Oct. 25, 1949. L. MAUERER 2,486,307

BALLAST REACTOR TRANSFORMER

Original Filed Aug. 28, 1942

Fig. 3.

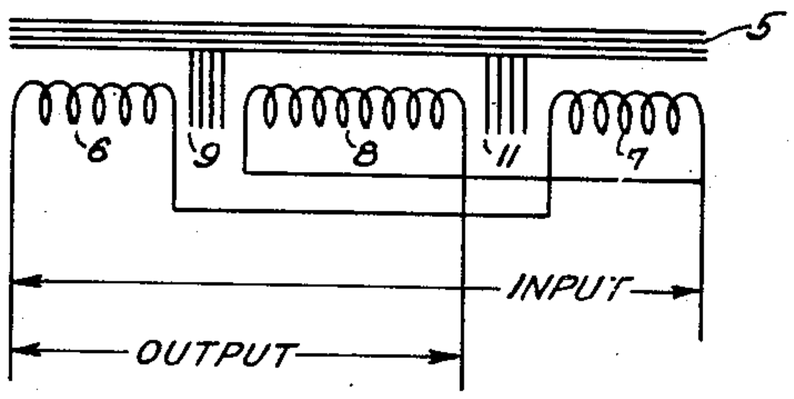
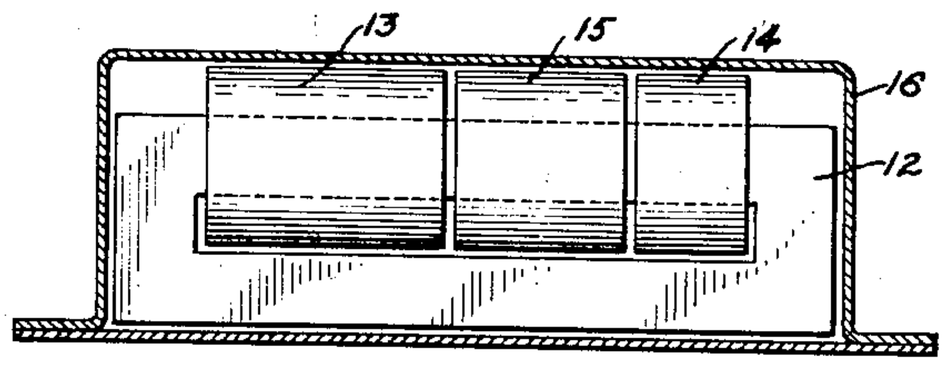


Fig. 1.



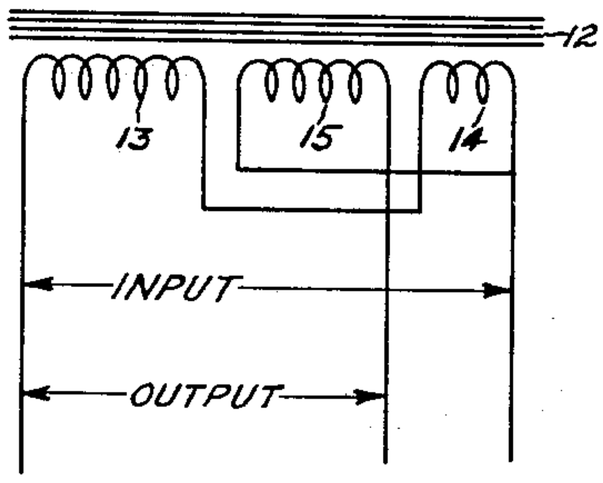


Fig. 2.

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BALLAST REACTOR TRANSFORMER

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Continuation of application Serial No. 456,521, August 28, 1942. This application June 27, 1947, Serial No. 757,568

3 Claims. (Cl. 171—119)

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My invention relates to fluorescent lamp ballasts and more particularly to high reactance auto transformers which are utilized as ballasts in fluorescent lamp circuits.

This application is a continuation of my application Serial No. 456,521, filed August 28, 1942, and now abandoned.

For the proper operation of fluorescent lamps from alternating current sources, it is necessary to use a suitable reactor, and where the power supply voltage is not the same as required for firing such lamps, an auto transformer is usually used to supply this voltage in connection with this reactor. Such a combination is often simplified by building an auto transformer which has the necessary leakage reactance. Since such transformers generally have been incorporated in the lighting fixture or are arranged to be attached to such a lighting fixture which is relatively long and narrow, the transformer is limited by physical dimensions which make the design of such transformers somewhat different than other transformer structures. When fluorescent lamps were first introduced, the ballast transformer arrangements were such that a relatively high starting current was permitted. Subsequent developments, however, have shown the need and desirability for reducing this starting current. High reactance auto transformer ballasts of the long narrow type were satisfactory in the conventional construction when the high starting current was permissible, since the reactance characteristic was one in which the reactance would drop to a very great extent from normal operating current to short circuit current due to saturation of the case which provided a considerable amount of the total leakage path. It was, however, necessary to closely couple part of the secondary winding to the primary winding because without this expedient the leakage would be so great as to not permit sufficient power output to the lamp. In order to obtain both a lower starting current and sufficient power output, it is proposed in accordance with the present invention to provide a leakage path which does not saturate readily.

It is, therefore, an object of my invention to provide a high reactance transformer for fluorescent lamps which will have a suitable reactance so as to limit the starting current to a relatively low value.

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Another object of my invention is to provide a high reactance transformer for fluorescent lamps which will have a limited low value starting current and yet supply sufficient power output for running operation.

Still another object of my invention is to provide a high reactance auto transformer arrangement for use in fluorescent lamp circuits which is arranged so as to reduce the high flux density heretofore found in the surrounding transformer case.

Other and further objects of my invention will be more readily understood by reference to the following description taken in connection with the accompanying drawing wherein

Fig. 1 is a cross section through a transformer made in accordance with a preferred embodiment of my invention;

Fig. 2 is a circuit diagram of the transformer shown in Fig. 1; and

Fig. 3 is a circuit diagram of a transformer similar to that shown in Figs. 1 and 2, but showing the use of magnetic shunts in addition to the leakage effect provided by the casing.

Referring more particularly to the figures, it will be remembered that the physical dimensions of ballast reactor transformers used in conjunction with fluorescent lamps require a relatively long narrow core structure 5 to fit within the lamp fixture or transformer case. In accordance with my invention the primary winding may be composed of two equal primary coils 6 and 7 disposed at opposite ends of a secondary coil 8 as shown in Fig. 3. The primary coils 6 and 7 are physically separated from the secondary coil 8 by magnetic shunts 9 and 11. The core 5 together with the coils 6, 7, 8, and the magnetic shunts 9 and 11 are mounted in a case of fluorescent lamp fixture. The primary coils 6 and 7 are connected in series to form a primary winding and this has been indicated by the legend "input" in the drawing. The secondary coil 8 is connected in series with the primary coil 6 and 7 to form a secondary winding indicated in the drawing by the legend "output," and hence it will be seen that this transformer arrangement is of the auto transformer type. The magnetic shunts 9 and 11 between

the primary and secondary coils restore the leakage lost by utilizing such coil arrangement and the resulting leakage path provides a more uniform flux path through out the current range of operation, thus producing a lower starting current. Such an arrangement therefore obviates the undesirable effects encountered in previous conventional construction where the principal leakage flux is concentrated through one portion of the case which soon saturates, thus permitting relatively high short circuit or starting current values.

Referring more particularly to Figs. 1 and 2 of the drawing, there is illustrated an embodiment of my invention which also obviates the conditions arising heretofore by the leakage flux readily saturating the surrounding case. In this embodiment a magnetic core **12** is provided with two primary coils **13** and **14** which are equal or unequal in number of turns, dependent upon the particular conditions encountered, and with a secondary coil **15**. The primary coils **13** and **14** are positioned adjacent the ends of the secondary coil **15** preferably so that the primary coils are spaced from the secondary coil. Because of the proximity of the case **16** to the coils, it will be readily seen that two leakage paths are provided between the primary coils and the secondary coil, thus distributing the leakage flux sufficiently to reduce the possibility of saturation of the case. Since in this arrangement a case provides a substantial part of the path for the leakage flux, it may be desirable to use a special alloy steel for the case or to laminate the case structure. The primary coils **13** and **14** are connected in series to form a primary winding. The secondary coil **15** is connected in series with the primary coils to form a secondary winding, and hence this arrangement also is of the auto transformer type.

Therefore, in accordance with the present invention, there has been provided a transformer arrangement of the auto transformer type which supplies a relatively low starting current, yet supplies sufficient power to the lamp.

While, for the purpose of illustrating and describing my invention, certain specific embodiments have been shown, it, of course, will be appreciated that modifications may be made therein without departing from the spirit and scope of my invention as set forth in the appended claims.

I claim:

1. A ballast reactor transformer comprising a relatively narrow elongated case formed of magnetic material and supporting therein a core structure, a secondary coil and two primary coils, said primary coils being spaced from the ends of said secondary coil and all of said coils being spaced closely adjacent a wall of said case, thereby to provide a plurality of parallel leakage paths through said case, said primary coils being connected in series to form a primary winding, and said secondary coil being connected in series with said primary coils to form a secondary winding.

2. A transformer for fluorescent lamps comprising a relatively narrow, elongated case formed of magnetic material and having therein a core structure, a secondary coil, a primary coil having a certain number of turns, a second primary coil having a different number of turns, said secondary coil being supported in spaced relation between said primary coils, said case having a portion spaced closely adjacent said coils and forming substantial and parallel leakage paths between said coils, said primary coils being connected to form a primary winding, and said secondary coil being connected in series with said primary winding to form a secondary winding.

3. A high reactance transformer for fluorescent lamps comprising a narrow elongated case formed of magnetic material and having therein a core structure supporting thereon a secondary coil at the center and a pair of primary coils separated from said secondary coil by magnetic shunt core portions to provide parallel flux leakage paths of low reluctance, said case being in close proximity to said coils thereby augmenting the effect of said magnetic shunt portions of said core, said primary coils being connected in series to form a primary winding, and said secondary coil being connected in series with both said primary coils to form a secondary winding.

LEOPOLD MAUERER.

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