

UNITED STATES PATENT OFFICE.

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STEEL ALLOY MATERIAL.

No Drawing.

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To all whom it may concern:

Be it known that I, GEORGE F. McMAHON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Steel Alloy Materials, of which the following is a specification.

This invention relates to improvements in steel alloy materials and in articles of manufacture for magnetic uses, particularly magnet cores, magnetic plates and the like.

In accordance with this invention electrolytic iron produced by electrodeposition from any suitable bath and particularly from that designated as the ammonium-sulphate-chloride-ferrous sulphate bath, is thoroughly pulverized, forming a powder of a size suitable for the formation of a product having desired characteristics. For example, powder which will pass through a screen having 60 meshes to the inch may be employed, although ordinarily a finer powder, for example, one which will pass through a screen having 200 meshes to the inch is preferred. This finely divided powder is then thoroughly mixed with a metal-containing material, preferably a metal, an oxide of a metal or mixtures thereof in proportions suitable for producing a desired material, for example, with metallic material containing metal up to about one-third the proportion by weight of the electrolytic iron. Of the metallic material thus admixed with the electrolytic iron, a proportion of oxide may be used up to that which will be reduced to the metal itself by the hydrogen present in the electrolytic iron. The term "metal," as used herein, is intended to include not only the metals proper, such as cast iron, tungsten, chromium, manganese, nickel, cobalt, molybdenum, vanadium, titanium, but also such elements as carbon, silicon, phosphorus and sulphur, which are frequently found as alloy materials for iron. The last named materials are preferably added in the form of alloys of iron or other materials, for example, in the form of cast iron, ferro-silicon, etc.

The admixed electrolytic iron and metal-containing material are placed in a sealed container adapted to exclude air or gases and are heated to a temperature below the melting point of the iron, the temperature being preferably not below 900° C. The admixed materials, may, if desired, be com-

pressed before or during the heating. The heating of the mixture is continued under these conditions until a complete diffusion of the materials has been effected, resulting in the formation of a sintered and somewhat porous alloy body. The resulting material may be employed as an alloy for addition to molten baths of other materials, or may be melted, cast or otherwise shaped. It may likewise be molded or pressed into shapes having valuable magnetic properties and particularly adapted for use in making laminated magnetic cores or other magnetic bodies.

For example, for the production of a nickel-containing alloy, electrolytic iron pulverized to about 200 mesh may be mixed with a desired proportion, for example, sufficient to supply 0.5% of nickel in the final material, the nickel oxide being likewise pulverized to 200 mesh. The thoroughly mixed electrolytic iron and nickel oxide are then placed in a closed container adapted to exclude external air or gases and heated to 900 to 1000° C. for approximately two hours. The mixture is then removed and is found to consist of a body or cake of iron-nickel alloy, of substantially uniform composition and porous in character, the particles being united by sintering or superficial fusion. This alloy cake may be drawn, rolled, swaged, or pressed into any desired shape, the resulting product having a high magnetic retention, a high coercive force and other desirable magnetic properties.

When higher proportions of nickel are desired to be introduced, nickel oxide may be used in proportion to react with the hydrogen present in the electrolytic iron and the remainder of the nickel may be supplied as finely divided nickel metal.

In place of the electrolytic iron I may employ as the base for the formation of alloy materials other electrolytic metals containing hydrogen such as electrolytic nickel, electrolytic cobalt, etc. In every case, the temperature employed must be somewhat below the melting point of the electrolytic metal and sufficient to form a sintered body.

I claim:

1. The method of forming alloy materials which comprise admixing pulverized powdered electrolytic metal with metal-containing material and heating the mixture with exclusion of extraneous gas to a tempera-

ture below the melting point of the electrolytic metal, thereby producing a sintered cake of uniform composition.

2. The method of forming alloy materials which comprise admixing pulverized powdered electrolytic metal with metal-containing material and heating the mixture with exclusion of extraneous gas to a temperature below the melting point of the electrolytic metal, the mixture being compressed, thereby producing a sintered cake of uniform composition.

3. The method of forming an alloy cake which consists in admixing powdered electrolytic metal with a metallic oxide, the proportion of the latter being not greater than required to react with the hydrogen of the electrolytic metal, heating the mixture to a temperature below the melting point of the electrolytic metal with exclusion of extraneous gases, thereby forming a sintered alloy body.

4. The method of forming an alloy body which consists in admixing finely powdered

electrolytic iron with metal-containing material in proportion not over one-third the weight of the electrolytic iron, heating the mixture to a temperature not less than 900° C. and not above the melting point of the electrolytic iron, thereby producing a ferrous alloy body of uniform composition.

5. The method of producing an alloy body which consists in admixing finely divided electrolytic iron with a metallic oxide, the proportion of the latter being not greater than is required to react with the hydrogen present in the electrolytic iron, heating the mixture to a temperature of at least 900° C. and not higher than the melting point of the electrolytic iron, with exclusion of extraneous gases, and thereby producing an alloy body of substantially uniform composition.

6. A magnetic body consisting of a compressed body of particles of ferrous alloy material of substantially uniform composition bonded by superficial fusion.

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