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ELECTROMAGNETIC DEVICE

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Fig. 1

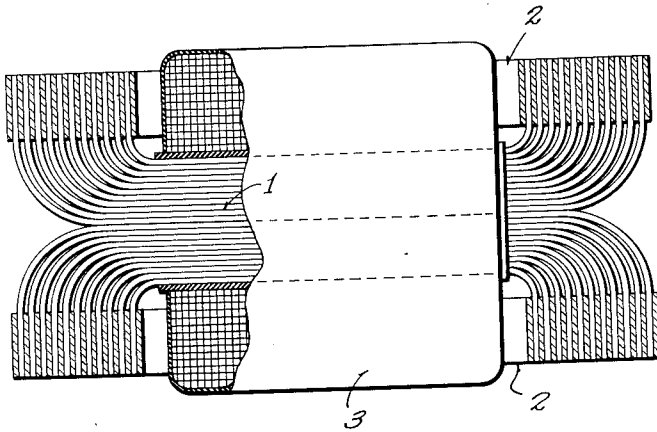
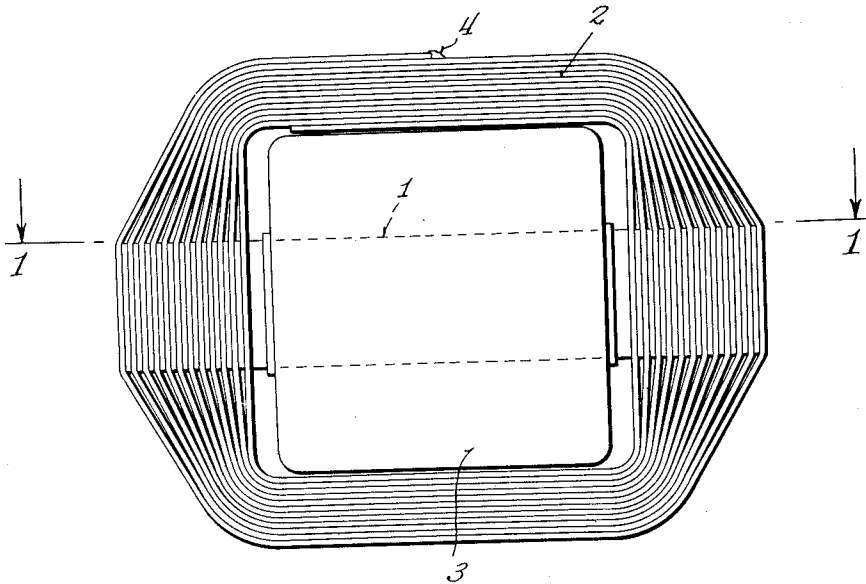


Fig. 2

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ELECTROMAGNETIC DEVICE

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7 Claims. (Cl. 175—356)

This invention relates to electromagnetic devices, such as transformers, chokes and other devices of this general nature, and to the method of making the same.

Objects of this invention are to provide a novel form of electromagnetic device in which a large portion of the magnetic core structure is formed of wound magnetic ribbon with the remaining portion of the core structure formed of magnetic laminations which are interleaved with the wound magnetic ribbon forming the closed core portion of the magnetic structure.

Further objects are to provide a construction in which a very extensive surface contact is secured between the wound cores formed of magnetic ribbon and the central core formed of magnetic laminations to thereby minimize the reluctance at the joint between the central and wound cores.

Further objects are to provide a construction in which the conducting winding may be either preformed and the central core slipped into the conducting winding, or in which the conducting winding may be wound directly on the central core in the ordinary manner without requiring any special equipment.

Further objects are to provide an electromagnetic device which is relatively simple to make and which is highly efficient in operation.

Further objects are to provide a method of making electromagnetic devices in which a central laminated, magnetic core is positioned between a pair of closed cores wound from magnetic ribbon, the method providing an easy way of interleaving the ends of the laminations of the central core with successive convolutions of the closed cores.

An embodiment of the invention is shown in the accompanying drawing, in which:

Figure 1 is a view of a transformer, with parts broken away and with parts in section, such view corresponding approximately to a section on the line 1—1 of Figure 2.

Figure 2 is a side view of the structure shown in Figure 1.

In making the electromagnetic device, such as a transformer illustrated in the drawing, a stack of punched or sheared laminations are stacked together to form the central core of the transformer indicated by the reference character 1. There laminations are straight and are held clamped together and are annealed.

The transformer is provided with a pair of outer cores 2 formed of magnetic ribbon. These outer cores 2 are wound on suitable mandrels to

give the approximate shape that they will take in the finished transformer and are held clamped to the mandrels and are annealed. After annealing they are unwound onto mandrels, preferably of larger size.

The annealed central core 1 is slipped through a preformed conducting winding 3 with the ends of the central laminations projecting straight out from opposite ends of this preformed conducting winding. If desired, the conducting winding may be wound on the central core in the usual manner.

The conducting winding 3 and the central core 1 are then held in a suitable fixture and mounted between the centers of a winding lathe, or other suitable machine, with the axis of rotation at right angles to the flat faces of the laminations of the central core. As the lathe is rotated, the closed core sections 2 are wound in place and after every 180° of rotation, the ends of the then outermost laminations of the central core are turned outwardly so as to be positioned between successive convolutions of the outer cores 2. This winding progresses until all of the central core laminations are interleaved between successive convolutions of the outer closed cores 2.

It will be seen that by proceeding in this manner what were initially the innermost convolutions of the closed cores 2 at the time they were annealed become the innermost convolutions of the closed cores 2 in the finished transformer and thus a minimum of distortion of the wound closed cores 2 is produced.

After the winding is completed, the ends of each of the closed cores 2 are tacked down as indicated at 4 by welding or brazing or in any suitable manner.

It will be seen that a very extensive surface is presented at the joint between the wound closed cores 2 and the laminations of the central core 1 and the reluctance of the gap is therefore comparatively small.

It is to be understood that the oxide formed on the laminations of the central core 1 and on the magnetic ribbon of the outer cores 2 prevents metallic contact at the joint and thus prevents eddy currents.

It has been found easier to trim the ends of the laminations of the central core 1 off after the winding of the outer closed core sections 2 has been completed than to cut the individual laminations forming the central core 1 to their exact final length.

While it is preferable to use two outer closed

core sections and turn the laminations at the ends of the central core section in opposite directions, it is within the province of this invention to use only one outer closed core section if so desired.

The laminations of the central core and the wound end cores 2 are formed of any suitable magnetic material preferably silicon steel either hot rolled or cold rolled.

It has been found that with a transformer constructed in accordance with this invention that the losses are relatively small and that an efficient transformer results.

A transformer constructed in accordance with this invention has the major portion of the flux traveling lengthwise of the laminations in both the outer closed cores and in the central core and this aids in securing the high efficiency of a transformer constructed in accordance with this invention for the reason that the reluctance of the magnetic path is less lengthwise of the strips than transversely thereof. The slight transverse path of the flux where it passes from the ends of the laminations of the central core into the continuously wound closed cores 2 is relatively short and does not greatly increase the reluctance of the magnetic path.

It has been found that the parts comprising this transformer will remain in their assembled position as there is sufficient grip between the successive convolutions of the outer cores 2 and the ends of the laminations of the inner core 1 to firmly hold the parts together. However, it is within the province of this invention to provide any suitable type of clamping means if desired, though such clamping means have not been shown.

It will be seen that a transformer or other electromagnetic device has been provided by this invention which has a relatively high efficiency. It will also be seen that with this invention a preformed conducting winding can be employed or the conducting winding may be wound on the central core as desired, and that the number of steps required in the production of the transformer is relatively small.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A core construction for an electromagnetic device comprising at least one closed, wound core formed of magnetic ribbon, and a central core formed of magnetic laminations having the ends

of the laminations of the central core located between convolutions of the closed core.

2. A core construction for an electromagnetic device comprising at least one closed, wound core formed of magnetic ribbon, and a central core formed of magnetic laminations having the ends of the laminations of the central core interleaved with successive convolutions of the closed core.

3. A core construction for an electromagnetic device comprising a pair of spaced, closed, wound cores formed of magnetic ribbon, and a central core formed of magnetic laminations located between the closed cores, the laminations at opposite ends of the central core being turned in opposite directions and being located between convolutions of the closed cores.

4. A core construction for an electromagnetic device comprising a pair of spaced, closed, wound cores formed of magnetic ribbon, and a central core formed of magnetic laminations located between the closed cores, the laminations at opposite ends of the central core being turned in opposite directions and being interleaved with successive convolutions of the closed cores.

5. A core construction for an electromagnetic device comprising a pair of spaced, closed, wound cores formed of magnetic ribbon, and a central core formed of magnetic laminations located between the closed cores, the laminations at opposite ends of the central core being turned in opposite directions and being interleaved with successive convolutions of the closed cores with the laminations on opposite sides of the central core interleaved with the inner convolutions of the closed cores and with the approximately centrally located laminations of the central core interleaved with the outermost convolutions of the closed cores.

6. A core construction for an electromagnetic device comprising a pair of outer, closed, laminated magnetic cores, and a laminated magnetic central core with the laminations at each end of the central core turned outwardly in opposite directions and interleaved with successive laminations of the outer closed cores.

7. A core construction for an electromagnetic device comprising a pair of spaced, closed, wound cores formed of magnetic ribbon, a central core formed of magnetic laminations located between the closed cores, the laminations at each end of the central core being turned outwardly in opposite directions and being interleaved with successive convolutions of the closed cores, the end portions of the laminations of the central core and the adjacent portions of the convolutions of the outer cores having a face to face flat contact.

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