

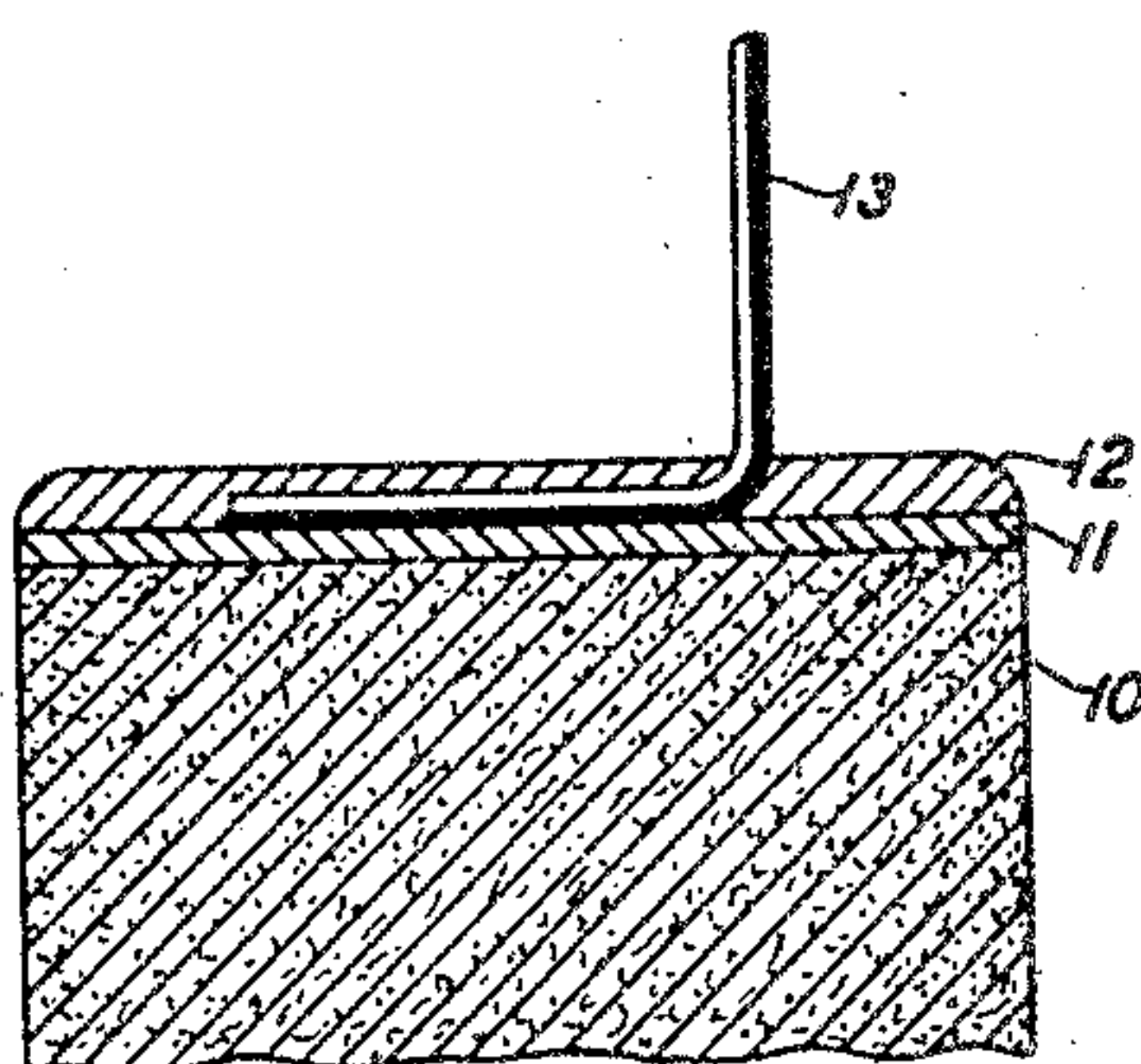
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RESISTOR

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RESISTOR

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This invention relates to resistors and more particularly to the making of electrical connection to resistor bodies.

The problem of making connections to resistor bodies has many ramifications, depending among other things, upon the material of the resistor body, and that of the contact or connecting means; the temperature at which the device is to be operated; the particular circuit use to be made of the resistor; and other factors. The present invention involves making connection to resistor bodies of non-metallic material with suitable metallic material or materials.

In many cases an electrical connection to a resistor is adequate if it will pass current into or out of a resistor in sufficient quantity without overheating. In many instances, however, the current passing through the resistor is variable and the pattern of its variation is of the essence in the circuit, where the resistor is employed. In such cases it is important that no additional variation of the current be caused at the junction between the resistor body and its connecting means. For example, in carrier telephone systems, there are employed resistors the resistance of which varies greatly with changes in temperature, which resistors have come to be known as "thermistors." These thermistors are often made from bodies of metallic oxide material with metallic connectors secured thereto. Unless suitable precautions are taken, unwanted variations of resistance may occur at the junctions between the resistor body and the metallic connections. This results in small but detrimental variations in current. These unwanted variations or "noise" may take the form of extraneous modulations or variations such as are made by a granular resistance microphone and which have been called microphonic noise.

It is an object of this invention to so make connection to resistor bodies, that the previously noted unwanted current variations or "noises" are avoided or greatly inhibited.

A feature of this invention resides in a connection comprising two layers of metallic material, the first of which is in tight adherence to the surface of the resistor and the second of which secures a connecting lead in place on the first, said layers being of the same metal but having different physical characteristics.

Other and further objects and features of this invention will be more fully and clearly understood from the following detailed description of an exemplary embodiment thereof taken in connection with the appended drawing in which the

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single figure is a sectional view of a resistor and a connection, illustrating the invention.

Referring to the drawing, 10 is a part of a body of resistance material, for example, one end of a cylinder or pellet of suitable metal oxide material. An adherent layer of metal 11 is firmly secured to one surface of the resistance material 10. Another adherent metallic layer 12 secures the lead 13 to the layer 11 and thus to the resistor body. The material of the layers 11 and 12 should have a thermal coefficient of expansion approximately the same as that of the resistance material 10.

When the material 10 comprises one or more of the oxides of manganese, nickel, cobalt, copper or uranium, a suitable material for layer 11 is platinum, and for layer 12 is a platinum material of somewhat different character.

In applying this type of contact to a resistor body, for example to the end of a cylinder of metal oxide resistance material, the end of the cylinder is ground or otherwise made relatively smooth and plane. A layer of a liquid material containing platinum or convertible into platinum is applied to the smooth surface. This material may be platinum chloride mixed with an essential oil such as oil of Rosemary or Lavender and may contain a small amount of a fluxing material such as glass. The material is allowed to dry and then is subjected to a sufficiently elevated temperature to convert the platinum chloride into metallic platinum. This temperature may be between 400° and 800° C., depending upon the resistance material being used. The temperature must not be high enough to cause any change in the resistance material.

The lead 13 is now secured to the end of the cylinder by means of the adherent metallic layer 12. It has been found that where the layer 11 is of platinum, particularly good results may be obtained if the layer 12, as applied, comprises a composite platinum material. This material, which for want of a better term has been called "platinum mush" may comprise a liquid material such as the platinum chloride composition used for the layer 11, a flux, and a sufficient quantity of finely divided platinum to give the material a mushy consistency. This material is applied to the surface of the layer 11 and the lead 13 inserted therein. The consistency of the material is such that the lead may be kept in the desired position with the minimum of difficulty. The assembly is then subjected to an elevated temperature as in the case of the layer 11, until the layer 12 is converted into metallic platinum. Upon

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cooling, the solidified material holds the lead 13 in excellent mechanical and electrical connection with the resistance body 10. A connection made in the foregoing manner is substantially free from unwanted current variations such as micro-
phonic noise and the like.

If the layer 11 is of some other metal than platinum, e. g., nickel, the layer 12 may be applied as a "nickel mush" containing finely divided nickel. With other suitable metallic material for the layer 11, the layer 12 would be applied as a "metal mush" including the same metal as in layer 11; but in a finely divided state.

Although the invention has been disclosed by means of particular embodiments thereof, it is not intended that it be limited thereby, but by the scope of the appended claims only.

What is claimed is:

1. In a resistor comprising a body of resistance material with a connecting lead secured to a portion of its surface, means inhibiting variations of resistance between the body and lead, and comprising a layer of platinum adhering to said surface portion, and a second layer of metal overlying and adhering to said first layer and securing said lead in electrical connection with said body, said second layer being of a platinum material converted in place from a layer comprising a platinum compound mixed with finely divided platinum.

2. In a resistor including a resistance body and means for making electrical connection thereto, said means including at least one connecting lead, joining means for securing such a lead to said body whereby resistance variations at the junction are inhibited, said joining means comprising a coating of platinum adhering to said body, and a metallic layer adhering to said coating and securing said lead in electrical and mechanical connection to the body, said layer being of a platinum material converted in place from a layer of a paste including finely divided platinum.

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3. The method of making electrical connection to a resistor body, that comprises applying to a portion of said body a coating of a metal having substantially the same thermal expansion coefficient as the resistor body, mixing together a liquid material capable of conversion to the same metal at a temperature lower than the melting point of the metal and finely divided particles of said metal to obtain a material of pastry consistency, and securing a connecting lead to said body, first temporarily by embedding a portion thereof in a layer of the pastry material spread over said coating, and then permanently by converting said layer into the metallic state at said lower temperature.

4. The method of making electrical connection to a resistor body of metal oxide material, that comprises applying to a portion of said body a coating of metallic platinum, mixing together a liquid material capable of conversion into metallic platinum by heating, and finely divided platinum to obtain a material of pastry consistency, and securing a connecting lead to said body, first temporarily by embedding a portion thereof in a layer of the pastry material spread over said coating, and then permanently by heating to convert said layer into metallic platinum.

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