336-212

EXAMINER'S ROOM.

119

No. 861,073. PATENTED JULY 23, 1907.

C. E. ALLEN.

TRANSFORMER.

APPLICATION FILED APR. 18, 1905.

Fig. 1.

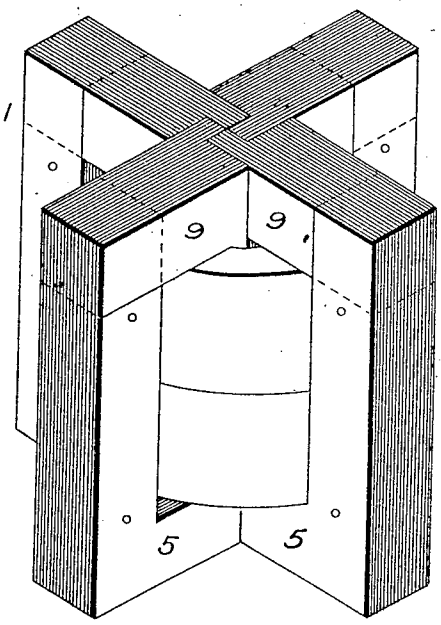


Fig. 2.

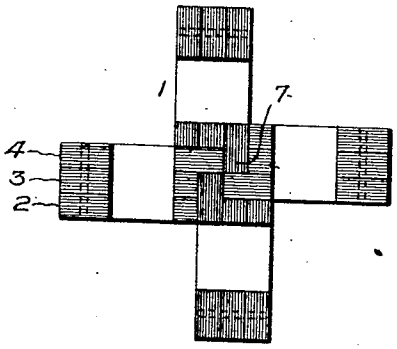


Fig. 3.

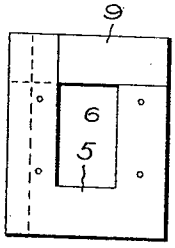
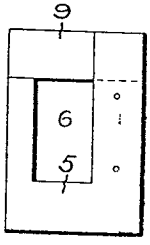


Fig. 4.



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UNITED STATES PATENT OFFICE.

CLAXTON E. ALLEN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

TRANSFORMER.

No. 861,073. Specification of Letters Patent. Patented July 23, 1907.

Application filed April 18, 1905. Serial No. 256,259.

To all whom it may concern:

Be it known that I, CLAXTON E. ALLEN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Transformers, of which the following is a specification.

The object of my present invention is the production of a transformer in which material is efficiently and economically employed, while at the same time a construction possessing excellent electrical, magnetic and mechanical properties is obtained.

In carrying out my invention I form the magnetic core of the transformer of a number of units or parts, each of which I ordinarily make substantially rectangular in outline and of laminated material and with an opening or passage also substantially rectangular in cross-section, extending through each unit transversely to the plane of lamination. The units are assembled together so that one side of each unit forms a part of a central leg or part. The portion of each unit entering the central leg is arranged to form a tongue and groove engagement with the remainder of the central leg, thus increasing the mechanical strength and rigidity of the structure. The windings or coils of the transformer pass through the openings in the several units and surround the central leg. By this arrangement in a transformer of given output, the necessary copper, which is the most expensive material employed in the transformer, is reduced to a minimum, while at the same time the mean length of the magnetic path is made short.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of my invention, however, reference may be had to the accompanying drawings and descriptive matter in which I have illustrated one of the forms in which my invention may be embodied.

Of the drawings, Figure 1 is a perspective view of a transformer; Fig. 2 is a cross-section on line 2 2 of Fig. 1; Fig. 3 is an elevation of one of the bundles of laminæ employed; and Fig. 4 a similar view of one of the other bundles employed.

In the particular construction shown in the drawings, the core is made up of four similar units 1, each of which is formed in the construction shown of three sections or bundles 2, 3, and 4 of laminæ. Each bundle may be formed by compressing together substantially U-shaped laminæ 5 which after compression are secured together in a suitable manner as by fiber rivets. The bundles are each substantially rectangular in outline and are formed with rectangular openings 6 in them extending transversely to the planes of lamination. In the assembled core the units are placed with one side of each unit in proximity to corresponding sides of the other units to form one central leg or branch of the core. Each unit may be regarded as extending substantially radial from the central leg or branch. The outer sides and the ends of the units form multiple return paths for the flux passing through the central leg or branch. The inner sides of the bundles 2 and 3 which are identical with each other, are square in cross-section. The bundle 4 in each unit, however, which is of the same thickness as the bundles 2 and 3 has the radial depth of its inner side equal to twice the thickness of a bundle of the others.

In the complete core structure the inner edges of the laminæ of the bundles 2 and 3 of each unit abut against the outer laminæ of the bundle 4 of one of the other units of the core. This arrangement gives a central leg which is square in cross-section, and in which the portion of the bundle 4 of each unit projecting by the bundles 2 and 3 of the same unit forms a rib or tongue 7 square in cross-section which enters a groove or recess formed to receive it between the inner ends of the middle bundle of a second unit and a bundle 4 of a third unit of the core. The bottom wall of the groove is formed by the side of the overlapping portion of the bundle 4 of said second unit. It will be observed that one corner of the rib or tongue formed by the overlapping portion of the bundle 4 of each unit lies at the center of the square leg. The central planes of the units are therefore off-set from the center of the central leg by an amount equal to one-half the thickness of said rib or tongue. The windings of the transformer which may be sub-divided into two or more parts and are usually approximately annular in form, surround the central leg of the core and fill the space between the central leg and the four outer legs formed by the outer sides of the units.

When the laminæ of each bundle are formed substantially U-shaped as in the particular construction illustrated, one leg of each U-shaped punching is made shorter than the other leg by a distance equal to the depth of the end-closing punching. In each side of each bundle the long and short legs are alternately reversed and rectangular end-closing members 9 alternately extend from the outer edge of the bundle to the inner edge of the inner side of the bundle, and from the inner edge of the bundle to the inner edge of the outer side of the bundle to complete the magnetic circuit. It will, of course, be understood that ordinarily the end-closing members 9 are put in place after the windings are placed about the central leg of the core.

In order to obtain the most efficient use of material each outer leg of the core should be made considerably greater in cross-section than one-fourth of the central leg. This may be done as shown in the drawings by

making the radial depth of the outer leg of each unit considerably greater than the average radial depth of the inner leg. In the particular construction illustrated the radial depth of the inner and outer legs of the laminæ forming the bundle 4 are shown as equal. A somewhat more efficient method of obtaining the same result is by interleaving the laminæ of magnetic material between the laminæ of the outer legs. I make no claim in this application to such interleaving, however, as it forms no part of my invention.

It will be obvious to those skilled in the art that changes may be made in the form in which I have shown my invention as embodied, without departing from the spirit of my invention, and I do not wish the claims hereinafter made to be limited to the particular construction shown and described more than is made necessary by the state of the art.

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

1. In a transformer a core composed of separate units or parts whose meeting edges have longitudinal ribs which intermesh to form a substantially solid leg, and a winding surrounding said leg.

2. A transformer core composed of four units or parts whose meeting edges have longitudinal ribs which are square in cross-section.

3. A transformer core composed of units or parts each of which comprises sections having one narrow and one wide leg, and a section having two legs of the same width.

4. A transformer core composed of separate units or parts each of which consists in part of sections each having narrow and wide legs, and in part of one section having legs of the same width, the thickness of each section being equal to the width of the narrow legs.

5. A transformer core composed of four units or parts, each of which consists of sections or bundles of laminæ of equal thickness, one bundle projecting along the meeting edge to form a rib whose width equals the thickness of the sections, said ribs abutting one against the side of another so that there is formed a solid square central leg to receive the coil.

6. A transformer core composed of separate intermeshed units or parts meeting at a common center, the central plane of each part being off-set from said center.

7. A transformer core composed of separate branches each having intermeshed ribbed edges meeting at a common center, the central plane of each branch being off-set from said center.

8. In a transformer, a coil or winding, and a core consisting of a number of units or parts, each formed with a coil-receiving passage extending through it, said parts being assembled together to form a common central leg surrounded by said coil or winding which passes through the openings in said units, the portions of the units forming said central leg being so shaped that each unit has a tongue and socket engagement with the remainder of the central leg whereby the mechanical strength and rigidity of the core is increased.

9. In a transformer, a coil or winding, and a core consisting of a number of units or parts each formed with a coil-receiving passage extending through it, said parts being assembled together to form a central leg surrounded by said coil or winding which passes through the openings in said units, the portions of the units forming said central leg being so shaped that each unit has a tongue or rib rectangular in cross-section which enters a socket formed to receive it in the remainder of the central leg, whereby the mechanical strength or rigidity of the core is increased.

10. In a magnetic core, a leg or portion formed of similar units each of which is provided with a tongue or rib, the sides of which are parallel, said tongue or rib entering a groove or space of a width equal to the distance between the parallel sides of said rib formed to receive it in the remainder of said leg or portion.

In witness whereof, I have hereunto set my hand this fifteenth day of April, 1905.

CLAXTON E. ALLEN.

Witnesses:
JOHN A. MCMANUS, Jr.,
ROBERT SHAND.