United States Patent

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[54] LEAD SEPARATOR FOR MICROMINIATURE DEVICES

11 Claims, 4 Drawing Figs.

[52] U.S. Cl. ..... 339/186 M, 339/17 C, 174/138 G
[51] Int. Cl. H01r 13/50, H01r 13/64
[50] Field of Search ..... 339/17, 17 C, 17 CF, 17 D, 17 N, 126 R, 192, 193, 21, 23, 186, 36, 184, 154 R, 154 A; 174/138.5

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ABSTRACT: This disclosure relates to a microminiature component lead separator which includes an elongated cylindrical electrical insulative body. The insulative body is provided with a suitable indexing means and a plurality of circularly spaced semienclosed grooves extending along substantially the entire length of the elongated body for receiving the conductive leads of the microminiature component.

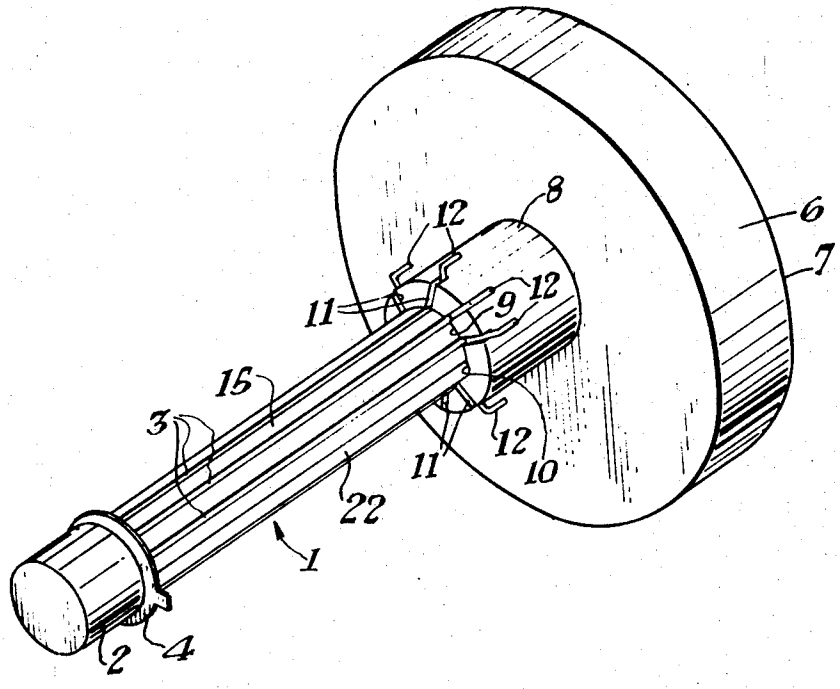
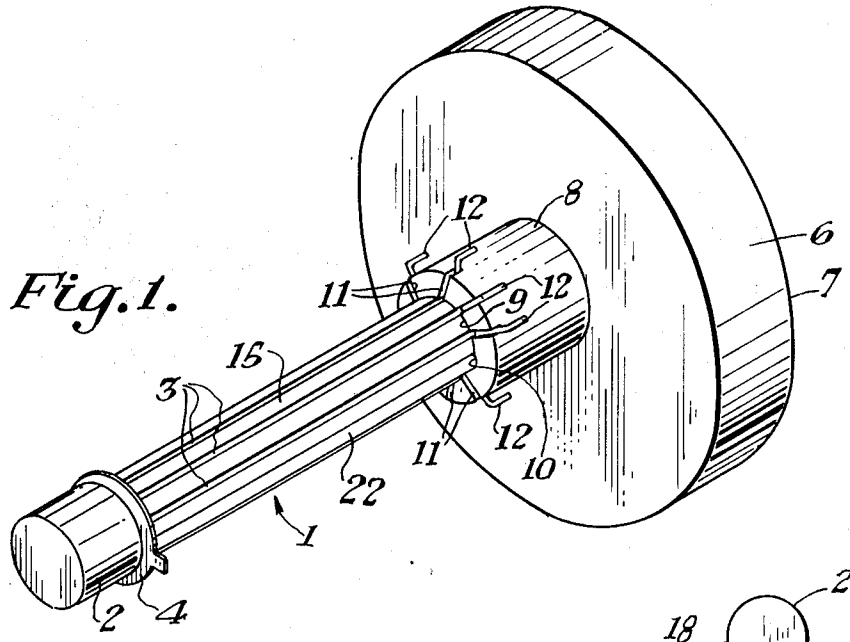


Fig. 1.



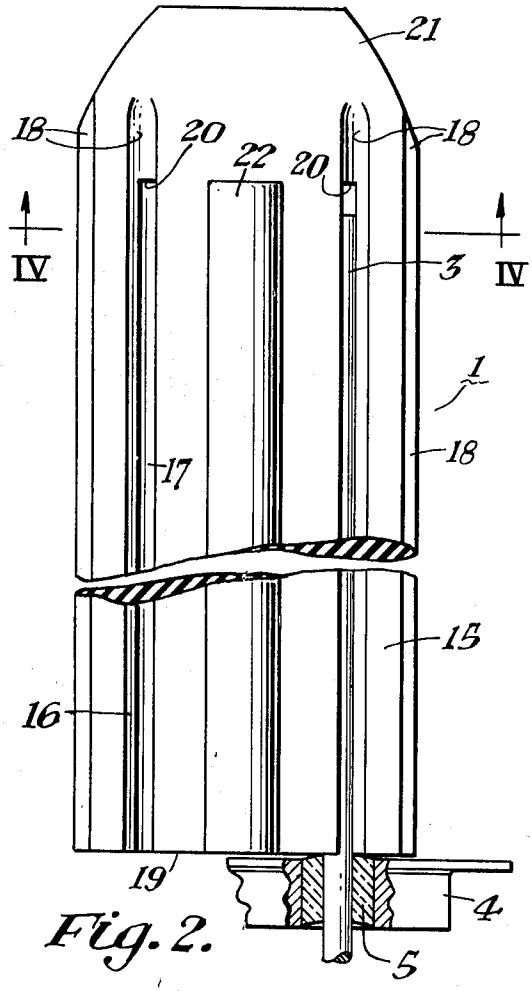


Fig. 2.

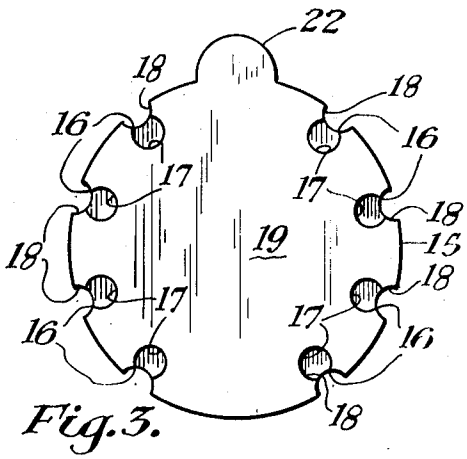


Fig. 3.

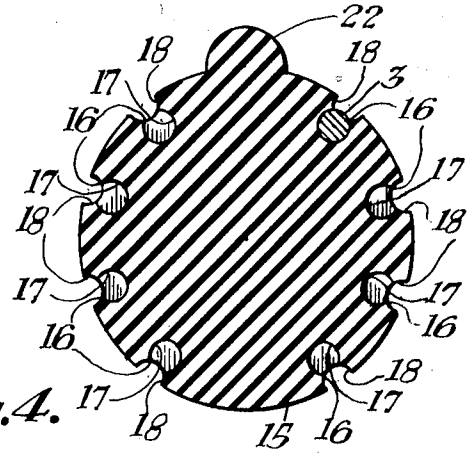


Fig. 4.

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LEAD SEPARATOR FOR MICROMINIATURE DEVICES

Our invention relates to a new and improved electrical component lead separator and more particularly to an insulative type of lead separator which prevents damage to the relatively long conductive leads of a microminiature device during manufacturing and testing.

In the production of microminiature electrical or electronic devices, such as, relays of the type shown and disclosed in copending application for Letters Patent of the United States Ser. No. 734,307, filed June 4, 1968, by Roscoe A. Norton for Microminiature Relay, it has been found that numerous relays are impaired and damaged during the mechanical assembling and electrical testing processes. For example, these relays are fabricated in successive steps so that repeated manipulations, such as, setting up and transferring the structure from one to another convenient holder or jig, occur during the manufacturing of the relay. Further, after the assembly is completed, it is necessary to make certain electrical tests, namely, pickup and drop characteristics, contact resistance and various other checks in order to positively ensure that each of the relays meets the rigid standards for Mil-Specs applications. It has been recognized that the repetitious handling, checking and testing generally cause a great many relays to be rejected and discarded due to the cracking and breaking of the fused glass seals where the relatively long conductive leads extend through the base of the relay. Further, it is not uncommon to find that electrical leads of the relays are also severely twisted and bent which require straightening and reforming prior to being acceptable for use. While it has been appreciated that the relatively long electrical lead of such minute relays are quite easily damaged and that it was necessary to exercise extreme care from the initial assembling to the final shipping of the relay, it has been found that even with the most meticulous attention, bending and twisting of the leads and breakage of the seals of the relays is very frequent so that the increased cost of care is not directly proportional to a decreased amount of damage.

Accordingly, it is an object of our invention to provide a new and improved protective lead separator for microminiature devices.

A further object of our invention is to provide a unique insulative lead separator for minute electrical relays.

Another object of our invention is to provide an electrical component lead holder which protects the leads of the electrical component from physical damage yet exposes the leads of the electrical component for facilitating electrical contact for various purposes.

Yet a further object of our invention is to provide an insulative lead separator which eases the assembling and simplifies the testing of an electrical device.

Yet another object of our invention is to provide an electrical component lead separator having an insulative body which includes a plurality of peripheral grooves for entrapping the leads of the electrical component yet exposing a portion of the leads for electrical connection.

Still a further object of our invention is to provide an insulative lead separator which facilitates assembling and testing of a microminiature device and reduces the chance of damage to the leads of the microminiature device.

Still another object of our invention is to provide an insulative lead separator having an elongated insulative body which is provided with a plurality of peripheral semienclosed grooves for accommodating the relatively long electrical leads of an electromagnetic relay.

Still yet a further object of our invention is to provide an insulative lead separator having an elongated body which includes a plurality of elongated circularly disposed peripheral grooves for mechanically holding the conductive leads of an electrical device in place while physically exposing a portion of the conductive leads along their entire length.

Still another object of our invention is to provide a unique relay lead separator which is economical in cost, simple in construction, reliable in operation, durable in use and efficient in service.

Further objects, features and advantages of our invention will become more apparent as the following description proceeds and the ingenuity and novelty which characterizes our invention will be pointed out particularly in the appended claims which form part of our specification.

Generally, our invention relates to an insulative lead separator for protecting the relatively long conductive leads of a miniature electrical device against damage yet exposing a portion of the conductive leads for electrical contact. The insulative lead separator includes an elongated cylindrical body having a plurality of spaced semienclosed grooves located on the circumference thereof. Each of the semienclosed grooves comprises an inner cylindrical bore for receiving and entrapping a conductive lead of the miniature electrical device and an outer contiguous semicylindrical bore for exposing the portion of the conductor lead along the entire length thereof. The lead separator includes an indexing key having a substantially semicircular cross section extending substantially the entire length of the elongated cylindrical body. One end of the elongated cylindrical body is flat so that the adjacent surface of the miniature electrical device is intimately contacted while the other end is tapered in order to facilitate the insertion of the lead separator into a suitable receiving socket.

A better and more complete understanding of our invention will be had by reference to the drawings in which similar characters of reference refer to similar parts throughout the several views in which:

FIG. 1 is a slightly enlarged perspective view of a lead separator of the present invention shown in association with a TO–5 case relay and an appropriate receiving socket.

FIG. 2 is a greatly enlarged elevational view of a lead separator in accordance with our invention with a central portion of the separator removed and with only a portion of the relay shown partially in the section.

FIG. 3 is an end view of the lead separator shown in FIG. 2 with the relay and conductive leads omitted.

FIG. 4 is a cross-sectional view of FIG. 2 taken along lines IV—IV.

Referring now to the drawings, there is shown in FIG. 1 a partially inserted lead separator generally characterized by numeral 1 carrying a transistor type of TO–5 relay 2 of the type shown and disclosed in the above-mentioned copending application Ser. No. 734,307. The relay is hermetically sealed by soldering or welding a suitable cover or casing (not characterized) to the relay base and the electrical connections from inside the microminiature relay 2 are established by a plurality of circularly disposed electrical conductors or leads 3 which pass through and extend from the base of the relay. As noted in FIG. 2, these leads include a relatively long portion which protrudes outwardly from the base or header plate 4. Each of the relatively long electrical leads 3 is secured in place by being embedded in a fused mass of suitable insulation material 5, such as, glass, which suitably fills and insulates each conductor from the metallic header plate 4. While the glass seals have highly favorable electrical characteristics, they are extremely fragile and therefore are susceptible to being fractured when excessive stresses and strains are incident thereon. Also, since the electrical leads 3 are relatively long, they are quite easily bent and twisted out of shape during normal fabricating and testing procedures. It will be appreciated that whenever a glass seal is damaged, the relay must be discarded because the associated conductor may become shorted by either direct contact with or arcing to the metallic header plate and also because contaminants which will result in ultimate failure of the relay are capable of entering the relay. While bent or twisted leads are generally not critical, it requires additional cost and time for straightening the leads to their original shapes.

As shown in FIG. 1, the lead separator 1 cooperates with a suitable receiving socket 6. The receiving socket 6 may be of the type shown and disclosed in our copending U.S. Pat. application Ser. No. 796,475, filed Feb. 4, 1969, entitled An Electrical Socket for Component Lead Separators. The receiving socket 6 is preferably constructed of suitable insulating material and includes an annular flange portion 7 and a central barrel portion 8. A cylindrical through bore 9 and a suitable keyway 10 are formed in the central barrel portion 8 and the flange portion 7 so that the lead separator 1 may be completely inserted to a point where the underside of the relay header plate 4 engages the upper surface of the central hollow barrel portion 8. A plurality of circularly disposed radial slots 11 are provided in the upper surface of the central barrel portion 8. As shown, a plurality of suitable electrical contact elements 12 are provided to cooperate with the associated conductive leads 3 of the electromagnetic relays 2. The contact elements 12 are preferably connected to various external circuits not shown.

Referring now to the particulars of the present invention, reference is made to FIGS. 2, 3 and 4 wherein the details of the lead separator 1 are more clearly shown. It will be noted that the lead separator 1 comprises a molded elongated cylindrical like body 15 which is formed of suitable insulating material, such as, "Nylon." As shown, the elongated cylindrical body includes a plurality of circularly spaced semienclosed grooves or slots 16 formed on the peripheral surface thereof. The circumferential or angular spacing of the semienclosed slots 16 corresponds with the circular disposition of the conductive leads 3 of the relay 2. Thus, as seen in FIGS. 3 and 4, a total of eight semienclosed grooves 16 are formed on the circumference of the elongated cylindrical body since the presently described lead separator 1 is adapted to accommodate an eight-lead TO–5 case electromagnetic relay. Further, in viewing FIGS. 3 and 4, it will be noted that each of the semienclosed grooves 16 comprises an inner circular bore 17 and an outer semicircular bore 18. As shown, one end of the lead separator 1 is provided with a flat or squared surface 19 which is adapted to agree with the underside of the relay flanged base 4. As noted, each of the semienclosed channels 16, namely, inner cylindrical bores 17 and outer semicylindrical bores 18 are open to the flat side of the lead separators so that the conductive leads 3 of the relay 2 may be readily inserted therein.

It will be appreciated that the diameter of conductive leads 3 should preferably be slightly less than the diameter of the circular bores 17 so that the leads may easily slide into position. In FIG. 2, it will also be seen that cylindrical bores 17 are closed or blocked off at the other end by walls 20 while the semicylindrical bores 18 continue beyond this point, the purposes of which will be described hereinafter. In order to facilitate the mounting of the relay 2, it may be advantageous to slightly enlarge or taper the ends of either the cylindrical bores 17 or the semicylindrical bores 18 in order to facilitate insertion of the conductive leads 3. Further, it will be noted in viewing FIGS. 3 and 4, that a common chord exists between the inner circular openings 17 and the outer semicircular openings 18 which defines an arcuate segment which is less than half of the total circumference of the circles. This insures that the relay conductors or leads 3 are effectively entrapped within the inner circular bores 17 yet are exposed to the outer semicircular bores 18. That is, the electrical conductors of the relay 2 are physically trapped and held securely within the inner cylindrical bores 17 for being protected against physical damage yet are exposed along a portion of the entire length to permit ready electrical connection therewith.

It will be noted that the other end 21 of the elongated cylindrical body 15 is tapered in order to facilitate insertion of the lead separator 1 into the cylindrical bore 9 of the socket 4. It is desirable to have the outer semicylindrical bores 18 run directly into the surface of the tapered end of the cylindrical body 15 so that the associated contact elements 12 are automatically aligned and smoothly enter into the respective bores 18 when the lead separator 1 is pushed into the socket 4. An indexing means, such as, a torus or rounded shape key 22, extends substantially the entire length of the cylindrical body. The key is preferably a molded portion of the insulative body 15 and is formed on the outer surface thereof. This permits the readily positioning of leads 3 of the relay 2 in regard to semienclosed grooves 16 of the lead separator 1 as well as provides a suitable means for orientating the lead separator 1 with respect to the receiving socket 4.

Normally, the first step in the process of assembling a relay involves the securing of the electrical leads 3 to the base or header plate 4. Preferably, once the electrical leads 3 are fused into place by the glass seals 5 so that a solid bond exists between the leads 3 and the header plate 4, concomitance between the subassembly and the lead separator 1 is established. That is, the leads 3 are immediately placed into the open ends of the respective cylindrical bores 18 and are pushed forward until the undersurface of the header engages the flat surface 19 of the lead separator 1 as shown in FIGS. 1 and 2. As shown in FIG. 2, it is preferable to have the length of the cylindrical bores 18 slightly greater than the length of the conductive leads 3 so that the conductive leads 3 are completely accommodated within the bores 18. Thus, it will be appreciated that in addition to protecting the conductive leads against physical damage, the lead separator 1 may be conveniently employed as a convenient holder for assembly purposes. As previously mentioned, since the relay is generally fabricated in various steps which involve many handling and transferring procedures, it is advantageous to provide an assembly stand or a setup jig at each location to more effectively carry out the assembling operation. Accordingly, the presently described lead separator may be effectively employed with a suitable assembly stand or jig similar to socket 6 so that the relay may be very easily set up and removed with less chance of damage to the leads and glass seals.

After the final assembly is completed, the relay is normally transferred to a suitable testing location wherein the electrical and mechanical characteristics of the relay are measured and compared to the given standards for that particular type of relay. Again the lead separator protects the leads against physical damage, such as, breaking of the glass seals of the relay header and/or twisting and bending of the conductive leads during the transferring of the relay to the testing location as well as during the insertion and extraction of the relay into and out of the testing socket. After testing, if acceptable, the relay is normally conveyed to the packaging facilities and prepared for shipment. It has been found highly advantageous from both an economic standpoint as well as customer satisfaction not to remove the inexpensive lead separator but to allow the lead separator to remain intact with the relay in order to prevent damage in route. Thus, it will be seen that the unique separator not only prevents damage to the relay and its leads during fabrication and testing but also during shipment.

Further, while the invention has been described in relation to an electromechanical device, such as, a TO–5 relay having eight conductors, it will be understood that the lead separator may be provided with a lesser or greater number of semienclosed channels 16 for accommodating relays having a greater or lesser number of electrical leads. It will also be appreciated that the presently described lead separator may be equally well employed with other electronic devices, such as, semiconductor transistors and integrated circuits having TO–5 type cases. In addition, it will be realized that while the body portion of the lead separator has been shown and described as an elongated cylindrical member, other forms and shapes, such as, hexagonal, rectangular or other polygonal cross-sectional configurations may be also used with other types of electronic cased devices. While the lead separator 1 has been described as being preferably molded, it is readily apparent to those skilled in the art that other construction methods such as extruding and machining processes may be equally well employed in practicing our invention. Further, it will be appreciated that the key 22 may take other cross-sectional forms and shapes and that the key and keyway may also be reversed.

From the foregoing, it will be noted that the new and improved lead separator of the present invention provides a highly effective yet inexpensive arrangement for preventing damage to an electromagnetic device yet effectively permitting electrical contact with its relatively long electrical leads.

Having thus described our invention, what we claim is:

1. A lead separator comprising, a body of insulative material in the form of an elongated cylindrical member, a plurality of semienclosed grooves located on the periphery of said insulative body for entrapping the conductive leads of an electrical device by encompassing more than half of the circumference of the conductive leads and exposing the remaining circumference of the conductive leads for electrical contact therewith, each of said plurality of semienclosed grooves extending along substantially the entire length of said elongated cylindrical member, and an indexing means for facilitating orientation of the conductive leads of the electrical device with respect to said plurality of grooves.

2. A lead separator as defined in claim 1, wherein said indexing means comprises a toruslike protuberance extending along substantially the entire length of said elongated cylindrical member.

3. A lead separator as defined in claim 1, wherein said elongated cylindrical member has one flat end which communicates with a congruous surface of the electrical device and has the other end tapered to facilitate insertion into a suitable receiving device.

4. A lead separator as defined in claim 3, wherein each of said plurality of semienclosed grooves comprises an inner cylindrical bore for entrapping the conductive leads and an outer semicylindrical bore for exposing the portion thereof for electrical contact.

5. A lead separator as defined in claim 4, wherein each of said inner cylindrical bores is opened at said flat sided end and is closed at said tapered end while said other semicylindrical bore is opened at said flat side end and is terminated flush with said tapered end.

6. A lead separator as defined in claim 1, wherein said body is constructed of a synthetic plastic material.

7. An insulated lead separator for protecting the relatively long electrical leads of a microminiature device against damage yet permitting electrical contact therewith comprising, an elongated cylindrically shaped body having a plurality of semienclosed slots spaced along the circumference of said body, each of said plurality of semienclosed slots having a cross-sectional shape in the form of an inner circle and an outer semicircle having a common cord for securely retaining the relatively long electrical leads of the microminiature device yet physically exhibiting a portion along the length of the electrical leads for providing an externally exposed conductive surface which permits electrical contact therewith.

8. An insulative lead separator as defined in claim 7, wherein said body is constructed of a resin material.

9. An insulative lead separator as defined in claim 7, wherein an indexing key is formed on the circumference substantially the length of said elongated cylindrical body.

10. An insulative lead separator as defined in claim 7, wherein one end of said elongated cylindrical body is flat while the other end thereof is tapered.

11. an insulative lead separator as defined in claim 10, wherein said inner circle of said semienclosed slots is blocked at said tapered end.