June 24, 1930. H. L. COLE 1,765,483

TRANSFORMER CORE STRUCTURE

Filed March 12, 1929

Fig. 2.

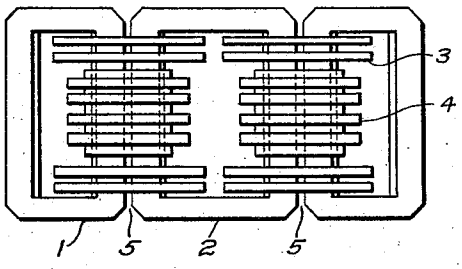


Fig. 3.

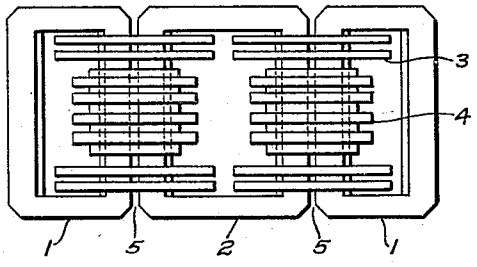


Fig. 1.

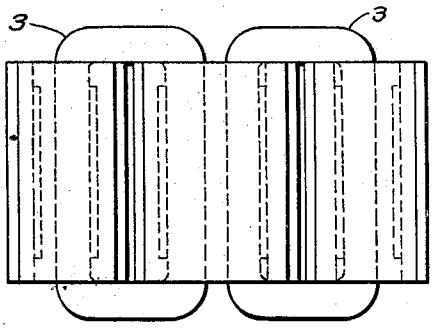


Fig. 4.

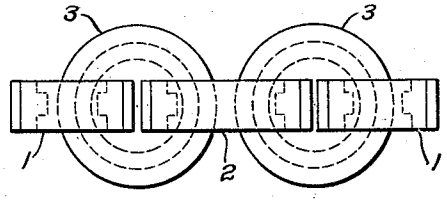
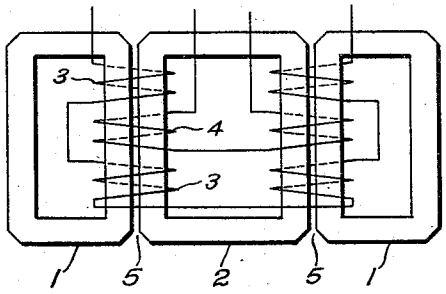


Fig. 5.



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UNITED STATES PATENT OFFICE

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TRANSFORMER CORE-STRUCTURE

Application filed March 12, 1929. Serial No. 346,394.

My invention relates to single-phase transformers, and more particularly to the construction of the core and the arrangement of the coils thereon.

It is common practice to mount the coils of a single-phase transformer along a common axis. When the coils are so mounted, the length of the stack of coils of the transformer increases with larger transformer capacities. Because of shipping requirements, the height of a transformer that is to be shipped assembled, is limited.

I propose to place the coils on two or more axes, and to connect them in series or parallel-circuit relation as desired. It is, therefore, possible to build a transformer of large size by increasing the length thereof, without increasing the height or the width. With the single-axis construction, the unit stresses are much higher per stack during a short circuit of the transformer than when a multiple-axis arrangement of the windings is employed, thus necessitating a more complicated system of bracing to withstand these stresses. By my proposed arrangement of the core and windings of a transformer, the amount of iron required for the magnetic circuit is reduced and the core ventilation is improved.

An object of my invention is to provide a single-phase transformer that will be compact and economical of materials used.

Another object of my invention is to provide a single-phase transformer in which the metal required for the core structure is materially reduced.

A further object of my invention is to provide a single-phase transformer having a plurality of cooperating primary and secondary windings that are magnetically linked by one or more sections of a core structure.

Other objects will appear from the accompanying disclosure and claims.

A better understanding of my invention will be obtained by reference to the accompanying drawings and the following detailed description:

Figure 1 is an elevational view, and

Fig. 2 is a plan view of a single-phase transformer having rectangular coils and embodying my invention.

Fig. 3 is an elevational view, and

Fig. 4 is a plan view of a single-phase transformer having circular coils, and embodying my invention, and,

Fig. 5 is a diagrammatic view of core members and coils of a transformer embodying my invention.

In the illustrated embodiment of my invention, I provide a single-phase transformer, its core structure comprising three single core units 1, 2, 1 said units being placed contiguously and extending in substantially the same plane, with spaces 5 left between them for ventilation. In other embodiments of my invention, the number of core units may be increased. Also, the disposition of the coils, with respect to each other, may be changed. I provide stacks of windings, each stack comprising cooperating primary and secondary windings interlinking adjacent legs of adjoining sections. While the figures shown illustrate the improved core structure with the well known "interleaved" windings, the invention is not limited to the employment of such windings, but may be employed with a winding of any other type commonly embodied in transformers, such, for example, as "concentric" windings.

The two end core units are of sufficient size to accommodate the interlinking of one leg of each core section with one leg of the intermediate core section by the cooperating primary and secondary windings. This necessitates the intermediate units being approximately twice as wide as the end units.

Referring particularly to Figs. 2, 3 and 5, the units 1 and 2 are illustrated as being of substantially rectangular shape, although any desired shape may be employed, each unit having a rectangular aperture, one dimension of unit 1 being substantially one-half that of the corresponding dimension of unit 2, the other dimensions being the same for all units. The units 1 and 2 may be formed of any suitable magnetic material, and each unit may be formed, or built up, from suitable punchings, as desired.

Suitable windings 3 and 4 are mounted

upon the units 1 and 2 in such manner, that the adjacent edges of two of the units comprise the core member for the primary and secondary windings. The primary and secondary windings may be respectively connected in parallel-circuit relation or in series-circuit relation. By so arranging the units 1 and 2, that small spaces 5 are left between them, sufficient ventilation of each core is obtained.

It will be observed that the core member for the windings 3 and 4 comprises a side wall of an intermediate unit and the adjacent wall of an end unit. One intermediate core unit and its magnetic circuit are common to two stacks of cooperating primary and secondary windings. The magnetic flux set up about the side walls of the intermediate core unit cuts both stacks of windings. By placing two of these core units contiguously to obtain the satisfactory amount of metal for the core for each set of windings, a considerable saving of material is effected over that required for two or more complete magnetic circuits for each stack of windings.

It will be seen that the core units may be multiplied indefinitely, and the capacities increased to any value desired, the only limitation being that of available space or shipping limitations.

It will be evident that I have provided an improved core structure for single-phase transformers in which there is a material reduction in the metal required, and in which its capacity is greatly increased without increasing the height or width of the transformer. The ventilation of the core is improved, the bracing of the coils requires a more simple mechanical structure, and the amount of material in the magnetic core is less than for the usual construction.

Since various changes and modifications may be made in the arrangement and assembly of the several features of my invention without departing from the scope and spirit thereof, it is to be understood that no limitations are to be imposed except as expressed in the appended claims.

I claim as my invention:

1. In a single-phase transformer, a core structure consisting of at least three apertured units, said units being placed end to end and in substantially the same plane, two of units being end units having one of the dimensions of the intermediate units and substantially one-half of another dimension of the intermediate units, said units having their apertures in parallel relation.

2. In a single-phase transformer, a plurality of windings, a core structure, said core structure consisting of at least three apertured core units, the said core units being of substantially rectangular shape, extending in substantially the same plane and contiguous, two of the units being end units, the said end units and their apertures having one of the dimensions of the intermediate core unit and its aperture, and substantially one-half the other dimension, said units having their apertures in parallel relation, said coils being so disposed on the core structure as to link the adjoining sides of two adjacent core units.

3. In a single-phase transformer, a core structure comprising a plurality of units each forming a closed magnetic circuit, a plurality of stacks of cooperating primary and secondary windings, the winding of each stack linking two units of the core.

4. In a single-phase transformer, a core structure comprising a plurality of units, each forming a closed magnetic circuit, a plurality of stacks of cooperating primary and secondary windings, the windings of each stack linking two units of the core, and the windings of the several stacks being interlinked through common units of the magnetic circuit.

5. In a single-phase transformer, a core structure comprising a plurality of units each forming a closed magnetic circuit, a plurality of stacks of cooperating primary and secondary windings, the windings of each stack linking two units of the core, and at least one of the units of the core member linking a plurality of stacks of coils.

6. In a single-phase transformer, a core structure comprising a plurality of units forming closed magnetic circuits, a plurality of stacks of windings linking different portions of said magnetic circuits, each stack comprising cooperating primary and secondary windings.

7. In a single-phase transformer, a core structure comprising a plurality of units, each forming a closed magnetic circuit, a plurality of stacks of cooperating primary and secondary windings linking different portions of said core structure, the magnetic circuit of at least one core unit linking the windings of a plurality of stacks, and the magnetic circuits of a plurality of said units linking single stacks of windings, respectively.

In testimony whereof, I have hereunto subscribed my name this 4th day of March, 1929.

HORACE L. COLE.