be short circuited progressively by means of a presser and an actuator for operating the several sets consecutively.

31. A rheostat comprising sets of bare
25 conductor loops arranged to be short circuited progressively by means of a presser, the loops in the several sets being of different conductivity and an actuator for operating the said sets in succession.

30 32. A rheostat comprising a bare conductor extended in a series of loops ar-

ranged to be progressively short circuited by means of a presser, and having its conductivity reinforced at points not subjected to the presser action.

33. A rheostat comprising a bare conductor extended in a series of loops arranged to be progressively short circuited by means of a presser and having its conductivity reinforced by plating at points not subjected
40 to the presser action.

34. An electrical resistance composed of a bare conductor extended between points of support in a series of loops and having its conductivity reinforced at those parts
45 which are in contact with the supports.

35. An electrical resistance composed of a bare conductor extended between points of support in a series of loops and plated with conducting metal at those parts which are
50 in contact with the supports.

36. A rheostat comprising a conductor of ribbon form extended in a series of loops and offset at each loop to bring the sides of the loop into face-to-face relation and a
55 presser for progressively short circuiting the loops by bringing their opposite sides into contact.

Signed at New York city, county and State of N. Y., this 7th day of May, 1919. 60

EDWARD M. BENTLEY.