Patented July 25, 1933 1,919,806

UNITED STATES PATENT OFFICE

HANS SCHULZ, OF CHARLOTTENBURG, BERLIN, GERMANY, ASSIGNOR TO SIEMENS AND HALSKE AKTIENGESELLSCHAFT, OF SIEMENSSTADT NEAR BERLIN, GERMANY, A GERMAN COMPANY

MAGNETIC MATERIAL

No Drawing. Application filed April 28, 1932, Serial No. 608,138, and in Germany May 20, 1931.

The present invention relates to magnetic materials and more particularly to methods of and means for reducing energy losses in cores containing such materials.

It is customary, in order to reduce energy losses in electro-magnetic cores comprising magnetic materials, to use these materials either in the form of laminations or sheets, or in the form of finely divided particles or dust, the laminations or particles in both cases being insulated from each other in a suitable manner.

Furthermore, in order to improve the properties of cores comprising such materials, it is usually necessary to subject the completely assembled cores to a heat treatment at relatively high temperatures. In order to prevent direct metallic contact between the individual laminations, or dust particles, the laminations or particles are individually insulated with an insulating material able to withstand the temperature of the heat treatment. A number of refractory materials which have hitherto been used for this purpose, such as magnesia, zinc oxide, kaolin, sodium silicate, iron or nickel halides, are unable to satisfactorily withstand temperatures above about 600° C.

An object of the present invention is to provide an efficient and simple method of insulating sheets or dust particles of magnetic materials with an insulating material capable of withstanding temperatures above 600° and up to red heat of these materials.

In pursuance of this object, the sheets or the particles of magnetic materials are first coated with a film or thin layer of metallic copper, for instance by electroplating or, preferably, by simply immersing the materials in copper sulphate. This film or layer of copper is then converted into copper oxide which is a refractory insulating material. This may be accomplished simply by giving the material the usual heat treatment. The temperature of this treatment depends upon the magnetic material in question and the particular set of magnetic properties which it is desired to develop. It may vary between about 400° C. and about 1100° C. The magnetic material is then cooled, preferably in the air. During this combined heat treatment and cooling, the metallic copper film is transformed into an adherent refractory insulating film of copper oxide. The methods of the present invention are especially suitable for treating magnetic materials having around 50% or less of nickel. They may be employed in connection with a wide range of well-known magnetic alloys.

What is claimed is:

1. A method of electrically insulating magnetic material which comprises coating the material with a film of metallic copper, and converting the copper into copper oxide.

2. Method as defined in claim 1 in which the copper film is caused to adhere to the particles of magnetic material by submersing them in copper sulphate.

3. Method as defined in claim 1 further characterized in this that the metallic copper is converted into copper oxide by subjecting the magnetic material to a heat treatment above a red heat.

4. Finely divided magnetic material having the particles thereof individually coated with copper oxide.

5. A method of preparing magnetic cores which comprises copper plating divided portions of magnetic material, giving the material a heat treatment for the combined purpose of improving the magnetic properties and converting the copper to copper oxide, and employing the material thus made to constitute the cores.

6. A magnetic core consisting of finely divided particles of ferromagnetic material insulated from one another by adherent coatings of copper oxide.

HANS SCHULZ.