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MAGNETIC MATERIALS AND HEAT TREATMENT THEREOF

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4 Claims. (Cl. 175—21)

This invention relates to improved magnetic materials adapted for use as permanent magnets.

An object of the invention is to increase the residual induction and/or the coercive force and/or the product of the residual induction and coercive force of a certain type of such materials consisting chiefly of nickel and iron alloyed with about ten per cent of aluminum.

In the specification of a certain French Patent No. 731,361, published September 2, 1932 and certain British patent specifications Nos. 392,658, 392,662 and 392,656, which correspond thereto in a general way, there are described certain alloys of iron, nickel and aluminum, which, with or without certain other added elements, are said to have a high residual induction, a high coercive force, and generally to be forgeable. Assuming that those compositions have the properties stated it would appear that at least some of them have the important advantage of being composed of relatively cheap raw materials.

Without at this time commenting upon the forgeability of these compositions, it may be said that numerous attempts by a plurality of independently acting investigators have failed to produce in any one of a number of different specimens the high degree of magnetic properties set forth in said specifications. In particular by following the teachings of these specifications and casting the materials without special heat treatment or quenching, it has been found that the magnetic properties are not as good as stated in those specifications.

With respect to such compositions having a certain range of constituents, however, we have discovered a method of heat treatment which achieves magnetic properties more nearly in the range set forth in the specifications for those particular compositions whereas by following the teachings of the patent specifications, these desirable results have not been secured even after repeated attempts.

Thus, for example, a composition of 10 per cent aluminum, 25 per cent nickel and 65 per cent iron, with quantities of impurities believed to be immaterial, was melted and cast in steel molds. It was found that the residual induction (B_r) was 6400 and the coercive force (H_c) was 280. The same material was then heated to 1200° C. for twenty minutes and quenched from that temperature in oil, whereupon it was found that the residual induction was 7310 and the coercive force was 407. Another sample of the same material was heated to 1300° C. for twenty minutes and quenched from that temperature in oil, whereupon it was found that the residual induction was 7570 and the coercive force was 407.

Similar results are generally obtainable in similar compositions wherein the nickel varies between 25 and 30 per cent, the iron correspondingly varies from 65 down to 60 per cent and the aluminum content varies between 8 and 12 per cent. Any other method of cooling the material rapidly from around 1200 to 1300° C., provided it effects a cooling of the same general order of rapidity, is equivalent to quenching in oil.

What is claimed is:

1. The method of improving the magnetic properties of a composition of material intended for use as permanent magnets, said composition comprising around 8 to 12 per cent aluminum, 25 to 30 per cent nickel and 65 to 60 per cent iron which comprises raising the temperature of the material to between approximately 1200° C. and below the melting point and then cooling the material at a rapid rate typified by quenching in oil.

2. A magnetic material consisting of from 8 to 12 per cent aluminum, 25 to 30 per cent nickel and 65 to 60 per cent iron, prepared by heating to over 1200° C. and quenching.

3. A composition according to claim 2 wherein the product of coercive force in oersteds by residual induction in gauss is numerically equal to or greater than 2,000,000.

4. A magnetic material consisting of 10 per cent aluminum, 25 per cent nickel and 65 per cent iron within the limits of manufacturing variations, prepared by heating the material to a temperature region over 1200° C. and short of the melting point, and cooling rapidly from such temperature region to room temperature.

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