Sept. 29, 1959 L. H. ROWLEY ET AL 2,906,977

MEANS OF PRODUCING HIPERSIL CORES TO FACILITATE MOUNTING THEREOF

Filed March 2, 1955

Fig. 1

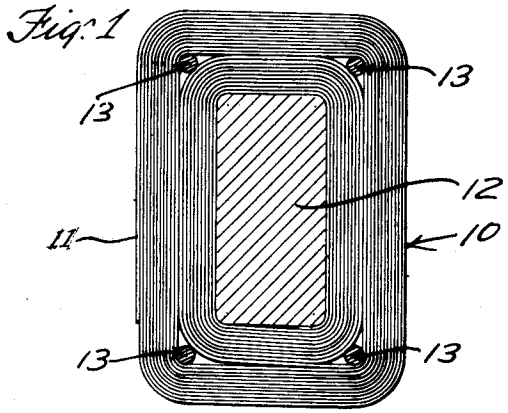


Fig. 2

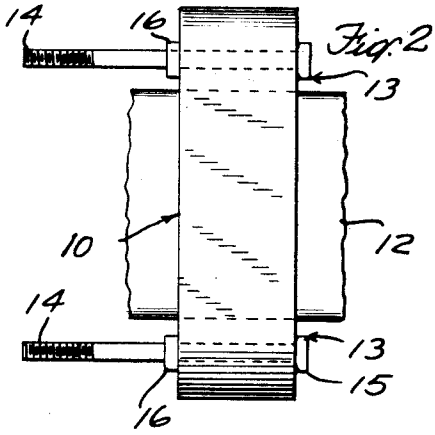


Fig. 3

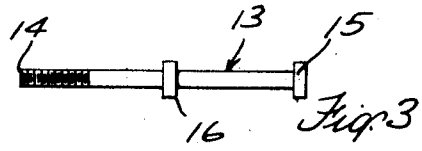


Fig. 4

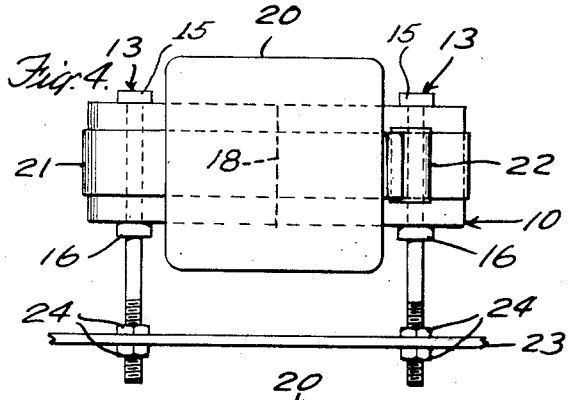


Fig. 5

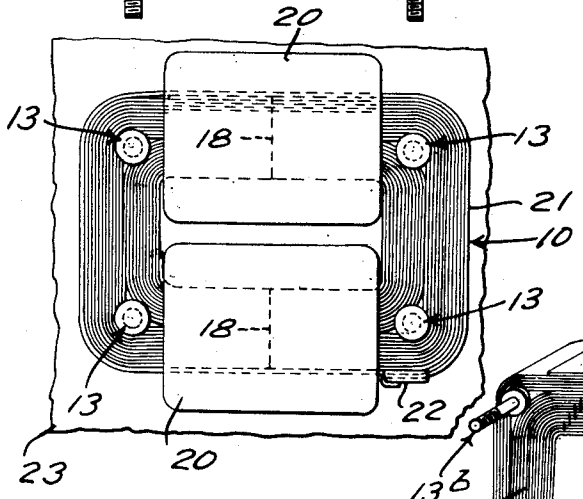


Fig. 6

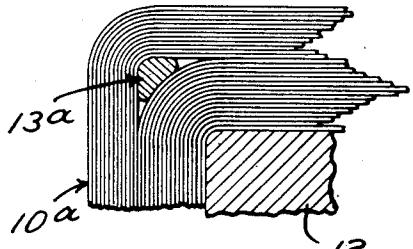
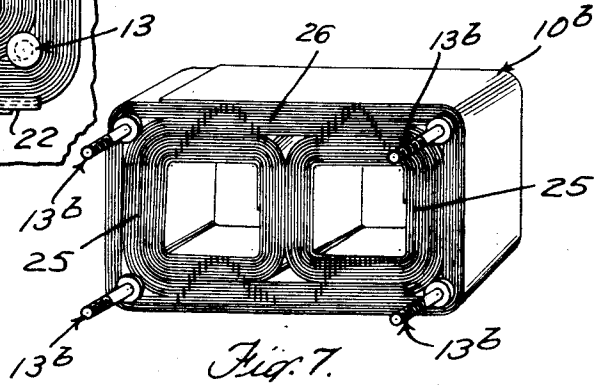


Fig. 7



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MEANS OF PRODUCING HIPERSIL CORES TO FACILITATE MOUNTING THEREOF

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5 Claims. (Cl. 336—68)

The present invention relates to magnetic cores of the type in which a thin continuous magnetic iron strip is wound spirally around a mandrel to form a laminated core and more particularly to the means for mounting such a core when forming part of a core-coil electromagnetic assembly.

In producing a core of the type described, a thin continuous magnetic iron strip is wound spirally around a rectangular mandrel. The resulting core may then be bonded with an impregnating material and cut into two parts, which can then be assembled in such a way as to link a coil or coils thereto electromagnetically. The core-coil assemblies so produced can be employed as iron-core inductors, such as transformers and reactors. A typical core of the type described is one sold under the name of Hipersil core.

Hitherto, for mounting a core-coil unit of the type described, a bracket, a foot or similar mounting device especially fabricated, was secured to the core by fastening elements, after it was completely formed, to secure the core-coil unit in position. This operation was expensive and time-consuming and did not always result in a rugged, firm, stable support or mounting for the unit.

One object of the present invention is to apply a mounting device to the magnetic core of the type described by a process, which will assure firm support and mounting of the core-coil unit, which is comparatively inexpensive to carry out, which requires a minimum of time to follow, and which dispenses with the use of elements for fastening the mounting devices to the core.

Another object of the invention is to provide a magnetic core of the general type described having mounting devices attached thereto in a new and novel manner.

In accordance with certain features of the invention, during the process of winding the continuous magnetic iron strip around the mandrel in the formation of the laminated core, mounting studs or pins are placed against an intermediate turn, which is the outside turn at that stage, so that these studs project from the face of the core. The winding is then continuous around the studs, without a break in the strip, until the core is completely wound for lamination. Since the strip is under tension when wound around the mandrel, the studs become firmly and permanently embedded into the laminating structure of the core. Thus the mounting devices are built into the core during the course of its manufacture, thereby cutting down the time required to manufacture the complete electromagnetic unit, and reducing the expense of manufacture. At the same time, mounting means are afforded which are rugged and secure and are able to withstand effectively rough handling and mechanical shock.

Various other objects, features and advantages of the invention are apparent from the following description and from the accompanying drawing, in which:

Fig. 1 is a view of a single-phase core after it is wound with mounting devices in accordance with the present invention, said core being shown partly in section and partly in front face view;

Fig. 2 is a side view of the core shown in Fig. 1;

Fig. 3 is a side view of a stud constituting one of the mounting devices embodying the present invention;

Fig. 4 is a side view of a core-coil electromagnetic unit having the core of Fig. 1 as a part thereof and shown in mounted position.

Fig. 5 is a top plan view of the core-coil unit of Fig. 4 in mounted position;

Fig. 6 is a view of part of the core shown with a modified form of built-in mounting stud; and

Fig. 7 is a perspective of a 3-phase core after it is wound with mounting devices in accordance with the present invention.

Referring to Figs. 1 to 3 of the drawings, there is shown a magnetic laminated single-phase core **10** adapted to form part of an electromagnetic core-coil unit. This core is made by spirally and tightly winding under tension, a very thin continuous magnetic iron strip **11**, made for example of silicon steel, around a mandrel **12** of substantially rectangular cross section. Somewhere in an intermediate stage of winding, mounting studs, pins or posts **13** are placed against the last applied turn at the corners, with their end sections **14** projecting from one face of the core, and the winding is continued under tension around said studs, without a break in the strip, until the core lamination is completed. These studs **13** are preferably inserted in position at a stage which will locate them substantially midway between the inside and the outside laminations of the core.

The mounting pins or studs **13** may be in the form of tubes or in the form of solid rods as shown in Figs. 1 to 3, and each has preferably enlargements to define a head **15** at one end and a collar **16** intermediate its ends, integral with the stud. The distance between these enlargements corresponds to the depth of the core **10**, so that these enlargements engaging opposite faces of the core, serve as shoulders to locate the stud **13** lengthwise in proper position on the partially completed core during the lamination build-up process and to hold said stud permanently and rigidly in said position against lengthwise movement in the completed core. The projecting ends **14** of the stud **13** may be shaped and constructed according to the manner in which the final core-coil electromagnetic unit is to be mounted. For example, the projecting ends **14** of the studs **13** may be offset and shaped to form brackets or feet, or if the studs are hollow they may be straight and may be internally threaded to receive a screw therein from a support member or chassis or may be externally threaded to receive a nut for connection to such a support member. In the specific form shown in the drawings, the studs **13** are straight and externally threaded at their outer ends.

After the lamination winding is completed, the last turn may be anchored in position as for example by spot welding it in place. The inner lamination is left either unfastened or taped in place depending upon the material and size of the core. The resulting core **10** will be in the form of a rectangular open frame.

After the core is formed as described, it may be impregnated in a suitable bonding material and cut in order to facilitate assembly of the core with a coil or coils. Figs. 4 and 5 show the core **10** of Figs. 1 and 2 cut along the lines **18** to permit the resulting sections to be separated for assembly with the preformed coil or coils **20**. The two sections of the core **10** are brought together, either in abutting relationship or in spaced relationship, to form an air gap therebetween, if this is desired. If such an air gap is required, the two sections of the core **10** may be separated by some intervening insulating material, such as a sheet of paper. After the coil or coils

20 and core 10 are assembled as described, then the two parts of the core are held in position by means of a banding strap 21 wrapped around the core and threaded through a seal 22, the tension being applied to the strap during this operation by means of a suitable banding tool. The assembly so formed will have a series of studs 13 as described, projecting from the unit in position to be easily attached to a suitable support.

In Fig. 4, the studs 13 are shown extending through a plate 23 which may constitute part of a frame structure to which it is desired to attach the core-coil unit. For example, this plate 23 may constitute part of a base or part of a chassis of an electric apparatus, and the studs passing through holes in said plate may be secured in position by means of nuts 24.

In Fig. 6 is shown a modified form of stud 13*a* having a cross section so designed as to eliminate the possibility of its displacement along the laminations of the core 10*a*, either during the process of winding or after the core is completely wound. For that purpose, the stud 13*a* is shown of somewhat angular cross-section and specifically of substantially right triangular cross-section, to correspond approximately to the shape of the corner of the core 10*a*. The stud 13*a* so shaped, is positioned with the sides bounding the right angle substantially parallel to the corresponding sides of the core at the corner. In all other respects, the stud 13*a* may be similar to the stud 13 of Figs. 1 to 5.

The stud 13*a* shaped as described, will seat properly in position between successive lamination turns during the intermediate winding stage, when it is first placed upon the partially wound core and will be firmly retained therein during the final winding stages. A stud 13*a* is placed at each corner of the core 10*a*, and the core is made with the studs built therein in the process of making this core, in the manner described in connection with the construction of Figs. 1 to 5. After the core 10*a* is completed and forms part of the core-coil unit as described, the studs 13*a* will be firmly held in position, not only against endwise movement by its shoulder formations abutting opposite faces of the core but also against transverse movement along the laminations of the core by its angular cross-sectional shape.

Fig. 7 shows the present invention applied to a core 10*b* of the 3-phase type. This core comprises twin rectangular laminated core elements 25, formed by continuous strip winding around mandrels, as was described in connection with Figs. 1 to 5, but without the insertion of the studs therein. These twin core elements 25 are then placed side by side and an outside core element 26 is wound around these elements 25 by a continuous strip. Before or during the intermediate stage of winding this outer core element 26, the studs 13*b*, similar to the studs 13 or 13*a* of Figs. 3 and 6 are inserted in the position. In the specific form shown, these studs 13*b* are inserted in position during the intermediate stage of winding of the outer core element 26, and the winding of the outer core element then continued around these studs. The core 10*b* can then be finished in the manner described in connection with the construction of Figs. 1 to 3.

It is seen therefore that in all of the forms shown, the studs will be built into the structure of the cores during the process of making the cores and no special attachments are necessary to secure these studs to the cores. As a result, the electromagnetic assemblies using these cores can be built in faster time and at less expense and the resulting studs will afford rigid mounting for the core-coil assembly, able to withstand the most severe mechanical shocks.

Although in the form of the invention described, four

studs are shown located at the corners respectively of the coil, as far as certain aspects of the invention are concerned, the number of studs may be modified according to the type of mounting required.

While the invention has been described with particular reference to specific embodiments, it is to be understood that it is not to be limited thereto, but is to be construed broadly and restricted solely by the scope of the appended claims.

What is claimed is:

1. A magnetic iron core of the character described which is adapted to be cut into two separate U-shaped sections for assembly with a pre-formed coil, said core comprising an elongated thin flat strip of magnetic material spirally contiguously wound under tension into an open laminated rectangular frame with the last lamination spot welded in place, said frame being impregnated with bonding material to prevent spreading of the laminations thereof when said frame is cut into two sections, and a plurality of transversely extending mounting studs each of which is firmly embedded at a corner of said frame between contiguous laminations intermediate the innermost and outermost laminations of said frame, each of said studs having an end projecting outwardly from the face of said frame for anchorage to a supporting member.

2. A magnetic core as defined in claim 1, in which each of said studs has a pair of spaced shoulders engaging opposite faces of said frame to locate said studs in fixed position against endwise movement in said frame.

3. A magnetic core as defined in claim 2, in which each of said studs is substantially triangular in cross section, and in which each of said studs is so embedded between said contiguous laminations that two of its adjacent sides are substantially parallel to two adjacent sides of said frame at said corner.

4. A magnetic core as defined in claim 1, in which each of said studs is substantially triangular in cross section, and in which each of said studs is so embedded between said contiguous laminations that two of its adjacent sides are substantially parallel to two adjacent sides of said frame at said corner.

5. An electromagnetic device comprising an open rectangular magnetic iron core cut into two separate opposed U-shaped sections two opposing legs of which are inserted into a preformed coil and said sections banded together, said core comprising a thin flat strip of magnetic material spirally contiguously wound under tension into an open laminated rectangular frame with the last lamination spot welded in place, said frame being impregnated with bonding material to prevent spreading of the laminations thereof when said frame is cut into two sections, and a plurality of transversely extending mounting studs each of which is firmly embedded at a corner of said frame between contiguous laminations intermediate the innermost and outermost laminations of said frame, each of said studs having an end projecting outwardly from the face of said frame for anchorage to a supporting member.

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