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(54) A resin encapsulated device and method of manufacture

(57) A resin encapsulated device (1) comprising a housing (2) defining a hollow body, a sensitive component (4) at least partly located within the housing, a resin material provided within the housing to at least partially encapsulate the component, characterised by a rigid

buffer element (5) embedded within the resin material adjacent at least one component to prevent the origination of cracks within the resin material and/or to prevent cracks which might propagate within the resin material from reaching the component.

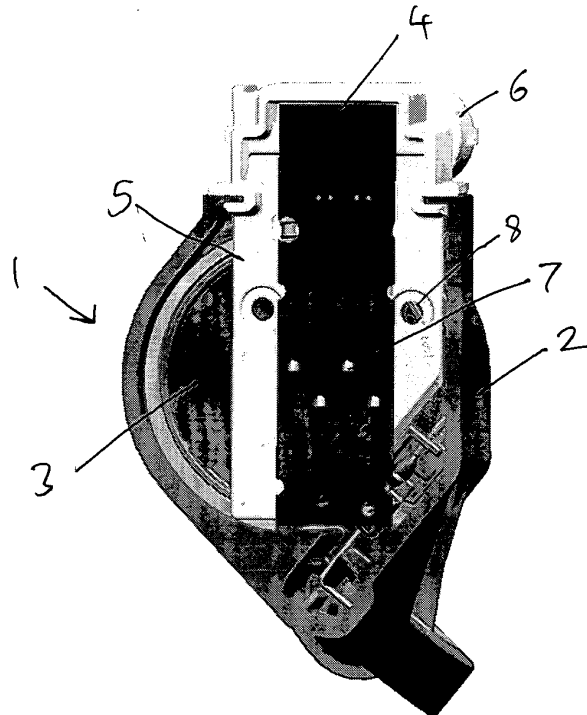


Fig. 2

Description

[0001] The present invention relates to resin encapsulated devices and in particular to a resin encapsulated device including means for preventing cracks from originating and/or propagating within the resin from damaging sensitive components embedded therein.

[0002] Epoxy resin is widely used in a number of products, in particular in electronic devices such as ignition coils and other ignition components, to insulate parts under high tension and to encapsulate sensitive components to protect them from damage.

[0003] One of the disadvantages of epoxy resin is that the material is relatively brittle and cracks can develop and propagate through the resin under conditions of mechanical stress and temperature gradients. If the cracks propagate as far as the components embedded therein severe damage can be caused to the very components the resin was intended to protect.

[0004] A known method of protecting sensitive electronic components against damage caused by the cracking of an encapsulating epoxy resin material is the use of a buffer made of a synthetic rubber material placed against the sensitive component. The buffer compensates for different expansions between the epoxy and the components and if a crack reaches the buffer the buffer will deform so that the crack stops at the edge of the epoxy.

[0005] Whilst such soft buffers can be used for protecting smaller components (e.g. pencil coils) wherein a small amount of epoxy resin is used, they are not effective for larger components (e.g. cassettes) wherein the mass of the components and the mass of the epoxy resin become much more substantial. In such larger components, the packaging of the component limits the size of the buffer that may be used.

[0006] According to the present invention there is provided a resin encapsulated device comprising a housing defining a hollow body, at least one sensitive component at least partly located within the housing, a resin material provided within the housing to at least partially encapsulate the component, characterised by a rigid buffer element embedded within the resin material adjacent the at least one component to prevent the origination of cracks within the resin material and/or to prevent cracks which might propagate within the resin material from reaching the component.

[0007] Preferably the rigid buffer element is interposed between a likely initiation site for cracks within the resin material and the at least one component.

[0008] In one embodiment the component may be mounted on the rigid buffer element. The rigid buffer element may include locating means for locating the component against and/or on the rigid buffer element.

[0009] The component may be an electronic component, such as a printed circuit board. In one embodiment the device comprises an ignition coil. The rigid buffer element may extend from an electrical connector for connecting the device to other components. Preferably the rigid buffer element is integrally formed with another component, such as the electrical connector.

necting the device to other components. Preferably the rigid buffer element is integrally formed with another component, such as the electrical connector.

[0010] According to a further aspect of the present invention there is provided a process for forming a resin encapsulated device comprising the steps of providing a housing defining a hollow body, locating a component and a rigid buffer element within the housing, the rigid buffer element being located adjacent the component, pouring a settable resin material into the housing to at least partially encapsulate the component and rigid buffer element.

[0011] Preferably the process further includes the steps of mounting the component on the rigid buffer element before locating both the component and the rigid buffer element within the housing.

[0012] An embodiment of the invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 is a sectional view through a known encapsulated ignition coil;

Figure 2 is a plan view of an encapsulated ignition coil according to an embodiment of the invention with the epoxy resin omitted;

Figure 3 is a perspective view of the buffer element of the embodiment shown in Fig. 2; and

Figure 4 is a further perspective of the buffer element of Fig. 3.

[0013] Referring to Figure 1, the resin encapsulated device 1, in this case an ignition coil, comprises a housing 2 defining a hollow chamber in which is located a coil 3 and associated sensitive electronic components including a printed circuit board 4. The coil 3 and other electronic components 4 are encapsulated in epoxy resin (not shown) to seal and protect the components from damage. The device 1 incorporates a known synthetic rubber buffer element 5 to compensate for different expansions between the epoxy and the components. If a crack in the epoxy resin reaches the buffer the buffer will deform so that the crack stops at the edge of the epoxy. However, the soft buffer element 5 does not provide sufficient support for the adjacent component and thus requires additional components to provide sufficient support and protection for the sensitive encapsulated components.

[0014] Figs. 2, 3 and 4 show an encapsulated ignition coil according to the present invention, wherein the known synthetic rubber buffer element is replaced by a rigid plastic component 5. The buffer element 5 can be provided with holes 8 for wires and/or locating pins 7 for locating an electronic component 4 on the buffer element 5 to assist the process of assembling the device 1. The holes 8 can also provide guidance to wires.

[0015] Compared to the traditional synthetic rubber

buffer material, the rigidity of the hard plastic buffer element of the present invention means that that, when mounted, it will not deform e.g. during the filling with epoxy, so that the assembly does not require an additional component to hold the electronic component 4 in place. It also means that the buffer can be formed integrally as part of an existing component, such as an electrical connector. Consequently, there is no need for a dedicated retaining component for the encapsulated electronic component.

[0016] Furthermore, when the hard plastic buffer element is integrally formed with the housing or connector portion of the encapsulated product, the process of encapsulating the component involves one less process assembly operation. Consequently, the process of encapsulating a component is reduced compared with traditional encapsulation processes.

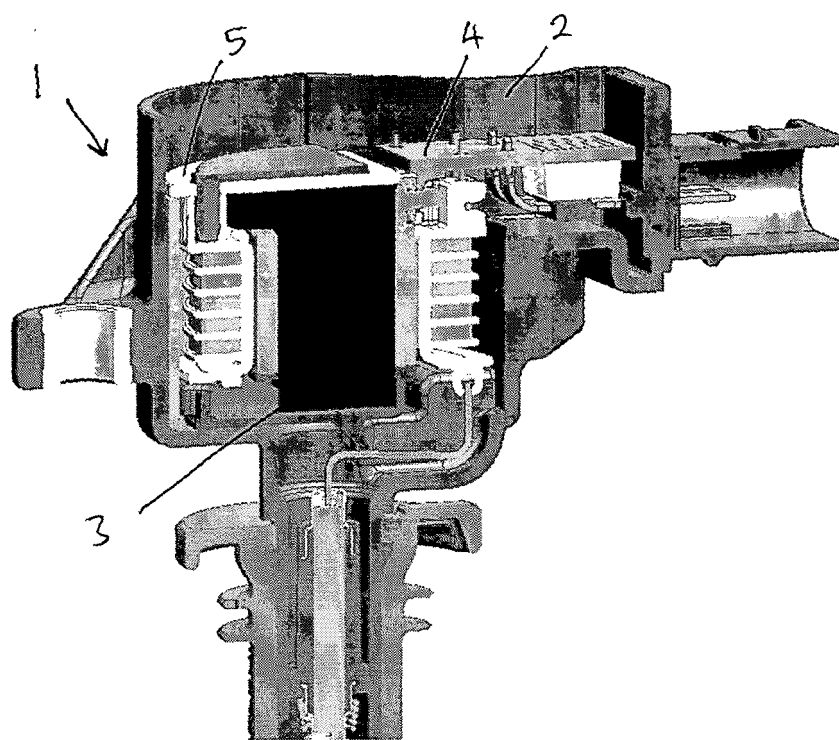
[0017] Finally, the buffer element of the present invention requires less material and utilises less expensive materials than is used in the conventional synthetic rubber buffer.

[0018] Alterations and modifications may be made to the above without departing from the scope of the invention as defined by the claims.

Claims

1. A resin encapsulated device comprising a housing defining a hollow body, a sensitive component at least partly located within the housing, a resin material provided within the housing to at least partially encapsulate the component, **characterised by** a rigid buffer element embedded within the resin material adjacent at least one component to prevent the origination of cracks within the resin material and/or to prevent cracks which might propagate within the resin material from reaching the component. 30
2. A device as claimed in claim 1, wherein the rigid buffer element is interposed between a likely initiation site for cracks within the resin material and the at least one component to be protected. 40
3. A device as claimed in any preceding claim wherein the component is mounted on the rigid buffer element. 45
4. A device as claimed in any preceding claim, wherein the rigid buffer element includes locating means for locating the component against and/or on the rigid buffer element. 50
5. A device as claimed in any preceding claim, wherein the component is an electronic component. 55
6. A device as claimed in claim 5, wherein the electronic component is a printed circuit board.

7. A device as claimed in claim 5 or claim 6, wherein the device comprises an ignition coil.
8. A device as claimed in any of claims 5 to 7, wherein the rigid buffer element extends from an electrical connector for connecting the device to other components. 5
9. A device as claimed in claim 8, wherein the rigid buffer element is integrally formed with another component, such as the electrical connector. 10
10. A process for forming a resin encapsulated device comprising the steps of providing a housing defining a hollow body, locating a component and a rigid buffer element within the housing, the rigid buffer element being located adjacent the component, pouring a settable resin material into the housing to at least partially encapsulate the component and rigid buffer element. 15
11. A process as claimed in claim 10, further including the steps of mounting the component on the rigid buffer element before locating both the component and the rigid buffer element within the housing. 20



PRIOR ART

Fig. 1

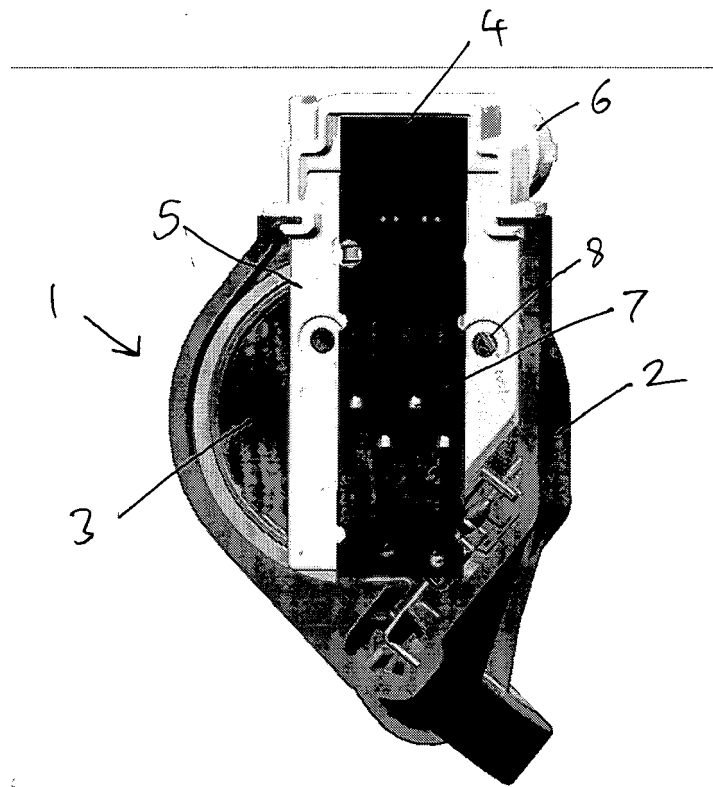


Fig. 2

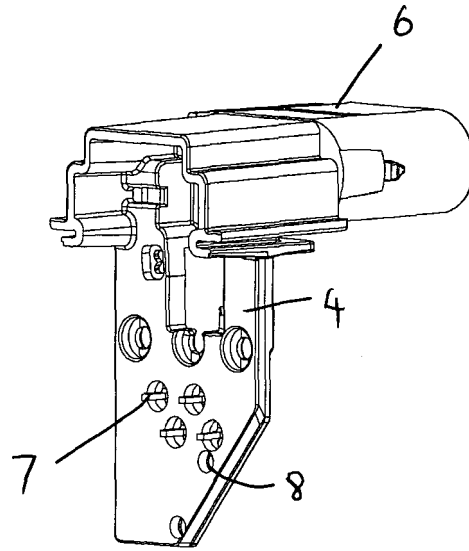


Fig. 3

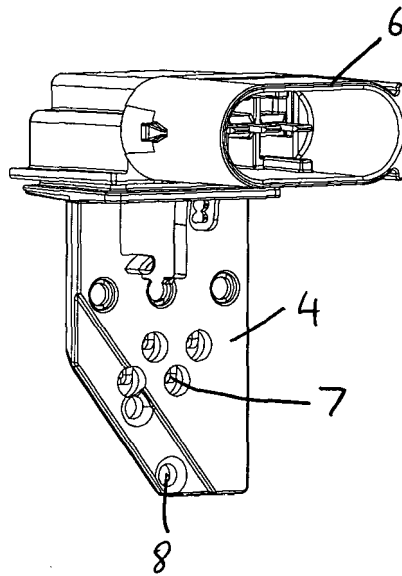


Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 0267

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 21 June 2005	Examiner Stichauer, L
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Place of search The Hague		Date of completion of the search 21 June 2005	Examiner Stichauer, L
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