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ELECTRICAL RESISTOR AND METHOD OF MAKING SAME

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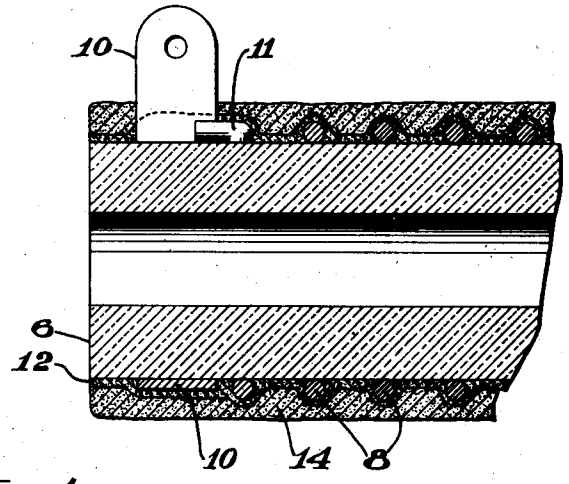

Fig. 1

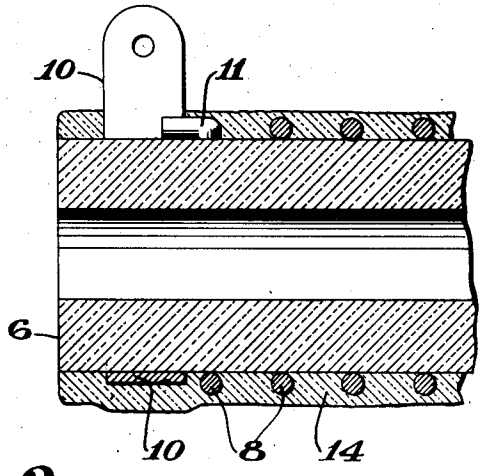

Fig. 2

INVENTOR.
Jason M. Zander
BY
ATTORNEY

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ELECTRICAL RESISTOR AND METHOD OF MAKING SAME

Jason M. Zander, Chicago, Ill., assignor to Chicago Vitreous Enamel Product Company, Cicero, Ill., a corporation of Illinois

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2 Claims. (Cl. 201—64)

This invention relates to electrical resistors.

More particularly it relates to electrical resistors comprising a cylindrical, generally tubular core, an electrical resistance wire spirally wound on said core, metallic connecting members on the ends of said core for securing the ends of said wire and providing an electrical connection to said wire, and a vitreous enamel protective coating covering said wire and core and the base of said metallic connecting members. This invention also relates to an improved method for producing electrical resistors of the type above described.

Many difficulties have been encountered, heretofore, in producing wire-wound electrical resistor units which will have a substantially smooth uniform coating of vitreous enamel and which will resist sudden changes in temperature without fracturing. Particular difficulty has been met by axial shifting of the coils of the spirally wound resistance wire during the firing of the enamel coating thereon. The wire coils separate in bunches along the core as a result of high surface tension of the fused enamel.

As the enamel fuses during the firing thereof, the enamel coating sometimes splits and the surface tension on the fused semi-liquid enamel causes the coating to draw away from the split, thereby resulting in the widening of the split and often leaving a considerable gap in the coating. The wire coils are pulled away from each other at the said gap, thereby being drawn into bunches along the core. This phenomenon is often referred to in the arts as "wire bunching." For obvious reasons this is objectionable.

It is an object of this invention to provide an improved method for the production of enamel coated wire-wound resistors which will not be subject to "wire bunching" during the firing of the enamel.

It is another object of this invention to produce a wire-wound electrical resistor having a fused coating of an enamel, the wire coils of the resistor being in the position as originally wound, and the enamel coating being smooth and uniform over the entire surface thereof.

Other objects of the invention will appear hereinafter.

The above objects may be accomplished, in general, by first applying to a wire-wound electrical resistor core, a clay slip (aqueous suspension of clay) and drying the same before application, and firing, of enamel on the outer surface thereof.

The resistor core is generally composed of a ceramic material, for example, steatite porcelain, magnesium silicate or magnesium aluminum silicate.

The resistor core is wound in a conventional manner with an electrical resistance wire, for example, a nickel-chromium alloy or nickel-copper alloy wire, and the wire securely held in place by means of metal fastening tabs or connecting elements to which the ends of the wire are fastened to form an electricity conducting unit from one tab through the wire to the other tab. The above described wire-wound core is then provided with a coating of a slip composed of clay. The clay may be kaolin, ball clay, china clay or the like. Preferably, the slip, i. e., the aqueous suspension, is made somewhat thin and fluid. As a general guide, the slip should be made sufficiently fluid to flow between the wire coils to the core, and to drain from the spaces between the wire coils so as to leave a substantially uniform coating on the exposed surfaces of the core and the wire. The actual proportion of water to clay in the slip will, of course, depend upon the gauge of the wire, the spacing of the wire coils, and the particular clay being used in the slip. It will be readily apparent that if the slip is too thick, it will not flow between wire coils but will bridge the space between coils and as a result a coating of uniform thickness on the wires and the core will not be obtained. In general, the clay slip should contain between 3 and 30 parts water for 1 part solids and preferably between 5 and 10 parts water for 1 part solids.

The clay slip may be prepared in any suitable manner. For example, the clay and the water may be mixed and ball-milled to obtain the desired dispersion of the clay in the water. The ball-milled product may then be diluted with water to the desired consistency.

The clay slip may be applied to the wire-wound core in any desired manner; for example, it may be applied by brushing, spraying or dipping. Preferably, the clay slip is applied to the wire-wound core by dipping and then allowed to drain; for example, by suspending by one end thereof. The clay slip is then dried on the wire-wound core. The drying is preferably accomplished by contact with the atmosphere at room temperature; however, forced air drafts, or even mild baking can be employed, if desired, to dry the same.

The wire-wound core containing the dry coating of clay is then coated with a vitreous enamel slip in a known manner. Any vitrifiable enamel may be used for coating the resistor unit without

material damage of splitting of the enamel, or "wire bunching," during the firing of the enamel. The enamel slip is then dried and fired in a known manner.

The present invention is illustrated by the accompanying drawing showing two stages in the manufacture of electrical resistors in accordance with my invention.

Fig. 1 is an enlarged fragmentary sectional view of a wire-wound core containing a clay bentonite undercoating and a vitreous enamel slip overcoating.

Fig. 2 is a similar fragmentary sectional view of the finished electrical resistor after firing of the structure shown in Fig. 1.

Referring to Fig. 1 of the drawing, reference numeral 6 designates a tubular ceramic core, upon which is spirally wound a resistor wire 8. The end of the wire 8 shown in this drawing is welded, brazed, or otherwise fastened at 11 to metallic tab 10 and is clamped firmly about the core 6. A clay slip of the type described above and designated by numeral 12 is shown in a substantially uniform layer about the core 6, the tab 10 and the wire 8. Although, in the stage of production shown in this drawing, the clay is dry and contains an overcoating 14 of enamel slip, it will be readily apparent that the clay, when applied as a slip, was sufficiently thin and fluid to flow in between wire coils and to drain from the spaces between coils to leave a more or less uniform coating.

In Fig. 2 of the drawing, in which like reference characters designate like parts, the enamel 14 has been fired. It will be noted that the clay has now substantially vanished. Since the clay is present in a thin uniform layer, as shown in Fig. 1, the fusing of the enamel during the firing operation, permitted an absorption of the clay and thereby causing a firm adherence of the enamel to the core 6 and the wire 8.

Throughout the specification, reference to parts, percentages and proportions refers to parts, percentages and proportions by weight, unless otherwise specified.

Since it is obvious that many changes and modifications can be made in the above described details without departing from the nature and spirit of the invention, it is to be understood that the invention is not to be limited by said details except as set forth in the appended claims.

I claim:

1. The method of making wire-wound electrical resistors which comprises applying to a core wound with resistance wire a coating of a slip comprising an aqueous suspension of a clay, the slip being sufficiently fluid to flow between the wire windings and to drain from the spaces between windings to leave a substantially uniform coating on the surfaces contacted, drying said coating, applying a coating of a vitreous enamel slip over said dry clay coating, drying said enamel slip, and firing said enamel.

2. The method of making wire-wound electrical resistors which comprises applying to a core wound with resistance wire a coating of a slip comprising an aqueous suspension of a clay, the slip containing 3 to 30 parts by weight of water for each part solids, drying said coating, applying a coating of a vitreous enamel slip over said clay coating, drying said enamel slip and firing said enamel.

JASON M. ZANDER.