

Dec. 16, 1930.

G. W. ELMEN

1,784,827

MAGNETIC MATERIAL

Filed June 15, 1928

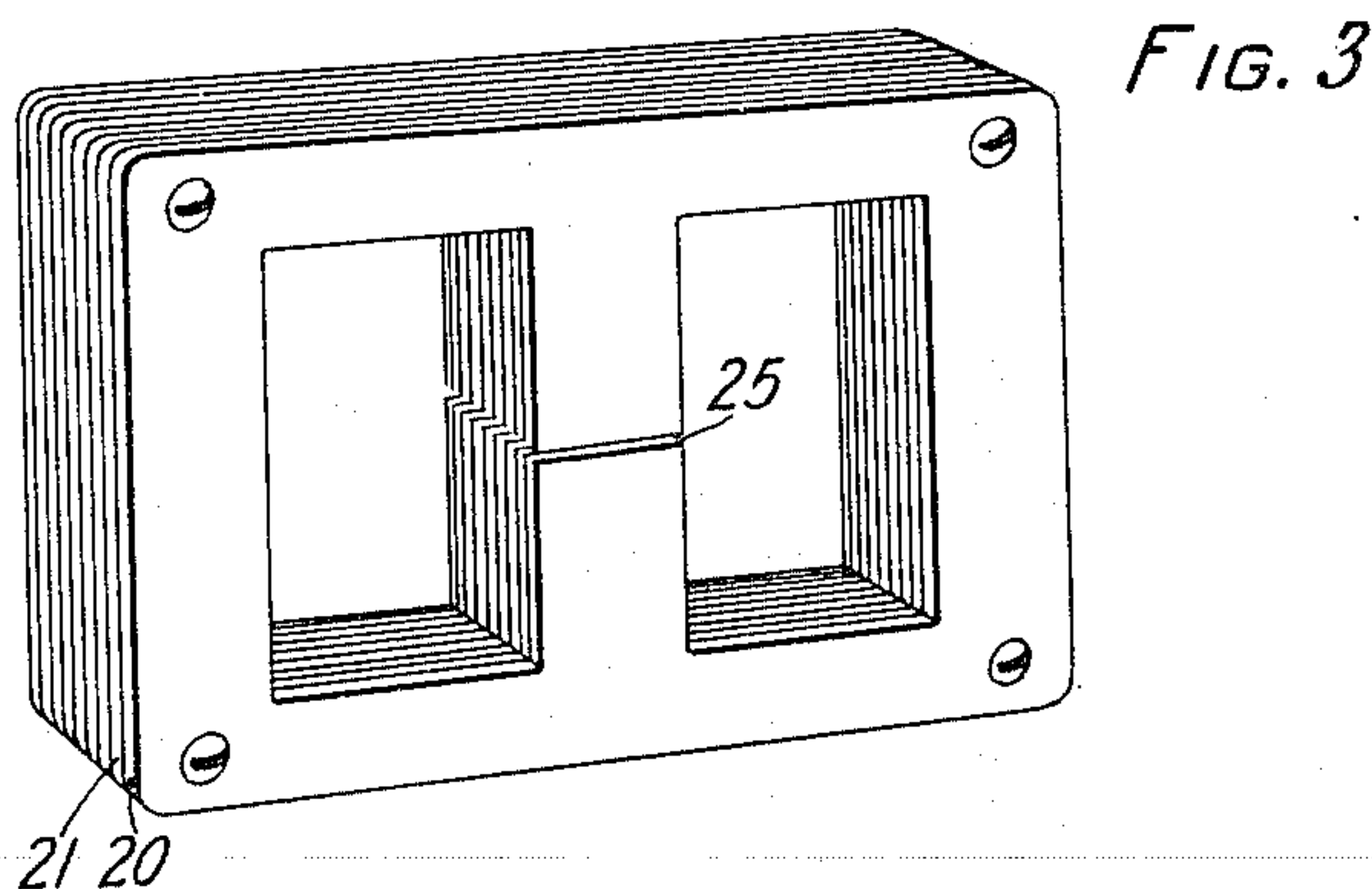
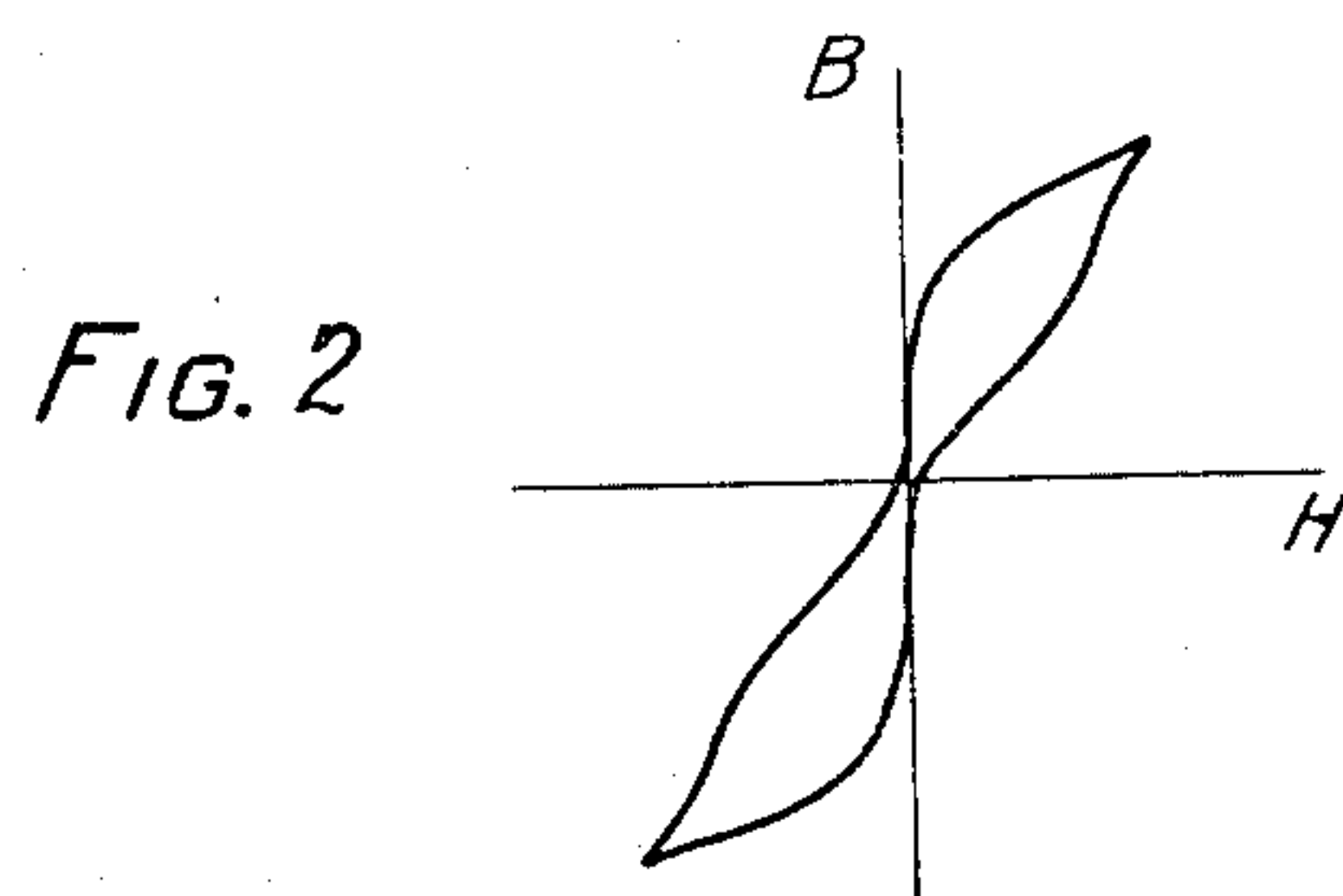
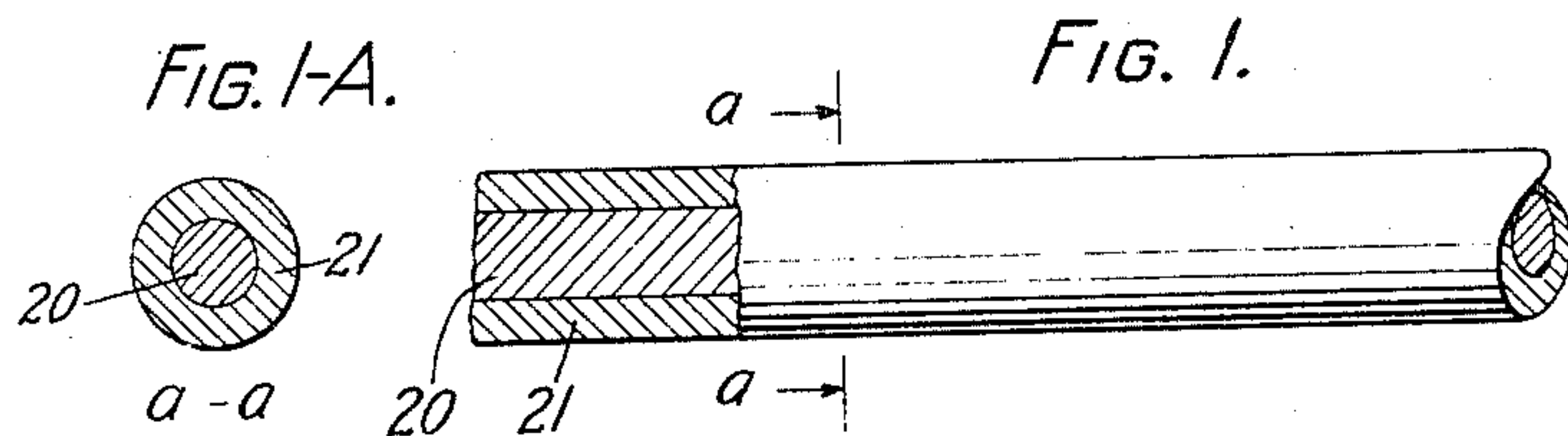
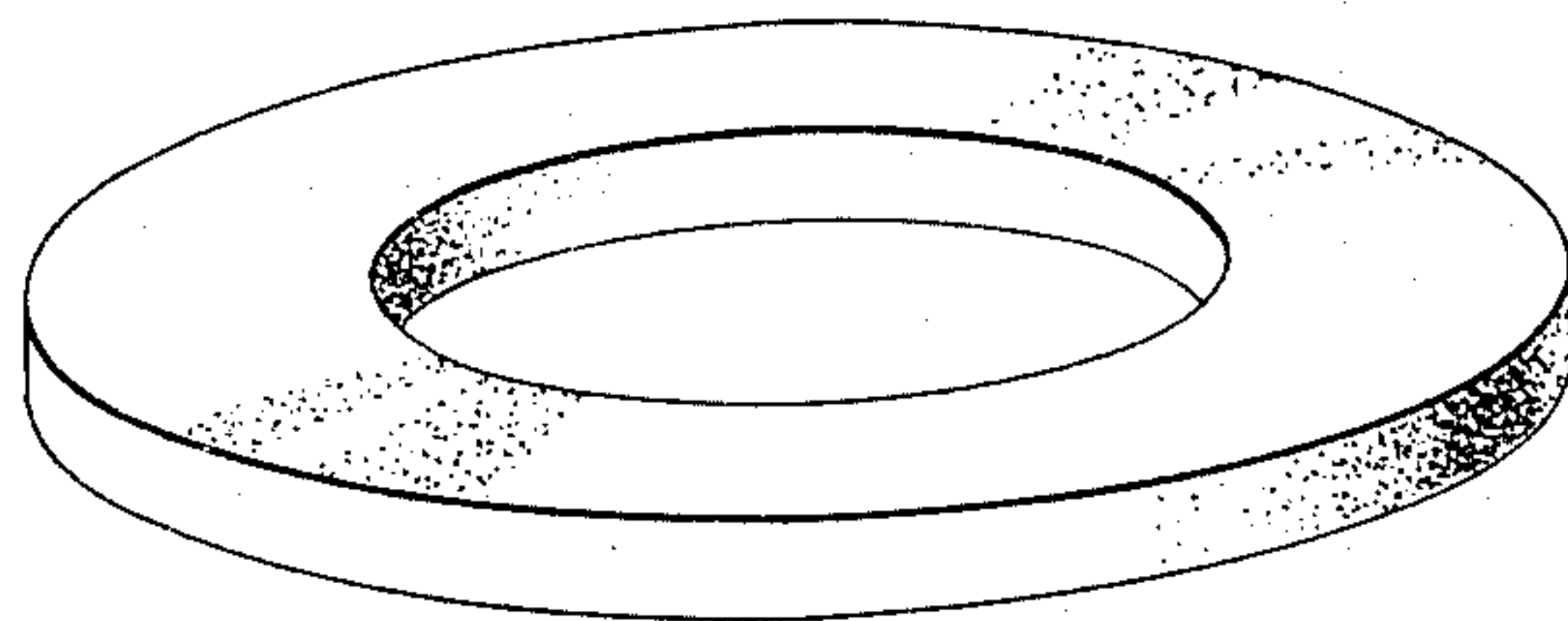


FIG. 4



INVENTOR
GUSTAF W. ELMEN
BY
J. W. Schried
ATTORNEY

UNITED STATES PATENT OFFICE

GUSTAF W. ELMEN, OF LEONIA, NEW JERSEY, ASSIGNOR TO BELL TELEPHONE LABORATORIES, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

MAGNETIC MATERIAL

Application filed June 15, 1928. Serial No. 285,643.

The present invention relates to magnetic materials and in particular to magnetic cores having high initial permeability, high constancy of permeability, and low hysteresis loss.

It is an object of the invention to increase the permeability, especially at low magnetizing forces, of magnetic cores, to increase the constancy of permeability, and decrease the hysteresis loss of such cores.

A feature of the invention is a magnetic core, such as a loading coil core, which may be cheaply and simply produced on a commercial scale.

In accordance with the invention magnetic materials are produced having properties qualitatively of the same kind as those described in U. S. patent to G. W. Elmen, 1,715,647, June 4, 1929. However, whereas in accordance with the application mentioned magnetic compositions are obtained by fusing the component elements, namely, iron, nickel and cobalt together in intimate union, the objects of the present invention are attained by employing in juxtaposition two materials having different and distinct magnetic properties. One material should preferably have slight coercivity and remanence and be possessed of high initial and maximum permeabilities, while the other should be magnetically harder and have a high coercivity.

Two materials which have been found to fulfill these requirements and which may therefore be used in a specific preferred embodiment are so-called permalloy (the manufacture and heat treatment of this alloy have been described in U. S. Patent No. 1,586,884, June 1, 1926) and hard steel such as is employed for permanent magnets. The composite core preferably has air gaps so that the magnetically hard and magnetically soft materials may have free poles interacting one upon the other.

Various embodiments of the invention will be described in connection with the accompanying drawings, in which:

Fig. 1 is a view partly in elevation and partly in longitudinal section; and

Fig. 1—A is a cross section of a bimetallic

structure in accordance with the invention;

Fig. 2 represents a hysteresis curve obtained with the structure of Fig. 1;

Fig. 3 represents a magnetic core built up of laminations of different materials; and

Fig. 4 shows a ring or section of a loading coil core embodying the invention.

In Fig. 1 the bimetallic structure consists of a wire 20 which is made of hard and unannealed piano wire. It is surrounded by a tube of permalloy 21 having a wall thickness of about 0.006", manufactured and heat treated for high permeability in accordance with the processes and heat treatments set forth in U. S. Patent 1,586,884.

An alternative arrangement would consist of a compact bundle of piano wire and permalloy wire suitably bound together by tape or material such as varnish or bakelite.

Fig. 2 depicts a hysteresis curve obtained by means of a cathode ray oscillograph when the composite core of Fig. 1 was used as a test piece. Noteworthy in the curve of Fig. 2 is the constriction of the hysteresis loop at the origin, a configuration characteristic of alloys such as that containing about 45% nickel, 25% cobalt, and 30% iron and heat treated as described in U. S. patent to G. W. Elmen, 1,715,647, June 4, 1929.

Fig. 3 shows a magnetic core which may be built up in accordance with the invention by using the two magnetic materials described in connection with Figs. 1 and 2 by forming the materials in thin sheets or laminations of about 0.014" thickness, stamping out the sections and assembling them alternately, as illustrated. One or more air gaps may be provided in the magnetic circuit. In assembling the core, one metal sheet or lamination 20 is alternated with a lamination of the other constituent 21 and the air gaps in the several laminations may be arranged in a staggered formation.

An equivalent method would be to electroplate or otherwise cause a layer of one component to adhere to a lamination of the other component.

In accordance with the embodiment of Fig. 4, the component magnetic materials are reduced to powder, the powders thoroughly

mixed in about equal proportions, insulated, and pressed into rings with suitable binders in accordance with methods and principles well known in the art and described in the following U. S. patents: 1,647,737 and 1,647,738, both granted November 1, 1927 to V. E. Legg; 1,651,957 and 1,651,958, both granted December 6, 1927 to H. H. Lowry; 1,669,642 and 1,669,644, both granted May 15, 1928 to J. W. Andrews. When heat treating the cores after they are compressed, the heat treatments to be employed will be selected in accordance with the principles of U. S. patents to G. W. Elmen Nos. 1,715,647 and 1,715,541, both granted June 4, 1928.

What is claimed is:

1. A composite magnetic body having an air-gap at which free poles may exist and a magnetic material having higher permeability and lower coercivity than ordinarily prepared iron in combination with a magnetic material having higher coercivity than such iron, said materials forming parallel branches of a magnetic circuit.
2. An inhomogeneous magnetic material comprising as essential constituents separate portions of hard steel and of an iron-nickel alloy in which the nickel content is substantially 30% to 80% of the whole.
3. A magnetic material in accordance with claim 2, characterized in this that, when in a magnetic field, the continuity of the magnetic circuit is interrupted by non-magnetic gaps.
4. A composite magnetic body comprising separate portions of an iron-nickel alloy containing 75 to 85% nickel and 15 to 25% iron, and of hard steel, to form a magnetic circuit in parallel, characterized by a negligible coercive force.
5. An inhomogeneous magnetic body comprising as essential constituents separate portions of hard steel and of an iron-nickel alloy in which the nickel content is 30% to 80% of the whole alloy, the steel and the alloy consisting of finely divided and intermixed particles separated by insulating material.

In witness whereof I hereunto subscribe my name this 12th day of June, 1928.

GUSTAF W. ELMEN.