

# UNITED STATES PATENT OFFICE.

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## RESISTANCE MATERIAL.

No. 920,861.

Specification of Letters Patent.

Patented May 4, 1909.

Application filed February 3, 1908. Serial No. 413,963.

*To all whom it may concern:*

Be it known that I, HENRY GEISENHÖNER, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Resistance Materials, of which the following is a specification.

This invention relates to resistance conductors for electric circuits and has for its object the provision of a material of such a character that the resistance may be varied through a considerable range by varying the composition and at the same time will withstand a high temperature without injury, in addition to having sufficient strength for general use and being exceedingly cheap, efficient and durable.

My invention relates more specifically to what is known in the art as molded or composite resistances. This type of resistance has been well known for some time but has not been successful practically because of certain objections which it has been found difficult to overcome.

It is the object of my invention therefore to overcome as far as possible the objections heretofore urged against this type of resistance. I have found that the metal aluminum is exceedingly well adapted for use in connection with this type of resistance. This is so for various reasons among which are found the facts that the material is self-protecting against more than a film oxidation, is refractory, is a good conductor, bulky relative to other metals of equal weight, and is well adapted for a mixture with non-conducting materials by reason of its slippery nature.

One of my objects therefore is to produce a resistance stick in which the metal aluminum is mixed with other materials which constitute a binder.

In the practical working out of my invention I have found that aluminum is very well adapted for use in connection with the binder described in an application of L. E. Barringer, No. 299,143. This material is of such a nature that when treated it produces a silicate which is highly refractory although not requiring a high temperature in its production. In producing this particular form of resistance material therefore I mix the desired quantity of aluminum with suitable quantities of calcium or magnesium hydrate and silica.

The quantity of aluminum will, of course,

vary with the resistance required while the other materials may be varied within a considerable range depending upon the use to which the resistance is to be subjected. The percentage of aluminum may be as high as 50% or even higher while a suitable proportion of the calcium hydrate to the flint in the binding base may be approximately 2 to 3. I find it convenient to use the aluminum in the form of a flaky powder, such as is used in the manufacture of aluminum paint. It is essential that the mixture of the aluminum and the other materials be exceedingly thorough so that the resistance of the stick in its final form will be uniform otherwise the material will become hot in spots or streaks. As a resistance it would not be dependable therefore and the stick will be eventually destroyed.

When the materials are thoroughly mixed they are compressed into a condensed mass and subjected to steam treatment, the pressure of which and therefore the temperature will depend somewhat upon the proportion of the materials used and also upon the time which is to be consumed in hardening. A pressure of 150 pounds corresponding to a temperature of 181° C. has been found to be sufficient to harden certain compositions in about five hours. In treating the material I find it advisable to protect the surface so that the metal will not be washed away. This may be done by inclosing it in a mold during the steam treatment. The steam converts the calcium hydrate and silica into a hydrous silicate of calcium, which makes a strong binder for the aluminum.

I have described my invention in connection with certain materials designed to be treated in a specific manner, *i. e.* I have described a specific binder for the conducting material. It should be understood, however, that I do not limit my invention to the particular binding material nor to the specific process of treating the same since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A resistance conductor comprising a compound of uncombined aluminum and a binder.

2. A resistance conductor comprising a

compound of comminuted aluminum and a binder.

3. A resistance conductor comprising a compound of uncombined aluminum and a non-conductor

4. A resistance conductor comprising a compound of aluminum and a hydrous silicate.

5. A resistance conductor comprising a steam hardened compound of comminuted aluminum with silica and a hydrate.

6. A resistance conductor comprising a

compound of comminuted aluminum and hydrous silicate of calcium.

7. A resistance conductor comprising a steam hardened compound of uncombined aluminum and a hydrate.

In witness whereof, I have hereunto set my hand this 31st day of January, 1908.

HENRY GEISENHÖNER.

Witnesses:

BENJAMIN B. HULL,  
HELEN ORFORD.