COIL FORM, AND COILS AND TRANSFORMERS MOUNTED THEREON

John O. Renskers, Lombard, Ill., assignor to Collcraft, Inc., Cary, Ill., a corporation of Illinois
Filed Aug. 17, 1959, Ser. No. 384,367

8 Claims.

My invention relates to an improved coil form, to a method for making coils and transformers and to the coils and transformers so made.

In printed circuitry as employed by the radio and television industry, certain coils and transformers are made in a spool-like form with terminals projecting from one end thereof which are inserted, often automatically, into appropriate receptacles in the printed circuit board. One significant problem in the manufacture of coils and transformers for such insertion resides in the maintenance of a proper orientation and regularity of the terminals so as to be insertable accurately into their receptacles.

A major object of my invention, therefore, is the provision of a new and novel coil or transformer structure whereby the coil leads are accurately oriented and shaped at the conclusion of the manufacture thereof.

Another major object of my invention resides in the method of making such coils and transformers.

Yet another object of my invention lies in a new and novel coil or transformer structure for printed circuits and the like which is simple and inexpensive, wherein the coil or coils and the terminals thereof are supported firmly and accurately, and which is well suited to automatic manipulation.

Yet another object of my invention lies in a new and novel coil form for such coil or transformer structures whereby such method may be practiced and such coils and transformers made.

Other objects and advantages of my invention will be apparent from the following descriptions and drawings of which:

FIG. 1 is a side elevation of a transformer incorporating my invention;
FIG. 2 is a side elevation of the secondary coil of FIG. 1;
FIG. 3 is a side elevation of the inner, primary coil of FIG. 1 rotated from the showing of FIG. 1 to illustrate the offset of the leads thereof;
FIG. 4 is a bottom plan view of the coil form of FIG. 1, shown with the coil leads projecting therefrom;
FIG. 5 is a fragmentary vertical section through the coil form taken substantially along the line 5-5 of FIG. 4;
FIG. 6 is a view similar to the right hand portion of FIG. 5, showing, however, a coil lead anchored in the coil form;
FIG. 7 is a fragmentary vertical section through the transformer of FIG. 1 showing it immersed and in a winding bath for winding the leads thereof; and
FIG. 8 is a view similar to FIG. 1 of a coil embodying my invention.

In FIG. 1 is shown a transformer 16 consisting generally of a coil form 12, a primary coil 14 and a secondary coil 16 surrounding and overlying the primary coil 14. The coil form 12 is made of thermoplastic insulated material such as nylon, polyethylene and the like, and includes a tubular post 18 which extends through the coils and an annular skirt or flange 20 extending about the lower end thereof. The post 18 may have internal provision for adjustably mounting a core, but as such provisions are well known in the art and play no part in my invention it has not been illustrated.

The top surface 22 of the skirt 20 is peripherally dimpled to provide a plurality of conical depressions 24 in the upper surface, there being six such depressions in the illustrated embodiment, and corresponding conical projections 26 on the underside 28 of the skirt. Holes 30 are formed through the skirt in the bottoms of the conical depressions. The holes are proportioned to be somewhat larger than the coil leads which they are to contain. Slots 32 are formed in the edge 34 of the skirt to extend to each of the holes 30. The slots are desirable formed to extend at a substantial angle away from the radial with respect to the skirt to meet the holes 30 at points spaced inwardly from the outermost edges thereof.

The coils of the described transformer are illustrated in FIGS. 2 and 3. FIG. 2 shows the secondary coil which is the outer coil of FIG. 1. This consists of a helical winding 36 of insulated wire with the bottom lead 38 thereof bent through a right angle to extend downward from the coil and the upper lead 40 bent likewise through a right angle to extend down outside the coil 36 and project therebelow parallel to the axis of the coil. The leads may be offset outwardly as needed to enter the appropriate holes 30 in the skirt 22.

The primary coil 14 of FIG. 3 includes a helical winding 42 of smaller radius than the radius of the secondary coil 16 so that it may be inserted within the secondary coil 16 and of sufficient inside diameter to fit over post 18 of the coil form. The lowermost lead 44 of the primary coil extends outwardly as at 46 from the coil and then downward as at 48. The upper lead 50 of the coil projects outwardly from the coil as at 52 and extends downwardly as at 54 to extend below the helix 42. The outward extensions 46 and 52 of the two leads is for the purpose of spacing the leads properly for reception in the holes 30 and the outward extension 52 is for the additional purpose of permitting the reception of the secondary coil 16 between the helix 42 of the primary coil 14 and the upper lead thereof 50.

The assembly of these components is believed evident from their description. The primary coil 14 is inserted in the secondary coil 16 and the two assembled coils are inserted into the winding and in a winding bath as illustrated in FIG. 1. The downwardly projecting leads 38, 40, 44 and 50 may be guided into certain pre-arranged holes 30 in the skirt 20 so that a particular orientation of the leads, either absolute or relative, pertains according to the coil user's specifications. It should be the case that the leads are not axial or properly spaced from the axis of the coil or oriented inaccurately for the direct insertion into holes 30, as will most likely be the situation, the leads may be inserted into the holes 30 subsequent to the deposits of the coil on the post 18 and the seating thereof against skirt 20 by snapping the leads through slots 32 into the appropriate holes 30.

A usual part of the manufacture of such coils or transformers involves turning the leads thereof. This is achieved by dipping the leads in a turning bath as illustrated in FIG. 7. The turning bath is simply a receptacle 56 having a molten turning composition 58 therein. The insulation of the wire used in coil manufacture is generally thermoplastic, and the turning dip strips back the insulation with immersion of the leads into the bath.

A part of my invention resides in dipping the leads of the assembled but not yet completed transformer as described above into the turning bath so that the surface of the turning bath touches the conical downward projections 26 encircling the leads in holes 30 and the thermoplastic material of which the coil form is made melts and flows on the surface of the bath to the holes 30 to close about the leads as illustrated in FIG. 6. Removal of the leads and subsequent cooling of the transformer skirt material then anchors the coils to the coil form by their leads and insures a precise angular rela-
tion of the leads and a relatively exact cylindrical extension thereof from the base of the coil form well suited for insertion in a printed circuit board. The floated plastic of the projections bonds successfully to bare wire, but particularly well to the insulation on the wire.

Upon cooling, the melted plastic of the projections provides an embedment which is a major means of securing the coil to the form. Possibly a seal may be achieved without actual contact of the projections with the surface. The projections will soften and flow somewhat from the radiated heat of the bath if brought very nearly into contact and from the conduction-heated leads extending therethrough and the stripped insulation may join the projection ends to contribute the seal.

Since the leads are anchored in the coil form skirt close to their ends the leads have substantial stiffness and are well able to withstand bending forces which may arise in subsequent handling. Should the leads be bent in handling they may easily be straightened again without destroying the seal between the leads and the coil form skirt.

I have tried forming the slots 32 radially in the skirt and leading directly into the holes 30 and have had some success with such structure but I find an occasional tendency of the leads to spring back out of the skirt through such slots in the timing and sealing process. In the timing process I find that the slots, particularly the non-radial slots shown, usually heal themselves and flow closed.

It will be noted in FIG. 6 that the conical downward extensions 26 are not completely leveled in the timing dip but rather, as may be seen in FIG. 1 the leads extend from what may be considered small bosses 60, the residues of the projections 26. This is a characteristic deliberately sought and controlled by the depth of the immersion of the transformer leads into the timing bath. In printed circuits it is desirable for ventilation and the avoidance of condensation between the mounting board and attached components that circuit elements that such elements be spaced slightly above the surface of the mounting boards, and the radial bosses 60 meet excellently this spacing function.

It is believed that the structure of the coil illustrated in FIG. 6 will be readily understood from the foregoing description of the transformer. The coil 61 is illustrated as being constructed in conjunction with the transformer. In this case, a single helical winding 64 is placed on the tubular post 66 of the coil form to abut at its lower end against skirt 58 of the form. The free ends 70 and 72 of the winding are passed through the desired holes in the coil form skirt either directly or by forcing them through slots identical with slots 32 of FIG. 4. Free end or lead 72 constitutes the upper free end of the winding 64 and is carried down the outside of the winding to extend below the coil form skirt as illustrated. The leads of the assembled winding and form are then tinned as described before to seal the conical projections, identical with projections 26 of the transformer structure, about the leads 70 and 72 and so create the bosses 74.

It will be evident from the foregoing description that my invention is capable of many applications and likewise that many variations and differences in structure will readily present themselves to those skilled in the art.

The coil form of my invention is not restricted to the six holes described and many holes may be provided to accommodate electric or electronic components having a considerably greater number of leads. Likewise it will be appreciated that my coil form and method need not be specifically limited to the manufacture of transformers and coils but that many other areas of application will suggest themselves.

It will be further appreciated that while I have described the sealing of the leads in the holes 30 as a part of a lead timing dip, this sealing may be effected independently by dipping the ends of the projections in a bath of any appropriate fluid heavy enough to cause a floating of the melted or softened thermo-plastic and hot enough to cause the requisite softening or melting.

Thus where timing of the leads may not be required, separate dip will be employed to make the seal. I therefore desire that my invention be regarded as being limited only as set forth in the following claims.

I claim:

1. A circuit component comprising a coil form having a post and an insulating skirt at one end thereof made of a thermoplastic material having the general characteristics of nylon and polyethylene including having a melting point below the temperature of a timing bath, said skirt having integral bosses on that side thereof away from said post, and an electrical winding about said said post having free ends extending through said said boss, and beyond said skirt, the portions of the ends of said winding beyond said said being tinned and the portions of said ends within said skirt being embedded in a solidified melt of said bosses, said embodiment of said ends being at least a major means of securing said winding to said form.

2. A coil form comprising a post, a thermoplastic insulating skirt about said said adjacent the lower end thereof, said skirt having a plurality of projections from the lower surface thereof and a plurality of apertures therethrough centered in said projections, and slots extending from the periphery of said said skirt at a substantial angle to a radial direction and intercepting said apertures at a point spaced from the outermost edges thereof.

3. A circuit component comprising a coil form having a post, an electrical winding about said said, an insulating flange on said said made of a thermoplastic material having the general characteristics of nylon and polyethylene including having a melting point below the temperature of a timing bath, at least one end of said winding extending parallel to the axis of said coil and through said flange, said flange including an integral boss on the surface thereof remote from said said, said end extending centrally through said said boss, the portion of said end within said boss being embedded in a solidified melt of said boss, said embodiment of said end being at least a major means of securing said winding to said form.

4. A circuit component comprising a coil form having a post and an insulating skirt at one end thereof made of a thermoplastic material having the general characteristics of nylon and polyethylene including having a melting point below the temperature of a timing bath, and an electrical winding about said said post and adjacent one face of said said at one end thereof, the free ends of said winding extending through and beyond said said, said said including integral bosses on the side thereof remote from said said, said ends extending through said said bosses, the portions of said said within said said being embedded in a solidified melt of said said, said embodiment of said ends being at least a major means of securing said winding to said form.

References Cited by the Examiner

UNITED STATES PATENTS

2,412,836 12/46 Rose -------------- 29—155.55
2,867,894 1/59 Hill -------------- 29—155.55
2,879,584 3/59 Skebel -------------- 29—155.56
2,889,497 6/59 Wolf et al. -------------- 336—192 X
2,889,524 6/59 Schmitz -------------- 336—192 X
2,918,640 12/59 Higbe -------------- 336—192 X
2,929,32 3/60 Wohlgemuth -------------- 336—192 X
2,941,172 6/60 Sutton -------------- 336—136 X

LARAMIE E. ASKIN, Primary Examiner.

ORS L. RADER, MILTON O. HIRSFIELD, JOHN F. BURNS, Examiners.