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MAGNETIC MATERIAL

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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.

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

Another object of the invention is to so condition various magnetic materials such as, for instance, alloys of iron and nickel containing about 78½% nickel and the balance iron plus molybdenum, and alloys of iron, nickel and cobalt containing about 45% nickel, 35% cobalt and the balance iron, or iron plus molybdenum, so that these materials may be more easily produced in finely divided form.

A further object of the invention is to increase the yield of finely divided dust resulting from working the alloys mentioned in 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 to as dust. It has been customary to hot roll cast billets of these materials preliminary to the comminuting operation in order to break up and transform the cast grain structure which is usually characterized by large primary crystals.

Iron-nickel alloys have their magnetic and electrical properties beneficially improved by the addition of such elements as cobalt or molybdenum but they are more difficult to reduce to dust of the fineness required for dust core coils when such elements are present. In the manufacture of magnetic cores with cobalt as a constituent element it is difficult to secure a high yield of dust in finely divided form by the usual hot rolling methods. This detrimental effect of cobalt is particularly noticeable and is perhaps enhanced by the presence of elements such as molybdenum, chromium or tungsten, and perhaps others which may be added to magnetic materials of this type for the purpose of increasing the resistivity thereof.

In accordance with the present invention the hot rolling operation is eliminated and a high yield in dust is secured by producing a fine grained brittle structure directly in the casting, thereby permitting the breaking up of the castings themselves without any intervening hot rolling. This is accomplished by the addition of the amounts stated of one or more of the following elements to the molten magnetic material: tin in percentages of ½% to 4%; bismuth in percentages of $\frac{1}{16}$% to 4%; and lead in percentages of ½% to 4%. Percentages up to 6% may be employed, but larger quantities do not give an improvement over results obtained with smaller quantities. The addition to and thorough mixing of these ingredients with the molten magnetic compositions has a two-fold beneficial influence. First, the addition agents tend to prevent the grains from growing too freely during the solidification of the casting, thus producing a fine grain structure. Second, they create incipient points, lines or surfaces of weakness in the surface area of the grains, in that they tend to form inherently brittle combination (or other) products with the matrix of the material, which segregate at the grain boundaries and enable an easy disruption of the crystal structure under the influence of mechanical comminuting agents. Regardless of what the scientific reason may be, the increase of yield of fine dust is a definite experimental fact.

In one embodiment of this invention a magnetic composition containing approximately 25% cobalt, 27% iron, 45% nickel, 3% tin and $\frac{1}{16}$% bismuth, after being comminuted in a ball mill, was found to have a yield in dust passing 120 meshes per square inch of about 90.8%.

In another embodiment of this invention a magnetic composition containing approximately 25% cobalt, 26% iron, 25% nickel, 4% molybdenum, and ¼% lead, comminuted in the same manner, produced a yield of dust passing 120 meshes per square inch of 90.6%.

What is claimed is:

1. The method of increasing the yield of fine dust resulting from reducing magnetic materials to finely divided form, which com-

prises melting said materials with a quantity greater than an incidental impurity and up to several percent of material composed of one or more of the following elements: tin, bismuth, lead.

2. Method of increasing the yield of fine dust resulting from reducing magnetic materials of the iron-nickel or iron-nickel-cobalt type to finely divided form, which method comprises embodying in said material a quantity greater than an impurity, but not exceeding about 6%, of one or more of the following elements: tin, bismuth, lead.

3. Magnetic material of the iron-nickel or iron-nickel-cobalt type having added to it resistivity increasing material selected from such elements as chromium, molybdenum, or tungsten, characterized in this that material composed of the following elements is added to embrittle the magnetic material: tin, bismuth, or lead.

In witness whereof, I hereunto subscribe my name this 20th day of March, 1930.

JAMES E. HARRIS.