

Description

BACKGROUND OF THE INVENTION

1. Field of the invention:

The present invention relates to a method to produce an encased transformer for use in audio equipment, video equipment, and any other electrical equipment.

2. Description of the prior art:

In order to explain the background of the present invention, reference will be made to Figures 1 to 7, illustrating typical conventional transformers:

As shown in Figures 1 and 2, the transformer as can be seen from JP Laid-Open Patent Publication No 1-110714 includes a bobbin 4 having a cylindrical portion 1 with an upper collar 2 and a lower collar 3 at its upper and lower ends, respectively. The lower collar 3 is provided with outwardly laterally oriented metal plate terminals 5a to 5d which are formed in one piece with the lower collar 3 or alternatively attached thereto after they are made by molding. Lead wires 6a to 6d of primary and secondary coils 7, 8 wound round the bobbin 4 are bent at their lower portions at a desired angle, with portions of several millimeter left for the convenience of the connection to the metal plate terminals 5a to 5d as used by the user (hereinafter referred to as "user metal terminal"), and the top ends of the lead wires 6a to 6d are outwardly bent at a desired angle so that they are positioned at the same level with the underside 3' of the lower collar 3. The primary coil 7 is wound round the cylindrical portion 1 of the bobbin 4 of the above-described construction, a lead wire 6a at the leading end thereof being passed through a groove 9a provided in the lower collar 3 for winding round the base 5e of the user metal terminal 5a. A lead wire 6b at the trailing end of the coil is passed through a groove 9b for winding round the base 5f of the user metal terminal 5b. The secondary coil 8 is wound round the primary coil 7, a lead wire 6c at the leading end thereof being passed through a groove 9c provided in a lower collar 3b for winding round to the base 5g of the user metal terminal 5c. A lead wire at the trailing end is connection in similar manner. The lead wire 6 wound about the user metal terminal 5 are then soldered, thereafter an E-type magnetic element 10 is incorporated vertically into the cylindrical portion 1 of the bobbin 4 and fixed in position to form a magnetic path. This is a typical conventional method for constructing transformers.

Referring to Figure 3, the construction of a conventional encased transformer like that mentioned in JP Utility Model Publication No. 56-3940 will be described as follows:

The encased transformer also includes a cylindrical portion 1 of a bobbin 4 with an upper collar 2 and a lower collar 3 provided respectively at its upper and lower ends. User's metal terminals 5 are implanted in the lower collar 3. The cylindrical portion 1 of the bobbin 4 have primary and secondary coils 7, 8 wound round it, and lead wires 6 of the coils 7, 8 are connected to the metal terminals 5 in corresponding relation thereto by being wound about the latter. A magnetic element 10, such as a ferrite core, is vertically inserted and fixed in position to form a magnetic path. A transformer constructed in this way is inserted into an opening of a case 11, and resin material 12, such as silicon resin, is then poured into the case. Finally, a bottom plate 13 is fitted in the opening of the case 11. The amount of the resin material 12 is adjusted to cover a substantial portion of the magnetic element 10 of the transformer, and the resin is normally set by heating.

A generally known conventional type of encased transformer used for flat mount will be described with reference to Figures 4 and 5.

Figure 4 is a sectional view of the transformer. A cylindrical portion 1 of a bobbin 4 has an upper collar 2 and a lower collar 3 formed respectively at opposite ends thereof, the lower collar 3 having metal terminals 5 inserted. A primary coil 7 and a secondary coil 8 are wound round the cylindrical portion 1 of the bobbin 4, lead wires 6 of the coils being wound round a metal terminals 14 (hereinafter referred to as "maker metal terminals"). A magnetic element 10, such as a ferrite core, is inserted and fixed in position. The assembly formed in this way is placed in the case 11 and then a bottom plate 13 is inserted in position to close the opening of the case 11. The opening of the case 11 is provided with a rib 15 extending along the inner circumference of the opening, and the bottom plate 13 has a stepped portion 16 extending along the outer circumference thereof. In assembling the transformer the bottom plate 13 is forced into the opening of the case 11, and after the stepped portion 16 of the bottom plate 13 is located inside of the rib 15, the expanded opening is allowed to narrow, thereby securing the joint between the bottom plate 13 and the case 11.

When an electric circuit is to be formed by using a transformer of the above described type, it is a common practice to employ a printed board. Such a circuit of the prior art will be described with reference to Figure 6. A printed board 17 has a circuit pattern 18 printed with copper foil or the like. A transformer 19 includes various "passive

elements 20", such as inductance L, capacitor C and resistance R. Active elements 21, such as transistors, are mounted in position on the printed board 17. These components are electrically connected by soldering to the printed board 17. In this way, it has been usual to have electronic parts mounted peripherally of the transformer 19 on the printed board 17. Figure 7 is a circuit diagram showing an embodiment of Figure 6.

Transformers of this type find many applications. For example, they are employed in electronic apparatus, such as video cameras, telephone sets, and liquid crystal TV sets. In these applications, the transformers are required to have a structure adapted for attachment on the surfaces of printed boards because of the trend toward sophisticated functions and increased versatilities of light weight and small size. On the other hand, the conditions under which transformers are used are becoming more severe than ever. For example, they are subjected to thermal stresses due to reflow soldering, and mechanical loads exerted by supersonic wave cleaning after soldering. These external stresses may break the lead wires of the transformer and/or crack the ferrite core, thus eventually breaking the transformer. This problem will be more particularly described with reference to Figure 2:

The metal plate terminals 5a, 5b of the transformer are attached to the printed board 17. When any load is accidentally applied to the transformer in the vertical directions 22a and 22b, the transformer is actually subjected to a lift upward, that is, in the vertical direction 22a because the base portions thereof are secured to the printed board 17. In contrast, the bases 5e, 5f, 5g, 5h of the metal terminals 5a, 5b, 5c, 5d around which lead wires 6a, 6b, 6c, 6d are wound are subjected to a downward pressure together with the printed board 17 in the downward direction 22b. In this way, the lead wires 6a, 6b, are pulled both upward and downward, thereby causing the lead wires 6a and 6d to break. Likewise, when any load is applied laterally in the directions 23a and 23b, the breakage of the lead wires 6a to 6d to occur.

Another problem is that the metal terminals 5 are easy to deform, even by a relatively light load applied to their front ends, thereby decreasing the dimensional precision. This problem derives from the fact that the entire length of each of the metal terminals 5a, 5b, is the sum of the length of each of the portions 5a, 5f, about which the lead wires 6 are wound, and the length of each of the bent portions.

A further problem derives from the reflow soldering. More specifically, when the resin cast transformer shown in Figure 3 is to be reflow-soldered, the components are subjected to thermal stress.

The problem arises during the stage of reflow soldering, in which the temperature within the reflow furnace reaches 230°C. As is common with the reflow soldering process, preheating is carried out at 150°C for one to two minutes, and then the temperature of the furnace is maintained at more than 200°C for about 30 seconds. The components of the transformers are subjected to such a high temperature treatment, which unfavorably affects the transformers. For example, the primary and secondary coils 7, 8, the magnetic element 10, and the casting resin material 12 are elongated or expanded. However, since they have different coefficients of thermal expansion, the degree of expansion of the magnetic element 10, such as ferrite core, is different from that of the casting resin material 12. Generally, the casting resin material 12 has a hardness of 50 or more, and a greater expandability. Therefore, the problem is that the casting resin material 12 positioned between the bobbin 4 and the magnetic element 10, such as ferrite core, is likely to expand outwardly so that the expanding force breaks the magnetic element 10.

In a transformer of the type shown in Figure 4, the bottom plate 13 is merely inserted in the case 11, thereby failing to achieve a strong joint therebetween. In addition, gaps are likely to be produced between the bottom of the metal terminals 5 and the bottom of the case 11 and/or the bottom of the bottom plate 13. It may happen that the metal terminals 5 are detrimentally raised relative to the bottom of the transformer. As shown in Figure 5, the transformer having such a deficiency is mounted on the printed board 17, a gap T is created between the printed board 17 and the metal terminals 5 of the transformer, which prevents an improper soldering connection. The improper connection results in electrical conduction.

When circuits are to be constructed with the above-mentioned conventional transformer, the common practice is to mount the transformer 19 and other components on the printed board 17 as shown in Figure 6. This practice has a drawback in that a space sufficient for mounting other components than the body of the transformer 19 is required, thereby preventing the achievement of compact-size apparatus.

SUMMARY OF THE INVENTION

The encased transformer produced according to the method of this invention, overcomes the above-discussed and numerous other disadvantages and deficiencies of the prior art, where the respective method to produce an encased transformer comprising a bobbin (34) including a plastic-molded cylindrical portion (36) and upper (34).

and lower collars (35; 35a, 35b) formed respectively at upper and lower ends of the cylindrical portion (36), a magnetic element (38a, 38b) extending centrally through the cylindrical portion (36), primary and secondary coils (39, 42) wound round the outer periphery of the cylindrical portion (36), comb-shaped metal terminals (30, 31; 30a, 30b, 31a, 31b) formed on the pair of lower collars (35; 35a, 35b) by insert molding, the comb-shaped portion of each metal terminal (30, 31; 30a, 30b, 31a, 31b) being bent at generally right angles, the metal terminals (30, 31; 30a, 30b, 31a, 31b) being further bent outwardly horizontally at an end portion thereof, said method being characterized by the following features:

- a) each of the metal terminals (30, 31; 30a, 30b, 31a, 31b) is substantially Z-shaped;
- b) a straight portion of the terminal (30, 31 30a, 30b, 31a, 31b) is positioned midways of the Z-shape and fixedly held in position between the inner wall of a case (43),
- c) a frame wall (46) having recessed terminal grooves into which are individually fitted said metal terminals (30, 31; 30a, 30b, 31a, 31b) is provided on a plastic square bottom plate (44);
- d) said comb-shaped portion of each metal terminal (30, 31; 30a, 30b, 31a, 31b) is further bent at right angles; and
- e) the bottom plate (44) having an electronic circuit formed by various electronic parts thereon is fitted in position so that the electronic circuit is positioned within the opening of the case, the circuit being thereby electrically connected to the terminals (30, 31; 30a, 30b, 31, 31b) of the transformer body.

In a preferred variant on the method of the invention, the body of the transformer is inserted in the case, the transformer body comprising a bobbin having primary and secondary coils wound round it and a magnetic element extending centrally therethrough, and wherein a resin having a low degree of hardness of from 20 to 50 (JIS K6301), such as silicone resin, is loaded into the case so that the transformer body is partially or entirely embedded in the resin, the bottom plate being fitted in position through an opening of the case.

In another preferred variant on the method of the invention, the transformer body is inserted into a case provided with an undercut portion in its interior, a bottom plate formed with an engaging projection being fitted in position so that the engaging projection goes into engagement with the undercut portion of the case, and wherein the size of the bottom plate is equal to or larger than the size of the opening of the case, the case being positioned on the bottom plate, and the underside of the bottom plate being flush with the bottom of the

user metal terminal of the transformer body.

Further more, the bottom plate of the transformer produced according to the invention can have an electronic circuit formed by various electronic parts thereon, the bottom plate being fitted in position so that the electronic circuit is positioned within the opening of the case, the circuit thereby being electrically connected to the terminals of the transformer body.

Thus, the transformer produced in accordance with the invention described herein makes it possible to solve the objects of (1) providing an encased transformer capable of withstanding physical and thermal stresses, (2) providing an encased transformer securing the stable mount of metal terminals to the printed board, and (3) providing an encased transformer of compact-size with operational reliability.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention may be better understood and its numerous objects and advantages will become apparent to those skilled in the art by reference to the accompanying drawings as follows;

Figure 1 is a perspective view of a conventional transformer;

Figure 2 is a sectional view thereof;

Figure 3 is a sectional view showing a conventional resin-cast type transformer;

Figure 4 is a sectional view showing a conventional encased transformer;

Figure 5 is a side view thereof;

Figure 6 is a top plan view showing an electronic circuit formed on a printed board which incorporates a transformer therein;

Figure 7 is a circuit diagram for the electronic circuit;

Figure 8 is a perspective view showing one embodiment of the encased transformer produced according to the invention;

Figure 9 is a sectional view in side elevation thereof;

Figures 10a to 10c are schematic views showing the steps of assembling the encased transformer produced according to the present invention;

Figures 11a to 11c are top plan views showing metal terminals employed in the encased transformer produced according to the present invention;

Figure 12 is a sectional view showing an encased transformer representing an embodiment in which a relatively soft casting resin is used;

Figure 13 is a sectional view of an encased transformer in which the case rests on the bottom plate;

Figure 14 is a side view thereof;

Figure 15 is a perspective view showing a modified version of encased transformer;

Figure 16 is a sectional view thereof; and

Figures 17a to 17c are schematic views showing the steps of assembling the encased transformer of Figure 15 in accordance with the method of the present invention

DESCRIPTION OF THE PREFERRED EMBODIMENT

One variant of a method in accordance with the invention will now be described with reference to Figures 8 to 17, inclusive. Referring to Figure 11, a metal terminal to be attached to a bobbin will be described:

User metal terminals 30 and maker metal terminals 31 are made in one piece so that each pair of these terminals 30 and 31 are connected at their lead wires to form a U-shaped configuration as shown in Figures 11a to 11c. The U-shaped terminals are made in one piece with a hoop member 32. In order to enable the user to secure the firm joint between the metal terminals and a printed board, the metal terminals may be shaped so that, as Figure 11b shows, each user metal terminal 30 is wider than each maker metal terminal 31. In order to secure the lead wire on the terminals 31, the terminals 31 may be provided with a notch 33, as shown in Figure 11c. In this way the bobbin 34 is fabricated with the insertion of the U-shaped metal terminal in on a lower collar 35 thereof.

Referring to Figure 9, the bobbin 34 will be described in detail:

The bobbin 34 includes a cylindrical portion 36 made of plastic material, and an upper collar 37 and lower collars 35a, 35b formed at opposite ends of the cylindrical portion 36. The lower collars 35a and 35b are formed by the insert molding method. The metal terminals 30a, 30b, 31a, 31b each have a substantially U-shape and comb-shaped configuration as already described, and are in parallel with the direction in which magnetic elements 38a, 38b are inserted. During the stage of insert molding, both the user metal terminals 30a and the maker metal terminals are in a continuous hoop form; and before the lead wires 40 are wound, the bobbins are individually separated. A predetermined length of the maker metal terminals 31 remains uncut so as to facilitate the connection thereof to other devices because of the portion left uncut by a predetermined length. Then, the metal terminals 31 are bent downward at right angles, so as to form maker the metal terminals 31a, 31b. The lower collars 35a, 35b are respectively formed with grooves 41a for passage of lead wires 40 of a primary coil 39 and grooves 41b for passage of lead wires 40 of a secondary coil 42.

Referring to Figure 10, a case 43 and of a bottom plate 44 will be described:

The case 43, made of plastic and being open at one side, is provided with a pair of undercut portions 45 on its inside wall in the direction of X. The bottom plate 44 is also made of plastic, and has a square frame wall 46 of several millimeters in height formed on its upper surface. The frame wall 46 is provided with a pair of engaging projections 47 for engagement with the undercut portions 45 facing in the directions of X, and with a plurality of terminal grooves 48 facing in the directions of Y.

Referring to Figure 9, the method of assembling the transformer will be described:

The primary coil 39 is wound round the cylindrical portion 36 of the bobbin 34, and lead wires 40 are passed through the grooves 41a for winding round the maker metal terminals 31a. Similarly, the secondary coil 42 is wound round the cylindrical portion 36, and lead wires 40 are passed through the grooves 41b for winding round the maker metal terminals 31b. The lead wires 40 are soldered to the portions round which it is wound.

Subsequently, an E-type magnetic element 38a is inserted in the cylindrical portion 36 from one side thereof, and then an I-type magnetic element 38b is inserted therein from the opposite side thereof. The magnetic elements 38a and 38b are joined such as by adhesive. Instead of the I-type magnetic element 38, two E-type magnetic elements 38a and 38b can be used in combination. Then, the user metal terminals 30 assembled in this way is appropriately shaped. Referring to Figure 9, the shaping process of the metal terminals 30 will be described:

The user metal terminals 30a and 30b horizontally projecting from sides of the bobbin 34 are bent downward except a specified length thereof measured from the side ends of the lower collars 35, and other portions than a portion 30i of the metal terminal 30 are bent outwardly in the sideways direction. In this way the shaping process is completed.

The body of the transformer is inserted into a plastic case 43 as shown in Figure 10. The straight portions 30i of the user metal terminals 30 are held in abutment with the inner side wall 43a of the case 43. Then, the bottom plate 44 is fitted in position so that the projections 47 and square frame walls 46 provided on the bottom plate 44 are positioned in the case 43, whereupon the undercut portions 45 formed on the inner side walls of the case 43 are engaged by the engaging projections 47 formed on the bottom plate 44. That is, respective catching portions of the engaging projections 47 are sized larger than the interior of the undercut portions 45 formed in the inner wall of the case 43, whereby the engaging projections 47 of the bottom plate 44

are mechanically brought into a secure engagement with the undercut portions 45 of the case 43. The square frame walls 46 having terminal grooves 48 are intended to house the straight portions 30i formed by downwardly bending the user metal terminals 30, therefore the straight portions 30i are sandwiched between the inner side wall 43a of the case 43 and the square frame walls 46 of the bottom plate 44, thus being fixed in position.

The user metal terminals 30a and 30b assembled in this way, together with the hoop members 32, are cut to provide a specified length for each.

Referring to Figure 9, a further description is as follows:

After the user metal terminals 30a and 30b of the encased transformer are soldered to the printed board 55, the transformer is subjected to a load whereby it becomes separated from the printed board 55 in response to any upward force acting thereon, and the metal terminals 30a and 30b are subjected to a peeling urge. However, because the straight portions 30i of the user metal terminals 30a and 30b are sandwiched between the inner side wall 43a of the case 43 and the square frame walls 46 of the bottom plate 44, any load transmitted from the user metal terminals 30a, 30b are absorbed by the portion sandwiched between the square frame walls 46 of the bottom plate 44 and the inner side wall 43a of the case 43 and, therefore, such loads are not transmitted to the lower collars 35a, 35b of the bobbin 34. Thus, the bobbin 34 has no possibility of breakage. There is no possible breaking either with respect to the lead wires 40 of the primary and secondary coils 39, 42 which are wound round the metal terminals 31a, 31b. A similar effect is obtained against any lateral load, there being no possible breaking of the lead wires 40 or bobbin 34 due to such load.

Referring to Figure 12, a resin case encased transformer will be described:

As described in the beginning, the magnetic elements 38a, 38b are incorporated in the bobbin 34 with the primary and secondary coils 39, 42, and then the transformer body is inserted into a plastic case 43 which is open at one end. In this case, a resin material 49 having a low degree of hardness, such as silicone resin, is filled in the case 43 until the body of the transformer is partly or wholly buried therein, and then the resin is set. Preferably, the soft resins have a hardness of 10 to 50 (JIS K6301), most preferably of about 30. The stretch of the resin material 49 is preferably of the order of not larger than 150%, preferably of about 120%.

Referring to Figures 13 and 14, the construction of the above mentioned plastic case 43 and bottom plate 44 will be described:

After the transformer is inserted into the case 43, the bottom plate 44 is fitted and fixed to the case 43. The opening of the case 43 is smaller in size than the bottom plate 44 so that the opening end of the case 43 can be mounted on the bottom plate 44. Therefore, when the transformer of the invention is to be mounted on a printed board, the bottom plate 44 and the user metal terminals 30 are in contact with the printed board. For the purpose of fitting, the inside wall of the case 43 is provided with undercut portions 45 adjacent to the open end of the case 43, and the bottom plate 44 is provided with engaging projections 47 so that the undercut portions 45 are engaged by convex portions 50 of the projections 47.

The inside wall of the bottom plate 44 is provided with circuit patterns 51 with the use of copper foil, with the part of it coated with photo-resist. In addition, electronic components 52 having inductance L, capacitor C and resistance R are added. Instead of forming the circuit patterns on the inside wall of the bottom plate 44, a flexible substrate having circuit patterns can be mounted on the bottom plate 44. A transformer incorporating a magnetic element 38 is inserted into the case 43 and then the bottom plate 44 incorporating an electronic circuit is fitted in the case 43. In this way a transformer incorporating an electronic circuit is constructed. For connection between the user metal terminals 30 and the circuit patterns 51, it is arranged that inverted U-shaped terminal grooves 48 formed on the bottom plate 44 are provided with a printed circuit pattern 51 as a portion of the circuit pattern 51, the partial circuit pattern 51 being coated with a solder cream or the like, which will be heated after the assembly operation, whereby a connection 54 between the metal terminal 30 and the circuit pattern 51 can be formed.

Claims

1. A method to produce an encased transformer comprising a bobbin (34) including a plastic-molded cylindrical portion (36) and upper (34) and lower collars (35; 35a, 35b) formed respectively at upper and lower ends of the cylindrical portion (36), a magnetic element (38a, 38b) extending centrally through the cylindrical portion (36), primary and secondary coils (39, 42) wound round the outer periphery of the cylindrical portion (36), comb-shaped metal terminals (30, 31; 30a, 30b, 31a, 31b) formed on the pair of lower collars (35; 35a, 35b) by insert molding, the comb-shaped portion of each metal terminal (30, 31; 30a, 30b, 31a, 31b) being bent at generally right angles, the metal terminals (30, 31; 30a, 30b, 31a, 31b) being further bent outwardly horizontally



are mechanically brought into a secure engagement with the undercut portions 45 of the case 43. The square frame walls 46 having terminal grooves 48 are intended to house the straight portions 30i formed by downwardly bending the user metal terminals 30, therefore the straight portions 30i are sandwiched between the inner side wall 43a of the case 43 and the square frame walls 46 of the bottom plate 44, thus being fixed in position.

The user metal terminals 30a and 30b assembled in this way, together with the hoop members 32, are cut to provide a specified length for each.

Referring to Figure 9, a further description is as follows:

After the user metal terminals 30a and 30b of the encased transformer are soldered to the printed board 55, the transformer is subjected to a load whereby it becomes separated from the printed board 55 in response to any upward force acting thereon, and the metal terminals 30a and 30b are subjected to a peeling urge. However, because the straight portions 30i of the user metal terminals 30a and 30b are sandwiched between the inner side wall 43a of the case 43 and the square frame walls 46 of the bottom plate 44, any load transmitted from the user metal terminals 30a, 30b are absorbed by the portion sandwiched between the square frame walls 46 of the bottom plate 44 and the inner side wall 43a of the case 43 and, therefore, such loads are not transmitted to the lower collars 35a, 35b of the bobbin 34. Thus, the bobbin 34 has no possibility of breakage. There is no possible breaking either with respect to the lead wires 40 of the primary and secondary coils 39, 42 which are wound round the user metal terminals 31a, 31b. A similar effect is obtained against any lateral load, there being no possible breaking of the lead wires 40 or bobbin 34 due to such load.

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After the transformer is inserted into the case 43, the bottom plate 44 is fitted and fixed to the case 43. The opening of the case 43 is smaller in size than the bottom plate 44 so that the opening end of the case 43 can be mounted on the bottom plate 44. Therefore, when the transformer of the invention is to be mounted on a printed board, the bottom plate 44 and the user metal terminals 30 are in contact with the printed board. For the purpose of fitting, the inside wall of the case 43 is provided with undercut portions 45 adjacent to the open end of the case 43, and the bottom plate 44 is provided with engaging projections 47 so that the undercut portions 45 are engaged by convex portions 50 of the projections 47.

The inside wall of the bottom plate 44 is provided with circuit patterns 51 with the use of copper foil, with the part of it coated with photo-resist. In addition, electronic components 52 having inductance L, capacitor C and resistance R are added. Instead of forming the circuit patterns on the inside wall of the bottom plate 44, a flexible substrate having circuit patterns can be mounted on the bottom plate 44. A transformer incorporating a magnetic element 38 is inserted into the case 43 and then the bottom plate 44 incorporating an electronic circuit is fitted in the case 43. In this way a transformer incorporating an electronic circuit is constructed. For connection between the user metal terminals 30 and the circuit patterns 51, it is arranged that inverted U-shaped terminal grooves 48 formed on the bottom plate 44 are provided with a printed circuit pattern 51 as a portion of the circuit pattern 51, the partial circuit pattern 51 being coated with a solder cream or the like, which will be heated after the assembly operation, whereby a connection 54 between the metal terminal 30 and the circuit pattern 51 can be formed.

Claims

1. A method to produce an encased transformer comprising a bobbin (34) including a plastic-molded cylindrical portion (36) and upper (34) and lower collars (35; 35a, 35b) formed respectively at upper and lower ends of the cylindrical portion (36), a magnetic element (38a, 38b) extending centrally through the cylindrical portion (36), primary and secondary coils (39, 42) wound round the outer periphery of the cylindrical portion (36), comb-shaped metal terminals (30, 31; 30a, 30b, 31a, 31b) formed on the pair of lower collars (35; 35a, 35b) by insert molding, the comb-shaped portion of each metal terminal (30, 31; 30a, 30b, 31a, 31b) being bent at generally right angles, the metal terminals (30, 31; 30a, 30b, 31a, 31b) being further bent outwardly horizontally



at an end portion thereof, said method being characterized by the following features:

- a) each of the metal terminals (30, 31; 30a, 30b, 31a, 31b) is substantially Z-shaped;
- b) a straight portion of the terminal (30, 31; 30a, 30b, 31a, 31b) is positioned midway of the Z-shape and fixedly held in position between the inner wall of a case (43),
- c) a frame wall (46) having recessed terminal grooves into which are individually fitted said metal terminals (30, 31; 30a, 30b, 31a, 31b) is provided on a plastic square bottom plate (44);
- d) said comb-shaped portion of each metal terminal (30, 31; 30a, 30b, 31a, 31b) is further bent at right angles; and
- e) the bottom plate (44) having an electronic circuit formed by various electronic parts thereon is fitted in position so that the electronic circuit is positioned within the opening of the case, the circuit being thereby electrically connected to the terminals (30, 31; 30a, 30b, 31a, 31b) of the transformer body.

2. A method to produce an encased transformer according to claim 1, wherein the body of the transformer is inserted in the case, the transformer body comprising a bobbin having primary and secondary coils wound round it and a magnetic element extending centrally there-through, and wherein a resin having a low degree of hardness of from 20 to 50, such as silicone resin, is loaded into the case so that the transformer body is partially or entirely embedded in the resin, the bottom plate being fitted in position through an opening of the case.
3. A method to produce an encased transformer according to claim 1, wherein the transformer body is inserted into a case provided with an undercut portion in its interior, a bottom plate formed with an engaging projection being fitted in position so that the engaging projection goes into engagement with the undercut portion of the case, and wherein the size of the bottom plate is equal to or larger than the size of the opening of the case, the case being positioned on the bottom plate, and the underside of the bottom plate being flush with the bottom of the user metal terminal of the transformer body.

Patentansprüche

1. Verfahren zur Herstellung eines umhüllten Transformators mit einer Spule (34) mit einem

aus Plastik geformten zylindrischen Abschnitt (36) und oberen (34) und unteren Kragen (35; 35a, 35b), die jeweils an oberen und unteren Enden des zylindrischen Abschnitts (36) ausgebildet sind, einem magnetischen Element (38a, 38b), das sich zentral durch den zylindrischen Abschnitt (36) erstreckt, primären und sekundären Wicklungen (39, 42), die rund um den äußeren Umfang des zylindrischen Abschnitts (36) gewickelt sind, kammförmigen Metallanschlüssen (30, 31; 30a, 30b, 31a, 31b), die auf dem Paar der unteren Kragen (35; 35a, 35b) durch Eingießen ausgebildet sind, wobei der kammförmige Abschnitt eines jeden Metallanschlusses (30, 31; 30a, 30b, 31a, 31b) im allgemeinen im rechten Winkel gebogen ist, und wobei die Metallanschlüsse (30, 31; 30a, 30b, 31a, 31b) weiterhin nach außen horizontal an ihrem Endabschnitt gebogen sind, wobei dieses Verfahren gekennzeichnet ist durch die folgenden Merkmale:

- a) jeder der Metallanschlüsse (30, 31; 30a, 30b, 31a, 31b) ist im wesentlichen Z-förmig;
- b) ein gerader Abschnitt des Anschlusses (30, 31; 30a, 30b, 31a, 31b) ist in der Mitte der Z-Form angeordnet und fest zwischen der Innenwand eines Gehäuses (43) in Position gehalten,
- c) eine Rahmenwand (46) mit vertieften Anschlußnuten, in welche die Metallanschlüsse (30, 31; 30a, 30b, 31a, 31b) individuell eingepaßt sind, ist auf einer quadratischen Bodenplatte (44) aus Kunststoff vorgesehen;
- d) der kammförmige Abschnitt eines jeden Metallanschlusses (30, 31; 30a, 30b, 31a, 31b) ist weiterhin im rechten Winkel gebogen; und
- e) die Bodenplatte (44) mit einer elektronischen Schaltung, die durch mehrere elektronische Teile darauf ausgebildet ist, ist in Position eingepaßt, so daß die elektronische Schaltung in der Öffnung des Gehäuses positioniert ist, wobei die Schaltung dadurch elektrisch mit den Anschlüssen (30, 31; 30a, 30b, 31a, 31b) des Transformatorkörpers verbunden wird.

2. Verfahren zur Herstellung eines umhüllten Transformators nach Anspruch 1, bei dem der Körper des Transformators in das Gehäuse eingesetzt wird, wobei der Transformatorkörper eine Spule mit primären und sekundären Wicklungen, die um sie herum gewunden sind, und ein magnetisches Element aufweist, das sich zentral durch ihn hindurch erstreckt, und wobei ein Harz mit einem geringen Härtegrad von 20 bis 50, wie z. B. Silikonharz, in das Gehäuse gefüllt wird, so daß der Transforma-



torkörper teilweise oder ganz in das Harz eingebettet wird, wobei die Bodenplatte durch eine Öffnung des Gehäuses in ihrer Lage positioniert wird.

3. Verfahren zur Herstellung eines umhüllten Transformators nach Anspruch 1, wobei der Transformatorkörper in ein Gehäuse eingesetzt wird, das in seinem Inneren mit einem unterschrittenen Bereich versehen ist, wobei eine mit einem eingreifenden Vorsprung ausgebildete Bodenplatte in ihrer Lage positioniert wird, so daß der eingreifende Vorsprung mit dem unterschrittenen Bereich des Gehäuses in Eingriff kommt, und wobei die Größe der Bodenplatte gleich oder größer als die Größe der Öffnung des Gehäuses ist, wobei das Gehäuse auf der Bodenplatte positioniert wird, und wobei die Unterseite der Bodenplatte bündig mit dem Boden des Benutzer-Metallanschlusses des Transformatorkörpers ist.

Revendications

1. Un procédé de production d'un transformateur hermétique comprenant une bobine (34) comportant une partie cylindrique (36) moulée en matière plastique et des colliers supérieur (34) et inférieurs (35; 35a, 35b) formés respectivement aux extrémités supérieure et inférieure de la partie cylindrique (36), un élément magnétique (38a, 38b) s'étendant de manière centrale dans la partie cylindrique (36), des bobines primaire et secondaire (39, 42) enroulés autour de la périphérie extérieure de la partie cylindrique (36), des bornes métalliques en forme de peigne (30, 31; 30a, 30b, 31a, 31b) formées sur la paire de colliers inférieurs (35; 35a, 35b) par moulage par insertion, la partie en forme de peigne de chaque borne métallique (30, 31; 30a, 30b, 31a, 31b) étant recourbée à angle généralement droit, les bornes métalliques (30, 31; 30a, 30b, 31a, 31b) étant, par ailleurs, recourbées horizontalement vers l'extérieur à l'une de leurs parties d'extrémité, ledit procédé étant caractérisé par les particularités suivantes:
 - a) chacune des bornes métalliques (30, 31; 30a, 30b, 31a, 31b) est sensiblement en forme de "Z",
 - b) une partie droite de la borne (30, 31; 30a, 30b, 31a, 31b) est positionnée à mi-chemin de la forme en "Z" et maintenue en place de manière fixe entre la paroi intérieure d'un boîtier (43),
 - c) une paroi d'encadrement (46) présentant des rainures à borne en retrait, dans lesquelles sont montées individuellement lesdi-

tes bornes métalliques (30, 31; 30a, 30b, 31a, 31b), est prévue sur une plaque de fond carrée en matière plastique (44),

d) ladite partie en forme de peigne de chaque borne métallique (30, 31; 30a, 30b, 31a, 31b) est, par ailleurs, recourbée à angle droit, et

e) la plaque de fond (44) présentant un circuit électronique formé de différents composants électroniques sur celle-ci est mise en place de manière que le circuit électronique est positionné dans l'ouverture du boîtier, le circuit étant ainsi raccordé électriquement aux bornes (30, 31; 30a, 30b, 31a, 31b) du corps de transformateur.

2. Un procédé de production d'un transformateur hermétique suivant la revendication 1, dans lequel le corps du transformateur est inséré dans le boîtier, le corps de transformateur comprenant une bobine présentant des bobines primaire et secondaire enroulés sur celle-ci et un élément magnétique s'étendant de manière centrale dans celle-ci, et dans lequel une résine ayant un faible degré de dureté de 20 à 50, telle qu'une résine silicone, est chargée dans le boîtier, de manière que le corps de transformateur est partiellement ou entièrement enrobé dans la résine, la plaque de fond étant montée en place à travers une ouverture dans le boîtier.
3. Un procédé de production d'un transformateur hermétique suivant la revendication 1, dans lequel le corps du transformateur est inséré dans un boîtier pourvu d'une partie découpée à l'intérieur de celui-ci, une plaque de fond formée avec une saillie d'emboîtement étant montée en place de manière que la saillie d'emboîtement vient en prise avec la partie découpée du boîtier, et dans lequel la grandeur de la plaque de fond est égale ou supérieure à la grandeur de l'ouverture du boîtier, le boîtier étant positionné sur la plaque de fond et le côté inférieur de la plaque de fond étant à fleur avec la partie inférieure de la borne métallique d'utilisateur du corps de transformateur.