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METHOD OF MANUFACTURING ELECTRICAL RESISTORS

Filed July 14, 1945

FIG. 1

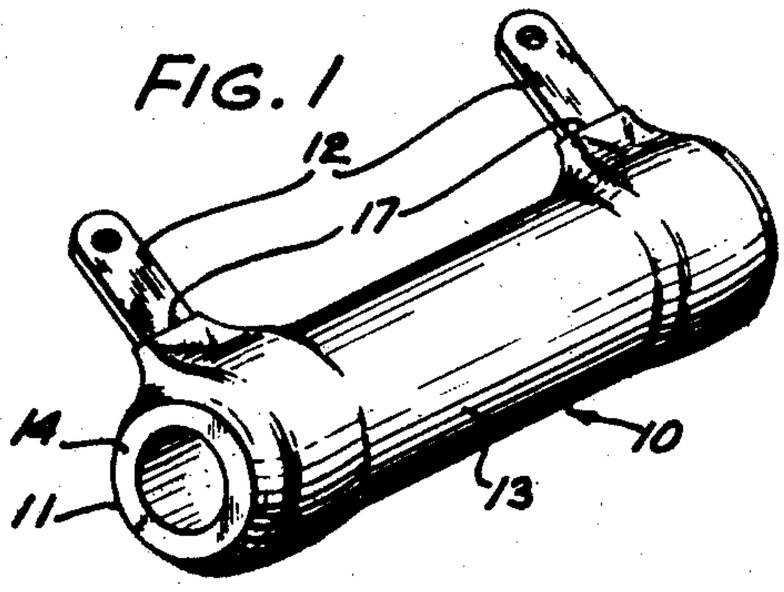


FIG. 2

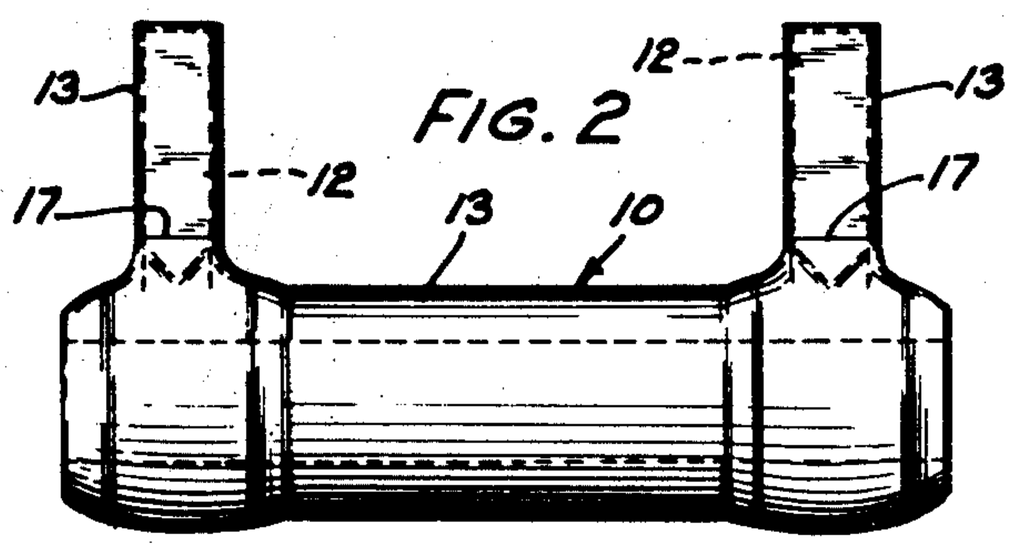


FIG. 3

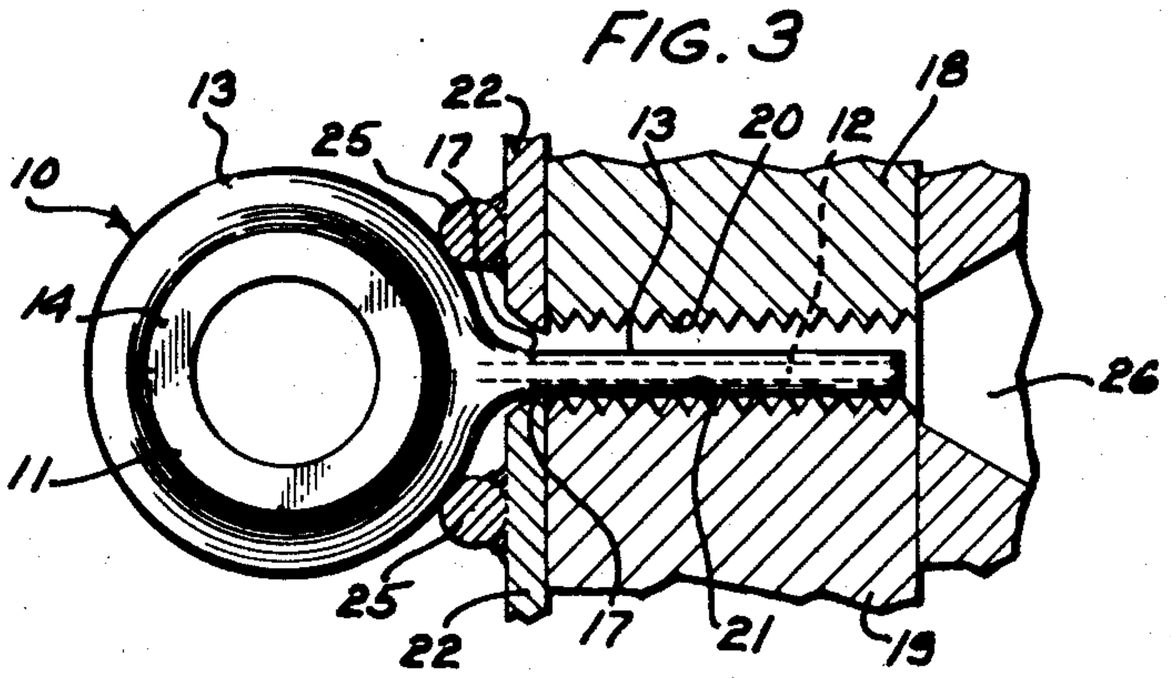
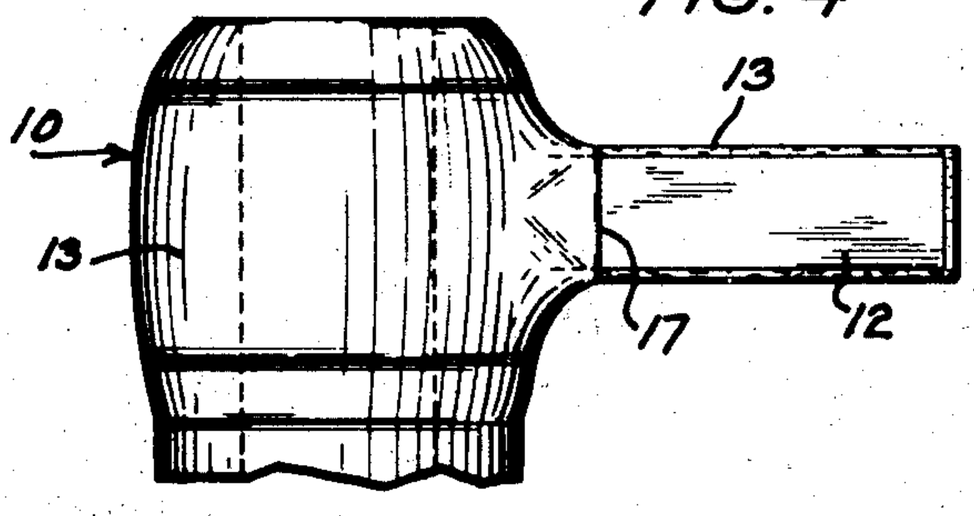


FIG. 4



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METHOD OF MANUFACTURING ELECTRICAL RESISTORS

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6 Claims. (Cl. 201—67)

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This invention relates to methods of manufacturing electrical resistors and more particularly to a method of manufacturing ceramic coated electrical resistors having exposed metallic terminals.

In the manufacture of certain types of ceramic coated electrical resistors requiring that the coating material be fired at a high temperature, considerable difficulty has been experienced in removing oxidation from the exposed surfaces of the metallic terminals acquired during the firing operation.

An object of the present invention is to provide an efficient and effective method of manufacturing such coated electrical resistors in such a manner that oxidation of the exposed metallic terminals is prevented.

In accordance with the present invention as applied to a wire wound ceramc coated electrical resistor having flat exposed and projecting metallic terminals, the resistor is dipped in a bath of vitreous enamel to coat the entire outer surfaces of the resistor and its terminals, whereupon the coated resistor and its terminals are then subjected to the required firing temperature to provide a ceramic coating thereon. After cooling of the ceramic coated resistor, the flat terminals thereof are inserted between spaced parallel surfaces of movable and stationary punch and die elements having aligned knife-edged serrations so that, upon the punch and die elements being closed, the ceramic coating on the opposite flat surfaces of the terminals is simultaneously fractured, cracked or chipped free therefrom for the greater portion of its length by the coacting serrated surfaces of the punch and die elements without deleteriously affecting the surfaces of the terminals and exposing clean unoxidized and unpitted surfaces thereon suitable for soldering leads thereto without further cleaning.

Other objects and advantages of this invention will more fully appear from the following detailed description taken in conjunction with the accompanying drawing in which

Fig. 1 is a perspective view of an electrical resistor manufactured in accordance with the method of this invention and after subsequent trimming and perforating operations on the terminals;

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Fig. 2 is a longitudinal plan view of a resistor after being dipped in a bath of vitreous enamel and the enamel fired;

Fig. 3 is a diagrammatic illustration of the serrated movable and stationary punch and die elements with a ceramic coated resistor terminal in position therebetween in preparation for the step of simultaneously cracking and freeing the ceramic coating from opposite surfaces of the terminal; and

Fig. 4 is an enlarged fragmentary plan view of the resistor and a terminal upon completion of the step of simultaneously cracking and removing the ceramic coating from opposite surfaces of the terminal.

Referring to the drawing, there is illustrated in Fig. 1 a completed electrical resistor 10 of a well-known type. The illustrated resistor comprises a cylindrical member or core 11, which may be of any suitable ceramic material, upon which is wound a length of resistance wire or other form of conducting material, to opposite ends of which are fixed metallic terminals 12, which extend laterally from the resistor. As shown in Fig. 1, the wound core 11 is provided with a coating of ceramic material 13, which covers the entire outer surface of the completed resistor 10, except the annular end faces 14 of the core 11 and the greater portion of the terminals 12, the ceramic coating terminating at the lines 17, also shown in Figs. 2 and 4. The terminals 12, in their initial form when fixed to the ends of the resistance wire, as shown in Figs. 2, 3 and 4, are not perforated, and rounded off at their outer ends, as shown in Fig. 1, since these operations may, with advantage, be performed subsequently to the steps of the method of this invention to be presently described for preventing oxidation of the exposed outer ends of the terminals during the firing of the ceramic coating material 13.

In accordance with the method of the present invention, a ceramic wound core 11, with the attached terminals 12 assembled in a usual manner, is dipped into a suitable bath or slip of vitreous enamel requiring a high temperature to vitrify it in order to provide the desired coating of ceramic material 13. After removal from the bath and before the coating on the terminals is completely dried, such coating is lightly scored

along the lines 17, which serves to facilitate the freeing of the ceramic coating on the terminals in a subsequent step in the method. This score line also prevents the ceramic coating from breaking beyond the score line and into the coating adjacent the resistor. Following this step, the enamel coated resistor and projecting terminals are dried and then fired in a usual manner at a high temperature, for example, 1600° F. Due to the vitreous enamel coating on the terminals 12, they are fully protected from oxidation and, if not protected by the coating, would, due to the high firing temperature, result in severe oxidation and pitting of the terminals and, as a result, considerable difficulty would be encountered in removing the oxidation before the usual coating of tin is applied thereto for soldering. After the cooling of the fired resistor 10, to provide the ceramic coating, the terminals 12 are freed upon their opposite flat faces of the ceramic coating by inserting them, referring to Fig. 3, between spaced parallel surfaces of movable and stationary punch and die elements 18 and 19, having formed therein knife-edged serrations 20 and 21, respectively. The peaks of the opposed serrations 20 and 21 are in direct alignment and extend laterally of the terminals 12. Adjacent the left vertical faces of the elements 18 and 19 are suitably spaced fixed guard members 22, which serve to restrict the entrance opening to the normal space between the serrated surfaces of the elements 18 and 19. Fixed to the guard members 22 are horizontal rod-like members 25, which serve as stop members for the resistor 10, the peripheral surface of which engages the same and thus predeterminedly longitudinally positioning the terminals 12 as the operator inserts the same between the serrations 20 and 21, as shown clearly in Fig. 3. Abutting the right vertical faces of the elements 18 and 19 is an air exhaust duct 26, shown fragmentarily, by the action of which the ceramic particles freed from the opposite faces of the terminals 12 in the step of simultaneously cracking, chipping or crushing the ceramic coating on opposite faces of the two terminals 12 by the pressure effected by coacting aligned serrations 20 and 21 when the punch and die elements 18 and 19 are closed by the downward movement of the punch element 18 are withdrawn. It will be understood that the downward movement of the punch 18 is predeterminedly limited by a suitable stop means (not shown) so that the opposed surfaces of the terminals which are thoroughly freed from the ceramic coating are left completely unmarred by the coacting serrations 20 and 21. Although, as shown in Fig. 4, the ceramic coating is shown as left extending around the three edges of the terminal 12 from the line 17 to its free outer end after the closing of the punch and die elements 18 and 19 upon the terminals in most cases, depending upon the thickness of the stock from which the terminals are made, these edges will also be freed of the ceramic material.

In practicing the method of making resistors having a ceramic coating and exposed metallic terminals of this invention, the opposed surfaces of the terminals are left thoroughly clean, unoxidized and unpitted and, without any further treatment, may be subjected to the usual tinning operation to facilitate the soldering of leads thereto.

In a subsequent operation, each terminal 12 is inserted between coacting punch and die members (not shown) and forming no part of this invention, wherein it is perforated and rounded

off at its outer free end, as shown in Fig. 1. In this latter operation, any ceramic coating material left on the edges of the terminal 12 after the previous step of this invention in removing such material from the opposed surfaces of the terminal is removed.

What is claimed is:

1. A method of making electrical resistors having a ceramic coating and exposed outwardly extending metallic terminals which comprises applying a ceramic coating material to a resistor and its terminals to completely cover all portions of the resistor and terminals, firing the resistor and terminals to vitrify the coating material thereon, and then removing the vitrified coating from opposed surfaces of the outwardly extending terminals by subjecting the coating to a pressure cracking operation without deleteriously affecting the surfaces of the terminals.

2. A method of making resistors having a ceramic coating and exposed outwardly extending metallic terminals which comprises dipping a resistor and its terminals in a bath of ceramic coating material to completely coat all portions of the resistor and terminals, heating the coated resistor and terminals to vitrify the coating thereon, and then removing the vitrified coating simultaneously from opposed surfaces of the outwardly extending terminals by subjecting the coating to a pressure chipping operation without deleteriously affecting the surfaces of the terminals.

3. A method of making resistors having a ceramic coating and exposed outwardly extending metallic terminals which comprises applying a ceramic coating material to a resistor and its terminals to completely cover all portions of the resistor and terminals, firing the resistor and terminals to vitrify the coating material thereon, and then removing the vitrified coating simultaneously from opposed surfaces of the outwardly extending terminals by subjecting the coating to a pressure chipping operation without deleteriously affecting the surfaces of the terminals by inserting the opposed coated surfaces of the terminals between serrated surfaces of relatively movable members.

4. A method of making electrical resistors having a ceramic coating and exposed outwardly extending metallic terminals which comprises applying a ceramic coating material to a resistor and its terminals to completely cover all portions of the resistor and terminals, drying the coating material, firing the resistor and terminals to vitrify the coating material thereon, cooling the fired resistor, and then removing the vitrified coating from opposed surfaces of the outwardly extending terminals by subjecting the coating to a pressure chipping operation without deleteriously affecting the surfaces of the terminals.

5. A method of making electrical resistors having a ceramic coating and exposed outwardly extending metallic terminals which comprises applying a ceramic coating material to a resistor and its terminals to completely cover all portions of the resistor and terminals, firing the resistor and terminals to vitrify the coating material thereon, and then freeing the vitrified coating simultaneously from opposed surfaces of the outwardly extending terminals by subjecting the coating to pressure chipping by inserting the terminals between opposed aligned serrated surfaces of relatively movable members.

6. A method of making resistors having a ceramic coating and exposed outwardly extending metallic terminals which comprises applying a

ceramic coating material to a resistor and its terminals to completely cover all portions of the resistor and terminals, forming score lines in the coating on the terminals adjacent the junctures between the terminals and the resistor, firing the resistor and terminals to vitrify the coating material thereon, and then removing the vitrified coating from opposed surfaces of the outwardly extending terminals up to the score lines by subjecting the coating to a pressure cracking operation without deleteriously affecting the surfaces of the terminals.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,950,507	McWeeny	Mar. 13, 1934
787,047	Leonard	Apr. 11, 1905
1,932,923	Bullinger	Oct. 31, 1933