106-84 CROSS REFERENCE EXAMINE

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RESISTOR MATERIAL.

18-47.5

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This invention relates to resistors or resistor materials, more particularly to resistor material of a non-metallic nature.

It has been common practice to make non-metallic resistors of ceramic materials including a kaolin binder, conducting materials, such as graphite or carborundum, and filler materials, such as silica, to provide the proper resistance, and to bake the same at a high temperature.

It has been found that, because of variations in the sizes of granules, imperfect control of firing conditions and of temperatures and time periods of baking, it was difficult to control the resistance in resistors made from the same batch of such materials with any degree of certainty. The specific resistance thereof varied greatly and, in service, changed as much as several hundred percent in a relatively short time.

It has also been proposed to substitute for the kaolin binder a binder such as water glass and, instead of baking, simply drying the resistor material to remove water. But the resistance of such material has been found to be variable in accordance with changes in atmospheric conditions. An increase in the moisture content of the air to which the resistor was exposed caused an increase of resistance thereof and vice versa.

The present invention is designed to improve upon such materials, it being among the objects of my invention to provide a resistor material which shall obviate the disadvantages of the materials of the prior art, which shall be stable and permanent and the manufacture of which may be controlled very closely.

In practising my invention, I provide a non-crystalline binder, such as a silicate, aluminate, stannate or the like of an alkali metal, and incorporate the same in a suitable mixture of conducting and non-conducting materials. The formed resistors are baked to remove water and are then treated with a substance which is capable of reducing the sensitiveness thereof to humidity by removing at least part of the alkali from combination with the binder and which preferably combines with the alkali to provide a soluble combination. The material is then washed to remove the alkali therefrom and the resistor is dried or baked.

A specific example of my invention is as follows: I make a dry mixture of 4.5% lampblack and 95.5% flint, which is calculated to provide a final resistivity of 50 ohms per centimeter cube. A mixture of this kind may be stored for relatively long periods of time without changes or deterioration therein. A solution of sodium silicate or commercial water glass is diluted to the desired strength and a suitable amount thereof mixed with the resistor material to give a consistency suitable for molding. The amount of water glass is relatively small. Resistors are molded and then baked at a sufficiently high temperature to remove most of the water therefrom.

If desired, the resistors may be strengthened by impregnating the same with a water glass solution and again baking or drying to remove water. I provide a saturated solution of a material capable of removing the alkali from the combination thereof with the silica, such as ammonium chloride, and immerse the resistors therein for a suitable length of time at room temperature, in a vacuum, if desired. The time of treatment is from one to two hours. The resistors are then removed from the solution and a stream of water passed over the same slowly for a period of from four to five hours to wash out the soluble alkali chloride formed in the treatment. The resistors are then dried at a suitable temperature to remove water and free ammonia from the material.

Resistors made in accordance with my invention are remarkably constant in their resistivity, there being less than 20% variation in resistivity of resistors made from the same mix compared to a variation for baked porcelain material of the same character of at least 500%. My resistors do not change in resistance either in the atmosphere or under the influence of a discharge such as the same may be subjected to when used in a lightning arrester. The steps of manufacture are very simple and various batches of materials may be made to agree closely in resistivity of the final product.

Although I have described my invention, setting forth a specific embodiment thereof, my invention is not necessarily limited to the details described. The binder need not be water glass but other colloidal binders may be substituted therefor. It is not essential that ammonium chloride be used to remove the alkali from the silicate, as various other salts or acids or acid salts may be

substituted therefor. However, I prefer to use this substance because it leaves the alkali in a soluble combination, and the ammonia resulting from the reaction may be readily removed. If desired, the resistors may be given several treatments with the alkali-removing agent and a corresponding number of washings and dryings. These and other changes may be made in my invention without departing from the principles herein set forth.

I claim as my invention:

1. The method of treating a solid resistor comprising conducting ingredients, insulating ingredients and a hardened binder including a hygroscopic sodium silicate, which comprises subjecting the solid resistor to the action of ammonium chloride.

2. The method of treating a solid resistor comprising conducting ingredients, insulating ingredients and a hardened binder including a hygroscopic sodium silicate, which comprises subjecting the solid resistor to the action of ammonium chloride, and subsequently washing and drying the resistor to remove soluble alkaline substances contained therein.

3. The method of making solid composite resistors which comprises mixing conducting ingredients, insulating ingredients and water glass solution, forming the mixture into a resistor, hardening the resistor by evaporating the water contained in the water glass solution and subjecting said resistor to the action of ammonium chloride.

4. The method of making solid composite resistors which comprises mixing conducting ingredients, insulating ingredients and water glass solution, forming the mixture into a resistor, hardening the resistor by evaporating the water contained in the water glass solution, subjecting said resistor to the action of ammonium chloride, and subsequently washing and drying the resistor to remove therefrom soluble substances resulting from the action of said ammonium chloride.

5. The method of treating molded hygroscopic articles utilizing a soluble alkali silicate as a binder, in order to render said articles non-sensitive to humidity conditions in the atmosphere, which comprises treating said articles with a soluble salt such that the acid radical of the salt will form a soluble salt with the alkali in said silicate and the base radical of the salt will form a compound which is readily removable from the composition, and subsequently washing and drying said articles.

6. The method of treating molded hygroscopic articles utilizing a body member and a colloidal binder including a hygroscropic substance, in order to render said articles non-sensitive to humidity conditions in the atmosphere, which comprises treating said articles with a salt having a volatile base and having an acid radical capable of rendering said hygroscopic substance separable by washing, and subsequently washing and heating said resistors.

7. The method of making a molded resistor body which comprises mixing finely divided insulating and conducting ingredients, adding a solution containing an alkali silicate, molding the resulting plastic mass and hardening the same, treating the article so formed with a solution of a salt having a volatile, readily removable base, whereby the alkali in said silicate is dissolved, and subsequently washing and heating said article to remove both the dissolved salt of the alkali and the volatile base residue from the molded body.

In testimony whereof, I have hereunto subscribed my name this 2nd day of May, 1923.

JOSEPH SLEPIAN.