Nov. 13, 1928. 1,691,251

T. C. RATHBONE

GRID LEAK

Filed April 2, 1925

Fig. 1.

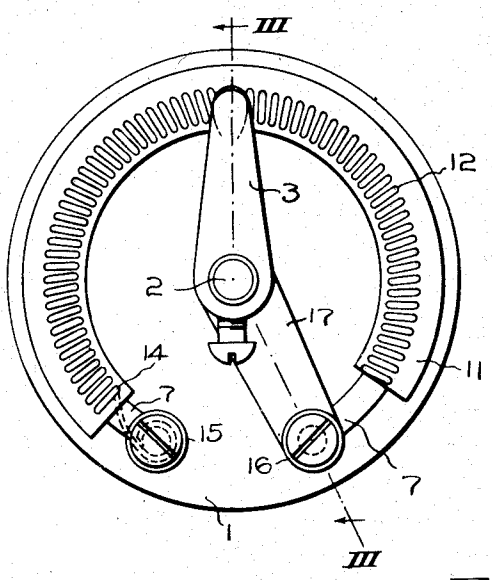



Fig. 2.

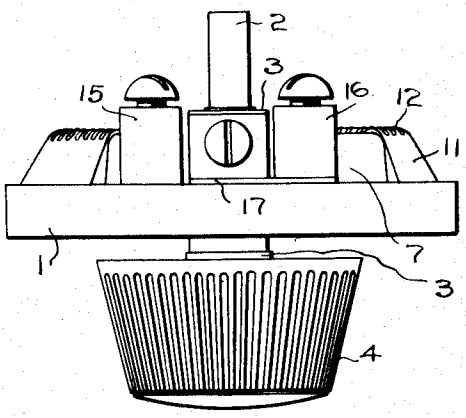



Fig. 3.

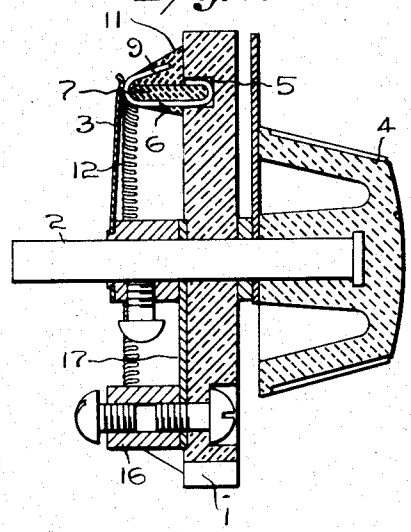
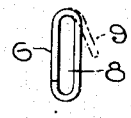



Fig. 4.




WITNESSES:

R. S. Harrison

H. A. Whittemore

INVENTOR

Thomas C. Rathbone

BY

Wesley G. Carr

ATTORNEY

Patented Nov. 13, 1928. 1,691,251

# UNITED STATES PATENT OFFICE.

THOMAS C. RATHBONE, OF MOORE, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

## GRID LEAK.

Application filed April 2, 1925. Serial No. 20,188.

My invention relates to rheostats and particularly to rheostats of the type used in connection with radio apparatus.

It is an object of my invention to provide means by which the terminals of that portion of the rheostat which is in use shall provide good electrical connection between the high resistance material and the rest of the circuit.

It is a further object of my invention to provide an effective rheostat of high resistance material in an inexpensive manner.

It is a further object of my invention to provide a rheostat of molded or cast composition having a high resistance, the rheostat also having a series of members of low resistance, each of which makes electrical contact with the molded composition of the contacting surfaces having a large area.

It is a further object of my invention to provide contact or terminal members each extending into the interior of the body of high resistance material, whereby the contacting surfaces between said material and said terminals may be of large area without increasing the bulk of the rheostat.

A still further object of my invention is to provide a rapid, easy and economical method for producing a rheostat of this type.

Other objects of this invention and details of the construction will be apparent from the detailed description, and from the accompanying drawing, in which

Figure 1 is a plan,

Fig. 2 is a side elevation,

Fig. 3 is a section upon the line III—III of Fig. 1, and

Fig. 4 is a detail, showing the method of manufacture.

The rheostat is mounted upon any convenient base 1 which preferably is provided with a central hole for the shaft 2, by which the contact arm 3 is operated. The end of the shaft 2, on the side of the base opposite the contact arm 3, is provided with the usual head 4 for actuating the shaft and arm.

A groove 5 is provided in the base 1. A resistance member, comprising a wire 6 wound on an arcuate insulating core 7, is mounted in the groove 5. Preferably, the core 7 extends through nearly the whole of a circumference.

When the wire has been wound on this core, a saw-cut is made on the outer face of the coil near the edge of the groove 5, as indicated at 8 in Fig. 4. Because of the elasticity of the wire, the outer arms of the individual turns will then spring outwardly as indicated at 9 in Figs. 3 and 4. The portion of the turns which are within the groove 5 are prevented by the walls of the groove from springing outward, but their tendency to do so causes a firm engagement between them and the base 1. The several turns are prevented by said engagement from moving about after the saw-cut is made.

The turns are more effectively fastened in place by being covered with a fusible or other moldable material, as indicated at 11. Shellac or sealing wax, which has been rendered slightly conductive by having lamp-black incorporated therein, is a suitable composition for this material, but I do not limit myself thereto. Any material, which can be cast or otherwise molded into place about the wire 6 and which will have a high resistance, is suitable.

The upper bight of each turn projects above the material 11, which covers the rest of the coil. If too much material has been used, the portion of it covering the upper surfaces of the individual turns may be removed by scraping or other suitable procedure.

There results a series of rounded metal protuberances 12 which are arranged in an arcuate row in the path of the contact arm 3. Preferably, the traveling end of this arm is convex toward the coil, in order that good contact may be obtained between the arm and the several turns.

The several whorls of wire each have a large surface in intimate contact with the high resistance material. Irregularities due to imperfect contact between the metal and the material constituting the resistance are, therefore, avoided. The only contact which may be of uncertain resistance is the contact between the arm 11 and the upper surfaces of the several whorls. Since both of these contact members are metal, a good contact between them is a question only of cleanliness and of proper mechanical adjustment, insuring good pressure. Both of these circumstances are easily controlled.

The whorl 14 at one end of the coil is connected to a binding post 15. The whorl at the other end is at a sufficient distance from

the binding post 16 to provide a place where the arm 3 may contact with insulating core 7 and thus introduce an infinite resistance. The binding post 16 is connected by a strap 17 with the shaft 2 and so with the arm 3.

In the operation of the device, the rheostat has an infinite resistance when the arm is in one extreme position, namely, against the binding post 16. As the arm is rotated counter-clockwise in Fig. 1, the several projecting bights 12 are engaged in turn by the arm 3. There is, at all times, good electrical connection between the binding post 16 and an abundant surface of the insulating material at the particular whorl with which the arm 3 is in contact. The length of insulating material between this whorl and the whorl 14 determines the resistance corresponding to that setting of the arm 3. Since the resistance of the junction between any whorl and the high resistance material is small and since the resistance of the connection between the high resistance material and the whorl 14 and, therefore, the binding post 15 is small, it follows that the change in resistance with changing position of the arm will be very regular and certain.

If the arm 3 is stopped between two of the bights 12, its elasticity will cause it to make contact with both of them. If the contact pressure of the arm 3 in this position is smaller than when it contacts with one bight only, the increase in contact resistance between the arm and the wire is more than compensated by the fact that the path of the current now includes two whorls. The area of the surface of wire 6 through which current enters the resistance material is now twice the normal area. Consequently, the total resistance of the current path from the arm 3 into the insulating material is practically constant for all positions of the arm.

If desired, the molded material may first be put about the unsevered coil and a cut then made, through both the wire and the embedding material, to sever the individual whorls. By means of this method, the molded composition assists in holding the wire stationary during the cutting operation.

The specific illustration and description of a single form only of the device is not to be taken as a limitation. The only limitation upon the invention intended is that necessitated by the prior art or explicitly indicated in the following claims.

I claim as my invention:

1. In a rheostat, a core, a coil on said core, a moldable high-resistance composition in which said coil is embedded, the several whorls of the coil being severed, and portions thereof projecting at one side thereof beyond said composition, whereby the several bights of the whorls form available surfaces, and a traveling contact member mounted to pass over said surfaces.

2. The method of manufacturing a rheostat which consists in winding a wire into a coil, severing the several whorls of the coil and embedding the severed coil in a high-resistance medium.

3. As an article of manufacture, a resistance device comprising a coil of wire partially imbedded in a moldable material having high resistivity, the several whorls of said coil being severed, and a portion of each of said whorls being exposed to the action of a contact device.

4. As an article of manufacture, a resistance device comprising a coil of wire partially imbedded in a moldable material having high resistivity, the several whorls of said coil being severed and separated an appreciable distance at the point of severance.

5. As an article of manufacture, a resistance device comprising a coil of wire partially imbedded in a moldable material having high resistivity, the several whorls of said coil being separated and severed, and a contact member so disposed as to be movable over the exposed portions of said whorls.

6. As an article of manufacture, a resistance device comprising a base-member having a groove therein, a coil of wire having elongated whorls partially stepped in said groove, the several whorls being severed adjacent said base member, a moldable material having high resistivity encompassing a portion of each of said whorls and maintaining them separated, and a contact device so disposed as to be movable over the exposed portion of said whorls.

In testimony whereof, I have hereunto subscribed my name this eighteenth day of March, 1925.

THOMAS C. RATHBONE.