

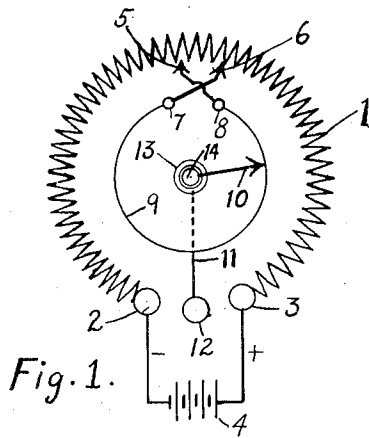
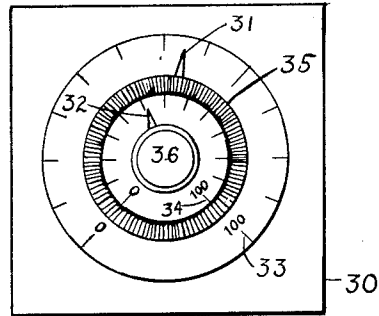
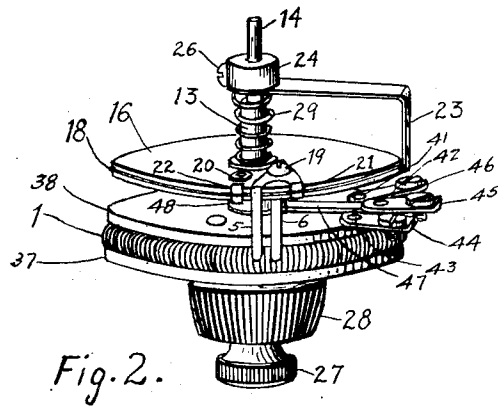
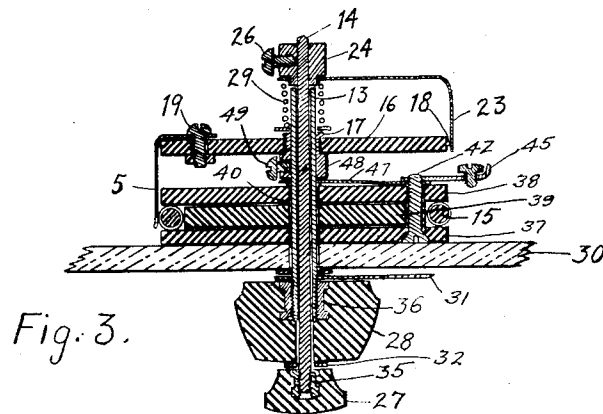
March 5, 1929.

E. R. STOEKLE

1,704,153

RHEOSTAT

Filed July 14, 1922



Inventor
Erwin R. Stockle

UNITED STATES PATENT OFFICE.

ERWIN R. STOECKLE, OF MILWAUKEE, WISCONSIN.

RHEOSTAT.

Application filed July 14, 1922. Serial No. 574,943.

This invention relates to improvements in regulable resistances commonly called potentiometer resistances, in which a variable potential may be obtained between a fixed terminal of the resistor and a contact free to move upon the resistor.

In resistances of this type the resistance element commonly consists of a helical wire coil upon which a contact shoe makes contact with the turns of the wire. Variations in the potential of the movable contact are obtained by passing from one turn to the next, and therefore are not of infinitesimal magnitude but consist of discontinuous steps whose magnitude is determined by the resistance of each turn.

An object of this invention is to provide a potentiometer in which the potential of a terminal having in series with it a plurality of movable contacts shall be regulable in both finite and infinitesimal steps over the range extending from the potential at one fixed terminal to the potential at the other fixed terminal.

Another object is to provide a potentiometer resistance in which relatively coarse variations of potential may be obtained by the motion of a pair of contacts over the turns of the resistor and infinitesimal variations may be obtained by interpolating in infinitesimal steps values of the potential intermediate between the potential of the said pair of contacts.

Another object is to provide independent control of the coarse and fine adjustments of the potentiometer and to provide in a simple manner for the indication at the operating knobs of the position of both the coarse and the fine adjustment contact levers.

Another object is to provide a simple and compact regulable resistance capable of fine and accurate adjustment especially adapted to the regulation required in radio receiving sets and similar instrument regulation where sensitive regulation and space economy are desirable.

Other operative and structural advantages of this new potentiometer resistance will be apparent from the following description and the Figures 1 to 4.

Figure 1 shows a diagram of the connections and the general scheme of operation of the potentiometer resistance. Figs. 2 and 3 show a perspective and cross sectional view respectively of a preferred form of construction. Fig. 4 shows a top view and the means

of indicating the positions of the contact levers at the operating knobs.

Referring to Fig. 1, the resistor element 1 has fixed terminals at 2 and 3 and a center terminal 12 which is connected by means of conductor 11 to a movable contact 10. The contact 10 bears on a slide wire 9, the ends of which are connected to the terminals 7 and 8. These terminals are connected as shown to the contact shoes 5 and 6, which bear upon the turns of wire in the resistor element 1. The slide wire 9 and the contact shoes 5 and 6 are mounted on a hollow shaft 13, which may be rotated by an operating knob fastened to the end of the shaft. The contact shoe 10 is fastened to the shaft 14 which extends through the hollow shaft 13, and may be rotated by another operating knob at the end of the shaft 14.

Referring to the Fig. 2 the resistor element 1 is retained in a groove between the insulating disks 37 and 38. This resistor element may be an unsupported helix laid into the groove if the resistance wire be sufficiently large to maintain its form, or if fine wire be used it may be wound upon an insulated supporting core as shown at 15 in Fig. 3.

Figure 3 shows how the resistor element is retained in the groove formed by the superposed disks 37, 38 and 39 which are held compressed by the hollow rivet or grommet 40 and the screws 41, 42 and 43. The ends of the resistor wire are connected to the binding posts 44 and 46 (Fig. 2) which are held in position by means of the screws 41 and 43. The center binding post 45 is similarly held by a screw 42 and is connected to the bronze strip 47 which makes a spring contact with the collar 48. This collar has a set screw 49 by means of which it is clamped to the tubular shaft 13. The insulating disk 16 is preferably made of fiber or a phenol condensation compound composition and is fastened to the collar 48 by means of a shoulder and the turned over edges 17 of the collar. The disk 16 carries the slide wire 18 in a groove at its edge, and also supports the contact shoes 5 and 6, the latter being fastened to the disk by means of screws or rivets 19 and 20. The contact shoe 5 is supported by the upper surface of the disk whereas the contact shoe 6 is supported by the lower surface, thus allowing the contact shoes to be crossed with respect to one another without coming into metallic contact. The reason for this transposition of the contact shoes will be made clear in the description of the opera-

tion of the device. The ears 21 and 22 are extensions of the contact shoe structure and are bent over the edge of the disk as shown in Fig. 2, in order to hold in place and to make good connection with the ends of the slide wire 18. The slide wire contact shoe 23 is fastened to a collar 24 which is fixed to the shaft 14 by means of a set screw 26. The lower end of the shaft 14 has fastened to it an operating knob 27, and the tubular shaft 13 has its knob shown at 28. These knobs are preferably of a moulded composition material and have moulded integrally within themselves the threaded metallic inserts 35 and 36 (Fig. 3). The spring 29 serves to hold the knob 27 against the knob 28. It will be noticed that adjustment of both the contact arm 23 and the disk 16 may be made by loosening the set screws 49 and sliding the collars 48 and 24 on their respective shafts. This allows for mounting the potentiometer on panels of various thickness.

Figure 4 shows a view of the knobs 27 and 28 as they appear from the front of the panel 30, the pointers 31 and 32 being fastened respectively to the shafts which carry the slide wire contact arm 23 and the main contact shoes 5 and 6 of Figs. 2 and 3. The graduations 33 on the panel serve to indicate the position of the main contact shoes whereas the graduations 34 on the larger knob 35 in conjunction with the pointer 32 show the position of the slide wire contact shoe.

The operation of the potentiometer is best made clear by referring to the Fig. 1. In this figure let it be assumed that the battery 4 maintains the terminal 3 at a positive potential with respect to 2. Since the battery potential will be distributed along the main resistor 1 and the slide wire 9, the potential of the terminal 12 will be determined by the position of the contact shoes 5 and 6 on the main resistor and by the position of the contact 10 on the slide wire. If the contact arm 10 is in the position 8 it will have the same potential with respect to 2 as the contact arm 5, whereas if it is in the position 7 it will have the same potential with respect to 2 as contact 6, the latter potential exceeding the former by the fall in potential in the turns of the main resistor between 5 and 6. For any position of the contact arm 10 intermediate between 7 and 8 the potential of 12 with respect to 2 will be intermediate between the potential difference between 5 and 2 and that between 6 and 2. When the contact shoes 5 and 6 are rotated in a clockwise direction by means of the shaft 13 the potential of 12 with respect to 2 is increased by steps whose magnitude is determined by the fall of potential in one turn of the main resistor.

A rotation of the contact 10 in a clockwise direction likewise increases the potential of 12 with respect to 2, but in infinitesimal steps, thus allowing for very fine and accurate ad-

justments of the potential of 12. It is further apparent that unless the contacts 5 and 6 be in crossed over relation to the terminals 7 and 8 of the slide wire, a clockwise rotation of the contact arm would decrease the potential of 12 with respect to 2 instead of increasing it as desired. In other words this transposed relation of the contacts 5 and 6 with respect to the terminals 7 and 8 is necessary in order to cause the potential of 12 to vary in the same sense for a given direction of rotation of either the contacts 5 and 6 or the contact 10.

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

1. A rheostat comprising a main resistor, suitable terminals for making electrical connections to the ends of said resistor, a pair of contact members bearing at separated points on said main resistor, said contact members being simultaneously movable on said main resistor, an auxiliary resistor having its ends connected to said pair of contact members and movable with said contact members, and a third contact member bearing on said auxiliary resistor whereby values of resistance intermediate the values at each of said pair of contact members may be obtained.

2. A regulable resistance in which a portion of a circularly disposed main resistor is shunted by two movable contact shoes rotatable about an axis through the center of said circular resistor, said two contact shoes being connected together by means of a circularly disposed slide wire, upon which a third contact shoe bears, said third contact shoe being movable from one end of the slide wire to the other to effect a fine adjustment of the resistance between the terminal connected to said third contact shoe and either of the terminals of said main resistor.

3. A regulable resistance comprising a resistor wound on an insulated annular ring, two terminals connected to the ends of said resistor; two contact shoes bearing on neighboring turns of wire of said resistor and carried by a rotatable insulating disk in the grooved edge of which is stretched a loop of wire whose ends are electrically connected to the said contact shoes; a third movable contact shoe bearing upon the wire of said loop to allow of fine adjustments of the resistance between the terminal of said third contact shoe and either of the terminals of the main resistor.

4. A regulable resistance consisting of a helically wound resistor bent into a circular form and laid into a groove formed by the superposition of three insulating disks, the middle one of which is of smaller diameter than the two outside ones; terminals for said resistor; a fourth insulating disk adjustably fixed to a tubular shaft passing rotatably through said three superposed disks, said fourth disk having fixed to it two contact shoes bearing on said resistor at two neigh-

boring points; a loop of wire laid in a circumferential groove on the edge of said fourth disk and having its ends electrically connected to said two contact shoes; a third contact shoe mounted on a shaft extending through said first mentioned tubular shaft and rotatable therein, said third contact shoe bearing on said loop of wire and being electrically connected to a third terminal fastened to the said three superposed disks.

5. A regulable resistance consisting of a helically wound resistor bent into a circular form and laid into a groove formed by the superposition of three insulating disks, the middle of which is of smaller diameter than the two outside ones; terminals for said resistor; a fourth insulating disk adjustably fixed to a tubular shaft passing rotatably through said three superposed disks, said fourth disk having fixed to it two contact shoes bearing on said resistor at two neighboring points; a loop of wire laid in a circumferential groove on the edge of said fourth disk and having its ends electrically connected to said two contact shoes; a third contact shoe mounted on a shaft extending through said first mentioned tubular shaft and rotatable therein, said third contact shoe bearing on said loop of wire and being electrically connected to a third terminal fastened to the said three superposed disks; means for so connecting said pair of contact shoes to the ends of said slide wire that a rotation of either of the said shafts in a given direction will vary the resistance between the last mentioned contact shoe and a terminal of said helically wound resistor in the same sense.

6. A regulable resistance consisting of a main resistor of wire wound upon an insulated annular ring, a pair of contact shoes bearing upon neighboring turns of said wire, said contact shoes being fastened to an insulating disk and connected to the ends of a slide wire retained in a circumferential groove at the edge of said disk, said contact shoes being in crossed relation with respect to each other so that contact with the turns of said main resistor is made by each shoe at a point lying diagonally opposite the point at

which said contact shoe is connected with said slide wire; a third contact shoe bearing upon said slide wire and movable to the ends of said wire.

7. A regulable resistance comprising a helically wound resistor upon which movable contact shoes bear, said resistor being placed in an annular groove formed by the coaxial superposition of three insulating circular disks, the center disk being of smaller diameter than the outside ones; means for holding said disks compressed whereby the turns of said resistor are held in lateral and circumferential alignment.

8. A regulable resistance comprising a circularly disposed main resistor; a contact shoe fastened to a disk carried by a tubular shaft; a knob and a pointer fastened to the end of said shaft whereby the position of said contact shoe upon said resistor may be indicated upon a graduated circular scale; a slide wire resistor retained in a groove on the edge of said disk; a contact shoe bearing on said slide wire and fastened to an inner shaft extending through said tubular shaft and its operating knob; a smaller knob and pointer fastened to the protruding end of said inner shaft, and a circular scale suitably marked upon the first mentioned larger knob whereby the position of the contact shoe upon the slide wire may be indicated with respect to the ends of the slide wire.

9. An electrical resistance, comprising a main resistance element; suitable terminals for making electrical connections to said element; two contact shoes bearing upon said main resistance element; an auxiliary resistance element having its ends connected to said two contact shoes; a third contact shoe bearing upon said auxiliary resistance element; a terminal for making electrical connection to said third contact shoe, and means for changing the location of said contact shoes upon their associated resistance elements whereby the resistance between said third contact shoe and the terminals of said main resistance element may be varied.

In witness whereof, I have hereunto subscribed my name.

ERWIN R. STOECKLE.