June 21, 1949. E. H. FREEMAN 2,473,746

TRANSFORMER

Filed June 24, 1946

FIG. 1

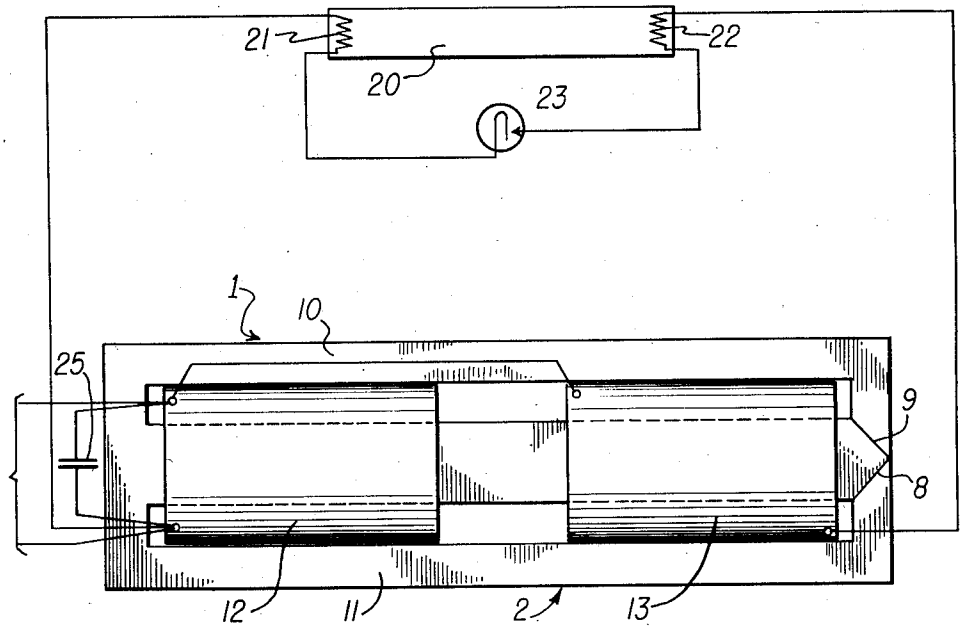
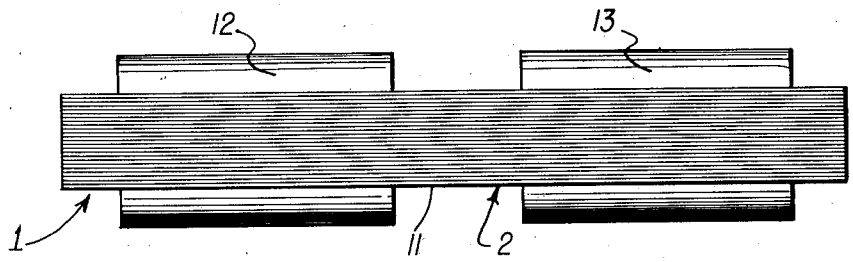



FIG. 2




Inventor
Ernest H. Freeman
By Morris Spector,
Attorneys

Patented June 21, 1949 2,473,746

# UNITED STATES PATENT OFFICE

2,473,746

## TRANSFORMER

Ernest H. Freeman, Wilmette, Ill., assignor to Hirsch Epstein and Louis R. Duman, Chicago, Ill.

Application June 24, 1946, Serial No. 678,785

1 Claim. (Cl. 171—119)

1

This invention relates to electric transformers that are to be used in connection with glow discharge tubes such as, for instance, fluorescent lighting tubes or the like.

It is one of the objects of the present invention to provide an efficient and economical transformer which is particularly adapted for supplying the necessary voltage and power for operating a single glow discharge tube such as, for instance, a fluorescent lighting tube. It is a further object of the present invention to provide a transformer for the above mentioned purposes having a pair of windings which are, preferably, identical and which are connected together in step-up auto transformer relationship with one of the coils constituting the primary and that same coil together with the other coil constituting the output or secondary. In accordance with the principles of the present invention the two coils are in suitably spaced relationship so as to provide a loose coupling between them. The coils are on a magnetic core which is so constructed that a central leg of the core passes through both coils and the core provides a magnetic path which includes the central core leg and core parts which extend in opposite directions from the central leg and substantially embrace the sides of the coil opposite to the center thereof in both directions.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawing forming a part thereof.

In the drawing:

Figure 1 is a plan view of a transformer embodying the present invention, with circuit connections; and

Figure 2 is a side view of the transformer of Figure 1.

The transformer of the present invention is indicated in general by the reference numeral 1 and consists of an elongated rectangular core 2 built up of laminations 3. Each lamination is of a construction such as is illustrated more fully in my pending application, Serial No. 669,228, filed May 13, 1946, to which reference may be had. Each lamination is in the form of an elongated rectangular sheet of transformer iron which is stamped to form two longitudinally extending slots leaving a central core portion or finger 5 between the slots. Each lamination is stamped to provide very narrow slits 8 and 9 at only one side of the rectangular lamination. The finger 5 can

2

therefore be flexed out of the plane of the rest of the sheet for insertion into the prewound coils. The successive laminations are assembled from opposite sides of the coils so that the slits 8—9 of superposed laminations are on opposite sides of the core. The opposite longitudinal sides 10 and 11 of each lamination are of the same width and approximately half as wide as the width of the central core portion 5. The longitudinal slot in each lamination between the central core 5 and either of the longitudinal sides 10—11 is of a width approximately equal to the width of each side 10 or 11.

The transformer core has two separate spaced apart preformed coils 12 and 13 thereon with the fingers 7 of the assembled stack of laminations assembled through the coils. The two coils are of identical construction. The coil 12 constitutes a primary winding. The coil 13 is connected in step-up auto transformer relationship to the coil 12 so that the coil 13 together with the primary coil 12 constitutes the output side of the transformer.

In one preferred construction, which was adequate for supplying current to a 40 watt fluorescent lamp, the coils 12—13 were each 1350 turns. They were each 2⅛ inches long and were spaced one inch from one another. This provides a loose coupling between the two coils and gives the necessary leakage reactance. Each of the coils 12 and 13 is of a thickness to fit snugly between the longitudinal sides 10—11 of the transformer. In that transformer the center core was ⅝ inch wide and each of the longitudinal sides 10—11 and also each end of each lamination was approximately $\frac{5}{16}$ inch wide. The stack of laminations constituting the core was approximately ¾ of an inch thick. The above dimensions are stated because it was found that this arrangement gave the most economical use of the copper and iron of the transformer.

The transformer of Figure 1 is adapted to be connected across commercial 120 volt 60 cycle alternating current power line and supplies power to a single fluorescent type glow discharge lamp 20 which has two heating filaments 21—22 that are interconnected by a usual starter switch 23 which is normally closed and which automatically opens after current has been flowing therethrough for a number of seconds sufficient to heat the filaments 21—22. Once those filaments have been heated and the starter switch opened an arc forms between the cathodes of the tube.

A condenser **25** is, optionally, provided for improving the power factor of the load.

In compliance with the requirements of the patent statutes I have here shown and described a preferred embodiment of my invention. It is, however, to be understood that the invention is not limited to the precise construction here shown, the same being merely illustrative of the principles of the invention. What I consider new and desire to secure by Letters Patent is:

A transformer for a discharge tube load comprising a single primary winding and a single secondary winding spaced from the primary and electrically connected thereto in step-up auto transformer relationship, a magnetic core for said windings, said core comprising a stack of elongated rectangular flexible laminations, each lamination having longitudinal and transverse sides and a central longitudinally extending leg integral with only one of the transverse sides of the lamination and separate from the other transverse side of the lamination and located



between and parallel to the longitudinal sides of the lamination and extending through both of said windings whereby the windings are embraced by the core on opposite sides of the longitudinal center of the core, the longitudinal sides of each lamination and the central leg thereof being free of projections between the windings thereby permitting sliding of the central leg through the windings to assemble the core through the windings.

ERNEST H. FREEMAN.


## REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 457,407 | Spencer | Aug. 11, 1891 |
| 2,370,633 | Boucher | Mar. 6, 1945 |
| 2,370,635 | Bridges | Mar. 6, 1945 |
| 2,391,873 | Boucher | Jan. 1, 1946 |