

UNITED STATES PATENT OFFICE

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MAGNETIC MATERIAL

No Drawing.

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The present invention relates to the production of magnetic materials and particularly to a method for producing such materials in finely divided form.

5 An object of the invention is to facilitate the production of finely divided metallic materials such as are used in loading coil and other cores.

Another object of the invention is to so-
10 condition various magnetic materials, such as an alloy containing about 78½% nickel, 4% molybdenum and the balance iron, or an alloy containing about 45% nickel, 35% cobalt, 4% molybdenum and the balance iron,
15 that these materials may be more easily produced in a finely divided form.

A further object of the invention is to increase the yield of finely divided dust resulting from working the alloys mentioned
20 into finely divided form.

The invention is of particular advantage in the manufacture of magnetic loading coil cores in which the core is composed of finely divided magnetic material, usually referred
25 to as dust, held together by a binder.

In the manufacture of such magnetic cores it is customary to subject the materials in solid form to mechanical working such as hot rolling, etc. After such rolling, the materials are converted into a finely divided or
30 dust form by subjecting them to comminution. It has been found that whenever molybdenum is a constituent of the magnetic materials of the type mentioned, the hot rolling operation, instead of being conducive to
35 producing a material which will subsequently readily break up when subjected to the effect of comminuting agents, will on the contrary toughen it. It has been observed
40 that molybdenum bearing materials such as those mentioned tend to crack deeply during rolling at temperatures of 900° to 1000° C., become oxidized in the cracks, and then break up prematurely into relatively large
45 fragments which will not give a satisfactory yield of finely divided material when subsequently comminuted.

In accordance with the present invention the premature breaking up during hot rolling
50 is prevented by adding copper to the mag-

netic materials. In a specific preferred embodiment of the invention, nickel, iron and copper are melted together in approximately the following proportions: 78½% nickel, 13½% iron and 4% copper. Then about
55 ½% of aluminum is added to the liquid mixture for deoxidizing the bath. After deoxidation about 4% molybdenum is added and the heat teemed and allowed to cool. After solidification the ingot is hot rolled in four
60 passes at about 1200° C., the total reduction being from ¾" to ½" diameter. Following this the bar thus obtained is reduced to ⅜" diameter by rolling it at about 1000° C. and is then quenched in water. The bar is then
65 broken up in a rock crusher to pass a ⅛" mesh screen, after which operation the material is placed in a ball mill and ground for about 20 hours. A yield of 85% in fine dust passing a 120 mesh screen, as against a yield
70 of 55% without the addition of copper, was produced by the methods of this invention.

The method above described may also be applied when it is desired to reduce to a finely
75 divided state alloys of nickel and iron and alloys of nickel, iron and cobalt which contain chromium or tungsten instead of molybdenum, since it has been found that these two elements are equivalents of molybdenum as
80 regards their effect upon the friability at red heat of the alloys mentioned.

Copper added to the magnetic materials as described above apparently has no beneficial electrical or magnetic effects thereupon. The permeability, resistivity and other magnetic
85 and electric properties are not improved; the action of the copper is beneficial only from a mechanical viewpoint, that is, the copper acts to improve the workability of the alloys when red hot.
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What is claimed is:

1. The method of increasing the yield of fine dust resulting from reducing magnetic materials including common elements of the chromium group of the periodic table to finely
95 divided form, which method comprises melting said materials with metallic copper, whereby premature breaking up into large fragments during mechanical hot working is avoided, hot working the materials and
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subjecting them to a comminuting operation.

2. In the method of preventing cracking in the early passes during hot rolling of magnetic materials containing molybdenum, the step which includes adding metallic copper to the molten material, hot working it and then comminuting it.

3. A method of producing a high yield of dust when comminuting magnetic materials containing considerable portions of nickel and also of iron and small proportions of common elements of the chromium group of the periodic table, whereby premature breaking up into large fragments during mechanical hot working is avoided, which method comprises incorporating in said material, by melting up to about 4% of copper, hot working the materials and comminuting them after cooling.

In witness whereof, I hereunto subscribe my name this 28th day of October, 1929.

JOHN H. WHITE.

In witness whereof, I hereunto subscribe my name this 11 day of November, 1929.

VICTOR E. LEGG.