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R. C. BENNER ET AL

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METHOD OF MAKING ELECTRICAL RESISTANCES

Filed April 5, 1927

Fig. 1



Fig. 2

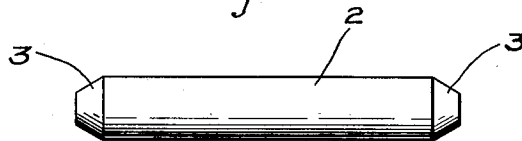


Fig. 3

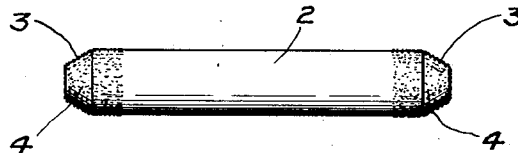
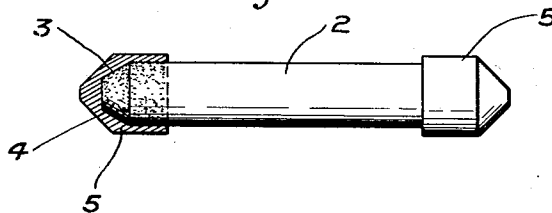


Fig. 4



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UNITED STATES PATENT OFFICE

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METHOD OF MAKING ELECTRICAL RESISTANCES

Application filed April 5, 1927. Serial No. 181,078.

This invention relates to electrical resistance devices, and more particularly extremely high resistances of the type commonly used in radio receiving circuits for grid leaks, couplings for resistance amplification, and the like, and to the method of making such devices.

According to the present invention, it is proposed to provide a resistance which is non-inductive, non-microphonic, which does not absorb moisture from the air, and whose resistance remains constant and is unaffected by changes in atmospheric humidity.

A further important feature of the present invention is the method of manufacturing the resistance so as to render the same non-microphonic and immune to atmospheric conditions, as well as a simple process for varying the resistance during the process of manufacture as may be necessary in a convenient and simple manner.

Our invention is more especially applicable to the class of resistances described in United States patent to Hutchins et al, No. 1,322,573, dated November 25, 1919, which consists, briefly, of fabricating resistors from a plastic mixture of silicon carbide and an easily fusible clay containing relatively large amounts of iron and calcining the resistors at a temperature at which part of the iron oxide is reduced by the silicon carbide to metallic iron.

In the accompanying drawings we have illustrated certain steps in the process of manufacturing a resistance according to the present invention. In the drawings:

Figure 1 represents a length of crude resistance rod;

Figure 2 shows the ends of the rod bevelled to receive the metallic cap;

Figure 3 shows the rod with a metallic coating applied to the ends thereof; and

Figure 4 shows the assembled resistance device, one end of the device being shown in section.

In the practice of the present invention, the material from which the rod is formed is mixed, as described in the said United States patent to Hutchins et al, molded to the desired shape, and baked at the desired tem-

perature, as described in said patent, the baking and composition of the mixture being so regulated that the resistance of the molded rods is higher than that required of the completed resistor. When the rod has been baked and is removed from the furnace, it is thoroughly hard and is of the shape shown in Figure 1. In Figure 1 the rod of resistance material is designated 2.

In order to accommodate the ends of the rod to metallic caps of the type commonly employed in devices of this kind, the ends of the baked rods are bevelled either before or after baking, preferably before, on account of the greater ease of performing the operation, as indicated at 3 in Figure 2. This may be done by holding the rod against an abrasive wheel at the proper angle.

The bevelled ends 3 of the rod 2 are then coated with a soft metal, such as lead, or lead alloy, by holding the end of the rod against a wheel made of lead, lead alloy, or other suitable soft metal. This lead coating, designated 4, forms a metallic contact material to the ends of the rod which is not microphonic.

Metal end caps 5 are then forced on to the coated ends 4 of the rod. The lead in the joint between the metallic caps and the composition rod forms a good conducting path, which is not microphonic, whereas graphite sodium silicate material heretofore commonly used in devices of this nature is microphonic at times.

After the devices have been assembled, as shown in Figure 4, they are immersed in a molten bath of a suitable non-conducting wax, pitch or resin which does not absorb water readily and which has a high permanent electrical resistance or dielectric constant, such for instance, as paraffin, ceresin or "Superla" wax.

If it is desired to simply waterproof the rod, it is immersed in the molten paraffin at 250° F. for about four minutes. This does not appreciably change the resistance of the device, but if it is desired to decrease the resistance, the device is left in the hot paraffin until such time as the resistance is reduced to the required value. Numerous

experiments have shown that the resistance of the rods can be decreased at a rate of approximately one per cent per hour by immersion in the molten paraffin at 250° F.

After the resistance devices have been immersed in the paraffin for the desired length of time, they are taken out of the bath and the excess paraffin is removed centrifugally or by wiping or by any other suitable method, and while the resistors are still hot, i. e. still above the melting point of the paraffin. After the resistors have cooled, they are classified by any suitable measuring apparatus.

It is obvious that by controlling the composition of the rods, that is, the relative proportions of clay and silicon carbide, the length of time and the temperature of calcining, as well as the length of time of heating in paraffin, it is possible to make resistance rods varying from over 10 megohms to about 1,000 ohms without varying the size of the unit beyond that shown in the accompanying drawings. Resistance units made in this manner are non-inductive, permanently non-microphonic, and are unaffected by atmospheric humidity.

While we have illustrated our invention particularly in connection with resistances of the familiar cartridge type, it will be understood that the invention is not limited to the particular form and style of resistance illustrated, and that various modifications and changes in the construction of the device may be made within the contemplation of our invention and under the scope of the following claims.

We claim:

1. In the manufacture of rigid resistor rods comprised principally of silicon carbide, the step of heat treating the rod in a bath of molten paraffin to vary the conductivity thereof.

2. In the manufacture of resistor rods, the steps comprising forming a rigid rod comprised principally of silicon carbide, heat treating the rod in the presence of paraffin for a predetermined time, and thereafter removing the excess paraffin.

3. In the manufacture of ceramically bonded resistor rods, the step which comprises immersing the rods in a bath of paraffin and varying the period of immersion to vary the conductivity of the rod.

4. The step in the manufacture of silicon carbide resistors which comprises immersing the resistors in a hot bath of paraffin and varying the period of immersion to vary the conductivity of the rods.

5. In the manufacture of silicon carbide resistors, the steps of forming the resistors and firing them to form rigid elements and subsequently impregnating the elements with a waterproofing compound having a

high dielectric constant and capable of increasing the conductivity of the rods.

6. In the manufacture of resistor rods comprised principally of silicon carbide, the step of impregnating the perviously formed and matured rods with a compound such as paraffin capable of decreasing the resistance of the rods and possessing a high dielectric constant.

7. In the manufacture of rigid self-supporting resistor elements containing a clay binder having iron oxide, the steps which comprise forming the resistor element from the raw mix, firing the element to mature the binder and reduce the iron oxide, and thereafter immersing the formed rigid rod in a bath of molten paraffin for a time longer than ten minutes, thereby adjusting its resistance value.

In testimony whereof we have hereunto set our hands.

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