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FIXED RESISTOR UNIT AND PROCESS OF FORMING THE SAME

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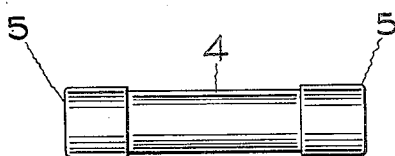


Fig. 1.

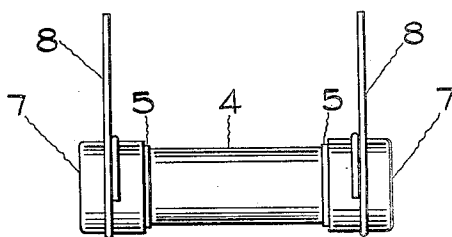


Fig. 2.

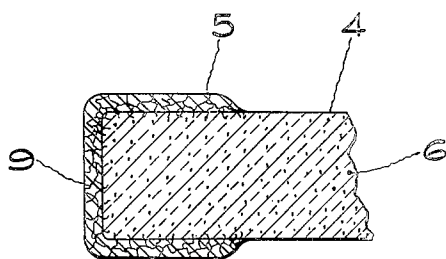


Fig. 3.

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FIXED RESISTOR UNIT AND PROCESS OF FORMING THE SAME

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5 Claims. (Cl. 201—76)

This invention relates to fixed resistor units and refers more particularly to the contact portions thereof.

It is of importance in electrical circuits including the resistance unit or units and where conditions must remain constant, that the junction between the resistance unit and the conductor connecting it into the circuit have a low resistance value and that this value should not change. The resistance units as employed in radio receiving circuits are in many instances of comparatively high values; that is, in the neighborhood of several megohms. The units are comparatively small in dimension, some of them not over five-eighths inches long and one-eighth inch in diameter and it is a requirement that the connection between the resistance unit and the conductor joining the resistance unit into the circuit be mechanically strong and unchanging in its physical properties. An efficient low resistance end or terminal of the resistance unit should take up only a small part of the total length of the unit proper for the reason that length is required to give the unit as great a wattage capacity as is possible.

A further requirement of a high resistance unit of this type is that the low resistance ends or terminals of the units be of the same dimensions so far as coverage is concerned so that the overall resistance of the units will be practically of the same value. It is also an essential to the manufacture of a resistance unit of this type that the process to produce the terminals or contacts should be economical.

It is therefore an object of this invention to provide a resistance unit of novel construction and a process of forming the same in which the contact portions are of low resistance value and remain constant at that low value.

Another object of this invention is to provide a contact of a resistance unit that is mechanically strong and which will permit capping of the unit or soldering a lead to the unit without damaging in any manner the contact portion of unit.

Another object of this invention is to provide a contact of a resistance unit that takes up only a comparative small length of the resistor unit and that the area occupied by the contact portion is always constant.

A further object of this invention is to provide a process of manufacture which is efficient in the production of contacts for the resistor and which is comparatively low in cost.

In the accompanying drawing I have illustrated two examples of the physical embodiment

of my invention, and in which: Figure 1 is a side elevation view of a resistance unit constructed in accordance with my invention; Figure 2 is a side elevation view of a resistance unit as in Figure 1 with the addition of end caps and wire leads; and Figure 3 is a longitudinal section view through an end portion of resistor unit shown in Figure 1.

Referring now more particularly to the accompanying drawing, the numeral 4 represents the body portion of a fixed resistance unit. As shown, the body portion is preferably rod shaped and in this example is formed from clay like material becoming porcelain on being fired in which is contained carbon particles indicated as at 6. The end contacts 5 are obtained by applying a coating of metallic paste and firing the same to a temperature at which the coating is bonded to the resistor body 4 by means of a matrix 9 formed by a flux which is part of the paste. My method provides for the formation of a contact on molded units of various materials including the different resins and clays, and I have illustrated the invention as applied to porcelain forming clay containing carbon.

The metallic contact 5 and matrix 9 do not penetrate deeply into the interstices of the resistor unit body 4 and any effect produced due to differences in expansivities of the contact and resistor unit proper is not sufficient to weaken the unit. The thickness of the metallic contact 5 required to obtain a low resistance at the ends of the unit is so slight as to introduce a negligible amount of strain in the event that end caps 7 as in Figure 2 are forced over the contacts which is quite a contrast to low resistance carbon or graphite contacts formerly used where many minor and some major factors resulted when the resistors were capped. My invention does not of necessity require an additional metal end cap; however, where the metal end cap is used my metal terminal does provide an efficient juncture between the resistor unit proper and the metal end cap. It is customary to connect the resistance unit into a circuit by wire leads which are shown in this case in Figure 2 as 8 wrapped around caps 7.

My process is similar to that employed in applying decorations to chinaware. The metallic paste may consist of any or a combination of finely divided low resistance metals preferably in colloidal form and mixed with a flux which when matured by heat treatment forms a matrix wherein the metal and particles of the resistor body are held into intimate contact.

An example of producing this low resistance

contact is explained in the following. The silver paste, a standard product used in chinaware decorations, has the general composition of twelve parts colloidal silver mixed with one part flux which may be bismuth-sub-nitrate, lead borate, borax or combinations of the three; and this mixture suspended in an extract of Canada balsam which forms approximately thirty percent of the total paste by weight. The consistency of the paste is regulated by the addition of spirits of turpentine. The paste may be applied to the ends of the resistance unit in various ways, one of which found most desirable is to carry the unit to a rubber roll allowing the end of the unit to penetrate into the roll to the desired depth of contact, the rubber roll carrying the paste. Due to the tackiness of the balsam the desired amount of silver is retained on the ends of the resistor units and the paste dries rapidly enough so that the unit may be fired soon after. The flux when maturing causes an incipient softening of the surface of the resistor body and particles of the resistor body are surrounded or partially surrounded by the flux. The flux acts as a matrix holding both the particles of metal and also particles of the resistor body. The units are passed through a furnace which has a temperature sufficiently high to mature the flux. The temperature used will depend upon the time the unit is in the furnace and also will depend upon the material which the resistor proper is made of. For example in the application of my low resistance end to a ceramic unit the temperature is maintained at approximately fifteen hundred degrees Fahrenheit and the time is thirty five seconds. In the application of the low resistance end on a unit made of bakelite resin the temperature is approximately nine hundred and fifty degrees Fahrenheit and the time of application of heat is in the neighborhood of thirty five seconds.

The metallic paste of the mixture as disclosed above is used successfully with either bakelite resin or porcelain forming clay units, however, it may be necessary that the flux in the paste be changed to obtain the described action on materials of other resistor bodies.

A feature of this invention resides in the novel formation of the contact portions and while in the foregoing description these contact portions are defined as part of a resistor unit, it is readily apparent that the spirit of the invention includes the formation of any electrical contact in the manner set forth as applied to any conductor of molded materials.

I claim as my invention:

1. A terminal for an electrical composition resistor comprising metal particles carried in a matured flux with said flux permeated into a portion of the surface of the resistor.

2. A terminal for an electrical composition resistor of porcelain and conducting particles comprising metal particles carried in a matured flux with said flux permeated into a portion of the surface of the resistor.

3. A terminal for an electrical composition resistor of synthetic resin and conducting particles comprising metal particles carried in a matured flux with said flux permeated into a portion of the surface of the resistor.

4. The method of formation of a terminal on a composition electrical resistor which includes the application of a compound containing metal particles and a flux, to a portion of the surface of the resistor and heat treating the resistor to cause a maturing of the flux and an incipient softening of said surface portion of the resistor whereby the flux bonds the metal particles and impregnates the said surface portion of the resistor.

5. The method of formation of a terminal on a composition electrical resistor which includes the application of a compound containing metal particles and a flux for said metal particles which flux is also adapted at the fluxing temperature to cause an incipient softening of the surface of the resistor, heat treating the resistor at said temperature to cause the flux to bond the metal particles and impregnate the said surface portion of the resistor.

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