July 11, 1944. T. T. SHORT 2,353,511

ELECTRIC APPARATUS

Filed Feb. 10, 1943

Fig. 1.

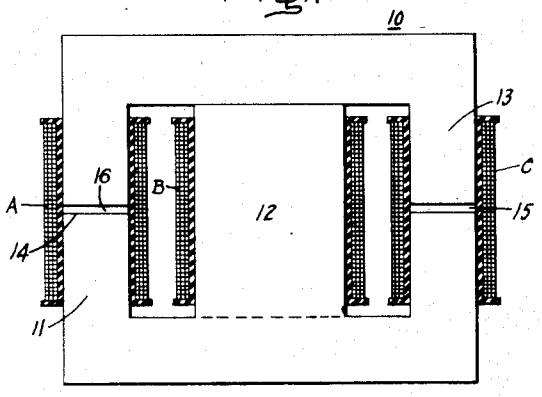


Fig. 2.

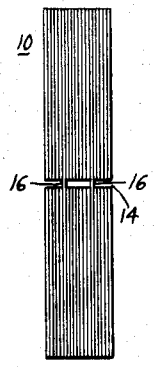


Fig. 3.

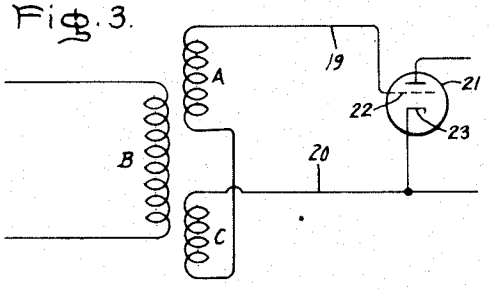
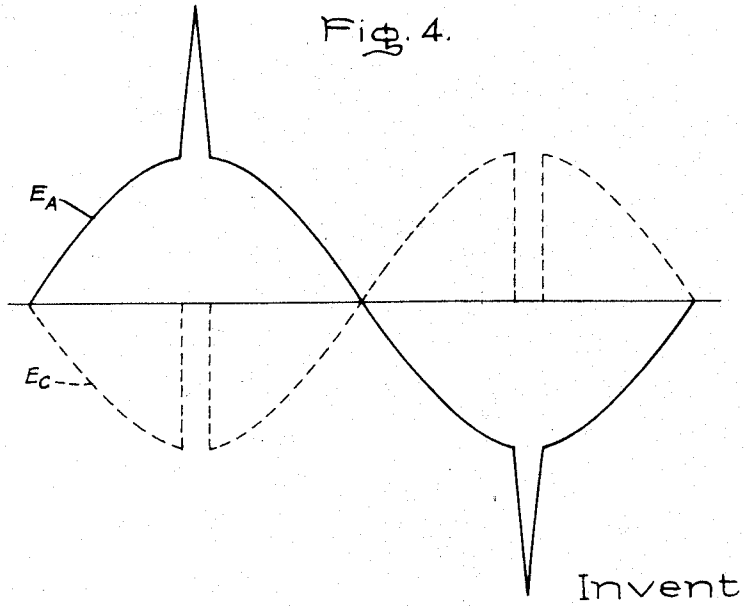


Fig. 4.



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2,353,511

ELECTRIC APPARATUS

Thomas T. Short, Fort Wayne, Ind., assignor to General Electric Company, a corporation of New York

Application February 10, 1943, Serial No. 475,419

3 Claims. (Cl. 175—356)

My invention relates to an electric apparatus and to a peaking transformer which may be employed in circuits with electric discharge devices.

Heretofore it has been customary to connect electric discharge devices with transformers which will produce a sufficiently high voltage for a relatively short time to break down or ionize the space between the electrodes in the electric discharge device or control the grids. These devices have usually included a secondary winding separated from a primary winding by a magnetic shunt which by-passes most of the magnetic flux from the primary winding. This makes it necessary to have a large air gap in the secondary core leg to prevent inducing excessive voltage of fundamental frequency. This in turn increases the length of the saturation laminations thereby making it more difficult to effect a complete and rapid saturation for a narrow peaked output voltage.

An object of my invention is to provide an improved peaking transformer which will be simple in construction and efficient in operation.

A further object of my invention is to provide an improved electric apparatus in which a relatively high voltage will be obtained for a relatively short portion of a cycle.

Further objects and advantages of my invention will become apparent from the following description referring to the accompanying drawing, and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In the drawing, Fig. 1 is a sectional side elevation of a transformer which is provided with an embodiment of my invention; Fig. 2 is an end view of one of the legs of the construction of Fig. 2; Fig. 3 diagrammatically illustrates the connection of the coils illustrated in Fig. 1, and Fig. 4 diagrammatically illustrates the voltages induced in coils and will be employed in the description of my invention.

In the construction illustrated in Fig. 1 an electric induction apparatus is provided including a core 10 having winding legs 11, 12 and 13. A primary winding B is placed around the center winding leg 12 and secondary windings A and C are placed around the winding legs 11 and 13, respectively. As is illustrated in Fig. 3 the secondary windings A and C are connected in series opposition across any suitable load, such as an electric discharge device. The winding legs A and C have air gaps 14 and 15, respectively, the air gap 14 in leg 11 being suitably bridged by one or more thin laminations of magnetic material 16.

The operation of the structure is as follows: When a voltage is impressed across the primary winding B the flux will begin to build up, and all of the flux will pass through the leg 11 through the laminations 16 until the laminations saturate. After the laminations saturate the gaps 14 and 15 will have substantially similar magnetic characteristics so that the flux will divide substantially equally through the legs 11 and 13, thus inducing similar voltages across the coils A and B during this condition. Since the coils A and B are connected in series opposition there will be no resultant voltage across the conductors 19 and 20 during the time the laminations 16 are saturated. The conductors 19 and 20 may be connected to any suitable load and in Fig. 3 there is shown an electron tube 21 with a grid 22 and cathode 23 connected to the leads 19 and 20, respectively. Thus, the grid is controlled by a narrow voltage wave each half cycle.

However, in order to produce a maximum voltage across the leads 19 and 20 the air gap 14 in the leg A is designed to carry substantially all the flux during a very small interval of time. Thus, this condition is obtained by employing suitable laminations which will remain unsaturated only during a suitable period of time when the flux is a relatively low value or when it is passing through zero. Since the laminations are unsaturated when the flux is passing through zero all of the voltage will be induced in the winding A instead of the winding B at a time when a maximum rate of change of flux obtains in the winding leg 11 and coil C. Thus, a relatively peak voltage will obtain during the relatively short portion of the cycle when the laminations are unsaturated.

As is shown in Fig. 4, the voltage in the coil C is plotted as E_C and the voltage in the coil A is plotted as E_A and it will be seen that during a relatively large portion of the cycle the voltage in coils C and A are equal and in substantial opposition so that no resultant voltage will obtain across the leads 19 and 20. However, during that relatively small portion of the cycle when the flux is passing through zero, the laminations 16 will be substantially unsaturated and not only will substantially all the flux pass through the leg 11 so that substantially no voltage will be induced in C, but a relatively high voltage will be induced in the coil A at that time. The peak voltage induced is approximately in the ratio of the turn ratio between the primary and secondary winding A.

By so designing the air gap, the time in which a peak voltage will obtain in comparison with the total cycle may be made any suitable amount, and in the construction illustrated in the drawing the peak voltage obtains for about 1 degree or about 1/180 of the total half cycle and these narrow peak waves, it has been found, are obtained with laminations of ordinary silicon steels instead of high permeability materials.

Although I have shown and described particular embodiments of my invention, I do not desire to be limited to the particular embodiments described, and I intend in the appended claims to cover all modifications which do not depart from the spirit and scope of my invention.

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

1. An electric apparatus including a core member having three winding legs, a primary winding adapted to be connected to an alternating current source of supply around a first leg and a pair of secondary windings around the second and third legs respectively, said secondary windings being adapted to be connected in series opposition across a load, and means in one of the secondary winding legs for conducting substantially all the flux emanating from the center leg through said one leg during a relatively short portion of the cycle when the flux wave is approaching a relatively low value so as to provide a peak voltage induced in said coil during that time.

2. An electric apparatus including a core member having three winding legs, a primary winding adapted to be connected to a variable current source of supply around a first leg and a pair of secondary windings around the second and third legs respectively, gaps in the said legs having said secondary windings. and magnetic means bridging said gap in one of said legs for conducting substantially all the flux emanating from the center leg through said one leg during a relatively short portion of a half cycle when the magnetic means is substantially unsaturated so as to provide a peak voltage induced in said coil during that time.

3. An electric apparatus including a core member having three winding legs, a primary winding around a first leg and a pair of secondary windings around the second and third legs respectively, gaps in the said legs having said secondary windings, and magnetic means bridging said gap in one of said legs for conducting substantially all the flux emanating from the center leg through said one leg during a relatively short portion of a half cycle when the magnetic means is substantially unsaturated so as to provide a peaked voltage induced in said coil during that time, said magnetic means being saturated for the remainder of the flux half cycle.

THOMAS T. SHORT.