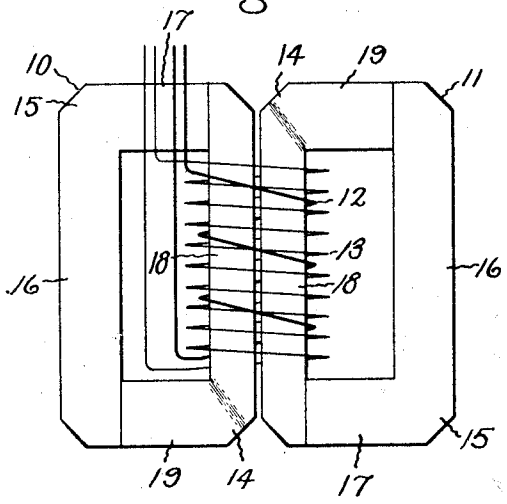
May 19, 1931. M. O. TROY 1,805,534

MAGNETIC CORE FOR ELECTRICAL APPARATUS

Filed Dec. 18, 1929

Fig. 1.



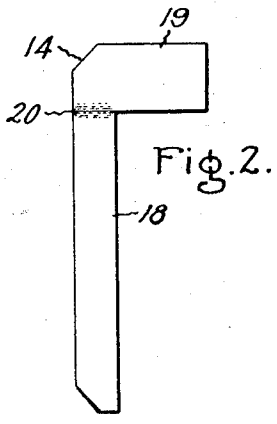


Fig. 2.

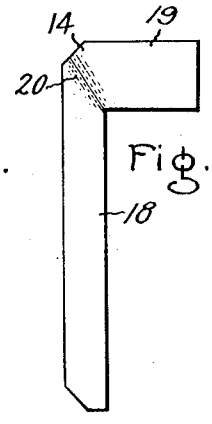


Fig. 3.

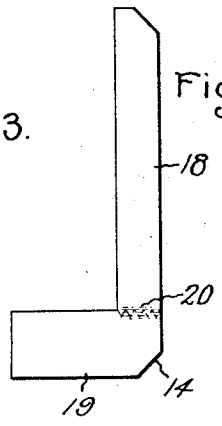


Fig. 4.

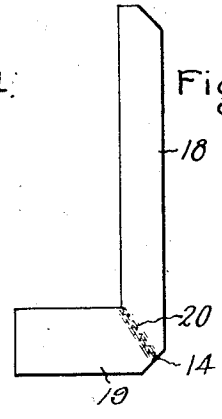


Fig. 5.

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Patented May 19, 1931 1,805,534

UNITED STATES PATENT OFFICE

MATTHEW O. TROY, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

MAGNETIC CORE FOR ELECTRICAL APPARATUS

Application filed December 18, 1929. Serial No. 415,003.

My invention relates to magnetic cores for electrical apparatus such as transformers and reactors. Such cores are generally formed of superposed sheets or laminations of magnetic material, the laminations being annealed to improve their magnetic characteristics and being insulated from each other to reduce eddy current losses. The magnetic material most commonly used is a high grade of silicon steel. There have been developed however certain other materials, such as nickel iron alloys, which have better magnetic characteristics but are so much more expensive as to prohibit their general use. It has been proposed therefore to use the better but more expensive material in the part of a magnetic core where it will do the most good, the remainder of the core being formed of less expensive material to keep down the final cost of the entire core. The greatest advantage is obtained by using the better magnetic material in that part of the core which is surrounded by a winding or windings because the space for the material is limited. In those parts of the core which are outside the winding or windings, the space is not limited and magnetic losses may be kept down by using an ample amount of the less expensive material. This is explained in United States Patent No. 1,698,634 to S. E. Johannesen, issued January 8, 1929. The general object of the present invention is to provide an improved magnetic core construction including two grades of magnetic material, the material having the better magnetic characteristics being used in that part of the core which is surrounded by a winding or windings.

The invention will be better understood from the following description taken in connection with the accompanying drawings in which Fig. 1 shows a transformer having a magnetic core constructed in accordance with the invention, and Figs. 2, 3, 4 and 5 show various forms of lamination sections which may be used in the core shown in Fig. 1.

Like reference characters indicate similar parts in the different figures of the drawings.

The invention will be explained in connection with the transformer shown in Fig. 1. This transformer has a magnetic core formed in two parts 10 and 11, both parts being of hollow rectangular shape placed edge to edge and with their adjacent sides surrounded by a low voltage winding 12 and a high voltage winding 13. Each of the parts 10 and 11 of the core is built up as usual of a plurality of superposed layers or laminations of magnetic material. Adjacent layers should of course be insulated from each other to prevent excessive eddy currents.

Each of the layers or laminations of each part of the core includes two L-shaped sections 14 and 15. Each section 15 has a long outer leg portion 16 and a shorter yoke portion 17. Both of these portions 16 and 17 may be as wide as desired so that there will be ample material in these parts of the core to keep down the magnetic losses. Very satisfactory and economical methods, such as is disclosed in United States Patent No. 1,334,149 to J. J. Frank, issued March 16, 1920, have been proposed for producing L-shaped magnetic sheet punchings and the sections 15 may be produced by any method desired.

Each of the lamination sections 14 includes a winding leg portion 18 and a yoke portion 19. Each of these portions 18 and 19 is a straight piece of material with parallel side edges and may obviously be cut or punched from large stock sheets with very little waste. The stock sheets are produced by a rolling process while heated and this results in a grain in the direction in which the sheets are rolled. It is well known that the best results are obtained if the path of the magnetic flux in the finished core is in the direction of this grain so the edges of the portions 18 and 19 are preferably parallel to the grain formed in these portions by the rolling process used in forming the stock sheets from which they were cut or punched. The grain will therefore extend longitudinally of each of the portions 18 and 19.

The portion 18 of each lamination section 14 is surrounded by the windings 12 and 13 and is formed of a high grade of magnetic material such as a nickel iron alloy. The magnetic losses in this winding leg part of the core are therefore kept to a low value by

the use of a high grade expensive material in the limited space available for it. The portion 19 of each lamination section 14 is formed of a cheaper magnetic material such as silicon steel, the losses being kept down in this yoke part of the core by making these portions 19 of ample width to provide an ample amount of material.

The portions 18 and 19 of each lamination section 14 are fitted together and united into an integral unit by a weld 20. The welds may be of any desired form, several variations being shown in the different figures of the drawing. The portions 18 and 19 may have straight meeting edges which are welded together as indicated in Figs. 1, 2 and 3 or they may have toothed edges welded together as indicated in Figs. 4 and 5. It has been found that the toothed edges permit the strongest weld to be made. Alternate laminations or alternate small groups of them are preferably reversed endwise as usual so that the joints between the sections 14 and 15 will be at different places in the core.

A core such as has been described consists entirely of simple L-shaped lamination sections formed of two grades of magnetic material, the better and more expensive material being restricted to the winding leg of the core where it is of greatest advantage.

The invention has been explained by describing and illustrating a particular form thereof but it will be apparent that changes may be made without departing from the spirit of the invention and the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A transformer core including magnetic laminations formed of a high grade expensive material and a lower grade less expensive material, the winding leg portion of each of said laminations being formed of the high grade material and being welded to a yoke portion formed of the lower grade material to form a unitary lamination section, the ends of each of said lamination sections being connected by an L-shaped lamination section of the lower grade material.

2. A transformer core lamination in the form of a hollow rectangle, one side of said rectangle being formed of a high grade expensive magnetic material welded to an adjacent side of the rectangle to form a unitary L-shaped lamination section, said adjacent side being formed of a lower grade less expensive magnetic material, and the ends of said lamination section being connected by an L-shaped lamination section of the lower grade magnetic material forming the other two sides of said rectangle.

3. A core lamination section including a straight winding leg portion of high grade expensive magnetic material, and a straight yoke portion of lower grade less expensive magnetic material, said two portions being welded together to form a unitary L-shaped lamination section.

4. A core lamination section including a straight winding leg portion of high grade expensive rolled magnetic material, and a straight yoke portion of lower grade less expensive rolled magnetic material, said two portions being welded together to form a unitary L-shaped lamination section, each of said portions having a grain produced by the rolling process extending substantially longitudinally thereof.

5. An L-shaped unitary core lamination section with its two straight portions connected together by a welded joint, one of said portions being of high grade expensive rolled magnetic material and the other portion being of lower grade less expensive rolled magnetic material, and each of said portions having a grain produced by the rolling process extending substantially longitudinally thereof.

In witness whereof I have hereunto set my hand this 17th day of December, 1929.

MATTHEW O. TROY.