Dec. 29, 1936. L. G. KETCHAM 2,065,711

TRANSFORMER UNIT

Filed Aug. 2, 1935

Fig. 1.

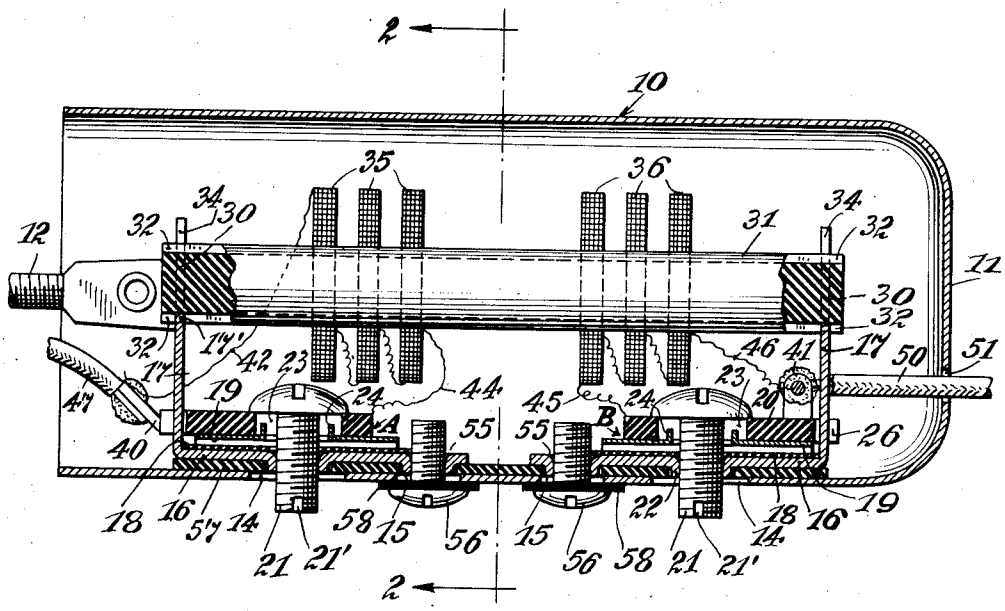


Fig. 2.

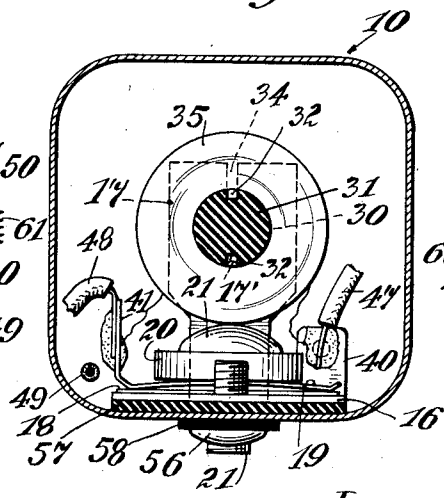


Fig. 3.

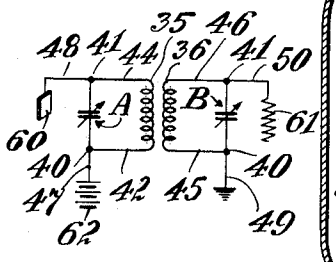
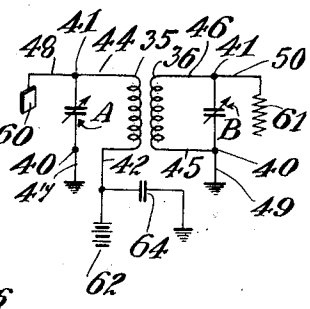


Fig. 4.



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UNITED STATES PATENT OFFICE

2,065,711

TRANSFORMER UNIT

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Application August 2, 1935, Serial No. 34,364

9 Claims. (Cl. 250—16)

This invention relates to improvements in transformer units and more particularly to transformer units adapted especially for use in radio equipment.

An object of the invention is to provide a new, simple and efficient transformer unit for use in connection with radio circuits.

Another object of the invention is to provide a transformer unit of such character that adjustments can be readily carried out.

A further object of the invention is to provide a transformer unit wherein the unit is contained in a shield and is provided with means whereby adjustments can be made without removing the unit from the shield.

Another object of the invention is to provide a transformer unit of such fashion that the form supporting the inductances of the unit are in turn supported by parts of condensers associated with the inductances.

In forming the desired unit of the present invention, use is made of two inductances mounted on a single form of insulating material. These inductances which constitute the primary and the secondary of the transformer unit are made of sectional windings to aid in securing the desired inductance value in each coil. Associated with the two coils are two condensers. Each condenser has a flat metallic plate, a portion of which is bent to extend upwardly at right-angles thereto. On top of the base plate is positioned a strip of dielectric material over which is mounted another condenser plate in the nature of a metallic leaf spring. A suitable pressure member of insulating material overlies the upper plate, and the two plates and dielectric together with the pressure member are held in desired position by means of a screw threaded into an aperture in the base plate and passing through the other parts of the assembly.

The upstanding angular portion of each base plate is provided with an opening for the reception of the form on which the two coils are mounted. Preferably, this form, which is in the nature of a rod, has a longitudinal groove therein into which tabs in the walls of the openings in the angular extensions of the base plates fit to prevent rotation of the form. In addition to the threaded openings in which the adjustment screws of the condensers are engaged, the base plates are provided with threaded openings for the reception of screws. These latter openings are designed to make possible the installation of the assembly in a metallic shield. A strip of insulating material is positioned between the bottoms of the base plates and a wall of the shield, this wall being provided with four openings aligned with the four openings in the two base plates. The adjustment screws of the condensers pass through the insulating material and through two openings in the shield. The two base plates are locked firmly in place by means of screws passing through openings in the shield into threaded engagement with the additional threaded holes in the base plates. To complete the insulation of the base plates from the shield, the attaching screws have insulating washers fitting under their heads and contacting with the exterior of the shield. The ends of the adjustment screws extending beyond the shield are slotted, whereby they may be engaged by a suitable tool to permit adjustment of the condensers without removing the condensers and the coils from the shield.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description accompanying the drawing, wherein

Fig. 1 is a vertical longitudinal section of an assembly embodying the invention;

Fig. 2 is a vertical section taken substantially on the line 2—2 of Fig. 1;

Fig. 3 is a portion of a circuit diagram illustrating one manner of employing a unit made in accordance with the invention; and

Fig. 4 is a view similar to Fig. 3 of a modified circuit arrangement.

Referring to the drawing, 10 indicates a shield of some suitable metal, such shield being of rectangular cross-section and of suitable length for the purposes desired. One end of the shield is closed as at 11, while the other end is open. To the open end of the shield are secured spade bolts 12 which may be utilized for attaching the shield with a transformer unit therein to the chassis of a radio set or to any other suitable support. One wall of the shield is provided with openings, such openings being indicated at 14 and 15.

The two condensers A and B used in the assembly are identical in construction. Each condenser has a base plate 16 of some suitable metal, such as for example, brass. The plates 16 are generally flat shaped, but have extending upwardly from one end thereof right-angular supporting portions 17. Overlying a part of each base plate 16 is a sheet of dielectric material 18, for example, of high quality mica. Resting on top of the strip of dielectric material is a second plate 19 which is bowed as shown in Fig. 2. A pressure plate 20 of some suitable insulating material,

such as isolantite, or any other suitable compressed ceramic material is positioned on top of plate 19. The two metallic plates, the dielectric strip, and the pressure plate, are all held together by means of a screw 21 which passes through openings in the pressure plate, the upper plate 19 and the dielectric strip into threaded engagement with the wall 22 of an opening in the lower plate 16. The end of screw 21 is slotted as shown at 21'. The wall of the opening in pressure plate 20 is provided with a number of recesses 23 for the reception of up-turned prongs 24 punched in the upper plate 19 when the opening therein is formed. This engagement of prongs 24 with recesses or slots 23 serves to definitely determine the position of the upper plate 19 relative to the screw 21 and also to prevent contact of any portion of the upper plate 19 with this screw 21. One end of the pressure plate 20 is recessed to provide shoulders 26 which fit on each side of the upstanding portions of the bottom plate to position the plate and to prevent undesired movement thereof.

The upstanding portion 17 of the bottom condenser plate has a widened top portion indicated in dotted lines in Fig. 2, such top portion being provided with an opening 30 for the reception of a core 31 of some good insulating material, such as a compressed ceramic material. The wall of the opening 30 has an upstanding tab 17' therein for engagement with one of a pair of diametrically opposite grooves 32 in the core 31. The top part of the extension 17 is split as indicated at 34.

Secured to the core 31 are sectional inductances 35 and 36, which inductances are wound and positioned on the core in the manner set forth more clearly in my copending application Serial No. 743,711, filed September 12, 1934, Patent No. 2,038,297, granted April 21, 1936. It is sufficient for the purposes of this application to point out that each sectional inductance 35 and 36 is made up of a single conductor wound on the core in such fashion that each inductance has the desired value. Other types of windings can be used with equal facility.

Each bottom plate 16 is provided with a terminal ear 40, while each top plate 19 is provided with a terminal ear 41. One lead 42 of the inductance 35 is secured to the terminal 40, while the other lead 44 is connected to the terminal 41 of the plate 19 of the condenser A. In the same manner one lead 45 of the inductance 36 is secured to the terminal of the lower plate of the condenser B, while the other lead 46 is secured to the terminal 41 of the upper plate of the same condenser.

In use a conductor 47 is secured to the terminal 40 of the condenser A and a conductor 48 is secured to the terminal 41 of this condenser. Likewise a conductor 49 (Fig. 2) is connected to the terminal 40 of the condenser B and a conductor 50 is secured to the terminal 41 of the same condenser. The conductors 47, 48 and 49 extend through the open end of the receptacle or shield 10, while the conductor 50 extends through an opening 51 in the closed end 11 of this receptacle.

In order that the assembly of condensers and inductances may be held securely in place, the lower plates 16 are provided at their inner ends with openings 55, the walls of which are threaded for the reception of screws 56. When the assembly is to be secured within a shield, such as the receptacle 10, use is made of a strip 57 of insulating material, which strip is provided with openings coaxial with the openings 14 and 15. In this type of arrangement the screws 56 pass through the openings 15 in the receptacle into engagement with the threaded walls of the openings 55 in the lower condenser plates. Insulating washers 58 are positioned between the heads of the screws 56 and the wall of the receptacle so that any potential on the lower plates of the condensers is insulated from the shield. It is to be understood, of course, that the assembly of condensers and inductances need not necessarily be secured in a shield as shown, since under some circumstances it may be desirable to secure the assembly directly to the chassis of a radio set or to some other supporting structure. However, in practice, it has been found advisable and desirable to enclose the assembly in a shield.

Illustrative circuit diagrams are shown in Figs. 3 and 4. In Fig. 3 the diagram shows at the points 40 and 41 representations of the respective condensers, terminals 40 and 41. In this arrangement the leads of the inductances are illustrated as being all connected to such terminals as to provide two tuned circuits acting as a transformer. The relation of the various parts is clearly shown, since the reference characters in Figs. 1 and 2 are carried out in Fig. 3. In the arrangement shown, the conductor 48 is connected to the plate 60 of a vacuum tube, while the conductor 47 is connected to a source of positive potential to be applied to this plate. At the same time the conductor 50 is connected to the grid 61 of another vacuum tube, while the conductor 49 is connected to ground or some other suitable point in the circuit. In this arrangement, it is apparent that the potential from the source 62 is impressed on the lower plate 16 of the condenser A, and since the adjustment screw 21 of this condenser is in good electrical contact with the lower plate, such potential will be found on this adjustment screw increasing the danger of shocks during adjustment of the condenser.

Should it be desired to remove the potential from the adjustment screw, the circuit arrangement in Fig. 4 may be used. In this circuit the connections are similar to those shown in Fig. 3 with the exception that the conductor 47 is grounded while the conductor 42 instead of being connected to the terminal 40 is connected directly to the source of potential 62 and is shunted by a by-pass condenser 64 which in turn is grounded. With this arrangement, adjustments of the condenser A can be readily made without incurring the danger of shocks from the source 62.

From the foregoing it will be seen that the present invention provides a transformer unit made up of adjustable condensers and inductances so connected together as to form a more or less self-supporting assembly. The inductances are wound on a core of insulating material, which core is supported by and between extensions of one plate of each condenser. In addition to the structural advantages inherent in the assembly as shown, the invention also has other advantages. Since each inductance is located in close proximity to its associated condenser, short leads from the inductance can be used so that capacity coupling, due to long leads, is greatly minimized. Since the adjustment screws 21 are threaded through the bottom plates of the condensers, accurate capacity adjustments can be made, and once an adjustment is made it remains permanent. Moreover, since these adjustment screws extend through the

shield and have their ends slotted, adjustments of the condensers can be made without removing the assembly from the shield.

The upper condenser plates are of novel construction in that they are more or less of a "floating type" being keyed to the pressure plates, which in turn are keyed to the extensions of the lower condenser plates. This arrangement permits the elimination of eyelets or other devices for locking the variable condenser plates relative to the stationary condenser plates.

It will be apparent from the foregoing that the present invention provides a transformer unit which is especially adapted to be used as an intermediate frequency transformer in radio sets. The invention is capable of modification, in view of which it is not to be limited to the illustrated embodiment but is to be limited only by the scope of the following claims.

I claim:

1. A transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of condensers associated with the respective inductances, one plate of each of said condensers being provided with an extension having an opening therein, said core fitting in said openings whereby the core is supported by and between the extensions with the inductances substantially directly above and spaced substantially equidistantly from the respective condensers with which they are associated.

2. A transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of condensers associated with the respective inductances, one plate of each of said condensers being provided with an extension having an opening therein, said core fitting in said openings whereby the core is supported by and between the extensions with the inductances substantially directly above and spaced equidistantly from the respective condensers with which they are associated, said core fitting in said openings with sufficient tightness as to hold the condensers in spaced relation.

3. A transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of condensers associated with the respective inductances, the bottom plates of said condensers having angular extensions, said core being supported by and between said extensions, said bottom plates being provided with threaded walled apertures, an enclosing shield for said unit, said shield being provided with openings in a wall thereof for the passage of screws engaging the threaded walled apertures of the bottom plates, and means for insulating said bottom plates from said shield.

4. A transformer unit comprising a pair of condensers, the bottom plate of each condenser being provided with an angular extension, a core of insulating material supported by and between said extensions, a pair of inductances mounted on said core above the respective condensers with which they are associated, each bottom plate being provided with a threaded walled aperture, adjustment screws for said condensers, an enclosing shield for said unit, one wall of said shield being provided with a pair of openings for the passage therethrough of said adjustment screws and being provided with another pair of openings, attaching screws passing through said last mentioned pair of openings into threaded engagement with the apertures in said bottom plates and means for insulating said bottom plates from said shield.

5. A transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of separate unitary condensers associated with the respective inductances, one plate of each of said condensers being provided with an angular extension, said core being supported by and between said extensions with the plates of the condensers spaced from the core in substantial parallelism therewith between the ends of the core.

6. A transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of separate unitary condensers associated with the respective inductances, one plate of each of said condensers being provided with an angular extension, said core being supported by and between said extensions with the plates of the condensers spaced from the core in substantial parallelism therewith between the ends of the core, an enclosing shield for said unit, one plate of each condenser being secured to said shield, and means for insulating said plates from said shield.

7. A self-supporting transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of separate unitary condensers associated with the respective inductances, the bottom plate of each condenser being provided with an angular extension, said core being supported by and between said extensions and serving as means for holding said condensers in separate relation whereby the said condensers and said core are in mutual supporting relation.

8. A transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of separate aligned unitary condensers associated with the respective inductances, the bottom plate of each condenser being provided with an angular extension, said extension having an opening near the top thereof, said core having the ends thereof inserted into said openings with pressed fits to cause the core to be supported by and between the extensions and the condensers to be held in separate aligned relation by the core, whereby the condensers and the core are in mutual supporting relation.

9. A transformer unit comprising a pair of inductances mounted on a core of insulating material and a pair of aligned condensers associated with the pair of respective inductances, the bottom plate of each condenser being provided with an angular extension, said extension having an opening near the top thereof with a slot extending from the top to the opening, said core having the ends thereof inserted into said openings with a pressed fit whereby the core is supported by and between the extensions, and the condensers are held in separated aligned relation by the core with each inductance directly above spaced equidistantly from the condenser with which it is associated.

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