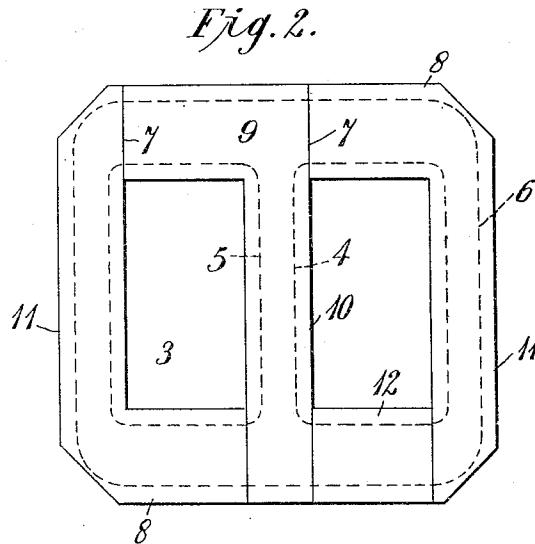
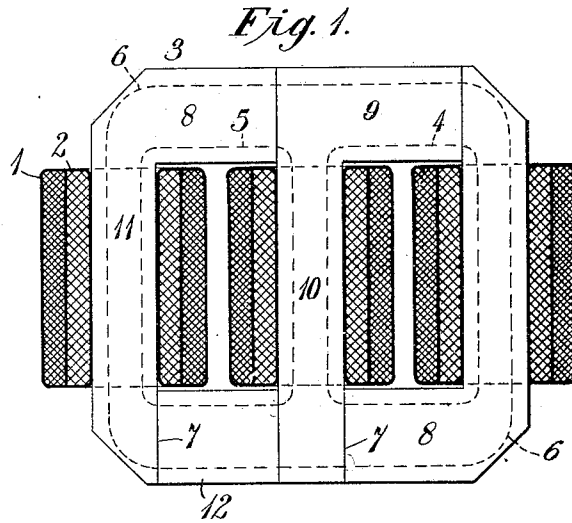


E. G. REED.
 TRANSFORMER CORE PUNCHING.
 APPLICATION FILED DEC. 26, 1913.

1,224,210.

Patented May 1, 1917.



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TRANSFORMER-CORE PUNCHING.

1,224,210.

Specification of Letters Patent.

Patented May 1, 1917.

Application filed December 26, 1913. Serial No. 808,736.

To all whom it may concern:

Be it known that I, EMERSON G. REED, a citizen of the United States, and a resident of Wilksburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Transformer-Core Punchings, of which the following is a specification.

My invention relates to electrical transformers employed in connection with alternating current systems of distribution, and it has for its object to provide transformer core punchings of such form as to insure a maximum economy of material and a reduction in the expenses of operation and in the losses of transformers.

In the manufacture of transformers, it is highly advantageous to provide core laminations having such a form as to utilize the maximum percentage of the stock from which the laminations are to be punched. Also, it is desirable to provide a core structure which will offer a minimum reluctance to the passage of the magnetic flux there-through. Again, it is important that the laminations be formed to possess the advantage of being easily assembled without tearing and cutting the coil insulation during the assembling operation. In order to comply with the above-mentioned requirements, I have invented laminations of a new form for a transformer core structure which will be hereinafter fully described.

In the accompanying drawing, Figure 1 is a view, in transverse section, of a transformer constructed in accordance with my invention, and Fig. 2 is a view, in another transverse section, of the core structure shown in Fig. 1.

Referring to Fig. 1, high-tension coils 1 and low-tension coils 2 are concentrically wound and adequately insulated from one another. After the coils have been assembled, the entire core structure 3 is built up to provide magnetic circuits 4, 5 and 6 for the flux generated by the three groups of coils previously assembled. If the above-mentioned magnetic circuits have full cross-sectional areas throughout their entire length, it is unimportant, from the standpoint of the magnetic properties of the core, where joints 7 which are formed by abutting edges of the laminations, are located. But, inasmuch as I have shown a structure in which the magnetic circuits comprise por-

tions which have reduced cross-sectional areas, it is particularly desirable that the air gaps formed between adjacent sections of the laminations shall always lie in those portions of the core which have the greater cross sectional area, as shown in Figs. 1 and 2. By positioning the air gaps 7 in the portions of the circuit which have a full cross sectional area, the reluctance offered to the passage of the magnetic flux across the air gaps is reduced to a minimum value because of the decreased flux density per unit of cross sectional area of the air gaps.

The core of my transformer comprises two similar L-shaped members 8, an L-shaped member 9 forming a central cross bar 10 which has substantially the same width as the outer cross-bars 11, and a rectangular member 12. It will be seen that the bars embraced by the coils are reduced in cross sectional area in order to decrease the length of the mean turn of the coils 1 and 2. The portions of the core structure not embraced by the said coils are given full cross sectional areas, thereby decreasing the flux density in these portions and, consequently, the total iron losses. The magnetic fluxes generated by the current-carrying coils embracing the bars 10 and 11 flow in the circuits 4, 5 and 6, as indicated in the drawing. The flux generated by the coils embracing the central bar 10 is divided into two portions, one portion flowing in the circuit 4 and the other portion flowing in the circuit 5, the said circuits being magnetically connected in parallel. The fluxes generated by the coils embracing the bars 11 are also divided into two portions, one portion flowing either in the circuit 4 or the circuit 5 in conjunction with the other portion which flows in the circuit 6. Of course, it will be understood that, in a three-phase transformer, as I have shown, the fluxes generated by the three groups of coils maintain the usual three-phase relations which obtain in core structures comprising three bars each embraced by a group of coils, such being well known in the art.

It is apparent that my core structure may be easily assembled because of the simplicity in the form of the laminations, which require no fitting together of intricate parts. In building up the core structure around the three groups comprising the coils 1 and 2, a plurality of punchings are placed together

to form a group of similarly laminated layers as shown in Fig. 1. When the punchings are thus assembled, the magnetic circuit 4 comprises two air gaps 7 and the magnetic circuit 5 comprises three air gaps. A plurality of punchings equal in number to those constituting the first group of laminations, are then placed together to form a second group of similarly laminated layers, as shown in Fig. 2. In this arrangement, the magnetic circuit 4 comprises three air gaps 7, and the magnetic circuit 5 comprises two air gaps 7. In each of the above-mentioned groups of laminated layers, the magnetic circuit 6 comprises five air gaps. To balance adequately the magnetic conditions obtaining within the transformer core and to make the reluctance of the built-up magnetic circuits 4 and 5 as nearly equal as possible, the two above-mentioned groups of similarly laminated layers are alternately reversed with respect to each other, thereby insuring the same total number of air gaps in both magnetic circuits 4 and 5 of the entire core structure. As a result of placing the laminated layers so as to alternately insert three air gaps and then two air gaps in each of the magnetic circuits 4 and 5, the magnetic reluctance of each of said circuits will be equivalent to that of a magnetic circuit having a number of air gaps which corresponds to the mean between two air gaps and three air gaps. It will be seen from the foregoing description of the assembling operation of the core, that each of the above-mentioned magnetic circuits comprises a minimum number of air gaps which results in a low reluctance being offered to the flow of the magnetic flux generated by the three groups of coils above mentioned. The L-plates 9 constitute a portion of both magnetic circuits 4 and 5 irrespective of whether the transformer is of a three-phase core type, as shown, or of the shell type with the coils embracing only the central bars 10.

The L-plates 8 are so formed that, in conjunction with the rectangular plates 12 and

the L-plates 9, a core of substantial construction is assured. At the same time, all the punchings are so simple in form that only a small amount of stock is wasted when the laminations are punched for the transformer core structure.

The forms of the several parts and the relative proportions thereof may be varied from those here described, and, therefore, I desire that my invention be restricted to no narrower limits than those imposed by the prior art and the demands of satisfactory service.

I claim as my invention:

1. A transformer core comprising a plurality of laminated layers each being composed of three L-shaped punchings and a rectangular-shaped punching to form three closed magnetic circuits one of which consists of two of said L-shaped punchings and another of which consists of the third L-shaped punching, said rectangular-shaped punching and the longer leg of one of the aforementioned two L-shaped punchings, said laminated layers being alternately reversed with respect to one another, thereby inserting in the built-up transformer core the same number of air gaps in each of said two magnetic circuits.

2. A lamination-layer for a transformer core member comprising three L-shaped punchings and a rectangular-shaped punching to form a plurality of magnetic circuits, one circuit consisting of two of said L-shaped punchings and another consisting of the third L-shaped punching, said rectangular-shaped punching and the longer leg of one of the aforementioned two L-shaped punchings.

In testimony whereof, I have hereunto subscribed my name this 19th day of Dec. 1913.

EMERSON G. REED.

Witnesses:

G. G. CROWELL,
B. B. HINES.