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2,332,376

METHOD OF MAKING INSULATED RESISTORS

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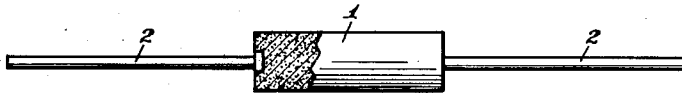


Fig. 1

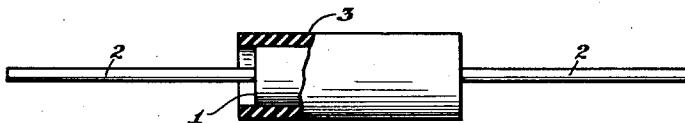


Fig. 2

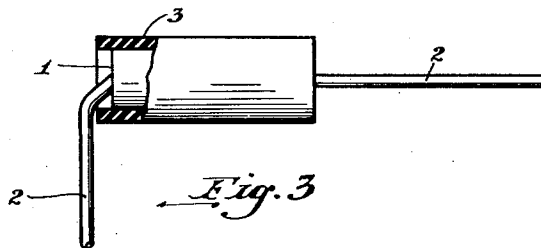


Fig. 3

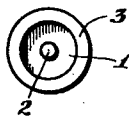


Fig. 4

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UNITED STATES PATENT OFFICE

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METHOD OF MAKING INSULATED
RESISTORS

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Original application February 28, 1941, Serial No.
381,030. Divided and this application April 8,
1942, Serial No. 438,158

2 Claims. (Cl. 18—59)

This invention relates to electrical resistors, and more particularly to a method of making insulated fixed resistors.

At present, most small fixed resistors, such as used in radios, are made from a cylindrical body of resistance material from which terminals or leads project, and many of them have a cylindrical coating or covering of insulating material. As insulation of the ends of the resistor bodies always presents a problem in manufacture and added expense, most of them do not have insulated ends. There are two general ways of insulating such resistors practiced heretofore; one, molding the insulation around a resistor body, and two, simultaneously molding both the body and insulation in intimate contact with each other. Both of these methods leave much to be desired.

In case the resistors have flexible terminals or leads embedded in their ends from which they project axially, flexing of the terminals when connecting a resistor in a circuit often causes them to break close to the resistor body due to the bending being sharp and more or less localized at that point. Also, the portion of a terminal molded in the resistor is apt to be flexed and thereby cause the resistor body to crack. In an effort to overcome these difficulties, the terminals have been strengthened inside of and adjacent the ends of the resistor body so that bending will occur farther out and be distributed over a greater length of the wire. This does not entirely solve the problems, and it requires special preparation of the terminals.

It is among the objects of this invention to provide an easy and inexpensive method of making an insulated fixed resistor, preferably a resistor which has uninsulated but protected ends and in which the insulation materially reduces the likelihood of the terminals breaking off next to the resistor body.

In accordance with this invention, a resistor body is provided with an insulated covering that extends beyond its ends which remain bare. The ends are thus protected to a large extent by the surrounding ring of insulation from accidentally making contact with an outside conductor. The resistor is generally provided with flexible terminals that project axially from its ends. The insulating sleeve projects far enough beyond the ends of the resistor body to materially decrease the distance that the portions of the terminals adjacent the body can be bent away from the axis of the body whereby to restrict the bending of those portions to an angle which does not

cause the terminals to break off near the body nor to crack it. That is, after a terminal engages the projecting end of the insulating sleeve its inner end portion cannot bend farther. Therefore, further bending is confined to the outer portion of the terminal. The body and sleeve are molded separately and not baked, but depend upon the natural cohesion of the particles from which they are made to hold them together. The body is then inserted in the sleeve and the unit thus formed is baked to cure it. The sleeve is made from a thermo-setting material which shrinks onto the resistor body when cured. Also, during the curing stage some of the material at the engaging surfaces of the body and sleeve unites or fuses so that the sleeve is firmly bonded to the body.

The preferred embodiment of a resistor made by the method of this invention is illustrated in the accompanying drawing in which Fig. 1 is a side view, partly in section, of a resistor body with terminal wire leads embedded in its ends; Fig. 2 is a side view of a resistor insulated in accordance with my invention with the insulation partly broken away; Fig. 3 is a view similar to Fig. 2 showing one of the terminal wires bent to the side; and Fig. 4 is an end view of the insulated resistor.

Referring to Fig. 1, a cylindrical resistor body 1 is cold molded from a mixture of powdered bonding material and an electrical conductor, preferably a polymerizable resin and graphite. The headed inner ends of flexible wire terminals 2 are embedded in the ends of the body from which the terminals project substantially axially. The resistor body shown in this figure has not been baked, but there is sufficient natural cohesion between its component particles to render it self-sustaining when handled with reasonable care.

As shown in Fig. 2, a cylindrical tube or sleeve 3 having an internal diameter substantially no larger than the diameter of the resistor body 1 is molded from a thermo-setting insulating material, preferably a polymerizable resin. This sleeve likewise is only cold molded at first, but it is strong enough to permit the resistor body to be inserted in it as shown. The assembled sleeve and body are then baked to cure them and to cause the sleeve to shrink onto the body so that they are held rigidly together. At the same time the bond between them is strengthened by the uniting of a small amount of resin at their engaging surfaces.

Another feature of this invention is that the

sleeve 3 is materially longer than the resistor body, and the latter is placed substantially midway between the ends of the sleeve so that they project an appreciable distance beyond the ends of the body. The ends of the body are thus protected from accidental contact with any outside conductor that is not inserted in the ends of the sleeve. As stated above, the ends of the sleeve project an appreciable distance beyond the ends of the resistor body, by which is meant far enough to materially shorten the distance that the portion of either terminal adjacent the body can be bent, so that the terminal will not be bent beyond its elastic limit at that point and broken, and will not crack the resistor. Thus, as shown in Fig. 3, when a terminal is bent it strikes the projecting end of the insulation sleeve before it has bent more than about 45° from the axis of the resistor, whereupon the inner end portion of the terminal can be bent no farther. Any further bending occurs at the point of engagement between terminal and sleeve and outwardly beyond that point. Consequently, when the outer portion of a terminal is bent at right angles, two spaced 45° angles are formed in the terminal instead of one 90° angle close to the end of the resistor body. The bending is therefore not only decreased at any one point along the terminal, but it is distributed throughout a greater length of it.

It will be seen thus that a resistor made in accordance with the method of this invention has its ends protected in a simple and inexpensive manner. In addition, the chance of breaking the terminals or cracking the resistor body is greatly reduced and in a manner that does not require special terminals. The method itself is relatively simple and inexpensive and requires only one baking.

According to the provisions of the patent statutes, I have explained the principle and construction of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have

it understood that, within the scope of the appended claims the invention may be practiced otherwise than as specifically illustrated and described.

5 This application is a division of my copending application, Serial Number 381,030, for Insulated resistor, filed February 28, 1941, now Patent No. 2,282,651, granted May 12, 1942.

I claim:

10 1. The method of making a resistor, comprising molding a mixture of powdered polymerizable resin and electrical conducting material into the form of a resistor body with flexible electric terminals embedded in its ends, molding from a
15 thermo-setting polymerizable resin an insulating sleeve of greater length than said body, inserting said body in the sleeve and positioning it substantially midway between its ends, and then heating said body and sleeve to cure them and
20 to shrink the sleeve on the body and to cause adjoining particles of resin in the body and sleeve to unite.

2. The method of making an insulated resistor having at its ends projecting flexible terminals
25 and also projecting insulation that prevents the terminals from being bent sharply adjacent the ends of the resistor body, said method comprising cold molding a mixture of powdered polymerizable resin and electrical conducting material into the form of a resistor body with flexible
30 terminals embedded in its opposite ends, separately cold molding from a thermo-setting polymerizable resin an insulating sleeve of materially greater length than said body, inserting said body
35 in the sleeve and positioning it substantially equal distance from the ends of the sleeve whereby said ends project an appreciable distance from the body and surround the exposed inner end portion of the terminals, and then heating said
40 body and sleeve to cure them and to shrink the sleeve on the body and to cause adjoining particles of resin in the body and sleeve to unite.

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