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(54) Title: SELF TOOLING, MOLDED ELECTRONICS PACKAGING

(57) Abstract

A method and package for protecting an electronic component (10) from the environment comprises providing at least one bag (22) made from thermoplastic heat shrink material, inserting the electronic component (10) into the bag (22), injecting a liquid polymerizable resin (38) into the bag (22), heating the bag (22) to shrink it about the electronic component (10) and the resin (38), and curing the resin (38). Precalculated shrink of the thermoplastic wrap over a measured amount of resin (38) results in minimum material usage, and in a light weight, self tooled, rigid assembly. The resulting cured shape of the molded self tooled assembly will be largely determined by the shape of the electronic circuit components (16, 18, 20) mounted to the electronic component (10). Thus, the final cured shape need not be governed or altered by subsequent tooling or processing. Conductive shielding around the electronic components is provided between a plurality of layers, or bags, of shrink wrap.

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SELF TOOLING, MOLDED ELECTRONICS PACKAGING

BACKGROUND OF THE INVENTION

Known methods of packaging electronic components generally entail enclosing the component in a specially designed container or encapsulating the components in a rigid media through dipping or molding. Such high integrity packaging of electronic components, sometimes termed "potting," often amounts to a disproportionate share of the weight and cost of the electronic component assembly. Such known methods have inherent disadvantages, particularly when electrical shielding is required. Moreover, installation of the "potted" components generally requires a relatively large volume allocation.

This situation is ameliorated to some extent by the use of molded packaging. However, molding requires time intensive steps for dipping or other application operations. In the case of electronic components that require grounded shielding for the suppression of electromagnetic interference, a second coating must be applied to the outer surface of the molded assembly. Since the vital outer coating must be protected against damage, additional processing is generally required to insure the integrity of the shielding.

SUMMARY OF THE INVENTION

It is therefore an object of the instant invention to provide a self tooling method and package for protecting an electronic component from the environment.

It is also an object of the instant invention to provide a method and package for protecting an electronic component from the environment which utilizes a thermoplastic shrink wrap enclosure so as to achieve a self tooling component packaging.

It is also an object of the instant invention to provide a method and package for protecting an electronic component from the environment which does not require numerous time intensive application operations, or subsequent tooling or processing to achieve a light weight molded component packaging having a minimum usage of material.

It is also an object of the instant invention to provide a method and package for protecting an electronic component from the environment which allows a conductive shielding to be easily and reliably sealed around the electronic component and internally of an outer plastic coating.

The aforesaid problem is solved by a self tooling, multilayered thermoplastic "shrink wrap" enclosure that is filled with a prescribed amount of an injectable low viscosity thermoset resin. Precalculated shrink of the thermoplastic wrap over a measured amount of thermoset resin results, when the assembly is heated for shrink and cure, in minimum material usage and in a light weight, self tooled, rigid assembly. The resulting cured shape of the molded self tooled assembly will be largely determined by the shape of the electronic components or mounting therefor. As the wrapping is exposed to heat and shrinks, it will bridge the high points of the assembly's components. The final cured shape need not be governed or altered by subsequent tooling or processing. Conductive shielding around the electronic components is provided between layers of the shrink wrap. When heat shrink and cure of the assembly is completed, the conductive shielding is reliably sealed internally of the outer plastic coating.

In accordance with the present invention, a method of protecting an electronic component from the environment comprises the steps of providing a bag made from thermoplastic heat shrink material, inserting the electronic component into the bag, injecting a liquid polymerizable resin into the bag, heating the bag to shrink it about the electronic component and the resin and thereby exhaust air from within the bag, and curing the resin. The bag and resin are preferably heated concomitantly to effect shrinking and polymerization thereof, respectively. The method also includes the step of providing a second bag and coating the surface of one of the bags that is juxtaposed to the surface of the other of the bags with an electrically conductive coating, or coating the exterior of the

bag with an electrically conductive material and placing the bag in an outer bag of thermoplastic heat shrinkable material.

Also in accordance with the present invention, a package for an electronic component comprises a thermoplastic heat shrinkable bag placed about the electronic component, and a polymerizable resin completely filling the space between the electronic component and the interior of the bag. The bag can include an electrically conductive coating. Also, a second bag of thermoplastic heat shrink material can be disposed about the first bag.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of a circuit board having a plurality of electronic components mounted thereon;

Fig. 2 is a perspective view of the circuit board of Fig. 1 enclosed within a plurality of thermoplastic layers with a resin injection nozzle extending thereinto;

Fig. 3 is a cross-sectional view taken along the line 3-3 of Fig. 2 after heat shrink of the enclosure and cure of the thermoplastic resin therein;

Fig. 4 is a cross-sectional view taken substantially along the line 4-4 of Fig. 3; and

Fig. 5 is a view similar to Fig. 3 of the completed shrink wrap package.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

As seen in Fig. 1 of the drawing, a circuit board 10 is provided with a plurality of electronic components 12, 14, 16, 18 and 20 which are secured to the board 10 in the conventional manner.

In accordance with a preferred constructed embodiment of the instant invention, the circuit board 10 is enclosed in a pair of plastic bags 22 and 24 made from a thermoplastic heat shrink material. It is to be understood that the number of bags employed is dependent upon the characteristics of the electronic components and whether the components are required to be electrically shielded from electromagnetic interference. As seen in Fig. 4, the outer bag 22 encloses the internal bag 24, which is provided with an electrically conductive

metallic layer 26 suitable for shielding the components 12, 14, 16, 18 and 20 of the circuit board 10.

The bags 22 and 24 may be formed as tubes and thereafter heat sealed along edges 30 and 32 thereof to form an enclosure 34. The enclosure 34 is provided with an air bleed sprue 36 to provide for the exhaust of air trapped internally of the enclosure 34 upon the injection of a liquid polymerizable resin 38 thereinto as well as to provide for exit of air from the inside of the enclosure 34 upon shrink of the plastic bags 22 and 24. Resin is injected through a resin injector tube 42.

As best seen in Fig. 5 of the drawing, the portion of the plastic bags 22 and 24 surrounding a pair of terminals 50 and 52 extending from the components 16 and 20 are ground away exposing the terminals 50 and 52 for electrical connection to an electrical circuit. The shielding layer 24 is provided with a ground terminal as may be required.

While the preferred embodiment of the invention has been disclosed, it should be appreciated that the invention is susceptible of modification without departing from the scope of the following claims.

I CLAIM:

1. A method of protecting an electronic component from the environment comprising the steps of

providing a bag made from thermoplastic heat shrink material,

inserting said electronic component into said bag,

injecting a liquid polymerizable resin into said bag,

heating said bag to shrink it about said electronic component and said resin and thereby exhaust air from within said bag, and

curing said resin.

2. The method of claim 1 including the step of providing a second bag and coating the surface of one of said bags that is juxtaposed to the surface of the other of said bags with an electrically conductive coating.

3. The method of claim 1 wherein said bag and resin are heated concomitantly to effect shrinking and polymerization thereof, respectively.

4. The method of claim 1 including the step of coating the exterior of said bag with an electrically conductive material and placing said bag in an outer bag of thermoplastic heat shrinkable material.

5. A package for an electronic component comprising

a thermoplastic heat shrinkable bag about said electronic component, and

a polymerizable resin completely filling the space between said electronic component and the interior of said bag.

6. The package of claim 5 including an electrically conductive coating on said bag.

7. The package of claim 6 including a second bag of thermoplastic heat shrink material disposed about said first bag.

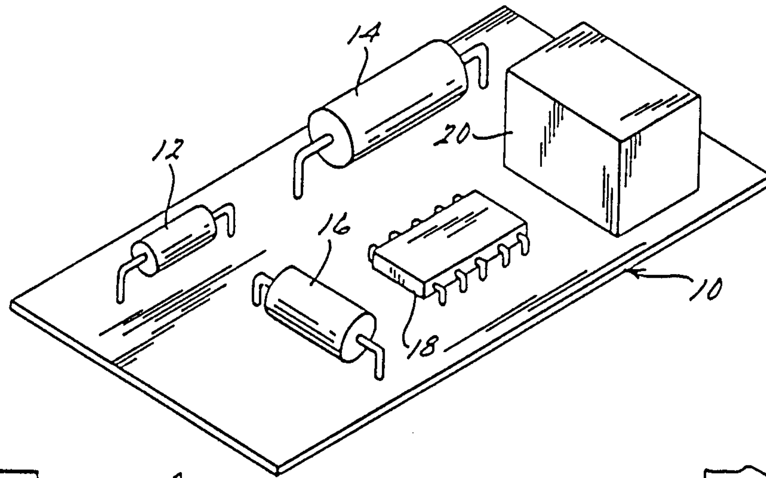

FIG. 1.

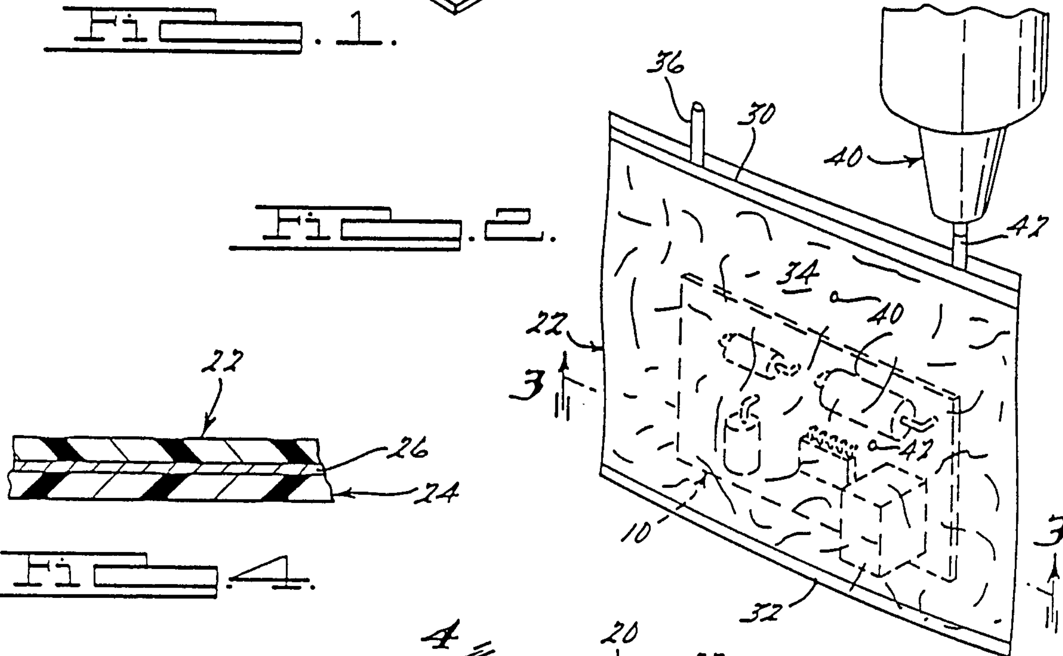

FIG. 2.

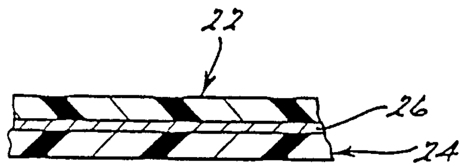

FIG. 4.

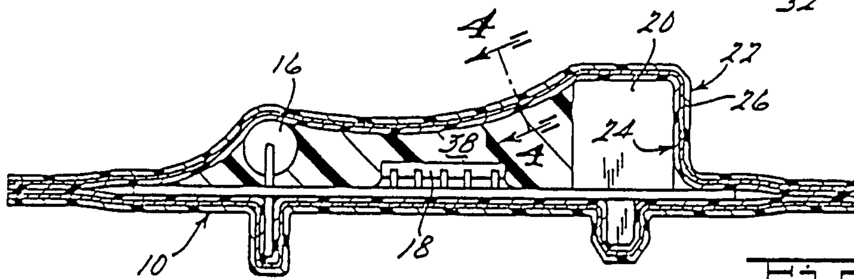

FIG. 3.

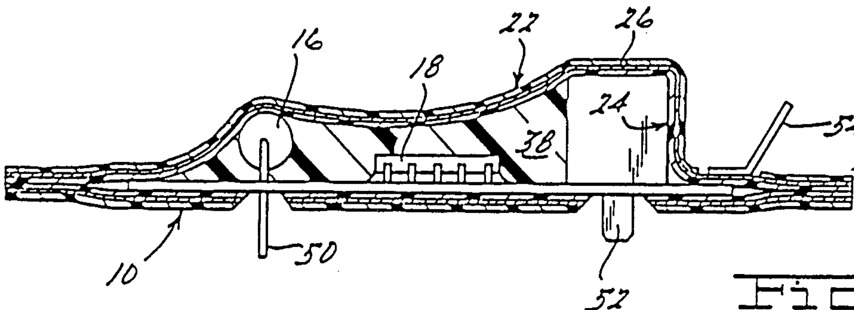

FIG. 5.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US93/05685

A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :B65B 23/00, 31/02, 53/02
US CL :53/431, 442, 472, 474, 557; 206/328, 524
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 53/431, 442, 472, 474, 557; 206/328, 524

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,267,927 (ENGLISH, Jr.) 19 May 1981, see entire document	5-7
Y	US, A, 5,033,253 (HAVENS et al) 23 July 1991, see entire document	5-7
A	US,A, 3,909,504 (BROWNE) 30 September 1975	1-7
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