Aug. 25, 1925. 1,551,365

L. H. BURNHAM

TRANSFORMER

Filed Oct. 6, 1924

Fig. 1.

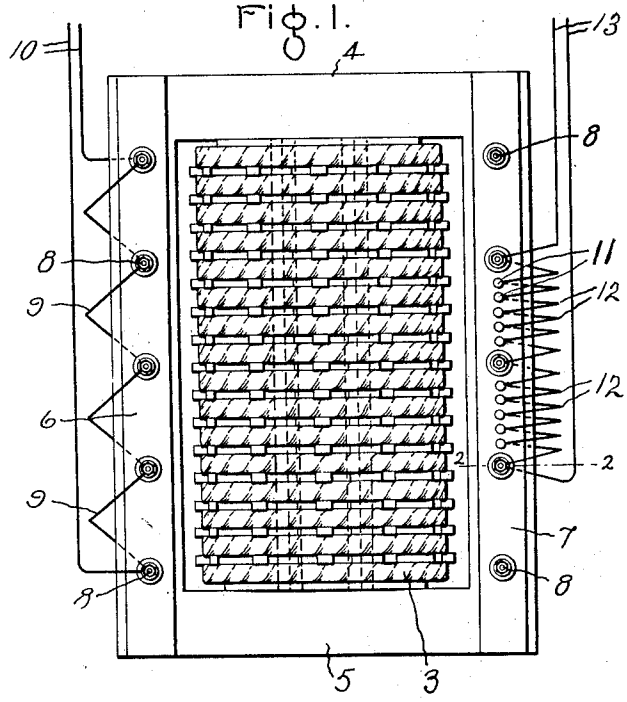
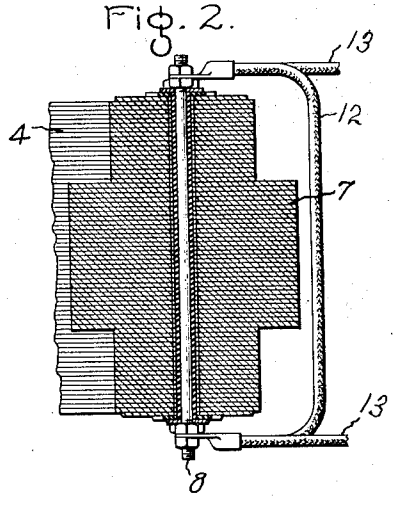


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TRANSFORMER.

Application filed October 6, 1924. Serial No. 741,819.

To all whom it may concern:

Be it known that I, LOCKE H. BURNHAM, a citizen of the United States, residing at Pittsfield, in the county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Transformers, of which the following is a specification.

My invention relates to transformers and its general object is to provide a transformer with an improved auxiliary winding to furnish small amounts of current for such accessories as lighting and signal circuits and small motors for operating transformer cooling systems, oil purifying devices, switches and the like. For such purposes, the voltages of both the primary and secondary windings of many transformers are too high and an auxiliary winding of the proper voltage is therefore useful and desirable.

The magnetic cores of all well designed transformers are built up of thin sheets of laminæ of iron or steel secured together by bolts, the bolts being insulated to avoid short circuiting the laminæ. These bolts are in the path of the core flux which induces in them an electromotive force so that a current will flow in them if they are connected in a closed circuit. By taking advantage of this fact, a convenient source of current for small accessory apparatus is obtained which is entirely separated from the main windings and which therefore need be insulated only for its own voltage.

In some cases, an auxiliary source of current may be desirable having a voltage greater than that obtainable from the core bolts alone. The core bolts divide the magnetic flux into separate paths and shield the thin sections of the core which lie immediately between the bolts from the flux so that these thin core sections may be removed or openings made in them without affecting the flux. A sufficient number of insulated conductors are therefore passed through openings in the shielded core sections and connected in series to provide auxiliary current at the desired potential.

The invention and its advantages will be more clearly understood from the following description taken in connection with the accompanying drawing in which Fig. 1 shows a transformer with two auxiliary sources of current arranged in accordance with the invention and Fig. 2 shows a cross section on the line 2—2 of Fig. 1.

Similar reference characters indicate like parts in both figures of the drawing.

The invention will be described in connection with a single phase transformer of the shell type such as shown in Fig. 1 of the drawing although it will be obvious that it may be applied to any transformer in which the core laminæ are secured together by bolts which are not concealed and rendered inaccessible by the windings. The core of the shell type transformer shown in Fig. 1 of the drawing has a central winding leg surrounded by the windings 3 and connected by yokes 4 and 5 to two outside legs 6 and 7. The core is built up of magnetic laminæ secured together by insulated core bolts 8 in the usual manner as indicated in Fig. 2.

Advantage is taken of the presence of the insulated core bolts 8 to provide a simple and convenient auxiliary source of current. If the desired auxiliary voltage is not greater than the sum of the voltages induced in the several available core bolts, as many of these bolts as may be necessary for the purpose are connected in series by conductors 9 passing around the adjacent outer edge of the core as indicated at the left side of Fig. 1. Current may be supplied from the bolts 8 and conductors 9 through two leads 10 connected to the two end bolts of the series.

The core bolts 8 and conductors 9 constitute a winding comprising turns which surround that part of the core flux which flows between the core bolts and the outer edge of the core leg 6 and that part of the flux is therefore effective in inducing current available at the terminals of the leads 10. The flux flowing between the core bolts and the inner edge of the core leg 6 is not surrounded by the core bolts 8 and the conductors 9 and therefore cannot induce any current in them. While current is being taken from the leads 10, there is a tendency for the flux which is surrounded by the core bolts 8 and conductors 9 to be forced from its normal path between the core bolts and the outer edge of the core leg 6 into other paths such as that

between the core bolts and the inner edge of the core leg 6 but this effect will be negligibly small where the capacity of the auxiliary source of current is small as compared with that of the main windings.

If an auxiliary voltage greater than that obtainable from the core bolts alone is desired, advantage may be taken of the presence of the core bolts due to the fact that thin sections of the core which are immediately between the bolts are shielded from the magnetic core flux. Openings through these shielded portions of the core accommodate conductors 11 which are connected in series by conductors 12 passing around the adjacent outer edge of the core as indicated at the right side of Fig. 1. If desired, the core bolts 8 between which the conductors 11 are located may be connected in series with these conductors 11, as shown. A winding is thus formed by the conductors 11 and 12 and such core bolts 8 as may be used, this winding surrounding that part of the core flux which flows between the conductors 11 and the outer edge of the core leg 7 and that part of the flux is therefore effective in inducing current available at the terminals of the leads 13 which are connected to the two ends of the winding.

The invention provides an auxiliary transformer winding which is useful for supplying small amounts of current at low potential. Such a winding is very simple and may be provided very easily and cheaply. Its parts are well separated from the main windings of the transformer so that insulation need be provided only for the low auxiliary voltage. The reactance of such a winding is considerable so that the winding is well protected against the possibility of excessive current.

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

1. A transformer including a laminated magnetic core, and insulated bolts extending through the laminations of the core and securing them together, said insulated bolts being conductively connected together to form an auxiliary source of current.

2. A transformer including a laminated magnetic core, and insulated bolts extending through the laminations of the core and securing them together, said insulated bolts being conductively connected in series to form an auxiliary source of current.

3. A transformer including a laminated magnetic core, insulated bolts extending through the laminations of the core and securing them together, whereby sections of the core between said core bolts are shielded from the magnetic core flux, and insulated conductors within said shielded core sections, said insulated bolts and conductors being conductively connected together to form an auxiliary source of current.

4. A transformer including a laminated magnetic core, bolts extending through the laminations of the core and securing them together, whereby sections of the core between said core bolts are shielded from the magnetic core flux, and insulated conductors within said shielded core sections, said insulated conductors being conductively connected together to form an auxiliary source of current.

In witness whereof, I have hereunto set my hand this 3rd day of October, 1924.

LOCKE H. BURNHAM.