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ALLOY

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11 Claims. (Cl. 75—1)

The invention relates to alloys containing iron, nickel and beryllium, the percentage of beryllium being preferably less than the nickel-content. The new alloy is characterized by its excellent physical properties. The beryllium-content is preferably chosen between 0.1–12 per cent, while the iron-content is at least 1 per cent and the nickel-content at least 0.1 per cent. If desired, the new iron-nickel-beryllium-alloy can also include maximum admixtures of 25 per cent of one or several other elements, more particularly chromium, tungsten, molybdenum, vanadium, manganese, copper, carbon, silicon and phosphorus. As to the last three elements; use will, in general, only be made of quantities up to 2 per cent.

The new iron-nickel-beryllium-alloys distinguish themselves most advantageously by the fact that they can easily be rolled and are very heat-resisting. They are scarcely brittle. The alloy which is first obtained when prepared according to one of the usual manufacturing processes, is relatively soft but is capable of being hardened to a high degree by a thermic treatment.

For this purpose an alloy of 88.5 per cent iron, 10 per cent nickel and 1.5 per cent beryllium was quenched in oil from 1000° C. and thereupon artificially aged by half an hour's heating to 550° C. Its hardness, determined as in the following example, by means of a 10 mm. ball and a loading of 3000 kg., was, before the thermic treatment, 351 Brinell, afterwards 544. A second alloy containing 71.3 per cent iron, 7.1 per cent nickel, 20.1 per cent chromium, 0.2 per cent beryllium and 0.3 per cent manganese was quenched in oil from 950° C. and subsequently aged during an hour's heating to 500° C. This thermic treatment increased the hardness of the alloy from 279 Brinell to 524.

The ternary iron-nickel-beryllium alloys hardened by a thermic treatment are considerably more heat-proof than corresponding steel alloys without beryllium and hardened by carbon. It was noted that the new alloys maintained their hardness with temperatures exceeding by several hundreds of degrees centigrade those endured by the steel-alloys mentioned above.

The new alloys present, in general, valuable magnetic properties, more particularly in the heat-treated condition. A practically carbon-free alloy of 88.3 per cent iron, 10.2 per cent nickel and 1.5 per cent beryllium was, for instance, magnetized by quenching it at 1100° C. in water and heating it slowly for an hour to 500° C. and it then had a magnetism which almost equalled that of tungsten-steel alloys.

By the term "balance substantially nickel", "balance substantially iron" etc. occurring in the claims, we mean that the alloys called for may also contain small amounts of addition metals totaling from a trace to about 25 per cent of copper, chromium, tungsten, molybdenum, vanadium and manganese, as well as (or) the addition of a trace to about 2 per cent of one or more of the elements carbon, silicon and phosphorus; these addition metals being insufficient in quantity to substantially alter the characteristic properties of the said alloys.

We claim:—

1. An alloy containing iron, nickel and beryllium in approximately the following proportions:—iron 50–98 per cent, nickel 1–40 per cent, beryllium 0,1–12 per cent; the said alloy being easily rolled and very heat resistant.

2. An alloy containing 50–98 per cent iron, 0,1–5 per cent beryllium, the balance being 1 to 10 per cent nickel; the said alloy having such structure, hardness and other properties as are produced in an alloy of said composition by heating the alloy to a temperature between 800° and 1200° C., cooling the same as rapidly as possible, reheating to a temperature between 300° and 700° C. and then cooling the alloy; the said alloy being magnetic, having great hardness and being heat resistant.

3. An alloy comprising from 5–10 per cent of nickel, .5 to 1.5 per cent of beryllium and chromium in substantial amounts up to a total of 25 per cent with a balance substantially iron; the said alloy being easily rolled and very heat resistant.

4. An alloy comprising from 5–10 per cent nickel, .5 to 1.5 per cent of beryllium and chromium in substantial amounts up to a total of 25 per cent with a balance substantially iron, the said alloy having such structure, hardness and other properties as are produced in an alloy of said composition by heating the alloy to a temperature between 1000–1100° C., cooling the same as rapidly as possible and reheating to a temperature of about 450° C.; the said alloy being magnetic, having great hardness and being heat resistant.

5. An alloy containing iron, nickel and beryllium in approximately the proportions by weight of from 50 to 98 per cent iron, 1 to 10 per cent nickel, and 0.1 to 5 per cent beryllium; the said alloy also containing at least one addition metal totaling from a trace to about 25 per cent selected

from a class consisting of chromium, tungsten, molybdenum and vanadium and as well as an addition of from a trace to about 2 per cent of at least one component selected from a class consisting of carbon, silicon and phosphorus; the said alloy being easily rolled and very heat resistant.

6. An alloy containing about 50 to 98 per cent iron, about 0.1 to 5 per cent beryllium, with a balance substantially nickel, and also containing at least one component selected from a class consisting of carbon, silicon and phosphorus in amount ranging from a trace to about 2 per cent, and having the structure, hardness and other characteristics produced by quenching the alloy from about 800 to 1200° C. and age-hardening at temperatures between about 300 to 700° C.; the said alloy being magnetic, having great hardness and being heat resistant.

7. An alloy containing iron, nickel and beryllium in approximately the proportions by weight of from 50 to 98 per cent iron, 1 to 10 per cent nickel, and 0.1 to 5 per cent beryllium; the said alloys also containing additional metals totaling from a trace to about 25 per cent selected from a class consisting of chromium, tungsten, molybdenum and vanadium; the said alloy being easily rolled and very heat resistant.

8. An alloy containing iron, nickel and beryllium in approximately the proportions by weight of from 50 to 98 per cent iron, 1 to 10 per cent nickel, and 0.1 to 5 per cent beryllium; the said alloy also containing additional metals totaling from a trace to about 25 per cent selected from a class consisting of chromium, tungsten, molybdenum and vanadium and having the structure, hardness and other characteristics produced by quenching the alloy from about 800 to 1200° C. and age-hardening at temperatures between about 300 and 700° C.; the said alloy being magnetic, having great hardness and being heat resistant.

9. An alloy containing about 50 to 98 per cent iron, about 0.1 to 5 per cent beryllium with a balance substantially nickel, and also containing at least one component selected from a class consisting of carbon, silicon and phosphorus in amount ranging from a trace to about 2 per cent; the said alloy being easily rolled and very heat resistant.

10. An alloy containing iron, nickel and beryllium in approximately the proportions by weight of 50 to 98 per cent iron, 1 to 10 per cent nickel and 0.1 to 12 per cent beryllium; the said alloy also containing at least one component selected from a class consisting of chromium, tungsten, vanadium and molybdenum in amount ranging from a trace to about 25 per cent; the said alloy being easily rolled and very heat resistant.

11. An alloy containing iron, nickel and beryllium in approximately the proportions by weight of 50 to 98 per cent iron, 1 to 10 per cent nickel and 0.1 to 12 per cent beryllium; the said alloy also containing at least one component selected from a class consisting of chromium, tungsten, vanadium and molybdenum in amount ranging from a trace to about 25 per cent, and having the structure, hardness and other characteristics produced by quenching the alloy from about 800 to 1200° C. and age-hardening at temperatures between about 300° to 700° C.; the said alloy being magnetic, having great hardness and being heat resistant.

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