June 27, 1950

A. W. FRIEND

2,513,161

CORE STRUCTURE

Filed July 30, 1946

Fig. 2

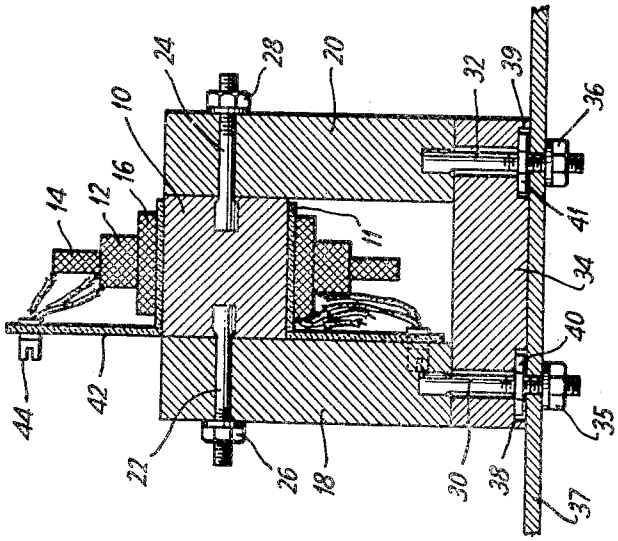
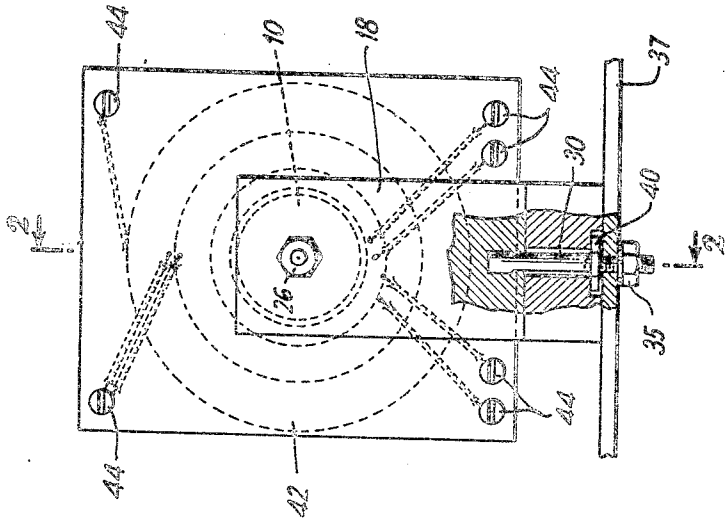


Fig. 4



INVENTOR
ALBERT W. FRIEND

BY W. S. Graves.

ATTORNEY

Patented June 27, 1950

2,513,161

UNITED STATES PATENT OFFICE

2,513,161

CORE STRUCTURE

Albert W. Friend, Collingswood, N. J., assignor to Radio Corporation of America, a corporation of Delaware

Application July 30, 1946, Serial No. 687,183

4 Claims. (Cl. 175—21)

1

The present invention relates to an improved form of core structure for electrical transformers or inductors.

In applicant's copending United States Patent applications, Serial Nos. 619,869, now Patent No. 2,451,026; 619,870; and 619,871, now Patent No. 2,476,854, each of which was filed on October 2, 1945, there is disclosed a type of transformer construction especially suited for use in the cathode ray beam deflection circuits of television systems. In one modification set forth in the above named copending applications, the transformer core is molded of comminuted or powdered iron, or other finely divided ferro-magnetic material, in combination with a binder. Transformer cores designed according to such principles have the following advantages in comparison with cores composed of steel laminations:

1. The particle size distribution of the powdered iron material may be so selected that maximum apparent permeability is attained in the frequency band of interest.

2. The low losses of powdered iron material in the television frequency range cause less heat loss in the transformer and hence a higher efficiency ratio.

3. The lower heat loss permits the enclosing of the transformer for protection against dirt and humidity.

4. The efficient energy transfer characteristics of the transformer permit reduction in the amount of power that must be delivered by the television power output tube or tubes. In some cases the number of power output tubes required may be reduced.

5. The acoustic energy radiation is considerably lower than with cores of the laminated type.

It is a principal object of the present invention to provide a core structure which includes, in one embodiment, a central molding of substantially cylindrical configuration around which one or more coils are coaxially wound. Two molded side members, preferably of rectangular cross-section, respectively adjoin the ends of the cylindrical central molding in such a manner that the adjoining surfaces lie in face-to-face relation. One or more threaded studs, which have their heads molded into the central section, pass through corresponding openings in each side member, and extend beyond the latter for a sufficient distance to permit nuts to be threaded thereon which act to clamp the side members to the cylindrical central section. Alternately, it is possible to employ a single threaded bolt or screw

2

passing through an axial opening in the central section.

A molded back member, also preferably of rectangular cross-section, is disposed so as to have a portion of one of its surfaces lying in face-to-face relation with one surface of each of the two side members. Additional threaded studs, which are molded into the side members, extend perpendicularly to the contacting surfaces and pass through corresponding openings in the back member. When nuts are threaded on these studs, the back member is clamped to each of the side members so as to produce a unitary transformer structure. If desired, the threaded studs projecting through the back member may be of sufficient length to pass through properly spaced openings in an instrument panel, chassis, or other support before the nuts are threaded thereon. Thus no additional mounting parts for the transformer structure need be employed. In a modification of the above, the back member may be molded with recesses to admit a first pair of nuts to clamp together the core assembly. In this case a second set of nuts may be used to mount the assembled core to the chassis or other support.

A molded core of the nature described immediately above has all the advantages previously set forth with respect to cores composed of steel laminations and, in addition, provides the following benefits:

1. The cylindrical configuration of the central molding permits a cylindrical coil form to be used in close relation to the core. This makes for uniformity in winding and also results in low leakage reactance.

2. Since the threaded studs have their heads molded in the core sections themselves, assembly of the complete core structure is greatly facilitated. This reduces the overall cost of manufacture of the cores.

3. Each core part, that is, the central portion, each of the two side pieces, and the back member, is of simple geometrical form. Less expense is thus incurred in making the required production molds.

4. The arrangement as described above does not require close tolerances in the size of each core portion in order to obtain close fitting of the parts. It is only necessary that relatively exact perpendicular plane surfaces be molded on the portions which are of rectangular cross-section, and that the ends of the central cylindrical member be very nearly normal to the axis of the cylinder. If the openings in the back

member which are to receive the threaded studs be slightly oversize, then considerable variations in the length of the central cylindrical member may be tolerated without affecting the performance of the assembly to a noticeable degree.

5. The core assembly may be mounted on the chassis without the use of additional nuts, bolts or other parts.

The principal object of the present invention, therefore, is to provide a core structure for electrical transformers or inductors which is molded in sections from powdered iron or other finely divided ferro-magnetic material, and which possesses the advantages enumerated in part above.

Other objects and advantages will be apparent from the following description of a preferred embodiment of the invention and from the drawing, in which:

Fig. 1 is a plan view of a core assembly in accordance with the present invention; and

Fig. 2 is a section along the line 2—2 of Fig. 1.

Referring now to the drawing, there is shown a core structure including a central member 10 of substantially cylindrical configuration. The member 10 is molded of some suitable comminuted ferro-magnetic material, such, for example as powdered iron, in combination with a binder. Encircling the cylindrical member 10 is an insulating tube 11 on which one or more coils are wound, these coils being arranged so as to be substantially coaxial with the member 10, as best shown in Fig. 2. While three coils, designated by the reference numerals 12, 14 and 16 respectively, are shown in the drawing, it will be appreciated that the number of such coils employed will depend upon the particular use to which the transformer or inductor is to be put. For example, the coils 12, 14 and 16 illustrated in the drawing may represent the primary winding, a stepped-up extension of the primary winding, and the deflection secondary winding, respectively, of a power output transformer as used in the horizontal deflection circuit of a television system employing a surge type rectifier. Such an arrangement is described in applicant's copending application Serial No. 619,870 referred to above. However, it should be clearly understood that the number and disposition of the coils themselves form no part of the present invention, and that any suitable number and type of coils may be used, if desired, in place of those illustrated.

Two side members 18 and 20, molded preferably of the same comminuted ferro-magnetic material composing the cylindrical member 10, are each shaped so as to have at least two substantially plane surfaces which are perpendicular to one another. Hence, the members 18 and 20 may be of rectangular cross-section. Member 18 is disposed so that one of its plane surfaces lies in face-to-face relation with one end of the cylindrical central member 10, as best shown in Fig. 2. Similarly, member 20 is disposed so that one of its plane surfaces lies in face-to-face relation with the other end of cylindrical central member 10.

In order to maintain the above-described relationship of the members 10, 18 and 20, a pair of threaded studs 22 and 24 is provided. Each of the threaded studs 22 and 24 has its head molded into the cylindrical central member 10 so as to project perpendicularly from one of the plane end surfaces of the cylinder. Openings are provided in the side members 18 and 20 for respectively receiving the studs 22 and 24, which extend for a sufficient distance beyond the outer surface of the side members to receive nuts 26 and 28, respectively. When these nuts 26 and 28 are tightened, they act to clamp securely the side members 18 and 20 to the cylindrical central member 10.

It will be appreciated that, if desired, the studs 22 and 24 may be replaced by a single threaded bolt or screw passing through an axial opening in the central member 10.

Each of the side members 18 and 20 has molded therein an additional threaded stud 30 and 32, respectively. These studs 30 and 32 project from surfaces the planes of which are perpendicular to the planes of the end surfaces of the cylindrical central member 10. Accordingly, each of the studs 22 and 24 lies at right angles to each of the studs 30 and 32.

The threaded studs 30 and 32 respectively pass through openings in a molded back member 34. This member 34, like the side members 18 and 20, is molded of comminuted ferro-magnetic material, and is preferably of substantially rectangular cross-section. In any event, one surface of the back member 34 is planar, and this surface if disposed to lie in face-to-face relation with each of the plane surfaces of the side members 18 and 20 from which the threaded studs 30 and 32 respectively project.

A pair of nuts 35 and 36 are respectively receivable on the threaded studs 30 and 32, and act to clamp securely the back member 34 to each of the side members 18 and 20. However, if it is desired to mount the assembly of Figs. 1 and 2 upon a chassis or other supporting member, designated in the drawing by the reference numeral 37, then the threaded studs 30 and 32 may be passed through openings in this mounting member 37 before the nuts 35 and 36 are threaded on the studs 30 and 32. This mode of construction eliminates the necessity for any additional mounting parts to secure the assembly of Figs. 1 and 2 to a support. Alternately, the back member 34 may be formed with recesses 38 and 39 to receive nuts 40 and 41, respectively, on studs 30 and 32 below, the mounting surface, in order to hold together the core members as a unit. The nuts 35 and 36 may then be used on the studs 30 and 32 for mounting the transformer to a panel or chassis, as described above.

An insulating plate 42, formed of "Bakelite," or other suitable electrically non-conductive and non-magnetic material, supports a number of binding posts or connectors 44. The plate 42, as best shown in Fig. 1, lies in a plane substantially perpendicular to the axis of the cylindrical central member 10, and is of such size as to extend appreciably beyond the outer limits of the side members 18 and 20. Plate 42 is provided with a circular opening formed centrally thereof which has an internal diameter substantially equal to the external diameter of the cylindrical central member 10. As shown in the drawing, plate 42 encircles the member 10, and lies between the coils 12, 14, 16 and the side member 20. The leads from the coils 12, 14 and 16 are respectively connected to the binding posts 44 so as to enable electrical connection to be conveniently made to each of the coil windings.

The openings in the back members 34 through which pass the threaded studs 30 and 32 are made slightly oversize, or, in other words, they have an internal diameter somewhat greater than the diameter of the studs 30 and 32. This allows for slight variations in the length of the cylindrical

central member 10, since such variations merely result in the threaded studs 30 and 32 being positioned slightly off-center of their respective openings.

It will be apparent that the configuration of the various core pieces 10, 18, 20 and 34 may be varied in a number of ways without changing the relative arrangement illustrated in the drawing. For example, the central member 10 may be made rectangular or elliptical in cross-section without altering the core assembly procedure, since the only surfaces of the member 10 which contact other portions of the core assembly are the end surfaces from which the threaded studs 22 and 24 project. Also, the only surfaces of the side pieces 18 and 20 and the back piece 34 which are at all critical in shaping are those which lie in face-to-face relation with a surface of one of the other core portions.

I claim:

1. A core structure for transformers and the like comprising a cylindrical central member molded of comminuted ferro-magnetic material and designed to have one or more coils mounted thereon, a pair of threaded studs having enlarged heads embedded in said cylindrical member and having portions projecting axially therefrom in opposite directions, a pair of side members also molded of comminuted ferro-magnetic material, said side members each being of substantially rectangular cross section and each being formed with an opening to receive one of said pair of threaded studs, means receivable on said threaded studs for clamping each of said side members to said central member, a second pair of threaded studs having enlarged heads respectively embedded in said pair of said members so as to lie substantially at right angles to said first pair of studs when said side members are clamped to said central member, a back member molded of comminuted ferro-magnetic material, said back member being of substantially rectangular cross-section and being formed with two openings adapted to receive respectively said second pair of studs, and means receivable on said second pair of studs for clamping said back member to each of said pair of side members.

2. A core structure according to claim 1, in which the two openings in said back member each have an internal diameter appreciably greater than the diameter of each of said second pair of studs, so that a variation in the normal length of said cylindrical second member will result in said second pair of studs being disposed off-center in the two openings in said back member.

3. A core structure according to claim 1, further including a plate composed of insulating material and having a circular aperture formed therein, said plate being disposed to encircle the said cylindrical central member intermediate the two said side members, a plurality of terminals supported by said plate, and electrical connections respectively between said terminals and the windings of said one or more coils.

4. A core structure for electrical inductors adapted to be mounted on a support, comprising a cylindrical member molded of comminuted ferro-magnetic material, two additional members also molded of comminuted ferro-magnetic material and each having at least two perpendicular plane surfaces, means for positioning said additional members so that one plane surface of each such member lies in face-to-face relation respectively with one end surface of the said cylindrical member, and also so that the remaining plane surfaces of the said two additional members are substantially coplanar, a fourth member molded of comminuted ferro-magnetic material, said fourth member having at least two parallel plane surfaces, means for positioning said fourth member so that one plane surface thereof is in face-to-face relation with each of the said coplanar surfaces of the two said additional members, means for maintaining the face-to-face relationship of the surfaces of said cylindrical member and said additional members, a pair of threaded studs molded respectively into said pair of additional members, said fourth member being formed with a pair of openings to receive said pair of threaded studs, a pair of recesses formed in said fourth member to act in effect as extensions of said pair of openings, a pair of nuts respectively receivable on said pair of threaded studs so as to lie respectively within said pair of recesses and to act to clamp said fourth member to each of said pair of additional members, said threaded studs being of sufficient length to pass through openings in said support after said pair of nuts have been received thereon, and a second pair of nuts respectively receivable on said pair of threaded studs so as to clamp the remaining plane surface of said fourth member in face-to-face relation with said support.

ALBERT W. FRIEND.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
956,485	Conklin	Apr. 26, 1910
1,297,858	Johnson	Mar. 18, 1919
1,579,955	Schermerhorn et al.	Apr. 6, 1926
1,599,924	Sanborn	Sept. 14, 1926
1,634,923	Thullen	July 5, 1927
1,659,596	Fischer et al.	Feb. 21, 1928
1,747,964	Wirth	Feb. 18, 1930
2,059,393	Polydoroff	Nov. 3, 1936
2,317,358	Campbell	Apr. 27, 1943

FOREIGN PATENTS

Number	Country	Date
436,428	Great Britain	Oct. 7, 1935
495,866	Great Britain	Nov. 22, 1938