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MAGNETIC MATERIAL

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This invention relates to magnetic compositions having desirable combinations of properties, substantially high initial permeability, high resistivity, good constancy of permeability and magnetic stability.

Nickel-iron alloys of high initial permeability and high permeability at low magnetizing forces are well known, as are also a number of such compositions including various constituents for increasing the resistivity. Such compositions in general have not ordinarily possessed good constancy of permeability combined with high resistivity.

Alloys of nickel, iron and cobalt with fourth substances added to increase the resistivity are also known and these compositions have a high degree of constancy of permeability when properly treated, but they have a tendency to lose their constancy of permeability or otherwise change their magnetic characteristics under the influence of moderately high magnetizing forces.

Others have claimed to have produced alloys including aluminum and/or silicon having favorable values of the properties herein discussed.

A feature of the present invention comprises magnetic compositions not including aluminum or silicon suitable for loading of telephone conductors both of the deep sea and paper insulated cable type. They are also of utility for cores of loading coils and other magnetic structures requiring high resistivity, moderate permeability, fair constancy of permeability and stability. In the following list is set forth a number of typical compositions with initial permeabilities, generally the average of three determinations, and percentage of change in permeability at specified magnetizing forces in gauss, likewise given as the average of three determinations. The resistivity in microhm cms. is also indicated. Where fractional percentages of composition are given the composition has been determined by chemical analysis, where whole percentages of composition are given the figures indicate the attempted composition by weighing the constituents used in the mixture. The list follows:

Per cent Ni	Per cent Fe	Per cent Mo	Per cent Cr	Per cent Cu	Per cent V	Per cent W	Per cent Mn	μ_o	Resistivity	Per cent change in μ	H at which per cent change in μ was measured
45.68	52.93		.87					1506	50.5	2.6	.0107
65	25	10						1200	96.85	2.16	.0239
36	61	3						965	84.8	3.25	.0237
39.54	56.37	3.36					.51	1435	79.8	5.42	.0180
45.97	51.16	2.87						1847	73	1.70	.0215
45.83	47.65	5.88					.57	2160	85.6	3.20	.0178
45	45	10						1015	88	1.12	.0238
55	39	6						1174	71.7	1.30	.0238
55	35	10						1134	96.5	1.96	.0239
65	29	6						1847	78	3.33	.0179
55	35		10					813	100.5	1.34	.0236
45	49				6			634	91	2.17	.048
50	32		10	8				789	103	2.10	.018
65	29					6		1855	51.4	2.46	.024
65	29				6			1141	89.6	1.84	.0179
50	32	10		8				1256	98.8	3.65	.018
45	54		1					1871	58.4	3.90	.012
45	52		3					1679	74	3.82	.012

All the above specimens were heat treated by placing in an annealing pot having a rim higher than the cover around the edge upon which was placed finely divided iron for protecting the specimens against oxidization. They were maintained in an annealing furnace at about 1000° C. for one hour and cooled slowly to room temperature in the furnace. Each specimen consisted of a narrow tape a fraction of an inch wide and a few thousandths of an inch thick wound into a ring.

It will be noted that although they differ somewhat in their properties, all these compositions are characterized by a high value of initial permeability, a high or fairly high resistivity and a very good constancy of permeability over the range investigated. Compositions having these properties to the extent indicated in the table are deemed to be quite desirable for the loading of telephone conductors.

What is claimed is:

1. A magnetic composition having between 30 and 70% nickel, an amount greater than an impurity and less than 20% of material for increasing the resistivity and the balance iron, with a negligible or zero content of metals of atomic weight under 30, characterized by a specific resistance of not less than 50 microhm cms., an initial permeability in excess of 500, and a constancy of permeability such that the permeability at a magnetizing force of .01 gauss does not differ by as much as 6% from the initial value.

2. A composition in accordance with claim 1 in which the resistance increasing material includes not in excess of 12% of the total composition of material selected from a group of elements including chromium, molybdenum and tungsten.

In witness whereof, I hereunto subscribe my name this 1st day of April, 1929.

GUSTAF W. ELMEN.