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PERMANENT MAGNET MATERIAL

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2 Claims. (Cl. 75-124)

This invention relates to permanent magnets and compositions of material suitable for making permanent magnets.

An object of the invention is to produce compositions of good permanent magnet properties which are more workable than previously known compositions.

Numerous materials for making permanent magnets have hitherto been proposed and most, if not all, of them have a poor degree of workability.

In accordance with the present invention, compositions for making permanent magnets contain nickel between 10 and 30 per cent, aluminum between 5 and 10 per cent, vanadium between 2 and 10 per cent, cobalt between 5 and 15 per cent, copper any amount from 0 up to 10 per cent and the balance iron. Generally the iron content is around 40 to 70 per cent. Compositions similar to the foregoing but including any amount of copper not over 10 per cent are disclosed in our application which discloses and claims subject-matter divided from the application upon which this patent issues, said application being Serial No. 506,092, filed October 13, 1943, in pursuance to a final requirement for division. In order that this may be accomplished, less than maximum amounts of some of the other recited elements are included, although there is no rigid limitation in this respect.

Typical compositions are indicated in the following table:

	Fe	Ni	Al	Co	Cu	V
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
(a).....	50.4	23.8	9.5	11.5	0	4.8
(b).....	41	28.5	9.5	11.4	4.8	4.8
(c).....	50.4	19.0	9.5	11.5	4.8	4.8

Compositions of this type may be given different heat treatments adapted for production of good permanent magnet properties with varying results. The following is illustrative:

Composition (a) was prepared by casting, then heated to 1200° C. and cooled in "Silocel," a trade name for a finely divided infusorial earth consisting largely of silica. This results in a slow cooling. After this the material was raised to a temperature of 650° C. and maintained there for five hours followed by slow cooling. It exhibited a coercive force of 530 oersteds and a remanence of 5,440 gauss.

When the heat treatment was varied by cooling the material from 1200° C. in air and then aging the coercive force was 472 and the remanence 6,556. Before aging the material had a quite substantial coercive force and remanence but in each case less than after aging.

When the same material was hot worked and thereafter similarly cooled in "Silocel," and thereafter similarly aged, it had a coercive force of 424 and a remanence of 6,047 after cooling but before aging and a coercive force 530 and a remanence of 6,265 after aging.

Composition (b) was more readily worked than composition (a) but had a somewhat smaller magnetic energy product. Thus, after casting, heating to 1200° C. and cooling in air, and then aging for five hours at 650° C., it had a coercive force of 655 and a remanence of 3,756.

Composition (c) when cast, similarly cooled in "Silocel," and similarly aged had a coercive force of 583 and a remanence of 5,412. These values were almost as high before cooling in "Silocel" as before aging. In fact, the measured remanence was somewhat larger.

When the material (c) was cast and hot worked and then heated to 1200° C. and cooled in "Silocel" the coercive force was 490 and the remanence 6,698. After aging the coercive force was 480 and the remanence was 6,476. With air cooling the remanence was higher but the coercive force was considerably lower in each case.

In the foregoing description the process of cooling in "Silocel" refers to completely covering a test sample of material in a substantial body of "Silocel" which is a very poor conductor of heat.

Bodies of such materials of any and all shapes commonly employed for permanent magnets may be magnetized by the usual processes; they are workable by hot rolling and swaging.

What is claimed is:

1. A workable alloyed composition adapted to be magnetized to serve as a permanent magnet comprising nickel between 10 and 30 per cent, aluminum between 5 and 12 per cent, vanadium between 2 and 10 per cent, cobalt between 5 and 15 per cent and the balance iron.

2. An alloyed composition adapted to serve as a magnetic material comprising iron 50.4 per cent, nickel 23.8 per cent, aluminum 9.5 per cent, cobalt 11.5 per cent and vanadium 4.8 per cent.

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