(No Model.)

E. THOMSON.

ELECTRIC TRANSFORMER.

No. 420,396. Patented Jan. 28, 1890.

Fig 1.

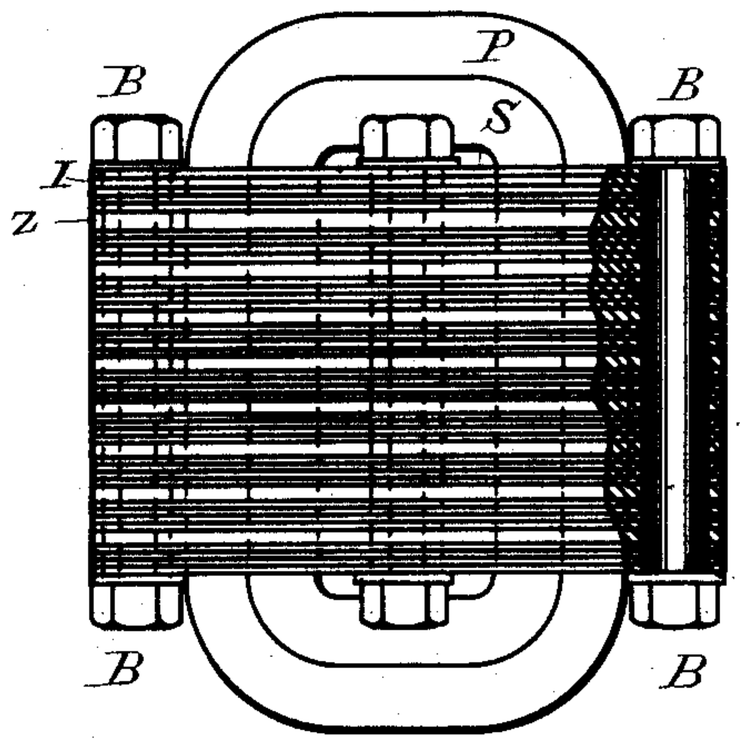


Fig 2.

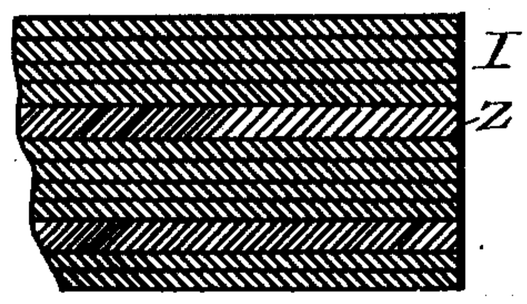


Fig 3.

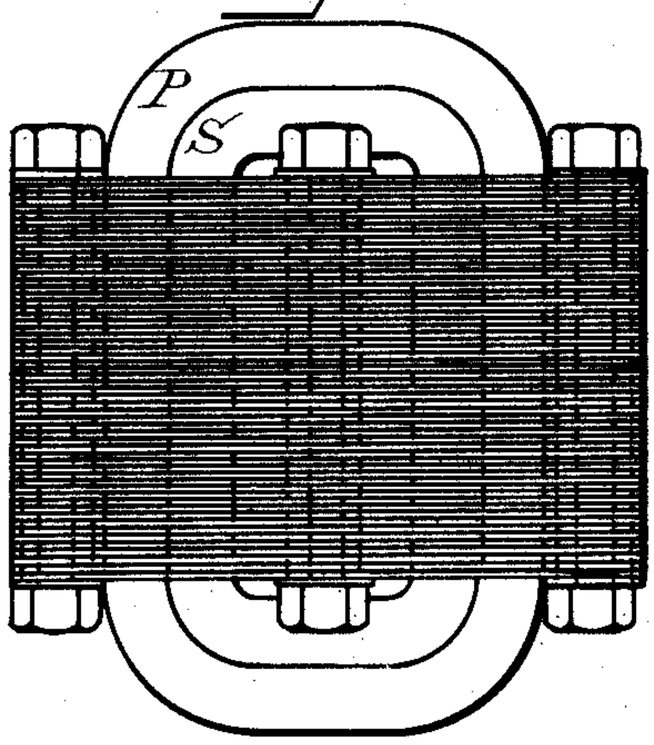


Fig 4.

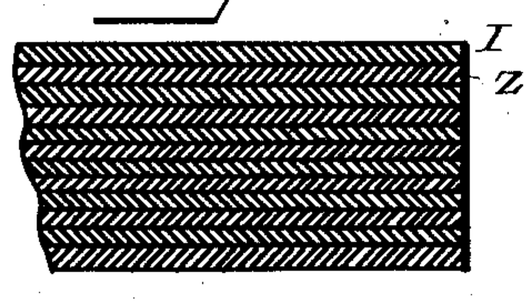
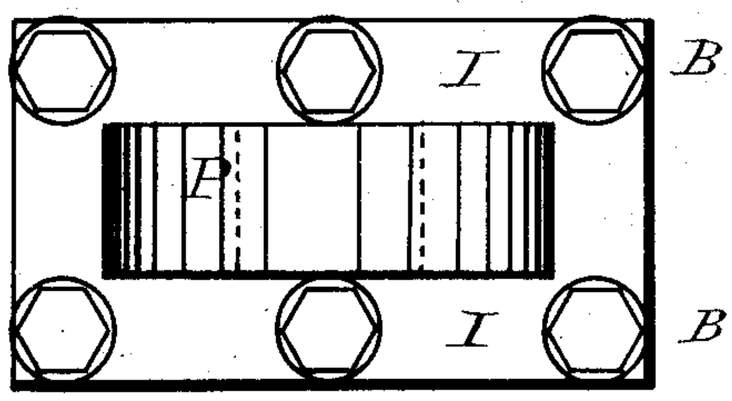


Fig 5.



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UNITED STATES PATENT OFFICE.

ELIHU THOMSON, OF LYNN, MASSACHUSETTS.

ELECTRIC TRANSFORMER.

SPECIFICATION forming part of Letters Patent No. 420,396, dated January 28, 1890.

Application filed October 9, 1889. Serial No. 326,493. (No model.)

To all whom it may concern:

Be it known that I, ELIHU THOMSON, a citizen of the United States, and a resident of Lynn, in the county of Essex and State of Massachusetts, have invented certain new and useful Transformers, of which the following is a specification.

My present invention relates to the construction of cores for transformers and induction-coil apparatus or similar apparatus, such as reactive coils, in which a magnetizable core is employed to set up inductions and self-inductions in windings, one or more applied to the work.

My invention consists, essentially, of a transformer or reactive coil whose magnetizable core consists of a number of sheets of iron having a thin coating of some insulating substance—as varnish—combined with sheets of zinc, tin, or other non-magnetizable metal interposed between the sheets of iron at any desired intervals, the sheets or plates of zinc or tin and iron being fastened or bound together as a permanently-solid core structure. In this structure the sheets of tin or zinc act as a magnetic separating material, which prevents the lateral diversion of magnetism from the sheets of iron to adjoining sheets, thereby effectually avoiding the losses due to the lateral spread of magnetism in the laminated iron core of the converter and confining the magnetism of each lamina to its own plane. The electrical insulation of the laminated structure of zinc and iron provided by the insulating coating on the iron effectually prevents the flow of Foucault or other currents in the core of the converter.

I am aware that it has been proposed to build up the core of an armature for a dynamo-machine from sheets of iron especially treated to give them a thin coating of zinc or tin. In such case, however, there can be no insulating coating on the iron sheets, as there may be in my invention. I am also aware that it has been proposed to use varnished sheets of iron placed in contact, and in some cases to interpose sheets of paper or other vegetable material, as a magnetic and electric insulator. The objection to this is the liability of the substance to deterioration and the consequent loss of solidity or rigidity of the core of the converter. In my invention the magnetic subdivision is obtained by solid metal plates of any desired thickness, and the electrical insulation by a thin adherent coating upon the iron sheets of the converter-core.

In the accompanying drawings, Figure 1 is a view of a transformer embodying my invention. Fig. 2 is a view of a section of the core. Figs. 3 and 4 are modifications thereof. Fig. 5 is another view illustrating the general form on end of the structure, Figs. 1 and 3.

In Fig. 1, P is a primary coil; S, the secondary, wound as usual for inductional purposes and passing through openings in the plates which compose the core, which plates are made of sheet-iron, preferably varnished or blackened, so as to have a coating of an electrical insulator, and bound together by insulated bolts running through the mass, as indicated in Fig. 1 at B B B B. The core mass between the bolts is made of a number of sheets of iron, as I, between which are interposed sheets of zinc or other metal of non-magnetic character, which is of sufficient thickness to substantially insulate magnetically the iron sheets between which it is interposed. This interposed sheet of non-magnetic metal is repeated as often as may be required, and may be placed between every fourth sheet of iron, as in Fig. 2, or other numbers, such as every second or third sheet, and be of zinc or other non-magnetic metal.

In other cases every alternate sheet, as in Figs. 3 and 4, may be composed of a magnetic insulating substance or non-magnetic separator of metal. In cases where thin paper has been applied as insulation between the sheets the main object has been to cut off the possibility of electric contacts between the sheets, which would result in Foucault currents passing from sheet to sheet, and thin paper or varnish has been used. I find that the losses mentioned are not the only losses involved, as there are, besides those due to circuits set up from sheet to sheet, Foucault currents set up by lateral diversion of magnetism from one sheet to adjoining sheets, owing to the fact that the iron surfaces are too near together or at irregular distances apart, and this must necessarily be the case where the separating material is of a soft yielding nature subject to shrinkage and swelling by moisture. By the use of a metal-

like zinc interposed between the iron sheets, which are simply blackened or scaled or slightly varnished, I obtain a core which is rid of both sources of loss—*i. e.*, the Foucault currents or local currents set up from sheet to sheet by electric contacts existing—and also those currents set up in the plane of the sheet by lateral diversion of magnetism between adjoining sheets, at the same time that I secure a rigid solid non-shrinkable mechanical structure not subject to deterioration by heat, &c. The non-magnetic separating metal is the zinc in solid metal sheets or plates, which should be of sufficient thickness to give a thorough separation magnetically between the iron, and should be repeated at sufficiently frequent intervals in the core to substantially divide the core into magnetic planes, distinct and separate one from the other. Each sheet of zinc, therefore, should best preserve its integrity all through the core and be substantially one sheet, even when made up of a number of pieces laid in the same plane.

The electrical insulation may be any thin adherent layer of a substance that is an insulator of electricity.

What I claim as my invention is—

A transformer or reactive coil for circuits carrying alternating or otherwise varying current, having a core consisting of a laminated structure made up from sheet-iron plates coated with an electric insulator, and plates of zinc or other non-magnetic metal interposed at any desired intervals, all being bound together as a solid core structure, as and for the purpose described.

Signed at Lynn, in the county of Essex and State of Massachusetts, this 4th day of October, A. D. 1889.

ELIHU THOMSON.

Witnesses:
F. HERMANN LEMP,
J. WESLEY GIBBONEY.