Dec. 12, 1939. L. MAUERER 2,183,355

TRANSFORMER CONSTRUCTION

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Fig. 1.

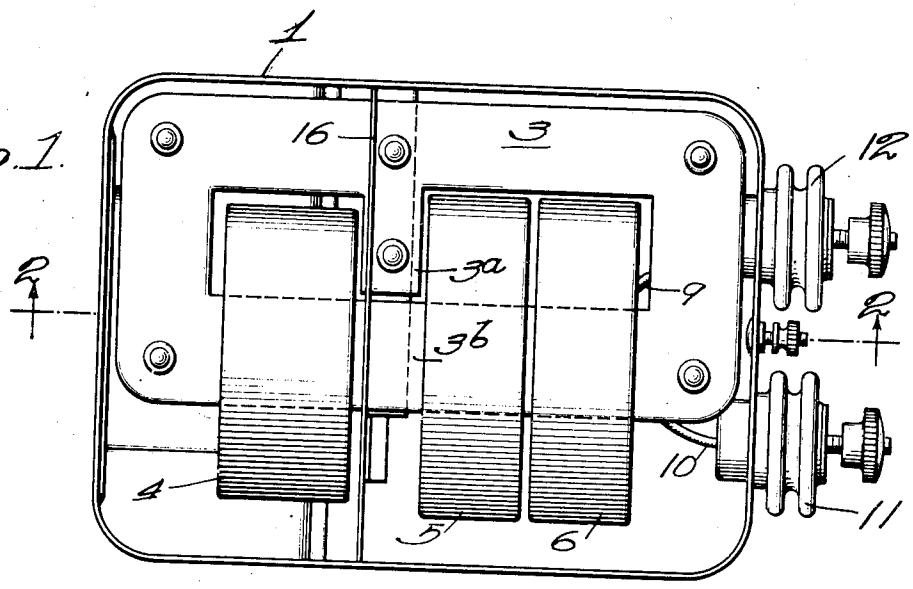


Fig. 2.

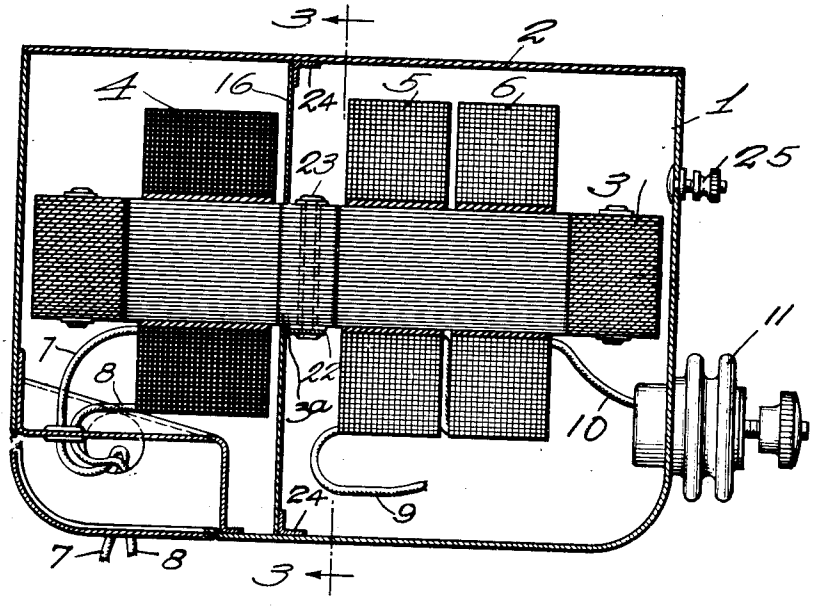
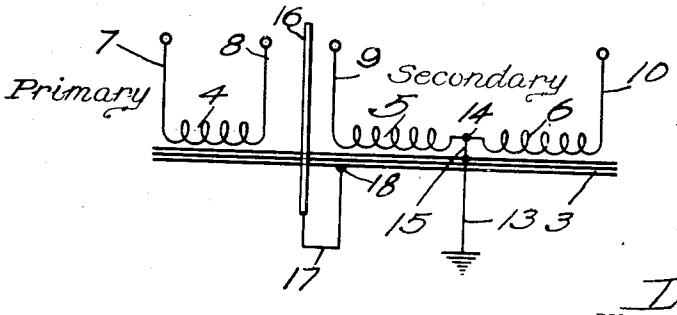


Fig. 7.



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Fig. 3.

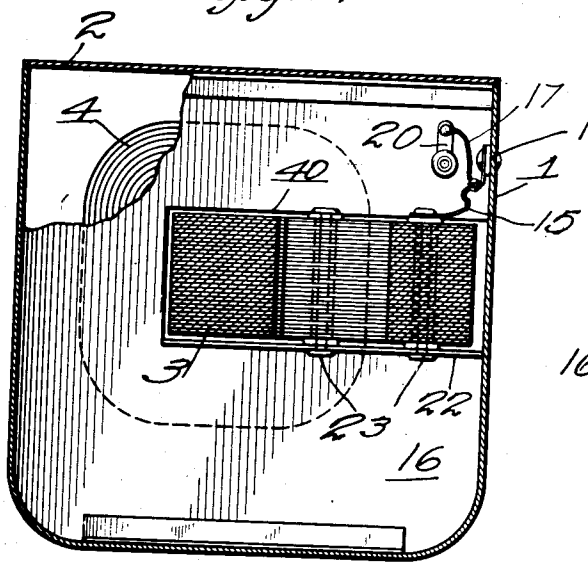


Fig. 4.

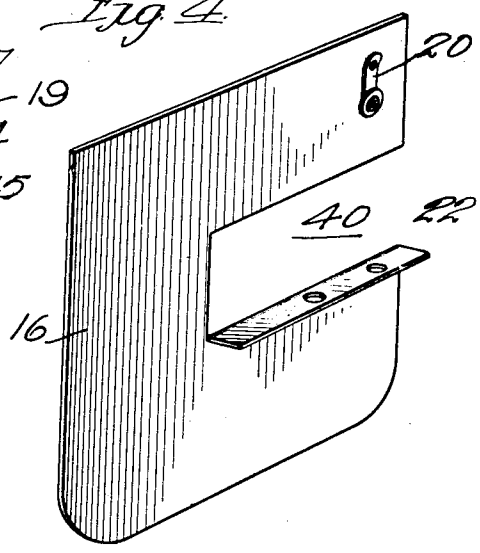
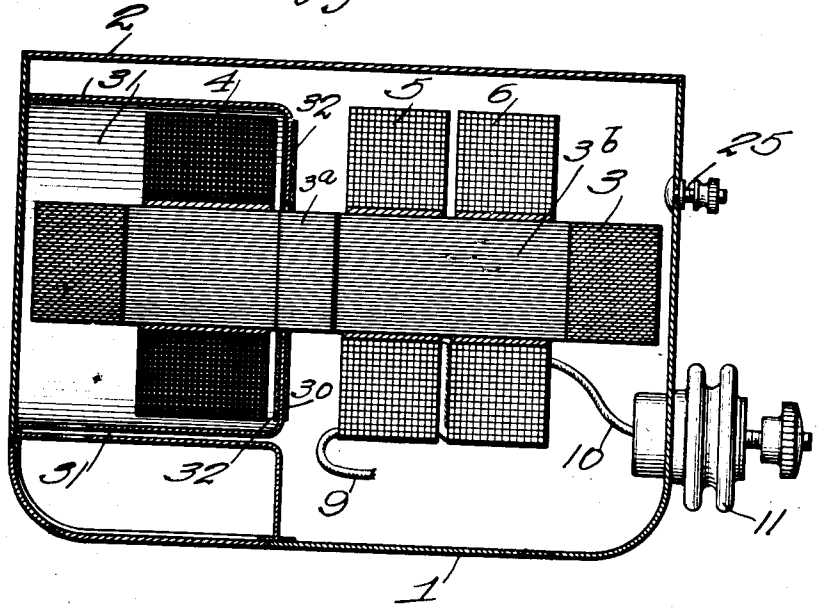


Fig. 5.



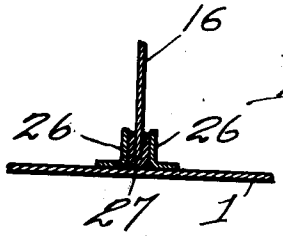


Fig. 6.

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TRANSFORMER CONSTRUCTION

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Application August 22, 1938, Serial No. 226,064

12 Claims. (Cl. 171—119)

An ignition transformer, such as is here depicted for purposes of illustration, being of the high reactance type, will cause disturbances in the feed lines to the primary winding and will reflect back quite some distance, because of high frequencies generated in the secondary circuit. These disturbances are initiated in several ways. It is to be understood that the action of an ignition device will cause a series of violent arcs or sparks at the terminals of the secondary winding, these terminals being the electrodes for igniting the fuel to be burned. The energy radiated at the terminals or spark-gap may be likened to a miniature broadcasting station.

Another source of disturbance is caused by the spark occurring in the presence of the flame-supporting or primary air which travels at a high velocity, this causing an extremely high oscillatory current which is induced by electrostatic action back into the primary winding, thence to the power lines.

To minimize this objectionable action it has been found desirable to build a transformer with both electrodes insulated from each other and from the ground; this type is commercially known as the double insulated transformer, in contradistinction to the grounded type, wherein only one electrode is insulated and the other is grounded. Such an insulated type is shown in the drawings and is here contemplated.

Unless provision be made to the contrary the high frequencies so generated will travel along the house wiring circuit and will interfere with the use and operation of delicate electrical devices, such for instance, as radio receiving sets and would cause very serious and objectionable noises which would be further amplified through the audio circuit and resound in the loud speaker, thus seriously interfering with radio reception.

The high frequency energy conducted through the primary and into the house wiring circuit as above referred to may be characterized differently, for instance electro-magnetic and capacitive. The electromagnetic coupling between the primary and secondary winding so far as the high frequencies are concerned, will be transmitted only through air, since the material of the metal core will not transmit these frequencies due to eddy current losses. By introducing between the primary and secondary windings a barrier or shield of proper material and of suitable thickness both of these coupling effects can be greatly reduced. The material of a shield or barrier for this purpose should be of high electrical conductivity, and diamagnetic though a barrier of iron or steel will in some instances give good results.

This shield acts in two ways, first, as an eddy-current shield suppressing the high frequency magnetic field existing in and surrounding the secondary coil. Second, when properly grounded as here contemplated, it will conduct the high frequency voltage impulses to earth-ground.

As here illustrated the total structure is to be enclosed in an iron box or casing and the shield or barrier be tightly fitted within the box and in contact therewith, and in close proximity with the core of the transformer, eliminating as much as possible all leaks or chances of communication between the compartments resulting from the placement of the shield. Special means as here provided are highly desirable to uninterruptedly and positively connect the shield with the grounding means.

While the magnetic coupling is responsible for the transmission of the greater part of the high frequency disturbances, the capacitive coupling must be prevented to whatever extent possible and to this end the shield or barrier is arranged to have its edges sealed as effectively as possible to the casing as above referred to.

Better understanding of the invention will be had from the following if read together with the accompanying drawings in which:

Fig. 1 is a plan view of an embodiment of the device with the cover member removed.

Fig. 2 is a section taken at the line 2—2 of Fig. 1.

Fig. 3 is a section taken at the line 3—3 of Fig. 2.

Fig. 4 is a perspective view of the shield or barrier member.

Fig. 5 is a view similar to Fig. 2 of a modified structure.

Fig. 6 is a detail section showing in modified form, a manner of associating the shield member and the case.

Fig. 7 is a diagrammatic showing of the windings, indicating the relative position thereof with the shield and illustrating a manner of grounding the various elements through to a common point.

The drawings illustrate a transformer having a casing 1 with cover 2. This casing contains the transformer core 3 having a winding leg 3b, a primary winding 4 and secondary windings indicated at 5 and 6. Supply wires 7 and 8 are provided to conduct current to the primary coil 4, the energization of which will, in a well understood manner, induce a current flow in the sec-

ondary windings 5 and 6 which windings will in this case supply a higher voltage through the leads 9 and 10. These leads are threaded through bushings 11 and 12 and supply current to the electrodes of the ignition device (not shown).

A ground connection 13 is indicated as connected to the middle point 14 of the secondary windings 5 and 6 through a short lead 15 which short lead is connected to the core 3 (see Figs. 3 and 7).

A shield or barrier 16 is interposed between the primary winding 4 and one of the secondary windings 5, the shield being preferably located adjacent the primary winding 4 and forming a chamber therefor excluding as much of the shunt 3a from the chamber formed therefrom as possible. This shield 16 is shown in the diagrammatic Fig. 7 as electrically connected by a conductor 17 to the core 3 as at 18 but, as shown in Fig. 3 the sections of conductors 15 and 17 may be continuous, and intermediate its length connected to the case 1 as indicated at 19 in Fig. 3.

A clip 20 riveted as at 21 to the shield 16 serves as a means of making a secure connection for the conductor 17.

Flange 22 of the shield 16 serves to securely connect it to the core 3 of the transformer as by the rivets 23—23. Flange angles 24 are secured to the casing 1 and serve as stops or abutments for the edges of the shield and insures a comparatively tight joint along the periphery.

In Fig. 5 is shown a modified form of shielding arrangement in which the shield takes the form of a cup, the bottom portion 30 and the sides of the cup or walls 31 surround the primary winding 4; the edges of the walls 31 extend to and contact the casing 1 through which ground connection is made as by the binding post 25. The bottom portion 30 is further provided with insulation indicated at 32—32.

In Fig. 6 is shown a modified means of forming a connection between the shield 16 and the casing 1 wherein is provided a groove or channel formed by the angle pieces 26—26 which angle pieces contact both sides of the binding 27 which engages the entire periphery of the shield 16.

The structure shown in Fig. 6 will insure close contact of the shield 16 and the case 1 but will be electrically insulated therefrom by the binding 27 which is secured at the outer edge of the shield 16, and the opening 40 which accommodates the iron core 3 will prevent short-circuiting of the shield 16.

It is regarded as of more importance to seal the shield at its periphery than elsewhere and therefore greater care has been given to accomplish it because the disturbing elements dwell more particularly at the outer strands of the windings.

From the foregoing description it will be understood that in one preferred aspect of my invention, it comprises a transformer adapted to prevent high frequency energy from the secondary winding 5, 6, from radiating to the primary winding 4 and comprising, in combination, a core 3 of magnetic material including a winding leg 3b and a yoke of magnetic material completing a magnetic flux path, primary 4 and secondary 5, 6 windings surrounding separated portions of the winding leg 3b, a metallic housing 1 and 2, enclosing the core 3 and windings 4, 5 and 6, a conductive shield 16 extending outwardly from and transversely across the winding leg 3b intermediate the primary 4 and secondary 5, 6 windings, said shield 16 extending substantially to the housing 1 and 2 and having a gap 40 therein to prevent the completion of a continuous short circuited turn around the winding leg 3b, and means comprising a part of said core 3 substantially closing said gap 40.

In other aspects of the invention, it is pertinent to note that the shield 16 divides the housing 1, 2, into two compartments, one compartment containing the primary winding 4 and its lead wires 7 and 8, and the other compartment containing the secondary winding 5 and 6 and its associated leads 9 and 10.

Though I have shown and referred to an ignition transformer it will be understood that the invention is equally applicable to other high frequency devices and that many changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. A transformer including a magnetic core having a winding leg, primary and secondary windings surrounding the winding leg, a magnetic shunt between the windings for diverting magnetic flux from the secondary winding, a conductive shield disposed around the winding leg between the primary winding and said secondary winding and shunt, and a casing enclosing the transformer, the shield extending to form a partition dividing the casing into two compartments with the primary winding in one compartment and the secondary winding and shunt in the other compartment.

2. A transformer including a magnetic core having a winding leg, primary and secondary windings surrounding the winding leg, a magnetic shunt between the windings for diverting magnetic flux from the secondary winding, a shield of magnetic material disposed around the winding leg between the windings, and a casing enclosing the transformer, the shield extending to form a partition dividing the casing into two compartments with the primary winding in one compartment and the secondary winding in the other compartment.

3. A transformer comprising, in combination, a core of magnetic material including a winding leg and a yoke connecting the ends of the winding leg to complete a magnetic flux path, a primary winding surrounding said leg, a secondary winding surrounding the leg and adapted to carry high frequency energy in the operation of the transformer, a metallic shield interposed between the primary and secondary windings for intercepting high frequency energy emanating from the secondary winding, and an enclosing metallic casing for housing the transformer, said shield extending to the enclosing walls of the casing and being contiguous therewith to form two compartments, one compartment containing the primary winding and the other compartment containing the secondary winding.

4. A transformer comprising, in combination, a core of magnetic material including a winding leg and a yoke connecting the ends of the winding leg to complete a magnetic flux path, a primary winding surrounding said leg, a secondary winding surrounding the leg and adapted to carry high frequency energy in the operation of the transformer, a diamagnetic shield interposed between the primary and secondary windings for intercepting high frequency energy emanating from the secondary winding, and an enclosing metallic casing for housing the transformer, said shield extending to the enclosing walls of the casing and

being contiguous therewith to provide a partition forming two compartments, one compartment containing the primary winding and the other compartment containing the secondary winding.

5. A transformer comprising, in combination, a core of magnetic material including a winding leg and a yoke connecting the ends of the winding leg to complete a magnetic flux path, a primary winding surrounding said leg, a secondary winding surrounding the leg and adapted to carry high frequency energy in the operation of the transformer, a metallic shield interposed between the primary and secondary windings for intercepting high frequency energy emanating from the secondary winding, an enclosing metallic casing for housing the transformer, said shield extending to and conforming to the enclosing walls of the casing to form two compartments, one compartment containing the primary winding and the other compartment containing the secondary winding, and means electrically insulating said shield from said casing.

6. A transformer comprising, in combination, a core of magnetic material including a winding leg and a yoke connecting the ends of the winding leg to complete a magnetic flux path, a primary winding surrounding said leg, a secondary winding surrounding the leg and adapted to carry high frequency energy in the operation of the transformer, a metallic shield interposed between the primary and secondary windings for intercepting high frequency energy emanating from the secondary winding, an enclosing metallic casing for housing the transformer, said shield extending substantially to the enclosing walls of the casing to form two compartments, one compartment containing the primary winding, and the other compartment containing the secondary winding, means electrically insulating said shield from said casing, and electrically conductive means for connecting the shield and core together and to ground.

7. A transformer comprising, in combination, a core of magnetic material including a winding leg, primary and secondary windings surrounding said leg, a metallic casing housing the transformer, a metallic shield interposed between the primary and secondary windings and dividing the said casing into two compartments, said shield being cut away so that the leg extends therethrough and transversely thereto, a flange integral with the shield adjacent the cut away portion thereof, and means securing the flange to the core to support the shield.

8. A transformer comprising, in combination, a core of magnetic material including a winding leg, primary and secondary windings surrounding said leg, a metallic casing housing the transformer, a metallic shield interposed between the primary and secondary windings closer to the primary winding than to the secondary winding and dividing the said casing into two compartments, said shield being cut away so that the leg extends therethrough and transversely thereto, a flange integral with the shield adjacent the cut away portion thereof, and means securing the flange to the core to support the shield.

9. A transformer comprising, in combination, a core of magnetic material including a winding leg and a yoke connecting the ends of the winding leg to complete a magnetic flux path, primary and secondary windings surrounding said leg, a metallic casing having walls for housing the transformer, a shunt of magnetic material between the yoke and winding leg and between the primary and secondary windings for diverting flux from the secondary winding, and a conductive shield between the primary and secondary windings, said shield including a metallic sheet extending outwardly from said winding leg and shunt to the casing and conforming to the walls of the casing.

10. A transformer comprising, in combination, a core of magnetic material including a winding leg and a yoke completing a magnetic flux path, primary and secondary windings surrounding portions of said leg, a magnetic shunt between said yoke and said leg and intermediate the primary and secondary windings, and conductive shielding means between the primary and secondary windings, said shielding means comprehending a metallic sheet extending outwardly from said leg and shunt and having a gap therein such that the continuous electrically conductive path of the said sheet around the leg is broken, and said shunt partially filling said gap to provide a part of the shielding means between the primary and secondary windings.

11. A transformer adapted to prevent high frequency energy from the secondary winding from radiating to the primary winding and comprising, in combination, a core of magnetic material including a winding leg and a yoke of magnetic material completing a magnetic flux path, primary and secondary windings surrounding separated portions of the winding leg, a metallic housing having walls inclosing the core and windings, a conductive shield extending outwardly from and transversely across the winding leg intermediate the primary and secondary windings, said shield being contiguous to the housing walls and having a gap therein to prevent the completion of a continuous short circuited turn around the winding leg, and means comprising a part of said core substantially closing said gap.

12. A transformer and shielding assembly comprising, in combination, a core of magnetic material including a winding leg and a yoke of magnetic material completing a magnetic flux path, primary and secondary windings surrounding separated portions of the winding leg and having leads for making connections thereto, a metallic housing enclosing the core and windings, a conductive shield extending outwardly from the winding leg to the housing and conforming to the housing intermediate the primary and secondary windings, said shield dividing the space within the housing so that the primary winding and leads are segregated from the secondary winding and leads, means electrically connecting the shield to the core, and means electrically connecting the shield to the housing.

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