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J. J. MUCHER

2,035,911

FLEXIBLE ELECTRICAL RESISTOR AND METHOD OF MANUFACTURING THE SAME

Filed Jan. 10, 1935

Fig. 1.

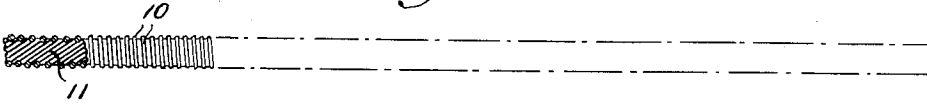


Fig. 2.

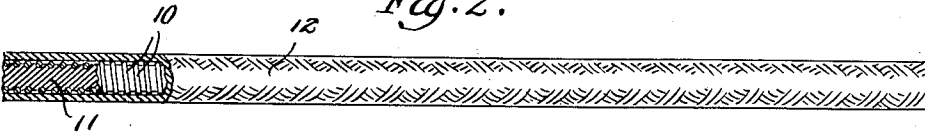


Fig. 3.



Fig. 4.

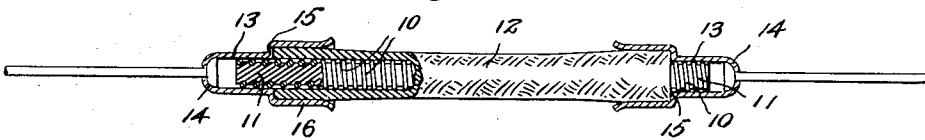


Fig. 5.

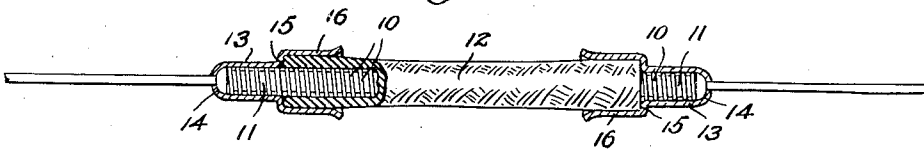
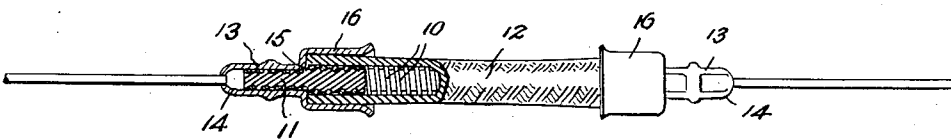


Fig. 6.



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2,035,911

FLEXIBLE ELECTRICAL RESISTOR AND
METHOD OF MANUFACTURING THE
SAME

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Application January 10, 1935, Serial No. 1,167

6 Claims. (Cl. 201-67)

This invention relates to flexible electrical resistors of the type having a fixed ohmage or resistance value and refers more particularly to an improved construction of a resistor of this character and a method of manufacturing the same.

Resistors of this character, particularly for use in connection with radio receiving apparatus, should possess a fixed or constant resistance value and to this end, the invention provides a resistor and method of manufacturing the same so that the ohmage or resistance value of the resistor may be accurately predetermined, fixed and maintained.

The invention comprehends an improved flexible electrical resistor which is so constructed that its ohmage or predetermined resistance value remains constant when the resistor is subjected to flexing strains or stresses encountered when the resistor is bent or looped.

More particularly the invention resides in an improved flexible electrical resistor which includes a core of insulating material having a resistance wire wound thereon and a pair of tubular terminal members at its opposite ends each of which is formed with an outer end adapted to abut with the outer end of the core and adapted to telescopically fit over the core and winding with a braided insulating sleeve for the covering, the convolutions of the resistor wire located between the inner ends of said members and which sleeve is initially contracted longitudinally so that it possesses an inherent tendency to expand longitudinally for covering and maintaining the convolutions between the inner ends of the applied terminal members in constantly covered condition.

Due to the fact that the improved resistor embodies a winding of extremely fine wire as fine as .001 to .0015 of an inch, it is impossible to strip off the usual insulation covering without destroying the winding and hence the present invention comprehends a method of manufacturing flexible electrical resistors which includes the braiding of an insulation covering over a core wound with a resistance wire as fine as .001 to .0015 of an inch, the cutting of the assemblage thus formed into predetermined lengths, the application to the opposite ends thereof of tubular terminal members of a size to push back the braided covering so as to expose the endmost convolutions of the winding without breaking, distorting or otherwise disturbing the same, while the terminal members receive therein the ends of the core and the end convolutions of the winding exposed by the

pushing back of the covering for establishing electrical connection between the terminals and winding. By this method, the resistance value or ohmage of the resistor may be predetermined as the same is fixed by the length of the winding between the inner ends of the terminals. The method also insures firm electrical connection between the winding and the terminals while avoiding any cutting or fraying of the wire which takes place when an attempt is made to sever the insulation covering for the purpose of stripping off the end portions of the covering. The resistors of this type are subjected to severe manufacturing tests and when constructed by the foregoing method, the number of rejections for failure to meet the requirements of the tests are materially lessened.

Further objects of the invention reside in a method of manufacturing resistors of the indicated character which greatly simplifies the manufacture thereof, reduces the expense of production and increases the quality and character of the product.

With the above enumerated and other objects in view, reference is now made to the following specification and accompanying drawing in which there has been set forth one embodiment of the invention, while the appended claims cover variations and modifications which fall within the spirit and scope of the invention.

In the drawing:

Fig. 1 is a fragmentary side view partially in section of a length of resistance wire spirally wound on an insulating core.

Fig. 2 is a similar view partially in section of said winding and core with a braided insulating covering applied thereto.

Fig. 3 is a side view partially in section showing the winding and core with the braided covering cut to a length for predetermining the ohmage or resistance value of the resistor when completed.

Fig. 4 is a view similar to Fig. 3 illustrating the terminal members in partially applied position and demonstrating the manner of their application.

Fig. 5 is a similar sectional view through the resistor showing the terminal members in fully applied position.

Fig. 6 is a side elevation partially in section of the completed resistor constructed in accordance with the invention and produced in accordance with the improved method.

The method of manufacturing a flexible electrical resistor of the type specified and constructed

ed in accordance with the invention, consists in spirally winding a resistance wire 10 of extremely small diameter, as fine as .001 to .0015 of an inch, continuously around an insulating core 11, which core is of such a character that the convolutions are substantially equally spaced and partially embedded in the periphery thereof so as to insulate adjacent convolutions from each other when the resistor is bent, flexed or otherwise distorted from a straight line. The resistance wire and core thus produced is then continuously covered by a braided covering 12 which is impregnated with a suitable coating such as lacquer, varnish, wax or the like. The product thus produced may be suitably spooled and stored away in quantities for future use to be incorporated in resistors of various sizes and values. The resistance wire and its core and braided covering are made into the finished resistors by cutting the same into predetermined lengths as shown in Fig. 3 of the drawing and the length of the severed sections serves as an accurate gage of the resistance value or ohmage of the ultimate completed resistor.

Tubular terminal members 13 having an outer end 14, are then applied to the opposite ends of the cut lengths or severed sections by telescopically engaging the same thereover as shown in Fig. 4 of the drawing. The members 13 are of a cross sectional size or diameter to receive the winding and core, but not of a cross sectional size or diameter to accommodate the braided cover 12. It, therefore, follows that the inner ends 15 of the terminal members 13 function to push back the opposite ends of the braided covering 12 thereby exposing the endmost convolutions of the cut length or severed sections so that the said exposed convolutions of the resistance wire 10 are adapted for electrical connection with the terminal members. After the terminal members 13 are shoved home, as shown in Fig. 5, the outer ends 14 limit the inward movement of said terminal members, the terminal members are compressed and contracted inwardly about the core and winding, as shown in Fig. 6, as set forth in United States Letters Patent, No. 1,987,489, granted to me January 8, 1935, so that the terminal member is securely bonded to the winding and core thereby completing the manufacture of the resistor.

It will be observed during the telescopic inward movement of the terminal members 13 over the winding and core, that the braided covering 12 is longitudinally contracted so that it then possesses an inherent tendency to expand longitudinally whereby its opposite pushed-back ends are forced into intimate engagement with the inner ends 15 of the members 13 and by virtue of this inherent longitudinal expansive action, said braided covering will remain in said intimate engagement throughout the length of life of the resistor so as to cover and maintain the convolutions of the resistance wire 10 between the inner ends of the applied terminal members in constantly covered condition even when the resistor is bent, flexed or otherwise distorted in ordinary handling or using of the same.

While not essential to the present invention, the terminal members 13 are shown with a skirt or shield 16 extending inwardly from the inner end 15 of the member 13 and of a diameter or cross sectional size greater than that of the member 13 and of a size to freely fit over and accommodate the braided covering 12 to lend to the resistor a neat and finished appearance.

The finished resistor manufactured in accordance with the improved method differs from the ordinary resistors of this type previously devised, in that the braided covering 12 in accordance with the present invention is initially braided onto the resistance wire and its core and is not telescopically fitted thereover after the covering has been manufactured and cut to lengths. This avoids the loose fitting outer coverings and the unsatisfactory and tedious task of telescopically sliding the cut lengths of outer coverings over the resistance wire wound on the core which tends to pick up the loose ends of wires and cause short circuiting of some of the convolutions thereby changing the resistance value or ohmage from that intended. The resistor also is provided with a longitudinally expansible resilient outer covering which due to its initial longitudinal contraction is constantly under tension to maintain its opposite pushed-back ends in engagement with the inner end 15 of the terminal member 13.

What I claim is:

1. A flexible electrical resistor including an elongated resistance element, a tubular terminal member secured over each of the opposite ends of said resistance element, and a longitudinally contracted tubular covering formed over the said resistance element and inherently expansible longitudinally to maintain its opposite ends in constant engagement with the inner ends of the terminal members.

2. A flexible electrical resistor including a core of insulation material, a resistance wire spirally wound thereon, a tubular terminal member having an outer portion secured over each of the opposite ends of the core and the opposite end convolutions of the resistance wire and having an enlarged inner portion defining a shoulder at its juncture with the outer portion thereof, and a braided tubular covering surrounding the core and extending from the shoulder of one terminal member to the shoulder of the other, said covering being initially contracted longitudinally and placed under tension so as to be inherently expansible longitudinally for maintaining its opposite ends in constant engagement with the shoulders of the terminal members.

3. A method of manufacturing flexible electrical resistors including the steps of braiding an outer protective covering over an elongated resistance element, cutting said covered resistance element together with the covering into predetermined lengths and telescopically sliding inwardly over the opposite ends of the said resistance element, tubular terminal members of such a cross sectional size that the inner ends of said members push back the outer covering from said resistance element and maintain the same under tension so as to be inherently expansible longitudinally for retaining its opposite ends in constant engagement with the inner ends of the terminal members.

4. A method of manufacturing flexible electrical resistors including the steps of braiding an outer protective covering over a resistance wire spirally wound on a core of insulation material, cutting said covered resistance wire and its core together with the covering into predetermined lengths, telescopically sliding inwardly over the opposite ends of the core and resistance wire of said lengths, tubular terminal members of such a cross sectional size that the inner ends of said members push back the outer covering from said resistance wire and its core and maintain the

covering under tension so that the same is inherently expansible longitudinally for retaining its opposite ends in constant engagement with the inner ends of the terminal members, and bonding the terminal members to the opposite ends of the core and the end convolutions of the wire which are exposed by the pushing back of the outer covering.

5 5. In a method of making resistors containing
10 two metallic terminal ferrules each having an intermediate shoulder therein, the steps of inserting into said ferrules the opposite end portions
15 of a wired core covered along the length thereof with a compressible sleeve, bringing the ends of the sleeves into abutment with the shoulders,
20 forcing the ends of the core farther into the ferrules whereby the said shoulders compressibly hold back the sleeve against further movement to expose the coils on the end portions of the core, and compressing together the ferrules at the shoulders thereof and the adjacent portions of the exposed coils to establish an electrical con-

nection between said shoulders through the covered winding on the core therebetween.

6. In a method of making resistors containing at each end a metallic terminal ferrule having an intermediate shoulder positioned between an enlarged socket and a constricted tubular portion communicating therewith, the steps of inserting into each of said ferrules the end portion of a wired core covered along the length thereof with a compressible sleeve, bringing the ends of each sleeve into abutment with said shoulders, forcing the cores into said constricted portions a predetermined distance whereby said shoulders compressibly hold back the sleeves against further movement to cause the compressed end portions of the sleeves to remain within said sockets and expose the coils on the end portions of the core to the walls of the constricted portions, and compressing together the ferrules at the shoulders thereof and the adjacent portions of the exposed coils.

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