March 7, 1944. F. P. KENYON 2,343,675

PLUG-IN TRANSFORMER

Filed Jan. 6, 1941 2 Sheets-Sheet 1

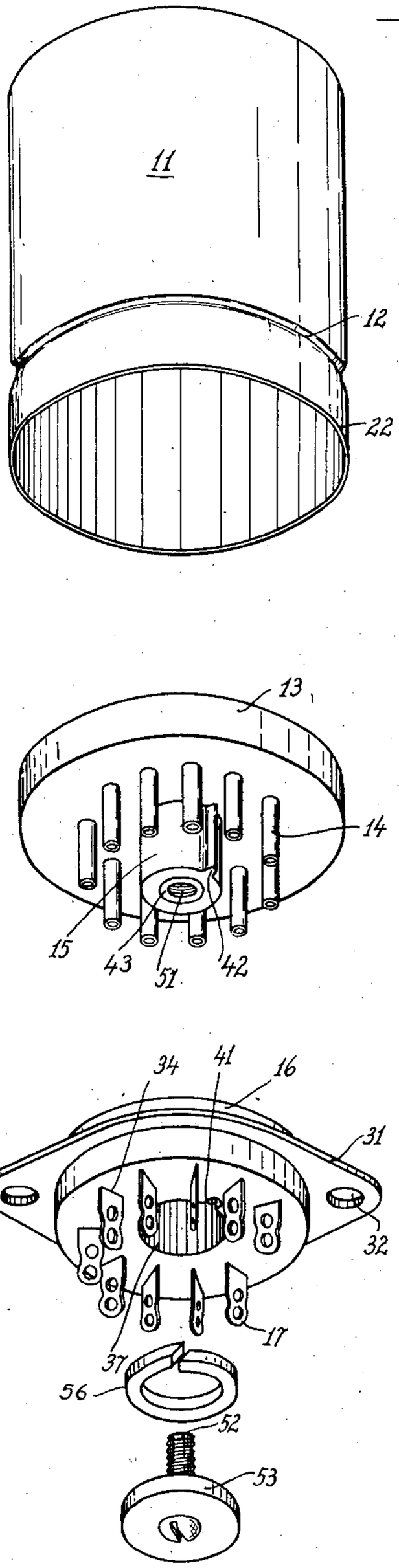

Fig. 1

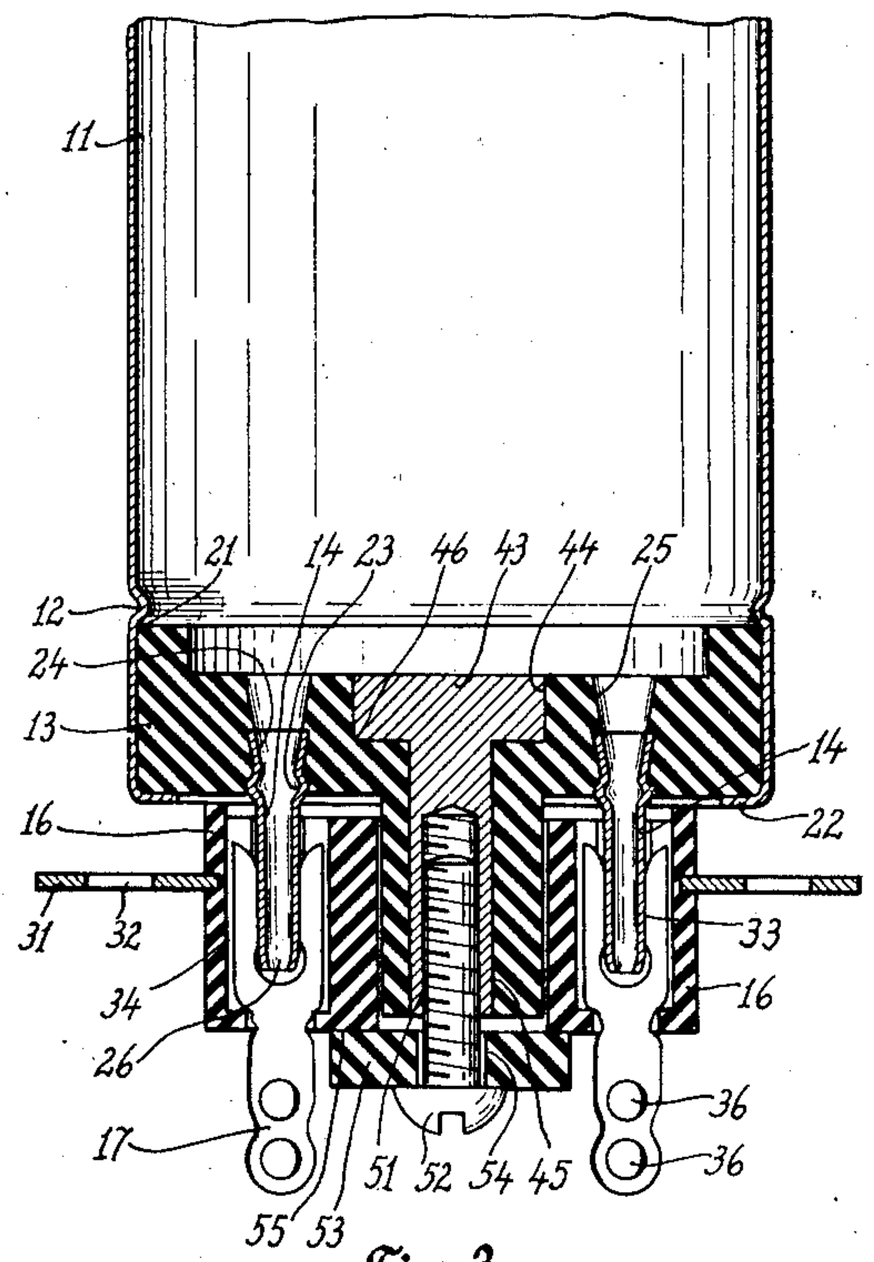

Fig. 3

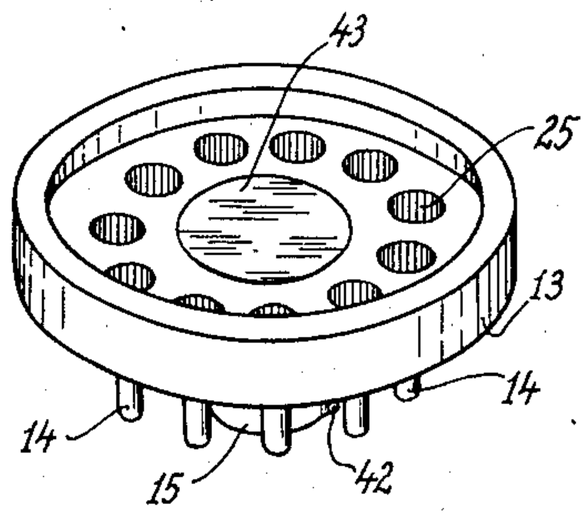

Fig. 2

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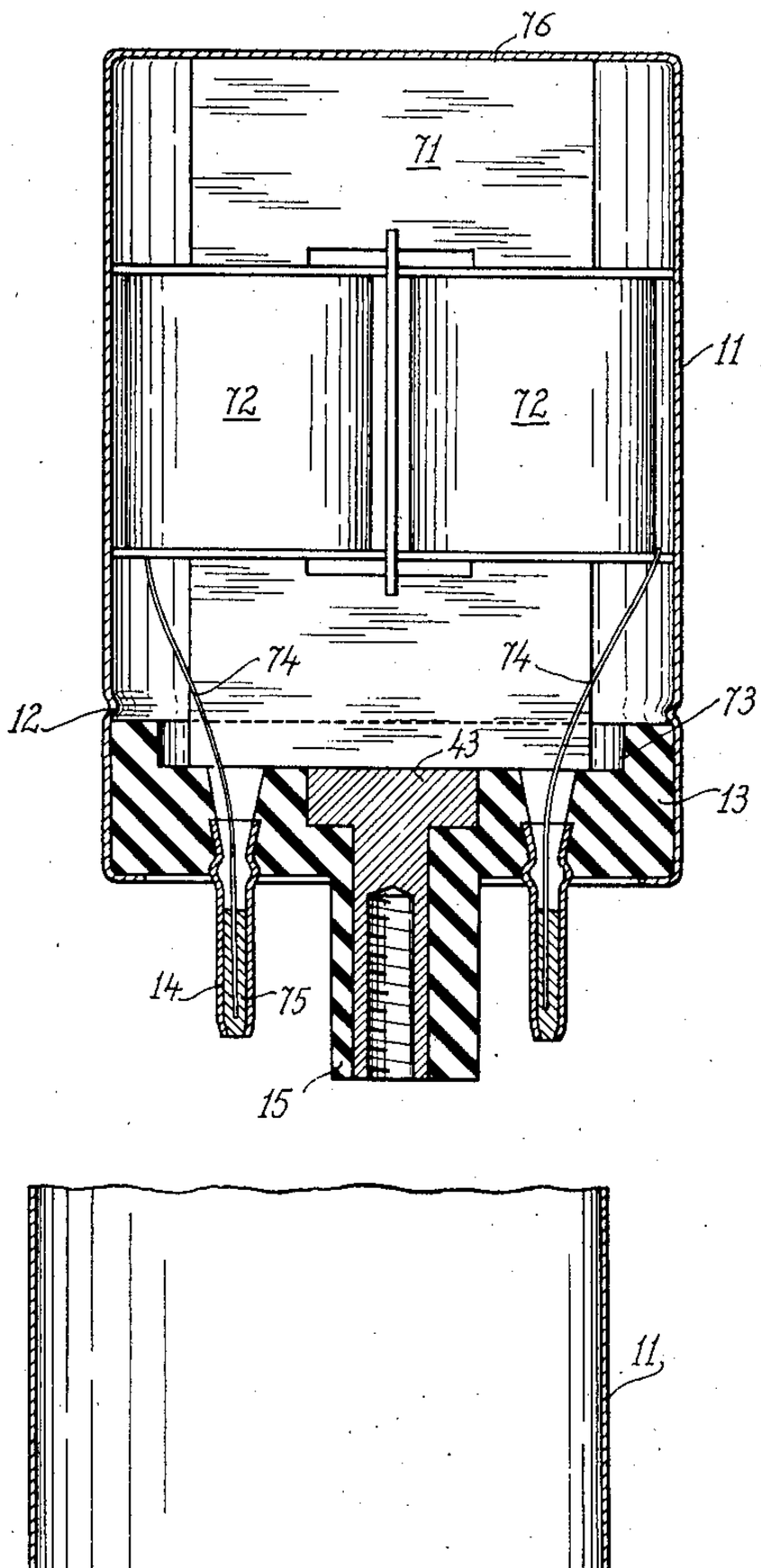

Fig. 5

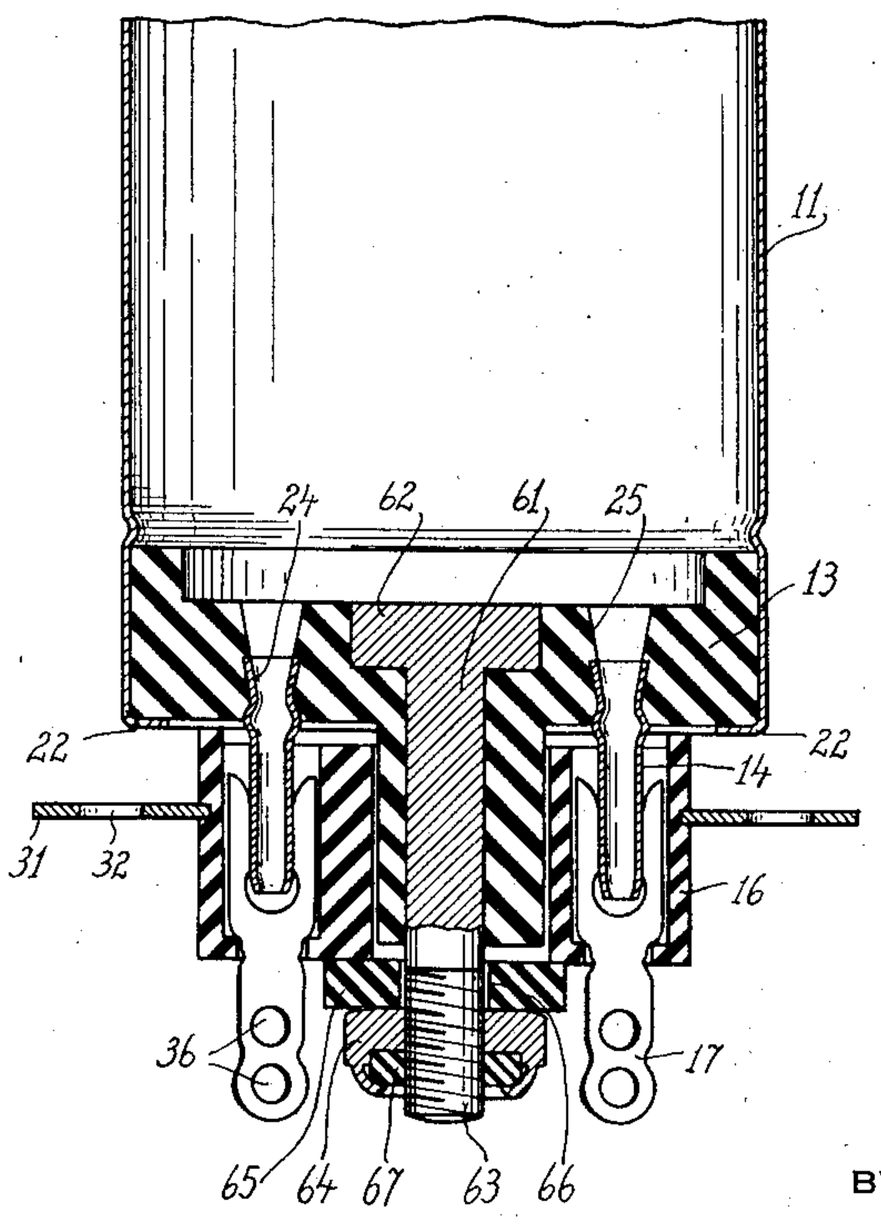

Fig. 4

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UNITED STATES PATENT OFFICE

2,343,675

PLUG-IN TRANSFORMER

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Application January 6, 1941, Serial No. 373,335

1 Claim. (Cl. 175—361)

My invention relates in general to the field of electrical transformers but more specifically concerns a transformer adaptable to installations where ease of interchangeability or replacement is particularly desirable.

Heretofore in apparatus employing transformers in circuit with other electical devices it was necessay to connect the transformer into the circuit by first mechanically mounting the device on a panel with screws and/or rivets and then effecting the required electrical connections by soldering or otherwise joining leads thereto. That is to say, the conventional transformers employed were connected into the electrical circuit through wires emanating directly from the coils or through wires soldered or otherwise mounted upon binding terminals thereon.

In installations where replacement is constantly required due to burn outs, experimental work, testing and the like, it has been necessary to unfasten whatever mechanical mounting means had been employed and to unsolder all of the electrical connections to the transformer.

In radio apparatus or other devices wherein the transformer has been mounted above a subpanel and all electrical connections thereto made beneath this panel replacement of the transformer would require dismantling the installation in order to properly disconnect the wires contained beneath this panel.

My invention comprises a transformer which may be completely encased and shielded in a suitable container and which employs as terminals a series of prongs which may be inserted into an appropriate socket. Thus my transformer may be instantly connected to or disconnected from an electrical circuit by simply plugging it into a socket or removing it therefrom.

Electrical connections to the transformer are therefore indirectly made through the terminals contained in the tube socket. Obviously the type of transformer lends itself to standardization, in that the various coils contained within the casing may be connected to the terminals in a predetermined order. Thus, certain terminals of the base may always be employed for primary coils, others for secondaries and this designation may be standardized and thereby simplify the work of those employing them.

The ease with which replacement may be effected makes my novel type of transformer adaptable to most radio installations including aircraft and marine radio apparatus. However for this particular type of work it is necessary that the transformer and the transformer mounting be able to withstand severe stresses resulting from jarring and other mechanical effects such as vibration and the like.

Therefore, in order to prevent possible loosening of the transformer when it is plugged into a corresponding receptacle, I provide means for securing the transformer to the panel chassis or other supporting members and thus eliminate the possibilty of accidental dislocation or removal thereof.

It is therefore an object of my invention to provide a transformer which may be inserted or "plugged" into an electrical circuit and removed therefrom in a simple and expeditious manner without the necessity for complicated or laborious connecting operations.

It is another object of my invention to provide for a transformer which employs a series of prongs for binding terminals, disposed to be engageable with an ordinary prong receiving socket.

It is a further object of my invention to provide a novel transformer casing which will completely enclose the transformer and which will provide the necessary prong mounting terminals for cooperation with a corresponding prong receiving and retaining socket.

It is a further object of my invention to provide means for insuring a fixed relation between my novel "plug-in" transformer and the supporting panel.

These and other objects will become apparent from the following specification taken in connection with the accompanying drawings in which:

Figure 1 is an exploded perspective view of the transformer casing, mounting means and fastening means,

Figure 2 is a perspective view of the base of plug-in transformer, and

Figure 3 is a cross sectional view taken through the center of the transformer and mounting means,

Figure 4 is a sectional view taken through the transformer and illustrating a modification of the securing means,

Figure 5 is a broken cross sectional view taken through the center of the transformer indicating the method of mounting an iron core transformer.

The coils of my transformer which may be wound upon an iron or air core are contained completely within a sheet material casing and a base which provides the necessary circularly dis-

posed connecting prongs, which in this embodiment of my invention serve as the terminals for the coils.

The sheet material container for the coils may be similar to the outer container employed to enclose the electrodes of an "all metal" vacuum tube. However, the container which I employ for my novel type of transformer is a thin seamless can 11 shown in Figures 1 and 3 which has been drawn to a suitable size as required by the coils and core.

Subsequent to the completion of the drawing operation required for the can 11, I spin or otherwise fabricate an annular recess or other type of indentation 12 which acts as a stop for the base of the transformer as will hereinafter be more completely described.

As indicated in Figures 1 and 2, the base 13 of the transformer contains a plurality of circularly disposed connecting prongs 14 which have been embedded therein during fabrication or molding. The base itself may be a single molding of some suitable insulating material such as Bakelite or the like and contains the integrally formed projecting guide 15 similar to the guide employed to properly locate the prongs of an ordinary octal type vacuum tube.

The base 13 and its associated connecting prongs 14 are engageable with a corresponding socket or receptable 16 containing a plurality of terminals 17 electrically and mechanically engageable with the prongs 14 contained in the base 13 of the transformer.

Referring now to Figure 3 there is shown in section, an assembled view of the transformer casing 11, its associated base 13 and the mounting means therefor. The base 13 is preferably circular and is dimensioned so that it corresponds with the inner diameter of the enclosing can 11 and is slipped therein so that the upper circular edge 21 bears firmly against the turned annular indentation 12.

Therefore the axial motion of the transformer base 13 into the enclosing container 11 is limited to juxtaposition with the indentation 12. Subsequent to the insertion of the transformer base 13 into the enclosing container 11, the lower edge 22 of the container is folded over as indicated in Figure 3 to fixedly mount the base within the container.

Obviously, of course, the length of the cylindrical can 11 allowed between the annular indentation 12 and the lower edge 22 must be greater than the axial length of the base 13 by an amount sufficient to provide metal for a strong bond between the base and the container 11.

Therefore when the base 13 is inserted into the open end of can 11 and locked thereto as indicated in Figure 3 the contents of the can will be completely sealed and protected from dust, moisture and other atmospheric effects. If the seal is made under sufficient pressure; or if an appropriate sealing material is inserted at the junction, the transformer may be made submersionproof, and thus be particularly applicable to marine or similar installations. Under appropriate conditions and for special purposes, the container may be made hermetically tight or air may be exhausted therefrom.

The base 13, contains the plurality of prongs 14 which are preferably of the form indicated by the sectional view of Figure 3. That is, they may be hollow tubular cylinders of metal containing a bead 23 to position them in the base 13 and flared at 24 to preclude possible withdrawal therefrom. To ensure a rigid relation between the tubular connecting prongs 14 and the base 13, these prongs may be molded directly into the insulating material comprising the base 13 and appropriate cores provided in the molding dies to allow for the openings 25 through which lead wires from the coils contained within the can 11 may be drawn and passed through the hollows of the tubular prongs 14.

The leads may be soldered or otherwise fastened to the prongs 14 and during this process the solder is allowed to completely fill or close the openings 26 in order that moisture may not penetrate to the inner contents of the can 11 through the hollows provided in the prongs for the accommodation of the leads.

The array of prongs 14 which have been embedded in the insulating base 13 cooperate with a receptacle 16, which again may have the form of a conventional tube socket or connector which provides means whereby electrical connections may be obtained to the tube prongs 14 while permitting the unimpeded removal thereof.

The receptacle 16 which I employ for my novel type of plug-in, replaceable transformer is preferably of the form indicated in the perspective view of Figure 1 and the sectional view of Figure 3. That is, the receptacle comprises a body of insulating material molded upon a metal lamination 31, and contains a plurality of circularly disposed terminals 17 designed to engage the corresponding prongs 14. The metal lamination 31 provides means for mounting the receptacle 16 upon a panel in alignment with a perforation therein of diameter large enough to permit the unimpeded passage of the array of prongs 14.

The perforations 32 within the metal plate 31 allow for the passage of appropriate rivets or screws which engage the panel upon which the receptacle is to be mounted. The insulating material which is contained above the lamination 31 functions to guide the receptacle 16 into the perforation of approximately equal diameter within the panel.

The terminals 17 as indicated in Figure 3 are engageable with the tube prongs 14, and may be of any form which affords positive electrical contact and still allows simple slidable removal therefrom.

In this embodiment of my device I have illustrated the terminal 17 as a flat metal member forked at 33 to provide gripping means for the tube prong 14. The resiliency of the metal binding terminal 17 is relied upon to effect proper electrical contact between the tines of the fork 33 and the engaged prong 14.

These terminals are inserted into suitable perforations 34 which have been provided while molding the insulating material of the receptacle 16. These perforations 34 are slots radially disposed, and after insertion, the binding terminals 17 are prevented from slipping therefrom by twisting the metal projecting from the base of the oblong slots 34, as indicated in the perspective view of Figure 1. The perforations 36 at the terminal 17 may mechanically engage a wire from an external circuit and thus facilitate soldering thereto.

The molded receptacle 16 is perforated at 37 to engage the projecting guide 15 on the transformer base 13. An additional indentation 41 of semi-circular cross-section or of other suitable form corresponds with an integral axial protru-

sion 42 upon the guiding projection 15 and thus uniquely determines the position in which the transformer base 13 may be inserted into the receptacle 16 to engage the binding terminals 17. This precaution is necessary to avoid interconnection between a prong connected to a particular coil and a terminal on the socket which belongs in another circuit.

Ordinarily the transformer will remain in fixed relation with respect to the receptacle 16 due to the spring like action of the tines of the forks 33 and the frictional engagement thereon with the prongs 14. However in airplane and marine installations the transformer may be dislodged due to centrifugal, vibrational and other forces which may be developed.

Therefore in order to securely mount the transformer upon the panel of the apparatus with which it is electrically interconnected I provide novel means for employing the projecting guide 15 of the transformer base 13 for a suitable rigid support.

In this embodiment of my invention I fabricate a brass or other metallic plug 43 (see Fig. 3) and insert it into the insulating material of the transformer base 13. I may accomplish this by molding the insulating material of the receptacle 16 directly around the centrally disposed metallic insert 43 or I may ream perforations 44 and 45 in the insulating material subsequent to its removal from the mold and fit the metallic plug 43 therein.

The metallic insert 43 may be turned or otherwise formed as indicated in Figure 3 and passes through the protruding guide 15 in the transformer base 13. The upper portion 46 has been flared as indicated in Figures 2 and 3 in order to provide the necessary mechanical support and the lower section is of a diameter which permits its passage through the guide 15, as indicated in Figures 1 and 3. The entire surface of the metallic member 43 may be roughened or slotted to provide additional mechanical support if the insulating material is molded about the member 43.

An axial threaded hole 51 in the lower section of the metallic insert 43 is engageable with a small screw 52 which serves to firmly engage the transformer base. The metallic insert 43 in the transformer base when cooperating with the screw 52 and the perforated insulating washer 53 provides the means for maintaining the transformer in fixed relation with its corresponding receptacle regardless of the strains which may be induced therein.

The assembled view of Figure 3 indicates the method of mounting the transformer when it is necessary to preclude the possibility of a jar or other stress causing withdrawal from the receptacle. The transformer base 13 is first "plugged in" to the receptacle 16 so that the tube prongs 14 make the proper electrical connections with the corresponding solder terminals 17. Following this operation the insulating washer 53 is placed over the perforation 37 in the receptacle so that a corresponding perforation 54 which has been cut into the washer is in alignment with the tapped hole 51 in the metal insert 43.

The washer 53 is of sufficient diameter to ensure surface contact between its base and the base of the receptacle 16 as indicated at 55 of Figure 3. Of course, the washer 53 must also be of a diameter which is not great enough to interfere with the terminals 17 circularly disposed about the periphery of the receptacle 16.

The screw 52 is then brought into engagement with the corresponding tapped perforation in the metal insert 43 as indicated in Figure 3 and the pressure developed at the surface contact 55 will then preclude unintended withdrawal of the transformer from the receptacle.

Obviously the screw may be securely positioned with respect to the receptacle and the guide projection 15 of the transformer base by employing a lock washer 56 of suitable dimensions and form, as indicated in Figure 1.

Should the head of the screw be sufficiently large, a lock washer may well be dispensed with.

If the lock washer 56 or the head of the screw 52 is of conductive material, it is important that it does not make contact with the terminals 17 and thus cause possible short circuits.

If the insulating material of which the transformer base 13 and its associated guide projection 15 are fabricated is sufficiently strong to withstand considerable stress the metal insert 43 may be dispensed with and the tapped perforation for engagement with the screw 52 may be formed directly in the guide projection 15.

In Figure 4 I have shown a modification of the means for securing the transformer to the receptacle and thus to the panel, chassis or other support. The modification illustrated dispenses with the need for an additional screw and tapped perforation.

The metal insert 43 illustrated in Figure 3 has been replaced by a metal insert 61 similar thereto in the means for embedding it in the plastic material employed for the base 13. That is, the insert 61 has a turned or otherwise fabricated shoulder 62 and may be roughened and molded directly into the base 13 or it may be inserted by reaming accommodating perforations in the base.

Whereas the metal 43 insert in the embodiment illustrated in Figure 3 extends axially through the locating plug 15 of the base and is of equal length, the metal insert 61 extends through and is of greater length than the molded plastic locating plug 15. The extension is sufficiently great to provide space for the screw threads 63 which are engageable with a corresponding nut 64.

Thus when the transformer is plugged into receptacle 16 the screw threads 63 extend below the material comprising the receptacle and in order to lock the transformer thereat the washer 65 having a central perforation 66 is slipped over the screw threads and the nut 64 is brought to bear therewith.

The nut 64 is preferably of the self-locking type in order to dispense with the need for a lock washer 56. That is, the nut contains, embedded therein, a fibrous material 67 which firmly grasps the screw threads 63 to prevent possible undesired rotation of the nut 64 accompanied of course by the loosening of the transformer.

This self locking nut is of conventional design and is therefore particularly well adapted to the installation illustrated. The washer 65 is preferably made of insulating material to preclude short circuiting of the binding terminals 17. If, however, an ordinary nut is employed with the embodiment illustrated in Figure 4, it may be desirable to employ a lock washer similar to that illustrated by 56 in Figure 1 and it is important to preclude contact between this washer and the binding terminals 17.

If it is desired to construct the transformer about a base not necessarily similar to the standard octal base 13 illustrated in Figure 1 (as for

instance a base not containing the guide projection 15) and if it is desired then to lock the transformer into fixed relation with the receptacle it will be necessary to place the tapped hole for engagement with the screw 52 into the body of the base itself, and perforate the socket or receptacle to receive the screw.

Also if it is desired to employ a socket which is not as thick as the socket illustrated but is of the "wafer" type, it will be necessary to substitute, for the washer 53, a sleeve which fits over the guide rod 15 and which projects to the under surface of the receptacle and fasten this sleeve to the guide in a manner similar to that illustrated for the heavier type of socket illustrated in Figures 1 and 3.

The novel casing and mounting means which I have devised and herein illustrated lends itself readily to application to electrical or iron core transformers. Thus in Figure 5 I have illustrated a means for adapting an iron core transformer to the casing illustrated in Figure 3. The laminated or otherwise fabricated core 71 may be rigidly secured in the casing illustrated between the top 76 and the hollowed portion 73 of the plastic or other insulating base 13. Thus, axial distance between the internal flange 12 and the top 76 of the sheet material casing is predetermined so that the core 71 will be rigidly supported between the top of the can and the base 13.

The diameter of the can will of course be determined by the dimensions of the core 71 and the transformer coils 72 which have been wound thereon. The coils, of course, will be a function of the particular type of transformer, its capacity and application.

Leads 74 from the coils 72, of which two have been illustrated in Figure 5, are passed through the hollowed prongs 14 and are soldered or otherwise securely fastened thereto at 75. It may be seen that the novel design of my casing including of course the location of the annular recess 12 will provide a support for the transformer within the casing which will not be subject to the deleterious effect of vibration and jarring.

The hollowed portion 73 of the transformer base 13 (illustrated in Figures 3 and 5) may be molded to accommodate a particular type of core. Thus the hollow may be of rectangular cross section to position a rectangular core of the type illustrated in Figure 5.

This in combination with the various forms of mounting means herein illustrated particularly adapt this type of transformer to airplane and marine radios or the like inasmuch as the constant vibration to which this type of installation is normally subjected will not impair in any manner the electrical operation or the mechanical support thereof.

To replace the transformer after a coil has been burned out or when experimental work so requires, it is merely necessary to remove the screw 52 or nut 64 (if it has been necessary to employ a locking device) and to slip the transformer from its binding terminals 17. Another transformer may then be slipped in with a minimum of effort and with no rewiring.

It is important to note that the device which I have herein illustrated and described for locking the transformer of my invention to a suitable receptacle may be employed without modification for the standard types of octal tubes employed in radio work.

Therefore it is apparent that many applications and modifications will be evident to those skilled in the art and accordingly I do not wish to be bound by the specific disclosures herein above set forth but only by the appended claims.

I claim:

A transformer retaining member comprising a metallic casing member having top and side walls and a base, connecting prongs extended from said base, leads within the container interconecting the transformer coils and said prongs; a socket having a plurality of circuit connecting means each individually engageable with a prong; means on the base of said transformer and means in said socket for positioning said transformer prongs in said socket with selected prongs interengaged with selected circuit connecting means, and additional means for securing said transformer container to said socket, said additional means comprising a threaded opening in said positioning means in the base of said container, a corresponding opening in said socket, a screw insertable through said opening in the socket and engageable with the threaded opening in the base of the container, and a washer on said screw engageable with the portion of the socket opposite the base of the container.

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