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J. R. FISHER

2,075,515

RESISTANCE

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FIG. 1

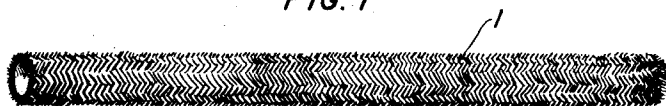


FIG. 2

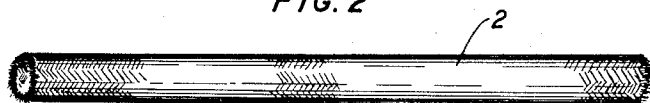


FIG. 3

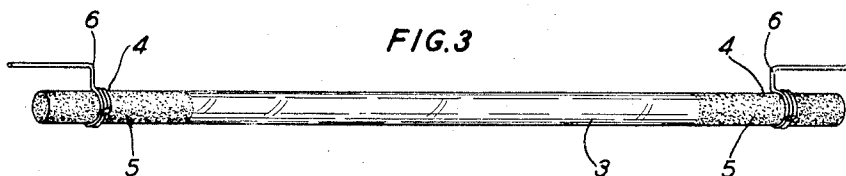


FIG. 4

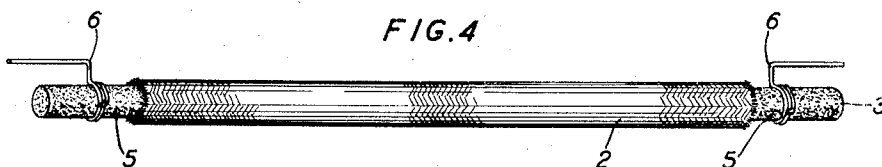


FIG. 5

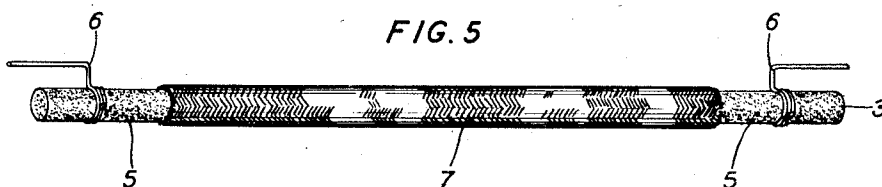
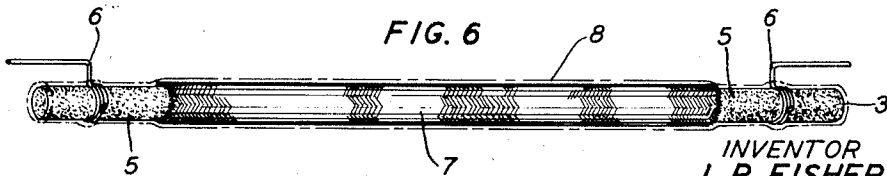


FIG. 6



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RESISTANCE

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6 Claims. (Cl. 201—75)

This invention relates to electrical resistance devices and more particularly to resistance devices of carbonaceous material.

The object of this invention is to provide a stable ohmic resistance device which is non-microphonic and which is suitable for grid leaks and other uses where the resistance value required is comparatively high and must be stable at the operating potential.

A feature of this invention resides in a fibrous sheath of carbon supported on an insulating rod.

Another feature resides in a method of producing the fibrous sheath of carbon on the insulating rod and making contact between ends of the fibrous sheath of carbon and terminals on the rod.

Referring to the individual figures in the drawing:

Fig. 1 is a view in perspective of a sheath of braided threads;

Fig. 2 is a view in perspective of the sheath shown in Fig. 1 after it has been partially processed;

Fig. 3 is a view in perspective of a rod of insulating material prepared to receive the sheath shown in Fig. 2;

Fig. 4 shows the sheath of Fig. 2 supported on the rod of Fig. 3;

Fig. 5 shows the sheath and rod of Fig. 4 after the sheath has been further processed than as shown in Fig. 2; and

Fig. 6 shows the finished resistance.

I have found in resistance devices made of finely divided carbonaceous material and a binder that such resistance devices almost invariably contain incomplete paths of the carbonaceous material. These incomplete paths are frequently arced by the current traversing the resistance and the resistance device, therefore, is microphonic. The microphonic characteristic of the resistance device, therefore, is due to there being in the resistance device incomplete paths for the current applied and the arcing-over of the gaps in these paths by the current traversing the resistance. For instance, in resistance devices made of carbon granules held in required form by a binding material, there are numerous places in the resistance device where the carbon granules do not touch adjacent carbon granules, but are slightly separated therefrom by some of the binder material. In resistance devices of the grid leak type where the resistance path is formed by applying a paint or India ink to a strip of insulating material and in resistance devices in which the resistance

path is formed by rubbing or otherwise applying graphite or other resistance material to a rod of insulating material, small gaps between particles of the resistance material are almost invariably found to be present in the resistance device.

In this invention due to the character of the material in the resistance element, and due to the method employed in making the resistance, a comparatively large number of unbroken paths of resistance material are produced from end to end of the device.

In the drawing in which like parts bear like numerals, 1 is a sheath of braided threads in which each thread is continuous from one end of the sheath to the other. The sheath 1 may be made of braided cotton threads, or threads of other suitable material and may be cut to a predetermined length from a comparatively long piece of sheathing. The sheath 1 after being cut to the required length is parchmentized by applying a solvent such, for instance, as sulphuric acid to the sheath sufficient to partially dissolve the threads. After washing, to check further dissolution of the threads, the sheath is dried. The sheath may be dried in air or in any other suitable drying atmosphere. I have found that when the sheath 1 is subjected to the application of sulphuric acid sufficient to partially dissolve the threads, the sheath becomes of a jelly-like consistency. When the sheath is dry it has shrunk about 10% in length and diameter. The sheath 1, therefore, shown in Fig. 1 becomes the parchmentized sheath 2 shown in Fig. 2. The braided cotton threads in the sheath 1 in Fig. 1 as before mentioned, are unbroken from end to end of the sheath and are still unbroken in the sheath 2 of Fig. 2, but have become smaller in diameter and smaller in length in Fig. 2 than they are in Fig. 1.

As shown in Fig. 3, a rod 3 of insulating material is prepared to receive the parchmentized sheath 2 of Fig. 2. The rod 3 may be, for instance, a glass rod of suitable diameter and length to receive the parchmentized sheath 2. Terminals 4 of conducting material are provided on the ends of the rod 3. The terminals 4 may be formed and applied by spraying the ends of the rod 3 with particles of finely divided metal until a coating of metal 5 is formed on the ends of the rod 3. Another way in which the ends of the rod 3 may be metallized is to rub a suitable metal compound on the ends of the rod 3 until the required coating of metal is obtained.

To provide means for connecting the resistance

device into a circuit, conductors 6 are attached to the metallized ends of the rod. End portions of the conductors 6 are wound around the metallized ends of the rod 3.

5 After the terminals 4, comprising the metallized ends 5 of the rod 3 and the conductors 6, have been applied to the rod 3, the parchmentized sheath 2 of Fig. 2 is placed on the rod 3 as shown in Fig. 4 with the ends of the sheath 2 extending
10 over the metallized ends 5 of the rod 3.

The rod 3 and the sheath 2, assembled as shown in Fig. 4, are then placed in an oven having therein an atmosphere of hydrogen and are baked in the oven and in the atmosphere of hydrogen
15 under a suitable temperature and for a sufficient length of time to reduce the threads in the parchmentized sheath 2 to carbon. I have found that by baking the parchmentized sheath 2 in an oven in an atmosphere of hydrogen that gases released
20 from the parchmentized sheath in the baking process are quickly taken up by the hydrogen and that there is no localization of the gases released such as might cause explosion in the threads of the sheath 2 and breaking or disruption of the threads. The parchmentized sheath
25 2, therefore, under the baking process is not broken or disrupted and the threads remain intact and provide threads of carbon which are unbroken from end to end of the resistance device.
30 vice.

The baking process as to length of time and heat applied may be varied to obtain different resistance values. The heating of the oven should also be regulated to prevent burning of the
35 parchmentized material and to permit taking up by the atmosphere of hydrogen of the gases released from the parchmentized material. I have found for instance that the parchmentized material begins to turn to carbon at a temperature of about 300° centigrade and that the oven containing the device, under heat treatment, should
40 be gradually brought to about this temperature to permit the gases released from the parchmentized material to be taken up by the hydrogen. After the oven has been gradually brought to a
45 carbonizing temperature the heat of the oven may be more rapidly increased to a required predetermined higher temperature. For instance to obtain a resistance of 1000 ohms a parchmentized element of predetermined length, texture and
50 diameter is placed in the oven. The temperature of the oven is then brought from room temperature to about 300° centigrade in from five to ten hours. The temperature of the oven is then further increased to about 700° centigrade in
55 about two hours from the time the 300° centigrade temperature was obtained and the element under heat treatment is left in the oven at about this temperature for about one-half hour. The oven with the element under heat treatment is
60 then permitted to gradually cool to room temperature. I have also found that if the temperature of the oven is raised much above 1100° centigrade the element under heat treatment becomes burned and the threads will be destroyed.
65

During the baking process the sheath 2, as before mentioned, becomes carbonized and

shrinks in length and diameter on the rod 3, as shown in Fig. 5, and becomes the carbonized sheath 7 which, as shown in Fig. 5, is smaller in length and diameter than the sheath 2 in Fig. 4. The sheath in the baking process also shrinks against the metallized ends 5 of the rod 3 and makes intimate contact with the metallized ends of the rod.

To protect the resistance device from moisture and other injurious agencies the unit as assembled, as shown in Fig. 5, may be dipped in paraffin or in some other suitable water-proofing compound or may be painted or otherwise provided with a moisture-proof coating 8 as shown in Fig. 6.

What is claimed is:

1. An electrical resistance device comprising a rod of insulating material, conducting terminals on the ends of the rod, a textile sheath of woven textile carbon threads shrunk on the rod and end portions of said sheath in engagement with said conducting terminals.

2. An electrical resistance device comprising a rod of insulating material, conducting terminals on the ends of said rod, a woven textile sheath of unbroken carbon threads shrunk on said rod and end portions of said woven textile sheath in engagement with said conducting terminals.

3. An electrical resistance device comprising a rod of insulating material, metallized portions on the ends of said rod, and a woven textile sheath of unbroken carbon threads shrunk on and enclosing said rod and in contact with the metallized portions on the ends of the rod.

4. A method of producing an electrical resistance which comprises applying conducting material to ends of an insulating rod, placing a sheath of woven textile over the rod, parchmentizing the sheath and subjecting the sheath and rod, in an atmosphere of hydrogen, to a carbonizing temperature for the sheath of woven textile to reduce the sheath of woven textile to carbon and to shrink the sheath into intimate contact with the conducting material on the ends of the rod.

5. An electrical resistance device comprising a tube of insulation having its ends provided with a coating of conducting material and a textile sheathing slipped over the tube and parchmentized and carbonized in place so that the sheathing shrinks into intimate contact with the metallized ends of the tube.

6. A method of producing an electrical resistance device comprising applying conducting material to ends of an insulating rod, placing a braided sheath of cotton threads on the rod, partially dissolving the cotton threads, drying the threads, placing the rod and sheath in an inert atmosphere containing hydrogen, raising the temperature of the sheath in about ten hours' time to 300° centigrade, increasing the temperature in about two hours' time to 700° centigrade, maintaining the sheath at the higher temperature for about one-half hour and then allowing the sheath to gradually cool in the atmosphere containing the hydrogen.

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