

[54] **DUAL IN-LINE PACKAGE**
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 336/96; 117/101 R, 101 CC

[57] **ABSTRACT**

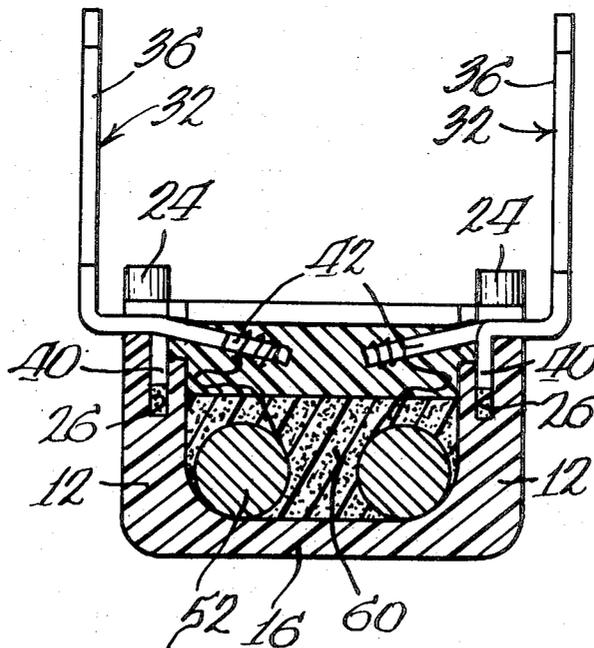
A dual in-line package construction conforming exteriorly to a standard size but providing greater interior capacity and greater ease of circuit element mounting characterized by the mounting of bifurcated lugs by one leg only in the side walls of an open-topped box with the remaining legs extending from the free edges of the walls.

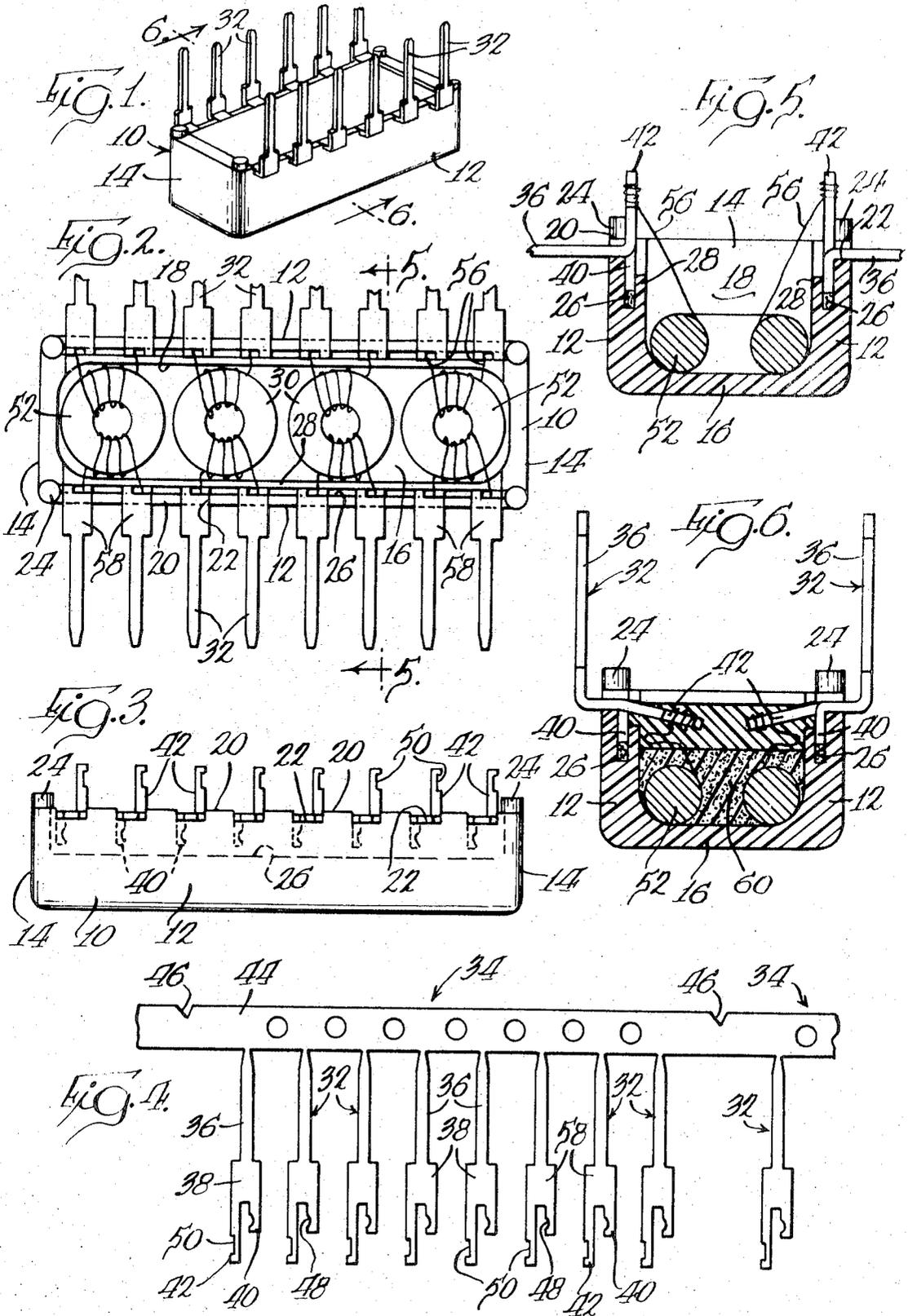
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11 Claims, 6 Drawing Figures





DUAL IN-LINE PACKAGE

BACKGROUND OF THE INVENTION

In the data processing equipment industry, a pair of modules or headers have been commonly accepted for packaging semiconductor assemblies which measure $0.85 \times 0.25 \times 0.185$ inches (16 terminal) and $0.75 \times 0.25 \times 0.185$ inches. (14 terminal) including a 0.025 inch stand-off provision. Two ranks of terminal points extend from opposite sides of the module and are bent down into parallel relation to result in a spacing of 0.30 inches (slightly wider than the module box itself). Automatic machinery has been devised for inserting these modules into circuit boards wherein, by program, the board is moved to place successive module positions into an insertion head, and, at the same time, magazines of modules are interchanged to feed the correct module to that position.

While this machinery has been designed to insert semi-conductor assemblies, there is obvious advantage to designing a header which can mount any of a variety of passive circuit elements or combination which can be incorporated into the insertion procedure of the machinery without special modification. One such passive element particularly present in quantity in data processing equipment is the pulse transformer, and the invention here is described in such context of usage although it will be evident that the header lends itself to any of a variety of passive elements, singly or in combination, as long as the capacity of the header is not exceeded.

Two approaches have been made to the problem of providing box-like receptacles with two ranks of terminal pins. One is a shallow open-topped box with perforations in the floor to accept "ski-pole" terminal pins (pins with an integral flange thereabout). Since the pins are inward of the sides of the box, these modules obviously require modification of the inserting mechanism; that is, the box is necessarily wider than the one specified if the ranks of pins are to be equally spaced. Additionally, however, this construction presents great difficulty and expense in mounting circuit elements. The box bottom is necessarily thin to give necessary depth, and the pins inevitably can wobble in the holes. To ensure an exact alignment of the pins, the assembly must be jig-mounted during the encapsulation process and cure.

The second approach provides a shallow, molded, open top box with bifurcated lugs molded therein. The floor of the box is the surface which confronts the circuit board when mounted. The points of the lugs extend laterally out from the sides of the box. One of the bifurcations is continuous with the prong and is embedded in the floor of the box. The other bifurcation is short, bent at a right angle and is embedded in and extends up a short distance above the side walls. The components are inserted in the box, the leads connected to the second bifurcations and a skirted lid overlapping the box sides placed on it. The lid has a large hole in the top through which the interior cavity is filled with encapsulant. Thereafter the points are bent down outside the box for circuit insertion.

The difficulty with this structure lies in the relatively great side wall and floor thickness. The floor must encompass the molded-in bifurcation and be heavy on the underside to resist flaking when the points are bent

downward. The walls are of augmented thickness by virtue of the overlapping skirt. Where the outside dimension is fixed, the inside must yield.

SUMMARY OF THE INVENTION

This invention contemplates the use of a box as in the latter of the foregoing approaches, but it contemplates the use of the box in inverted form; that is, the components will be mounted in the box with the floor generally lowermost, but the assembled module will have the prongs extending upward from the sides of the box and thus the box proper will be inverted in circuit use with the floor remote from the circuit board, and the encapsulant constituting the sole enclosure of the circuit components and forming the surface confronting the circuit board. The terminal lugs are mounted in the walls of the box, the embedment of only one bifurcation being necessary. The other bifurcations to which the circuit element leads are connected extend outward from the mouth of the box and are of relatively substantial length. This length, which is impossible in the second approach above by reason of a still further reduction in the depth of the box, permits an easier hookup procedure (which must be manually done), dip-soldering, and a subsequent bending over into the box to encapsulate the hookup and provide excellent strain relief. Breakage of transformer leads or lead-terminal lug connections during encapsulation in previously used headers is a common source of failure and is attributable to the lead wires being under tension throughout the encapsulation process with its attendant wide temperature variations.

Finally, the bottom of the box which is plane is presented to the eye as the completed module is used, and is neater in appearance than the varying lumps or concavities characteristic of the encapsulant surface and lends itself far better to marking.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a dual in-line pulse transformer mounted in accordance with the present invention;

FIG. 2 is a top plan view of the mounting header shown with terminal racks and transformers emplaced;

FIG. 3 is a side elevation of the header of FIG. 2;

FIG. 4 is a plan view of a rack of terminal pins;

FIG. 5 is a section taken along the line 5—5 of FIG. 3 looking in the direction of the arrows showing the terminal lugs arranged for transformer lead connection; and

FIG. 6 is a section similar to FIG. 5 taken along the line 6—6 of FIG. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

The header of this invention is described here in conjunction with the mounting of four pulse transformers, although it will be appreciated, as stated above, that it is adaptable to the mounting of a variety of circuit elements or combination of elements. It consists of an elongated rectangular open-mouthed box 10 formed of molded plastic and having side walls 12, end walls 14, a floor 16, and a central cavity 18. The side walls 12 are castellated to provide alternate elevations 20 and depressions 22. Posts or stand-offs 24 extend upwardly

above the castellated line at the corners. The side walls are longitudinally channeled deeply as at 26, the channels being defined by inside walls or flanges 28 which rise to a less height than the depressions 22 of the castellated edges.

The specific embodiment illustrated mounts four toroidally wound transformers 30 for circuit connection, and to this end, each side of the cup will be furnished with eight terminal lugs 32. For mounting other components in other numbers, however, it will be evident that the desired number of terminal lugs may vary widely. The length of the box, of course, also may vary, although variance from the above-stated standard sizes disqualifies it from the automatic insertion machinery described above.

The terminal lugs desirably are provided in connected racks 34 of eight. Each terminal lug consists of a narrow point 36 adapted for circuit board or receptacle insertion and a relatively broad base 38 to accommodate a bifurcation into a short mounting leg 40 and a longer solder leg or lead leg 42 to which the transformer leads are to be connected. The lugs are formed integrally on the edge of a carrier strip 44 to extend laterally therefrom in the spaced relation of the depressions 22 of the castellated sides 12 of the cup 10. The tips of the points 36 constitute the point of join of the lugs 32 to the strip 44. The strip 44 is notched 46 to divide it individual racks 34.

The legs 40 and 42 have notches 48 and 50 in their longitudinal edges, the notches 48 constituting a key with an adhesive of the completed module and the notches 50 providing a point of wrap for the transformer leads. Prior to assembly the legs 48 are bent through 90° in one direction and the legs 50 through 90° in the other direction on the line transverse to the base of the bifurcation such that the legs 48 and 50 extend oppositely in a plane and the points 36 extend outwardly perpendicularly from that plane as may be best seen in FIG. 5.

The pulse transformers 30 are torus cores 52 with toroidal windings 54 on opposite sides thereof terminating in leads 56.

The assembly of the header and the subsequent module is as follows. The racks of lugs with the oppositely bent legs are secured to the box by inserting the mounting legs 40 in the channels 26 so that the unsplit portion 58 of the base 38 of the lugs comes to rest in the depressions 22 of the castellated side edges with the portions 58 extending laterally outward and the lead legs 42 extending upward. The mounting legs are dipped in an epoxy or equivalent cement prior to insertion to bond them within the channel, and the cement cured. The header is thus completed.

For the pulse transformer assembly, the individual pulse transformers are laid in the box with the leads extended out of the box. In the specific instance of the pulse transformers, they should be wrapped or contained in a highly yieldable material such as a resilient foam 60 so as not to inhibit magnetostriction. The leads 56 are wrapped around the lead leg ends 42 at the notches 50 and the excess cut off. The header is then inverted and the wraps of lead wire solder-dipped. Although the lead wire is light, the support of four lengths of it is sufficient to hold the transformers within the box despite the inversion.

It will be appreciated that in order to obtain a good wrap, the lead from the transformer must be taut. It cannot be slack without resulting in a loose wrap. Therefore, strain in the lead wire is necessarily present, barring any change in spatial relationship, and lateral or thermal stresses added to the strain might easily result in breaking of the lead or failure of the wrap connection.

The header is then restored to its open-end-up position and the solder ends bent inward into the box, desirably through slightly more than 90° so as to have a downward inclination and place the solder joints below the level of the sides of the box, but spaced above the transformers. This infolding of the solder legs introduces a large amount of slack in the transformer leads for strain relief. The portions 58 of the lug bases 38 occupy at least half the depth of the castellation depressions 22.

The boxes are then filled with encapsulant so as to embed, at least, the solder joints of the lead-lead leg connection and the encapsulant cured. The terminal prongs 36 are bent upward slightly outboard of the sides of the box and the carrier strip 44 clipped off. The box bottom may be marked with the module contents and trade names, and the module is thus completed.

I claim:

1. A mount for a circuit element comprising an open topped box adapted to contain said element and a terminal lug bifurcated at one end to define a mounting leg, a lead leg, and a terminal point, at least one member of said bifurcation being bent on a transverse line with each of said legs and said point extending in a different direction from said line, said mounting leg being mounted in a side wall of said box with said line adjacent the free edge of said wall and the free end of said mounting leg extending toward the floor of said box.
2. The mount of claim 1 wherein the means for mounting said mounting leg comprises means defining a pocket within said wall opening on the free edge of said wall and extending toward the floor of said box.
3. The mount of claim 2 including additionally an adhesive embedding said mounting leg within said pocket.
4. The mount of claim 1 wherein said box has straight opposite sides and each of said sides has a plurality of said terminal lugs mounted thereto.
5. The mount of claim 4 wherein the means for mounting said terminal lugs comprises means defining channels opening on the free edge of said side walls and extending toward the floor of said box.
6. The mount of claim 5 including additionally an adhesive embedding said mounting legs within said channels.
7. The mount of claim 1 wherein said lead leg extends generally upward of the free edge of said box and said terminal point extends generally outward therefrom.
8. The combination of claim 4 wherein the free edges of said side walls have notches therein outward of said channel, and a portion of each of said terminal points adjacent said line lies in said notches.
9. A mounted circuit element comprising an open topped box, a circuit element contained in said box, terminal lugs each bifurcated at one end to define a mounting leg, a lead leg and a terminal point, each of

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said mounting leg being contained in a side wall of said box with the free end thereof extending toward the floor of the box, said lead legs having the leads of said element secured thereto and extending angularly from said mounting legs at a point adjacent the free edge of said side wall into said box, said terminal points extending from the open top of said box generally perpendicularly to the plane of said open top, and encapsulant in

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said box enclosing said element and the connection of said leads to said lead legs.

10. The mounted circuit element of claim 9 wherein said box is otherwise uncovered.

11. The mounted circuit element of claim 9 wherein opposite sides of said box are straight and said terminal points extend from said sides in parallel rows.

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