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METHOD OF HEAT TREATING NICKEL-IRON ALLOYS

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2 Claims. (Cl. 148—13.1)

This invention relates to a method of heat treating nickel-iron alloys to improve their magnetic properties, and to nickel-iron alloys having improved magnetic properties.

Objects of the invention are to provide nickel-iron alloys having a high magnetic permeability and methods of making such alloys.

In accordance with one embodiment of the invention, a nickel-iron alloy is heated to a high annealing temperature in a hydrogen atmosphere and slowly cooled in that atmosphere. The alloy is then reheated to a lower temperature from which it is rapidly cooled.

Other objects and advantages will appear more fully from the following detailed description.

The invention is particularly applicable to nickel-iron alloys having a high nickel content, such as, for instance, a nickel-iron alloy having a nickel content of 78½% and an iron content of 21½%. Such alloys are commercially well known and a description of their manufacture is, therefore, unnecessary.

In practicing the invention, an alloy, such as described, is heated in a hydrogen atmosphere to a temperature in the neighborhood of 2000° F. and maintained at this temperature for a period of two to twenty-four hours. It appears that the period of heating is not critical and excellent results have been obtained by maintaining the material at the high annealing temperature for a period of about five and one-half hours. The material is then slowly cooled in the hydrogen atmosphere, preferably by allowing it to cool in the furnace. After the material is thus cooled, it is reheated in air to a temperature in the neighborhood of 1120° F. and maintained at this temperature for a short time, for example, fifteen minutes. The alloy is then cooled rapidly as by placing it on a copper plate.

In a modified form of the invention the alloy, after having been heated to a temperature of about 2000° F. for a period of several hours in an atmosphere of hydrogen is slowly cooled to a temperature of 1000° to 1200° F. in the hydrogen atmosphere and then removed into an atmosphere of air and rapidly cooled.

As a specific illustration of the invention, a 78½% nickel and 21½% iron alloy in sheet form was heated to a temperature of 2000° F. in a substantially pure hydrogen atmosphere and retained at this temperature for two hours. The sheets were then slowly cooled in the furnace and after cooling were reheated in air to a temperature of 1120° F. and retained at this temperature for fifteen minutes. The sheets were then placed on a copper plate and cooled to substantially room temperature. A test of the material showed it to have a maximum permeability of 92,100.

In another case a similar alloy in sheet form was subjected to the same treatment except that the material was maintained at a temperature of 2000° F. for a period of twenty-four hours in a hydrogen atmosphere before slowly cooling the material, after which it was reheated to a temperature of 1120° in air and maintained at this temperature for fifteen minutes and then cooled rapidly on a copper plate. A test of this material showed it to have a maximum permeability of 118,600.

In other cases high permeability alloys of this type were made by varying the period of the high annealing temperature in values between two and twenty-four hours and the second heat treating temperatures were varied within the range of 1000° to 1200° F., and in all cases higher permeabilities were achieved than by other known or conventional methods in use at the time.

It will be understood that the methods and alloys herein described are merely illustrative and that many changes and modifications may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An article of manufacture comprising an industrial magnetic product composed of an iron-nickel alloy which has been super-annealed, slowly cooled in a hydrogen atmosphere, reheated in air to a high temperature and then rapidly cooled on a copper plate to impart a high permeability to the product.

2. The process of making an industrial magnetic product composed of an iron-nickel alloy which comprises super-annealing the product, slowly cooling the product in a hydrogen atmosphere, reheating the product in air to a high temperature and then rapidly cooling the product on a copper plate to impart a high permeability to the product.

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