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W. C. YATES & P. ZIMMER.

RHEOSTAT.

APPLICATION FILED JULY 25, 1903.

NO MODEL.

Fig. 1.

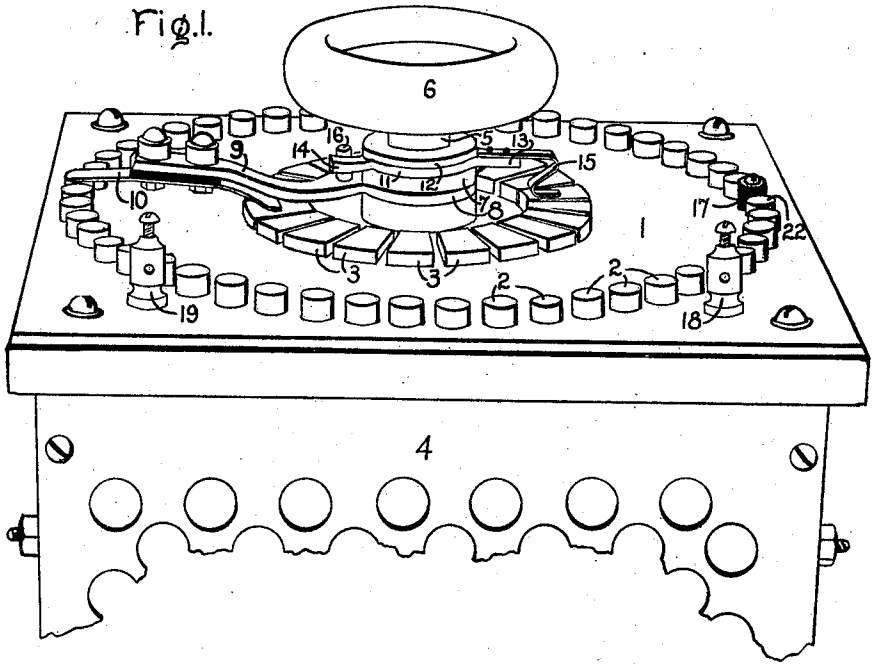
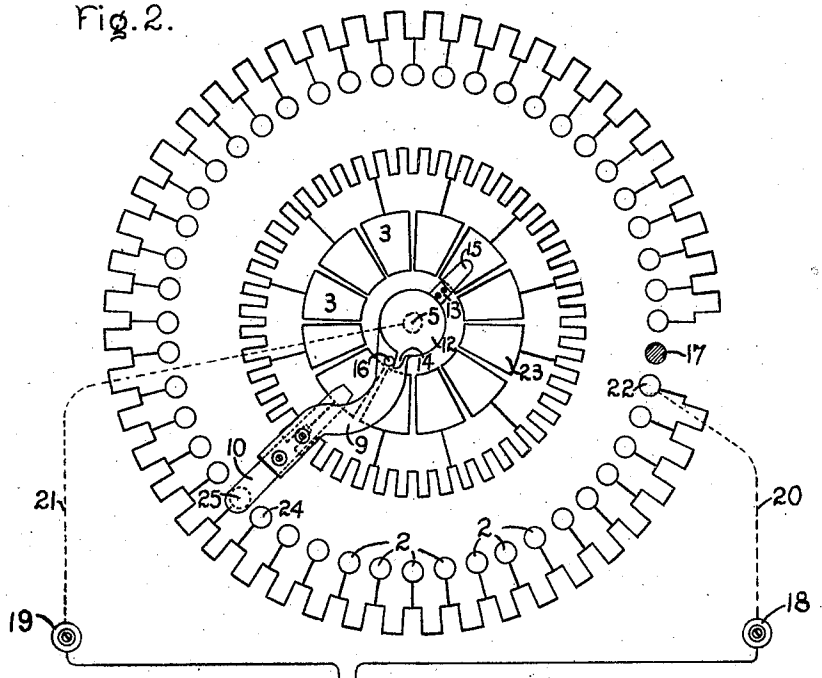


Fig. 2.



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No. 755,827. Patented March 29, 1904.

UNITED STATES PATENT OFFICE.

WILLIAM C. YATES AND PAUL ZIMMER, OF SCHENECTADY, NEW YORK, ASSIGNORS TO THE GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RHEOSTAT.

SPECIFICATION forming part of Letters Patent No. 755,827, dated March 29, 1904.

Application filed July 25, 1903. Serial No. 166,949. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM C. YATES and PAUL ZIMMER, citizens of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Rheostats, of which the following is a specification.

This invention relates to rheostats; and its object is to provide a compact device by which a wide range of resistance can be regulated in small gradations. In devices of this kind heretofore made the entire resistance has been cut into circuit in small steps either by employing a great number of contact-studs connected to the resistance or by having two sets of resistances and mechanism so arranged that after a definite number of small units have been cut into circuit a further movement of the rheostat-handle will first substitute a single large unit for the small ones and then cut the small units in again progressively. By our invention the resistance is cut in in large units until an amount approximating the desired amount has been obtained and then in small steps to get the exact amount required. In this way a very large amount of resistance can be cut into circuit quickly and by a small movement of the rheostat-handle, and when near the desired amount the adjustment may be accurately completed with the small units.

In carrying out our invention we provide two sets of resistances connected to contacts which are preferably arranged in two concentric circular rows, one of which sets is composed of large units which are progressively cut into circuit in series. The other set is composed of smaller resistance units arranged to subdivide any one of the larger units into a number of small steps. A single handle operates the brushes coöperating with the two sets of contacts, and the arrangement is such that the large units may be cut in until an amount of resistance approximating the desired amount is obtained without affecting the resistance of the set of small units. The brush coöperating with the studs connected to the small units can then be manipulated to obtain the exact resistance desired without affecting the brush for the heavy resistance units.

Our invention therefore comprises a rheostat by which resistance may be cut into a circuit in large steps until near the desired amount, and any large step may be shaded by smaller steps for more exact regulation.

In a more specific sense it comprises a rheostat having two sets of resistances, one of which is adapted to subdivide into many steps any unit of the other and means operated by a single handle for increasing or decreasing the resistance of either set without affecting the resistance of the other set.

It further comprises other features of novelty, which will be definitely indicated in the appended claims.

In the accompanying drawings, which illustrate one embodiment of our invention, Figure 1 is a perspective view of our improved rheostat, having the lower part broken away; and Fig. 2 is a diagrammatic view of the arrangement of the resistances and the circuit connections.

In the drawings, 1 represents a base-plate of soapstone or other insulating material on which are mounted two sets of studs 2 2 and 3 3, preferably arranged in two concentric circular rows. Connected between the studs of each row are resistance units, which may be iron grids, coils of wire, or resistances of any other desired form mounted in a box-like structure 4, having perforated side walls secured to the bottom of the base-plate. The units connected between the studs of the inner circle are of much lower resistance than those connected between the studs of the outer circle, the function of the former being to subdivide into numerous small steps any unit of the outer series. At the center of the circles of studs is mounted a shaft 5, rotated by a handle 6. Surrounding the shaft and lagged fast to the base-plate is a collar 7, having a peripheral groove forming a bearing for a hub 8, carrying an arm 9. Secured to the outer end of this arm, but insulated therefrom, as shown in Fig. 1, is a bridging-contact

brush 10, adapted to cross-connect the contact-studs of the two circular rows. Above the collar 7 on the shaft 5 and rigidly secured to the shaft are two other collars 11 and 12, one of which has two fingers 13 and 14. One of these fingers carries a brush 15, arranged to bear on the studs of the inner circle and electrically connect them with the shaft 5, and both of the fingers coöperate with a lug 16 on arm 9 to move the brush 10 in either direction over the contact-studs. In the outer row of studs is a stop 17, and from the stud adjoining this stop around the circular row the resistance units are arranged in series and connected to the contact-studs, as shown in Fig. 2. In the preferred form of our invention all the studs of the inner circle are connected together by the small resistance units, there being no break in the continuity of the circuit around the entire circle. Mounted on the base-plate are two binding-posts 18 and 19, the former being connected to the first stud 22 of the outer row by wire 20 and the latter to the shaft 5 by wire 21.

In Fig. 2 of the drawings we have shown the rheostat as used to regulate the field-current of a dynamo-electric machine; but it is obvious that it may be used in numerous other ways.

The operation of the device is as follows: With the brush 10 on the first stud 22 of the outer series and stud 23 of the inner series and the brush 15 on this same stud 23, the arm 9 being bent laterally to permit such a movement, there is no resistance in the circuit, and the path of the current is from binding-post 18 over wire 20 to stud 22, brush 10 to stud 23, brush 15 to shaft 5, and wire 21 to binding-post 19. From this position movement of the handle in a clockwise direction moves brush 15 from stud 23 around to the stud diametrically opposite, in which position the current divides at stud 23 and flows in two parallel circuits around the inner circle of resistance units to the brush 15 and thence out as before. The resistance in circuit is then one-fourth of the entire resistance of the inner circle, as there are two parallel circuits, in each of which one-half of this resistance is included. When in this position, the finger 14 abuts against lug 16 on arm 9, and a further movement of the handle in the same direction will move brush 10 over the outer row of studs, cutting in in series one of the high-resistance units for each stud passed over, but not changing the resistance of the inner circle, as the two parallel paths of equal resistance are still maintained. When the operator has moved the brush 10 until it bears on a certain stud—as, for instance, stud 24—he may find that he has almost reached the required amount, and when he moves the brush to the next stud 25 he may find that he has cut in too much resistance. Under such circumstances the natural impulse would be to turn the handle in the opposite direction, but in doing so the position of brush 10 would not be changed, the only effect of such movement being to bring the brush 15 around over the studs of the inner circle toward the inner end of the brush 10. This decreases the resistance of one and increases the resistance of the other of the two parallel circuits around the inner circle, the effect of which is to decrease in steps the total resistance between the inner end of brush 10 and brush 15. The inner circle of resistance may be so proportioned that a movement of brush 15 from the stud diametrically opposite that on which the inner end of brush 10 bears to the stud on which brush 10 bears reduces the total resistance in circuit in steps by the same amount as that included between two adjacent studs of the outer circle. The operator is thus enabled to obtain the exact amount of resistance required. Should it be desired to decrease the resistance in circuit, the handle is turned in a counter-clockwise direction and the resistance is decreased in small steps until finger 13 abuts against stud 16, and then in large steps. When the operator finds that in going from one step to the next he has reduced the resistance too much, his impulse again is to turn handle 6 in the opposite direction, in doing which he does not affect the position of arm 9, but merely moves brush 15 over the contacts 3 3. This transfers the small resistance units from one of the parallel circuits to the other, increasing in small steps the total resistance between brush 10 and brush 15. To return the brush to its original position, a continued counter-clockwise movement of the handle brings finger 13 against lug 16 and pushes arm 9 back over the contacts to its original position.

Many variations can be made in our device—such, for instance, as breaking the continuity of the circuit through the small resistance units between stud 23 and the stud next preceding it or at some point depending upon the position of arm 9, in either of which cases there would be only one path through the smaller resistances; but all such variations we consider to be within the spirit of our invention.

What we claim as new, and desire to secure by Letters Patent of the United States, is—

1. A rheostat provided with a series of resistance units, a contact device for cutting them into circuit progressively, a handle for said device, and means operated by said handle for varying the resistance at intermediate points of the series by fractional parts of a unit without affecting said contact device.

2. A rheostat having a plurality of coarse resistance-steps, a plurality of finer steps, a handle, and means operated thereby for regulating the resistance on either set of steps at will at different points of adjustment.

3. A rheostat having a plurality of resistance units, a handle, and means operated there-

by for regulating the resistance in circuit in relatively large steps until an amount approximating the desired amount has been obtained, and then in smaller steps for more exact regulation.

4. A rheostat having a variable resistance, a handle for cutting the resistance into or out of circuit in steps, and means operated by said handle for subdividing the steps at different points of the resistance into a number of smaller steps if desired.

5. A rheostat having two sets of resistances connected to two rows of studs arranged in concentric circles, and means for regulating the resistance of either set without affecting the resistance of the other set.

6. A rheostat having a plurality of resistances, an operating device, means operated by a movement of the device for regulating the resistance in circuit in steps, and means operated by a reverse movement for regulating the resistance in circuit in smaller steps.

7. A rheostat having a plurality of resistances, a rheostat-arm, means operated by a movement of said arm in one direction for regulating the resistance in circuit in steps, and means operated by a movement in the other direction for regulating the resistance in circuit first in small steps and then in larger steps.

8. A rheostat having a series of resistances arranged in steps, an operating device for cutting them into and out of circuit, means operated by a movement of the device in one direction for regulating the resistance in circuit in steps, and means operated by movement in the other direction for subdividing a step of the resistance into a number of smaller steps.

9. A rheostat having two concentric rows of studs, resistance connected between the studs of each row, a handle, a contact device operated thereby, and means whereby movement of the handle in one direction increases the resistance in large steps and in the other direction decreases the resistance in small steps.

10. A rheostat having two concentric rows of studs, resistance connected between the studs of one row, resistance of less value connected between the studs of the other row, a handle, means operated thereby for regulating the resistance in steps, and means for subdividing any step into a plurality of smaller steps.

11. A rheostat having resistances differing in value, an operating-handle for regulating the amount of resistance in circuit, and means whereby movement of the handle in one direction regulates the resistance of one value and movement in the other direction regulates the resistance of a different value.

12. A rheostat having two concentric rows of studs, two sets of resistances, one set connected to the studs of each row, a handle, and means operated thereby for regulating the resistance of either set without affecting the resistance of the other set.

13. In a rheostat, two concentric rows of studs to which the resistance is connected, two switch-arms bearing on the contacts, an operating-handle, and means whereby movement of the handle moves one arm to a predetermined position and then moves both arms simultaneously.

14. In a rheostat, two rows of studs to which the resistances are connected, a contact-arm cross-connecting the two rows, a contact-arm adapted to bear on the studs of one row, and means whereby one of said arms may be moved independently of the other.

15. In a rheostat, two rows of studs to which the resistances are connected, a contact-arm cross-connecting the two rows, a contact-arm adapted to bear on the studs of one row, and means for moving said contact-arms together or one independently of the other.

16. In a rheostat, a row of contact-studs, resistance connected between each stud and two other studs forming a closed circuit, two contacts, means for moving them over the studs in a fixed relation to each other, means whereby said movement regulates a resistance in series with said contacts in steps, and means whereby one of the contacts can be moved independently of the other.

17. In a rheostat, two parallel circuits through resistances, a variable resistance in series with the parallel circuits, and means for transferring resistance from one of said parallel circuits to the other at any step of the variable resistance.

In witness whereof we have hereunto set our hands this 24th day of July, 1903.

WILLIAM C. YATES.
PAUL ZIMMER.

Witnesses:
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HELEN ORFORD.