

J. C. WOODRUFF.
MAGNET CORE.

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1,292,206.

Patented Jan. 21, 1919.

Fig. 1

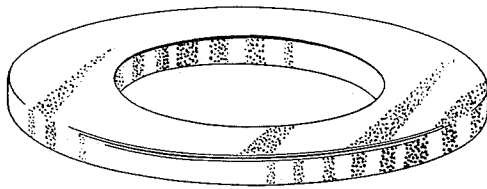
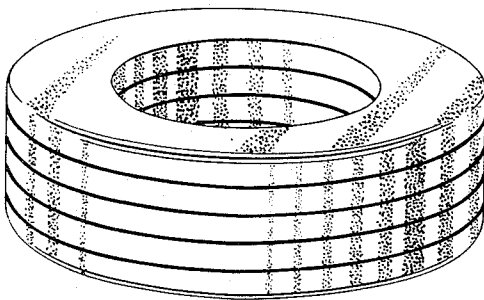


Fig. 2.



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UNITED STATES PATENT OFFICE.

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MAGNET-CORE.

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Specification of Letters Patent.

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Application filed May 26, 1916, Serial No. 100,056. Renewed June 28, 1918. Serial No. 242,506.

To all whom it may concern:

Be it known that I, JOHN C. WOODRUFF, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Magnet-Cores, of which the following is a full, clear, concise, and exact description.

This invention relates to magnet cores generally, and particularly to cores for loading coils for telephone circuits. Its general object is to provide a new and improved core material which is cheap to manufacture, which is easily formed to the desired shapes, and which possesses to a high degree those characteristics most advantageous in cores for loading coils and other electrical apparatus.

The present invention may be considered an improvement upon the magnet cores and processes of manufacture described and claimed in applications for Letters Patent in the name of James Buckner Speed, Serial No. 89,409, filed April 6, 1916, for improvements in magnet cores, and in the name of Gustaf W. Elmen, Serial No. 89,467, filed April, 6, 1916, for improvements in magnet cores, both of which applications are assigned to the same assignee as the present application.

The present invention is the result of the discovery that the specific resistance of a core made of particles of finely divided magnetic material insulated from one another and formed into a solid mass by great pressure, is considerably increased if, before being coated with insulating material, said particles are coated with some other metal such as lead, aluminum or zinc. The present invention, therefore, relates to a magnet core and method of making the same, characterized by the fact that articles of magnetic material are first given a coating of some other metal, are then coated with insulating material, and are finally compressed to form a core or core material from which cores can be made.

In the drawing, Figure 1 is a perspective view of a section of loading coil core made in accordance with the present invention, and Fig. 2 shows a plurality of these sections

assembled to form a complete core. It will be understood, however, that this is merely illustrative, and that the invention is not limited to the production of this form of core, but is adapted for the making of cores of many forms.

In the making of loading coil cores, the present invention is preferably carried out in the following manner: Magnetic material, such as electrolytic iron, obtained in any well-known manner (for example from a cell containing a bath of ferrous ammonium sulfate), after being broken into small pieces, is reduced to small particles by grinding in a ball mill. Experience has shown that, for the best results, the particles used in core-making should not be larger in size than what will pass through what is known as 80-mesh screen, and about forty per cent. (40%) of them should be so small as to be capable of passing through a 200-mesh screen.

Electrolytic iron particles of this size are heated in any suitable form of furnace to anneal them and to drive off any occluded gases, principally hydrogen. Oxidation of the iron particles during annealing may be prevented in any suitable manner, for example, by packing the iron particles in an iron box which is sealed by inverting over it another iron box and filling the space between the sides of the boxes with iron oxid. The annealing temperature preferably employed is 1400° Fahrenheit. If the box is not opened until it has cooled to room or atmospheric temperature, practically no oxidation of the iron particles takes place during annealing. In case the mass of particles cakes during the annealing, it may be again reduced in any suitable manner to particles small enough to pass through an 80-mesh screen.

The annealed iron particles are then mixed with pieces of zinc, and the mixture is tumbled in a drum for a considerable length of time, say for thirty-six (36) hours. A satisfactory form of zinc for this purpose is so-called "feathered-zinc," which is obtained by pouring molten zinc into water. Upon being removed from this drum, the larger zinc pieces are separated from the

iron particles by sifting the mixture first through a coarse screen, such as one of 16-mesh, and then through a screen of 80-mesh which removes substantially all of the zinc particles and allows the iron particles to pass through.

To the mass of annealed zinc-coated iron particles obtained in the manner just described, is added a thin solution of insulating material such as shellac, and the mixture is stirred until the surfaces of the iron particles are thoroughly covered with the shellac. A satisfactory shellac solution is one obtained by dissolving approximately two hundred and seventy-five (275) grams of shellac in fifty-two hundred (5200) cubic centimeters of denatured alcohol, and heating the solution at a temperature of 160° Fahrenheit for about one hour. Approximately one and four-tenths (1.4) gallons of shellac solution to each one hundred (100) pounds of annealed zinc-coated iron particles has been found sufficient to satisfactorily coat the iron particles. In order to evaporate the alcohol from the mixture of zinc-coated iron particles and shellac solution, any satisfactory method may be employed, for example, the mass may be slowly tumbled in a tumbling barrel through which a current of air is drawn. After the alcohol has been evaporated in this manner, the annealed zinc-coated shellac-coated particles are then ready for compression either into bulk material from which cores may be made, or directly into the desired form of core.

The remainder of the method of making magnet cores is substantially the same as that described in the Speed application, Serial No. 89,409, above referred to; but in order that this application may contain a full disclosure of the best method of carrying out the present invention, the remaining steps of the method will be herein described.

The mold and press employed in the compressing process should be capable of standing and exerting exceedingly high pressures. Preferably, pressures as high as two hundred thousand pounds to the square inch should be employed; and for the best results as to uniform density, the thickness of any core section, in the direction in which the pressure is exerted in forming it, should usually not exceed approximately one-quarter of an inch.

In practice, it has been found desirable in making loading coil cores, to use core sections having a thickness of about 0.2 inches and to use about five sections in building up a core; a suitable insulating material such as paper, lacquer, or shellac being interposed between the sections. Fig. 1 shows such a core section or ring, and Fig. 2

shows the built-up core. As shown, the outside edges of the outside core sections are rounded, this being desirable in order that the windings may closely conform to the surface of the core.

It has been found that cores made in the manner above described are strong mechanically and stable chemically; and that their specific gravity is approximately 7, which is nearly that of undivided iron, which is approximately 7.7. Electrically, a loading coil core of this kind has high specific resistance, an extremely low hysteresis characteristic, excellent magnetic stability, and comparatively high permeability, as understood in telephone loading coil design.

Experiments have shown that cores made in the manner described have a higher specific resistance than cores made in the manners described in Speed application Serial No. 89,409, and Elmen application, Serial No. 89,467, hereinbefore referred to.

What is claimed is:

1. A magnet core composed of finely divided iron particles, a coating of some other metal on said particles, and insulating material separating the coated iron particles.

2. A magnet core composed of finely divided iron particles, a coating of some other metal on said particles, and insulating material separating the coated iron particles, said compound having a specific gravity of approximately 7.

3. A magnet core composed of finely divided iron particles, a coating of zinc on said particles, and insulating material separating said zinc-coated iron particles.

4. A magnet core composed of finely divided iron particles, a coating of zinc on said particles, and a coating of shellac on said zinc-coated particles, said compound having a specific gravity of approximately 7.

5. The method of making magnet cores, which consists in covering iron particles with a coating of some other metal, then covering said coated iron particles with a coating of insulating material, and then forming a mass of said coated particles into a solid body by pressure sufficient to give it a specific gravity of approximately 7.

6. The method of making magnet cores, which consists in covering particles of magnetic material with a coating of zinc, then covering said zinc-coated particles with a coating of insulating material, and then forming a mass of said particles into a solid body by pressure sufficient to give it a specific gravity of approximately 7.

7. The method of making magnet cores, which consists in covering particles of iron with a coating of zinc, then covering said zinc-coated particles with a coating of shellac, and then forming a mass of said par-

tibles into a solid body by pressure sufficient to give it a specific gravity of approximately 7.

5 8. The method of making magnet cores, which consists in covering particles of iron with a coating of zinc, wetting said zinc-coated particles with a solution of shellac and alcohol, evaporating the alcohol from

the mixture, and submitting a mass of said coated particles to pressure sufficient to give 10 the mass a specific gravity of approximately 7.

In witness whereof, I hereunto subscribe my name this 24th day of May A. D., 1916.

JOHN C. WOODRUFF.