Dec. 6, 1955 H. E. FERGUSON 2,726,306

ELECTRONIC RESISTOR

Filed May 27, 1953

Fig. 1.

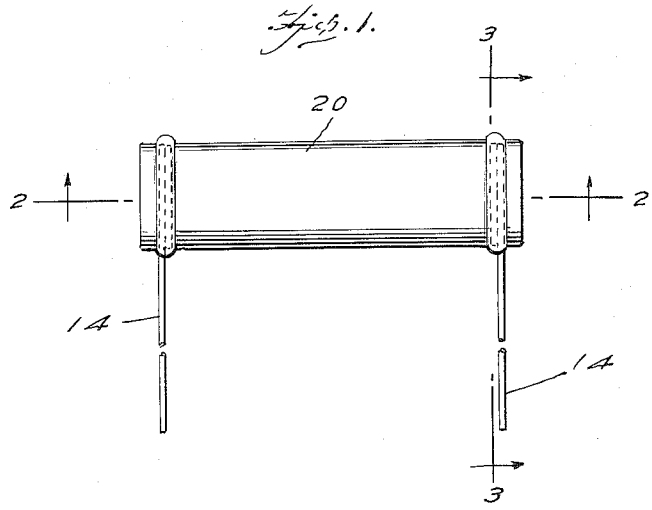


Fig. 2.

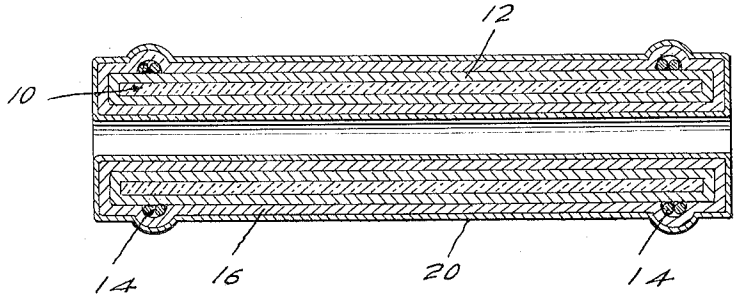
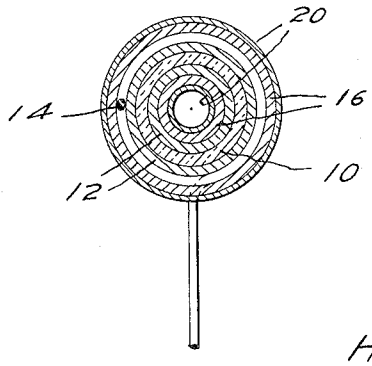


Fig. 3.



Inventor
Houston E. Ferguson

By Wilfred L. Lawson
ATTY.

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ELECTRONIC RESISTOR

Huston E. Ferguson, High Point, N. C.

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3 Claims. (Cl. 201—64)

This invention relates generally to improvements in electronic devices and is directed particularly to an improved resistor.

An object of the present invention is to provide a resistor unit having a number of advantages over units of known construction such as:

1.—No flash over.
2.—Longer shelf-life.
3.—Longer working-life.
4.—Unaffected by humidity and most acids.
5.—Excellent recovery if subjected to momentary high overloads.
6.—Light weight.
7.—Very good derating curve.
8.—Low noise generation, if any.
9.—Fast heat dissipation.
10.—Low inductive and capacitive effect.
11.—Very good frequency characteristics.
12.—More economical due to simplified method of manufacture.

Other objects and advantages of the invention will become apparent as the description of the same proceeds and the invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawing forming a part of the specification, with the understanding, however, that the invention is not to be limited to the exact details of construction shown and described since obvious modifications will occur to a person skilled in the art.

In the drawing:

Figure 1 is a view in side elevation of a resistor constructed in accordance with the present invention.

Figure 2 is a longitudinal section taken substantially on the line 2—2 of Figure 1.

Figure 3 is a transverse section taken substantially on the line 3—3 of Figure 1.

Referring now more particularly to the drawing it will be seen that the resistor unit illustrated comprises a tubular carrier body which is generally designated 10. However, while the body 10 has been illustrated as being tubular it is to be understood that the invention is equally applicable to a solid rod of suitable material such as glass or ceramic material.

The body 10 which is preferably ceramic material and which will be identified as the core is, in accordance with the present invention prepared by having applied to its surfaces, by dipping or in any other suitable manner, a mixture of phenolic resin and acetone, which mixture is prepared by dissolving the phenolic resin in the acetone in a quantity that is of suitable resin content to leave a thin film of resin on the ceramic body when the latter is dipped therein. This preparatory mixture functions to close the pores of the ceramic body.

After the coating or dipping operation the tube, or rod, is then dried in freely moving air or at a suitable elevated temperature until the solvent is completely removed.

The ceramic core then is completely coated as indicated at 12 with the phenolic resin.

After the coating has dried pigtails 14 are attached to the ends of the core, providing suitable connector leads. Such leads may be tinned copper or other suitable material, a portion of each of which is wrapped at least twice around the core as shown in Figure 2 and soldered. The core body with the prepared resin coating is now ready for the application of the improved resistance mixture, hereinafter described, which is applied to the core by the dip method.

The current conducting mixture is prepared by combining phenol formaldehyde resin with graphite. To this mixture there is added a solvent such as denatured alcohol or a ketone, or any other suitable liquid which will act as a solvent for the stated resin.

To this mixture of phenol formaldehyde resin, graphite and solvent, there is added a sufficient quantity of acetone to bring the mixture into a high state of solvency and the mixture is then thoroughly mixed or agitated either by hand or with a suitable mechanical mixture.

The conducting mixture is then ready to be applied by dipping the coated core therein stated. Thus the coated core receives a second coating, designated 16, of the current conducting material.

In order to obtain various ohm ratings the mix is varied to the rating in ohms desired by increasing the phenolic resin content for higher ratings or by increasing the graphite content for lower ohm ratings. By this method the value in ohms can be varied from zero through any value desired.

In view of the fact that a method employed for determining the ohm rating of a mixture of this character will be readily known or apparent to those versed in the are of preparing resistance units or similar electrical devices, no description of the manner of determining such ratings is believed to be necessary to proper understanding of the present invention.

After the conducting layer or coating 16 has been applied to the core in the manner stated the units are air dried until no trace of solvent is found and they are then baked at a proper temperature suitable for setting the resin in the resistance film or coating.

After baking, the units are insulated by applying a coating of suitable insulating material such, for example, as the material known as "Insulex" or "Durez," or any other suitable material having dielectric strength.

If thermo-setting insulating materials are used the units are again baked to set the insulating coat.

After applying the insulating coating which is designated 20, the units are then color coded for value identification, in the customary manner.

As an illustration of the proportions of the ingredients used for obtaining different resistance values, the following examples are given, it being understood that the invention is not limited by these illustrations and that other resistance values may be obtained by proportionate changes in the percentage of graphite.

Example 1.—A mixture of 2% graphite, 75% phenol-formaldehyde resin, 20% methyl denatured alcohol and 3% acetone may produce a film having one million ohms resistance, depending on film thickness and length of tube or rod, or distance between pigtails.

Example 2.—A mixture of 8% graphite, 60% phenol-formaldehyde resin, 20% methyl denatured alcohol, and 12% acetone may produce a film having 12,500 ohms resistance, depending on film thickness, length of rod or distance between pigtails.

Example 3.—A mixture of 70% graphite, 10% phenol-formaldehyde resin, 10% methyl denatured alcohol and 10% acetone may produce a film having 200 ohms re-

sistance, depending on film thickness, length of tube or rod, or distance between pigtails.

From the foregoing it will be seen that there is provided by the present invention an improved resistor unit which has been found to have the characteristics set forth in the first part of the description and accordingly it will be apparent that such unit has many advantages over other units of known type.

I claim:

1. A resistor unit of the character stated comprising a core body of ceramic material, a conductor coating comprising a mixture of phenol, formaldehyde resin and graphite encasing said body, leads attached to said coating adjacent the ends of said body and a second coating of phenolic resin interposed between said conductor coating and said body.

2. A resistor unit of the character stated comprising a tubular core body, a conductor coating comprising a mixture of phenol formaldehyde resin and graphite covering the inner, outer and end surfaces of said body and

leads attached to said coating adjacent the ends of said body.

3. The invention according to claim 1, wherein said ceramic body is tubular and both the conductor coating and said second coating overlie the inner, outer and end surfaces of the tubular core.

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