Aug. 27, 1968 S. VADIM 3,399,365

WOUND MAGNETIC CORE HAVING STAGGERED STRIPS

Filed Oct. 20, 1965

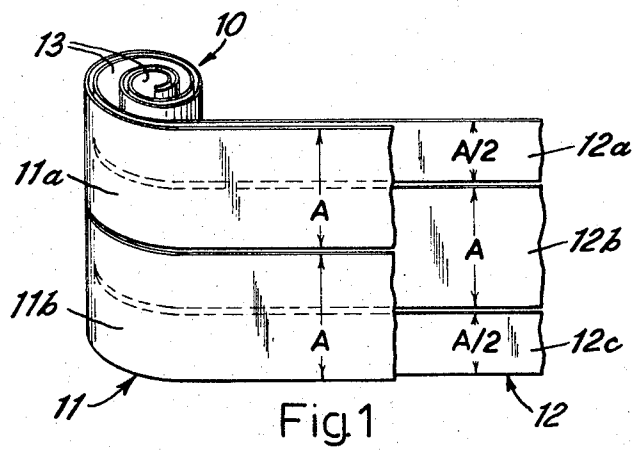


Fig. 1

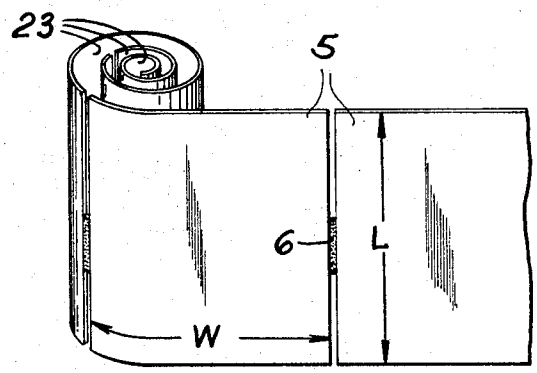


Fig. 2

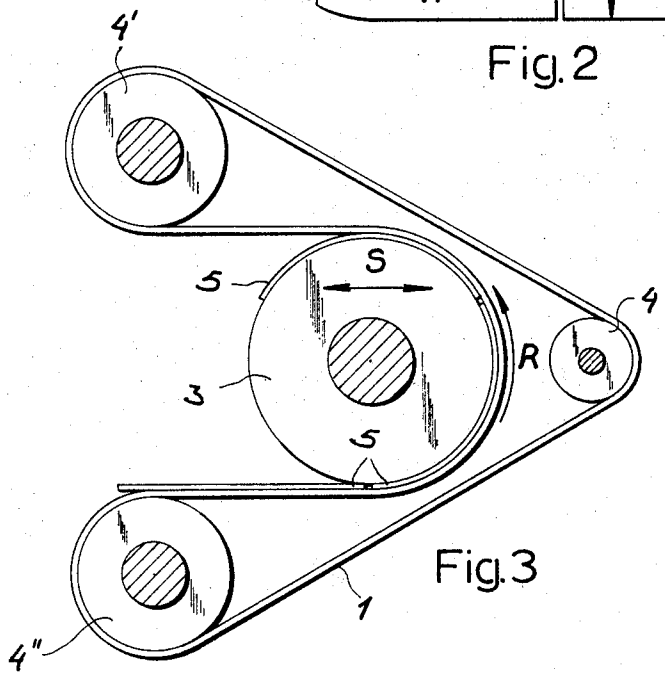


Fig. 3

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WOUND MAGNETIC CORE HAVING STAGGERED STRIPS

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3 Claims. (Cl. 336—213)

ABSTRACT OF THE DISCLOSURE

A coiled magnetic core is spirally wound from magnetic sheet material arranged in two juxtaposed coextensive layers each composed of a plurality of parallel strips with adjoining longitudinal edges, the widths of the individual strips differing in the two layers so that the gaps formed by their adjoining edges are staggered in axial direction. There is also disclosed a method of coiling a magnetic core by cutting a strip of grain-oriented magnetic sheet material into successive sections of equal length and successively bending them about a mandrel, with their longitudinal dimension parallel to the mandrel axis; the sheets may be soldered or welded to one another and may be annealed after coiling.

My present invention relates to coiled cylindrical magnetic cores wound from strips of magnetically permeable sheet material, i.e. steel, for the legs of transformer armatures and the like, as well as to a process for manufacturing such cores.

Conventional coiled magnetic cores have the shortcoming that their height, i.e. axial dimension, is limited by the original width of the strips from which they are wound; this requires axial superposition of several such coils whenever the length of the core exceeds the width of the strips, thereby tending to introduce additional air gaps. Also, the need for reducing the current flow due to induced voltage dictates the formation of radial slits, to be filled with insulating material, whose presence decreases the mechanical strength of the core.

The principal object of this invention is to provide an improved magnetic core avoiding the aforestated disadvantages. Another object is to provide a process for making a core with relatively staggered gaps, avoiding the need for a separate slitting operation.

In accordance with an important feature of my invention, a magnetic core is wound from two coextensive and juxtaposed layers of permeable sheet material which are jointly coiled about an axis, each layer consisting of a plurality of parallel strips with adjoining longitudinal edges; the width of the strips in the two layers is so chosen that their adjoining strip edges are relatively staggered in axial direction. Thus, one layer consists of n juxtaposed strip (n being equal to 2 or more) while the other layer contains $n+1$ strips; in order to realize the largest possible offset between the longitudinal gaps of the two layers, I prefer to make the first layer from strips of a given width and the second layer from one or more inner strips of the same width and two outer strips half that wide.

According to another aspect of this invention, I cut an elongate strip of grain-oriented permeable sheet material into a succession of sections of the same length, corresponding to the height of the core to be made, and form a spirally wound core body by successively bending these sections about an axis which is parallel to their dimension of length; since the sections are cut from the same strip, they will generally be of like width but the axially extending gaps therebetween will not coincide, by reason of the increasing radius of the coiled sheet sections.

The invention will be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a perspective view of a pair of juxtaposed multistrip layers partly wound into a core according to the invention;

FIG. 2 is a view similar to FIG. 1, showing a modified core; and

FIG. 3 is a top plan view of an assembly for producing the core of FIG. 2.

In FIG. 1, I have shown a transformer core **10** in the process of being wound from two juxtaposed layers **11**, **12** of sheet steel. Layer **11** consists of two parallel strips **11***a*, **11***b* of given width A which is equal to half the axial length or height of the core. Layer **12** consists of three parallel strips **12***a*, **12***b*, **12***c*, the central strip **12***b* having the width A whereas the two outer strips **12***a*, **12***c* have only the width $a/2$ so that the total width of that layer also equals 2A. As a result of this dimensioning, the longitudinal gaps between strips **12***a*, **12***b* and strips **12***b*, **12***c* are axially staggered, by a distance $A/2$, with reference to the gap between strips **11***a* and **11***b*. Regardless of the number of strips in each layer, the half-width strips **12***a*, **12***c* are always at the outer edges.

As further shown in FIG. 1, the two-layer turns of core **10** are separated by a spiral clearance **13** forming axially extending voids for the circulation of a cooling medium.

The completed core may be annealed in a neutral atmosphere, for the relief of bending stresses, and may be stabilized by suitable reinforcements, not shown. Its structure is practically monolithic and free from radial air gaps.

The modified core **20** of FIG. 2 is wound from a single layer composed of a succession of steel sheets **5**, these sheets are sections of uniform length L cut from a strip of width W. The strip may have been rolled with its crystals or grains oriented in the longitudinal direction L, thus in a direction parallel to the coil axis O. The sheets **5** may be joined togethed for continuity, e.g. by soldering or welding as indicated at **6**. A spiral clearance **23** again forms a channel for the circulation of a cooling medium.

FIG. 3 shows a device for producing the core **20** of FIG. 2. The device comprises a flexible endless element **1**, such as a belt, band or cord, wound about three rollers **4**, **4'**, **4''** and a mandrel **3**, represented by a further roller, whose sense of rotation has been indicated by an arrow R. Mandrel **3** is shiftable in two directions, as indicated by an arrow S, and is under constant stress to maintain the band **1** taut. The rectangular sheets or strip sections **5** are introduced, one after the other, into the gap between band **1** and mandrel **3** so as to bend about the mandrel axis and form an Archimedean spiral. When the necessary number of sheets have been thus assembled into a coil, the resulting cylinder body may be temporarily held in position by clamping rings or wire and is then annealed whereupon the retaining means can be replaced by permanent reinforcements. The gaps between successive sheets, which may be soldered or welded together as noted above, will generally not register on successive turns of the coiled body **20**.

The device shown in FIG. 3 may be supplemented by suitable means for laterally guiding the sheets, for welding or soldering them, for straightening their edges and for applying the retaining means.

It will thus be seen that I have provided a magnetic core whose axial length is not limited by the width of the steel strip from which it is made.

I claim:

1. A cylindrical magnetic core comprising a pair of juxtaposed and coextensive layers of magnetically permeable sheet material wound together about an axis, each

of said layers consisting of a plurality of parallel strips with adjoining longitudinal edges, the adjoining strip edges within said layer being relatively staggered in axial direction.

2. A core as defined in claim 1 wherein one of said layers consists of n strips and the other of said layers consists of $n+1$ strips, all of said strips having the same axial width except for a pair of outer strips of said other layer, said outer strips being half as wide as all the other strips.

3. A core as defined in claim 1 wherein said layers are jointly wound in radially spaced turns forming axially extending voids for the circulation of a cooling medium.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,399,365 August 27, 1968

Vadim Subovici

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

In the sheet of drawings, line 1, "S. VADIM" should read -- V. SUBOVICI --. In the heading to the printed specification, line 4, "Subovici Vadim" should read -- Vadim Subovici --.

Signed and sealed this 17th day of March 1970.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents