Dec. 12, 1967 J. J. STEINMETZ, JR., ET AL 3,358,196

PRESSURE MULTIPLE ELECTRICAL CONTACT ASSEMBLY FOR ELECTRICAL DEVICES

Filed June 8, 1966

2 Sheets-Sheet 1

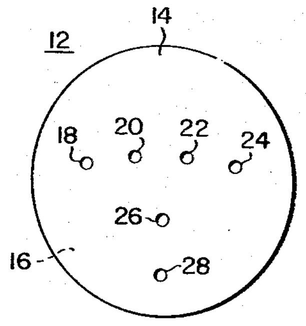

FIG. 1.

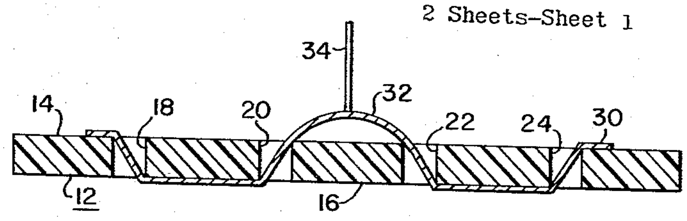

FIG. 2.

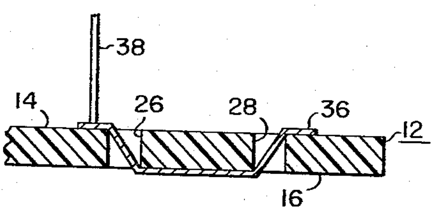

FIG. 3.

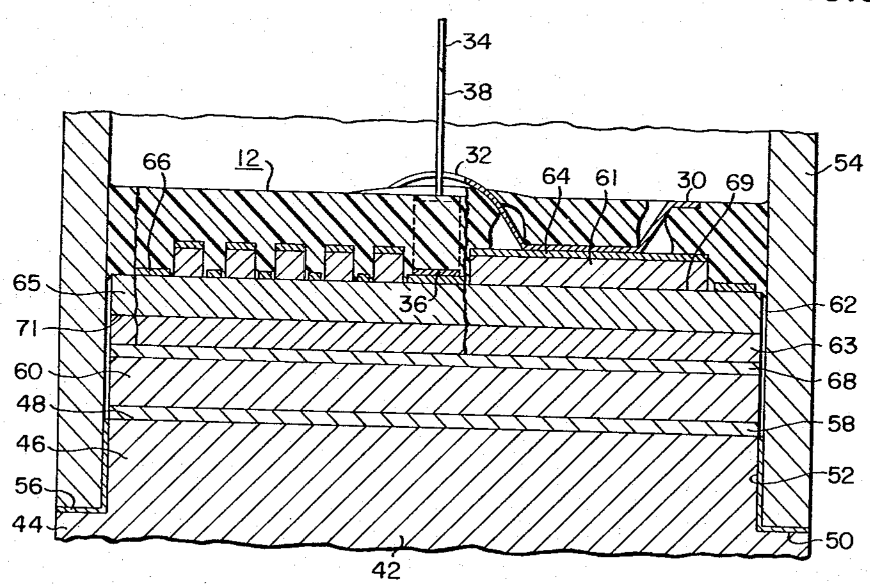

FIG. 4.

WITNESSES

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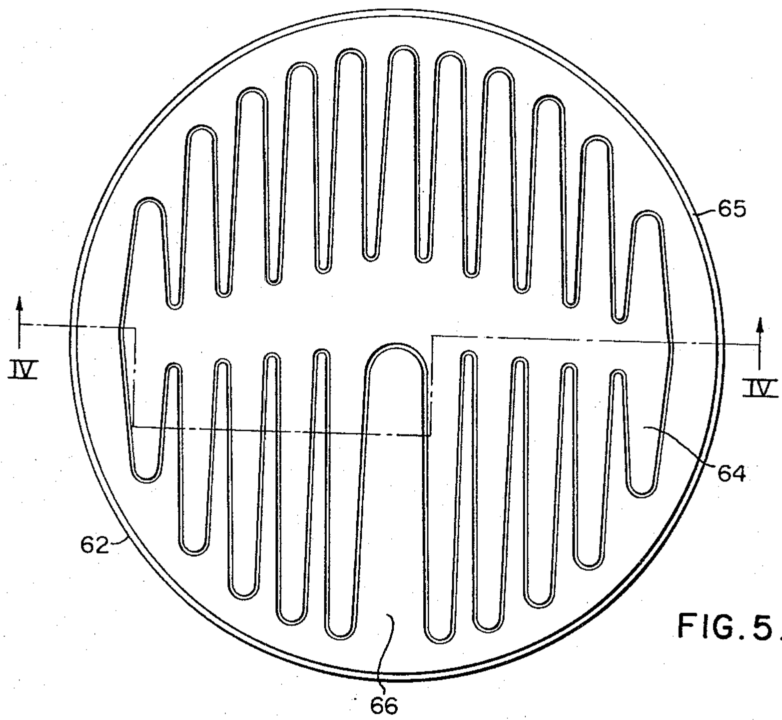
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FIG. 5.

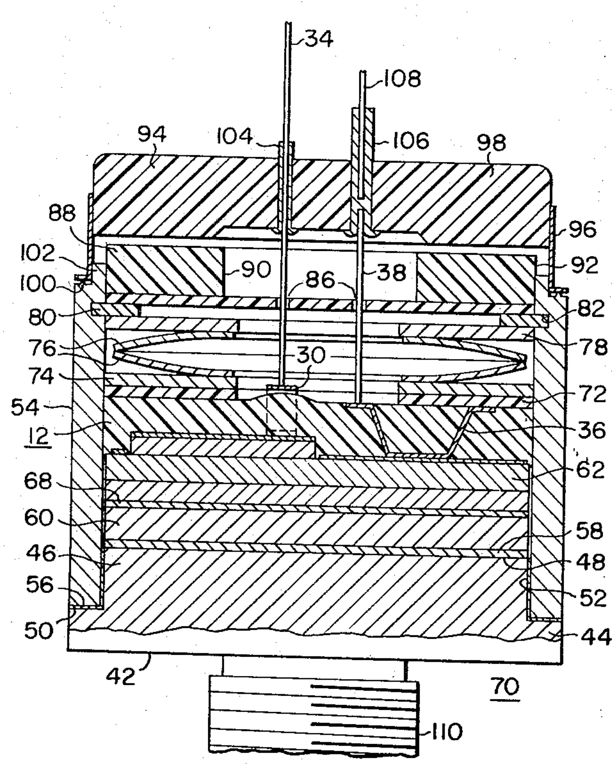
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FIG. 6.

United States Patent Office

3,358,196

Patented Dec. 12, 1967

1

3,358,196
PRESSURE MULTIPLE ELECTRICAL CONTACT ASSEMBLY FOR ELECTRICAL DEVICES

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Filed June 8, 1966, Ser. No. 556,206
9 Claims. (Cl. 317—234)

This invention relates to a pressure multiple electrical contact assembly suitable for use in compression bonded electrical devices.

An object of this invention is to provide a pressure multiple electrical contact assembly for electrical devices wherein an electrical connection is made to each of at least two contact surfaces of a mesa-type semiconductor element and at least one of the electrical connections incorporates a stress relief member to reduce the stresses caused by thermal changes within the electrical device.

Another object of this invention is to provide a pressure multiple electrical contact assembly which distributes the force applied to the contact assembly uniformly over the mesa-type configuration surfaces of semiconductor elements in physical contact with the contact assembly while providing electrical contact means to each surface of the mesa-type configuration as required and at least one of the electrical contact means incorporates a means for reducing the effects of thermal stressing within the electrical contact means.

Other objects of this invention will, in part, be obvious and will, in part, appear hereinafter.

In order to more fully understand the nature and objects of this invention, reference should be had to the following description and drawings, in which:

FIGURE 1 is a top view of a partially deformable cushioning member embodying the teachings of this invention;

FIG. 2 is a side view, partially in cross-section, of a portion of an electrical contact assembly employing the partially deformable cushioning member of FIGURE 1;

FIG. 3 is a side view, partially in cross-section, of another portion of an electrical contact assembly employing the partially deformable cushioning member of FIGURE 1;

FIG. 4 is a side view, partially in cross-section; of a portion of a compression bonded electrical device employing the portions of the electrical contact assembly of FIGS. 2 and 3;

FIG. 5 is a top view of the semiconductor element employed in the device shown in FIG. 4; and

FIG. 6 is a side view, partially in cross-section, of a compression bonded electrical device employing the portion of the compression bonded electrical device shown in FIG. 4.

In accordance with the present invention and in attainment of the foregoing objects, there is provided a pressure multiple electrical contact assembly comprising a partially deformable cushioning member having two major opposed surfaces, the member having a plurality of apertures, each aperture extending completely between the opposed surfaces, at least two electrical contacts, each contact being threaded through a separate portion of the plurality of apertures, at least one contact having an integral expansion element contained therein, an electrical lead affixed to the expansion element of each electrical contact having an expansion element and and electrical lead affixed to each of the other electrical contacts.

In order to more fully describe this invention, and for no other purpose, a pressure multiple contact assembly having only two electrical contacts, only one of which incorporates a stress relief member, will be described as one illustrative example of the use of the contact assembly in pressure electrical devices.

2

With reference to FIG. 1, there is shown a top view of a partially deformable cushioning member 12 embodying the teachings of this invention and particularly suitable for use in compression bonded encapsulated electrical devices.

The cushioning member 12 has a top surface 14 and a bottom surface 16. The member 12 has a plurality of apertures 18, 20, 22, 24, 26 and 28 extending between surface 14 and surface 16 disposed therein.

The cushioning member 12 consists of a material which can be partially deformed to match or compensate for any unevenness in any surface which comes in contact with the surfaces 14 and 16 of the member 12.

The material of the member 12 has properties which will allow it to cold flow under pressure. The cold flow proceeds only to a given limit and then essentially ceases, whereupon the member 12 acts as a rigid member.

Upon assuming the property of a rigid member, the material of the member 12 then transmits the applied force without any further appreciable restrictive cold flowing occurring. During operation of an electrical device at a temperature level as high as 200° C. to 250° C. but preferably lower and a pressure preferably exceeding 800 pounds per square inch, the allowable further deformation of a member 12 is as little as possible in order to protect the functional reliability of the electrical device in which the member 12 is utilized.

Preferred materials having the desired properties mentioned above are polytetrafluoroethylene and trifluoromonochloroethylene. These two materials in addition to having the desired properties, also are good electrically insulating materials for the operating range of devices up to approximately 250° C.

With reference to FIG. 2, a first electrical metal contact 30 is threaded through apertures 18, 20, 22 and 24 of the member 12. Although the contact 30 may have any desirable cross-sectional geometric shape, a rectangular or square metal strip is preferred for use in compression bonded electrical devices. The flat surfaces of the contact 30 provides a better distribution of forces and also provides a large electrical contact surface area.

The contact 30 comprises a metal selected from the group consisting of copper, gold, nickel, silver, tin, indium and base alloys thereof.

The contact 30 is formed in a manner which allows those portions of the contact 30 in contact with the surfaces 14 and 16 to be flat, parallel to, and touching, the respective surfaces of the member 12. This configuration for the contact 30 permits handling of the assembly without fear of the contact 30 dropping out of the member 12.

An integral expansion portion 32 is provided in the contact 30 to allow for the restricted flowing of the material comprising the member 12 and to compensate for any thermal and mechanical stresses which may occur in the contact 30. An electrical lead 34 is affixed to the expansion element 32 to provide a means to connect the contact 30 to an electrical system external to the assembly.

With reference to FIG. 3, there is shown a second metal electrical contact 36 threaded through apertures 26 and 28. The preferred cross-section of the contact 36 is square or rectangular. The contact 36 comprises a metal selected from the group consisting of copper, gold, nickel, silver, tin, indium and base alloys thereof.

Like the first contact 30, the contact 36 is formed so that the portions of the contact 36 in contact with the surfaces 14 and 16 lie flat, parallel to, and touching, the respective surfaces of the member 12. This configuration prevents the contact 36 from falling out of the member 12 during any handling and also provides a large electrical contact surface area for connecting to an electrode. An electrical lead 38 is affixed to one end of the contact 36 to provide a means for connecting the contact 36 into a remote electrical system.

With reference to FIG. 4, there is shown a portion of a compression bonded semiconductor device utilizing the teachings of this invention.

The portion of the device is comprised of an electrically and thermally conductive support member 42, made of a metal selected from the group consisting of copper, silver, aluminum, base alloys thereof and ferrous base alloys. Copper and brass, a base alloy of copper, have been found particularly satisfactory for this purpose.

The support member 42 has a peripheral flange 44 and an upwardly extending pedestal portion 46. The upwardly extending pedestal portion 46 has an uppermost mounting surface 48. The peripheral flange 44 has a top surface 50 and the upwardly extending pedestal portion 46 has a peripheral side surface 52.

An upwardly extending hollow cylindrical member 54 is affixed to the support member 42. The inner periphery of the member 54 conforms to the peripheral surface 52 of the pedestal portion 46. The member 54 is affixed to the support member 42 by any suitable means known to those skilled in the art, such, for example, as by disposing a suitable braze material 56 between the top surface 50 of the flange 44 and the side surface 52 of the pedestal portion 46 and a portion of the inner pheriphery and all of the bottom of the cylindrical member 54.

The cylindrical member 54 is preferably made of a ferrous base material although other suitable materials, particularly metals, may be employed.

A non-reactive malleable, electrically and thermally conductive layer 58 is disposed on the mounting surface 48. The layer 58 comprises a metal selected from the group consisting of gold, silver, tin, indium, lead and aluminum. The layer 58 simultaneously compensates for any surface irregularities which may occur on the surface 48 and the mating surface of an electrical contact 60. The layer 58 may be disposed upon the surface 48 by any suitable means known to those skilled in the art, such, for example, as electrodeposition means, or as a preformed disc of a suitable metal affixed to the surface 48 and then contoured to specific requirements.

Another suitable method of disposing an equivalent non-reactive, malleable, electrically and thermally conductive structure in lieu of the layer 58 is to coat the surface 48 with a suitable material to promote electrical and thermal conductivity by such suitable means such, for example, as electro-deposition. A metal member comprising a metal selected from the group consisting of gold, silver, tin, indium, lead and aluminum may then be disposed between, and in contact with, the coated surface 48 and the electrical contact 60 without employing a bonding material to form a permanent joint between the components.

The electrical contact 60 comprises a metal, such for example, as molybdenum, tungsten, tantalum and combinations and base alloys thereof. The contact 60 may also be plated with a suitable material such, for example, as gold.

The contact 60 is a firm supporting structure for a body of semiconductor material. The contact 60 should therefore have good electrical and thermal conductivity properties and a thermal expansion characteristic closely matched to the material comprising the body of semiconductor material disposed on the contact 60.

A semiconductor element 62 is disposed on the electrical contact 60. The semiconductor element 62 comprises a body of a semiconductor material selected from the group consisting of silicon, silicon carbide, germanium, compounds of Group III and Group V elements and compounds of Group II and Group VI elements. The semiconductor element 62 has two regions 61 and 63 of a first type semiconductivity and a region 65 of a second type semiconductivity, a first p-n junction 69 between regions 61 and 65 and a second p-n junction 71 between regions 63 and 65.

With reference to FIG. 5 there is shown a top view of the semiconductor element 62. The view of the element 62 in FIG. 4 is taken along the cutting plane IV—IV.

The semiconductor element 62 has a mesa-type structure, or multi-level electrical contact surfaces. An electrical contact area 64, with a shape as shown in FIG. 5, is disposed on, and in an electrically conductive relationship with the region 61 of semiconductivity. A second electrical contact area 66 is disposed on, and in an electrical conductive relationship with the region 65 of semiconductivity. The electrical contact area 64 of this element 62 is at a higher elevation than the electrical contact area 66. The contact areas 64 and 66 are also physically separated from each other.

The element 62 is affixed to the contact 60 by suitable means such, for example, as by employing a solder layer 68 of an alloy of silver, lead and antimony.

Referring again to FIG. 4, the electrical contacts 30 and 36 assembled in the member 12 is disposed on the semiconductor element 62. The first electrical contact 30 is aligned, and is in electrical contact, with the electrical contact 64. At the same time, the second electrical contact 36 is simultaneously aligned, and is in electrical contact, with the other electrical contact 66. Alignment of the contacts 30 and 36 with the respective ohmic contacts 64 and 66 is relatively simple. The thickness of the cushioning member 12 is thin enough, approximately 15 mils, so that the member 12 is translucent. One is therefore able to orient the electrical contacts 30 and 36 with the respective ohmic contacts 64 and 66 on the surface of the element 62 quite easily by visual means only.

FIG. 4 is also illustrative of the deformation of the cushioning member 12. The member 12 partially deforms under the required force necessary to keep the contacts 30 and 36 and the respective contacts 64 and 66 of the element 62, as well as the element 62, the contact 60 and the support member 42 in an electrical and thermal conductivity relationship. This required force causes the material comprising the cushioning member 12 to flow whereby the member 12 molds itself to conform to the surface irregularities of the element 62 and its electrical contacts 64 and 66 as well as at least partially filling the apertures present within the member 12 and the voids existing between the assembled components of the electrical device immediately adjacent to the member 12.

With reference to FIG. 6, there is shown a compression bonded electrical device 70 which incorporates the structure of the portion of the electrical device shown in FIG. 4.

An apertured electrically insulating washer 72 is disposed about the electrical conductors 34 and 38 and upon the top surface of the contact assembly 10. The insulating washer 72 comprises a material selected from the group consisting of ceramic, mica, glass, quartz and fluorocarbon.

A first apertured metal thrust washer 74 is disposed about the electrical conductors 34 and 38 upon the top surface of the apertured insulating washer 72. At least one apertured metal spring washer 76 is disposed about the electrical conductors 34 and 38 upon the top surface of the thrust washer 74.

A second apertured metal thrust washer 78, similar to, or the same as, the washer 74 is disposed on the uppermost spring washer 76. An apertured expandable metal retaining ring 80, similar to a snap ring, is disposed about the electrical conductors 34 and 38 within, and is retained by, a groove 82 formed in the inner periphery of the upwardly extending cylindrical member 54.

The ring 80 cooperating with the cylindrical member 54 and acting on the thrust washer 78 resiliently urges the apertured spring washer 76 to transmit a compression force through the apertured thrust washer 74 and thence through the apertured electrically insulating washer 72 to force the electrical contacts 30 and 36, the semiconductor element 62, the electrical contact 60 and the uppermost mounting surface 48 of the upwardly extending pedestal portion 46 of the support member 42 into a firm, intimate, electrically conductive relationship with each other.

More than one apertured spring washer 76 of the same, or different thickness, may be required to cooperate with the retaining ring 80 and the cylindrical member 54 to create the necessary compressional force required for a reliable operating device 70.

An electrically non-conducting washer 84 is disposed on the retaining ring 80. The washer 84 has a plurality of apertures 86. Each of the leads 34 and 38 project through an individual aperture 86 of the washer 84. The washer 84 limits the lateral movement of the leads 34 and 38 thusly reducing the associated stresses resulting from the movement from deleteriously affecting the joints between the contacts 30 and 36 and the respective leads 34 and 38.

A molecular sieve 88 is disposed on the washer 84. The sieve 88 has an aperture 90 through which the leads 34 and 38 project. The sieve 88 is self-centered since its outer peripheral side surface 92 conforms to the inner wall of the member 54. The sieve 88 functions as a moisture gettering device.

The device 70 is completed by providing a hermetic enclosure for the semiconductor wafer 62. The hermetic enclosure is formed by affixing an apertured header assembly 94 to the member 54. The header assembly 94 comprises an outwardly extended flanged member 96 affixed to a multiple apertured insulating seal member 98.

The header assembly 94 is joined to the member 54 by welding the outwardly extended flanged member 96 to an integral annular weld ring 100 formed within the member 54. An upwardly extending integral flange 102 of the member 54 acts as a guide for positioning the header assembly 94 during assembly and joining operations.

The electrical lead 34 passes through a metal sleeve 104 in one of the apertures of the header assembly 94. A hermetic seal is achieved by compressing the sleeve 104 by any suitable means, such, for example as by swaging, rolling and the like, about the portion of the outer periphery of the lead 34 which it encompasses.

The electrical lead 38 terminates in an electrical connector 106 hermetically sealed into the header assembly 94. To electrically connect the lead 38 into an external system, another electrical lead 108, suitably affixed to the connection 106, is required.

An electrical contact and thermal dissipating stud 110 is either affixed or is integral with the support member 42. The stud 110 is used to connect the support member 42 to an electrical conductor and heat sink.

The following example is illustrative of the teachings of this invention:

A good electrically and thermally conductive support member having an integral electrical contact and thermal dissipating stud was prepared from a piece of copper alloy bar stock. The finished machined configuration was the same as illustrated in FIG. 6. A layer of silver was then affixed to the uppermost mounting surface of the pedestal portion and machined to a specific flatness and diameter.

A ferrous integral case and weld ring assembly was then affixed to the support member by disposing a layer of braze material between portions of the assembly and the top of the peripheral flange and the side surface of the upwardly extending pedestal portion.

A silicon semiconductor transistor element suitable for use as a compression bonded electrical device was prepared. The element had a top surface which had been divided into two separate distinct regions of semiconductivity. The electrical contact to one semiconductivity region was 0.5 mils higher than the electrical contact to the other region of semiconductivity.

The semiconductor element was affixed to a molybdenum electrical contact by disposing a layer of a silver-lead-antimony alloy electrical solder material between the bottom surface of the element and the top surface of the contact. The element and contact, affixed to each other, was then disposed within the integral case and weld ring assembly and upon the layer of silver on the pedestal.

A polytetrafluoroethylene cushioning member was prepared. The member was about 15 mils in thickness and large enough to cover the entire surface of the semiconductor element. Apertures were formed entirely through the thickness of the member.

A piece of flat silver metal ribbon was threaded through one series of apertures in the cushioning member. A flat tab was formed at the beginning end of the ribbon pressed against the top surface. The ribbon passed down through one aperture and was flattened against the bottom surface of the cushioning member for the entire length to the next aperture. The ribbon transversed the aperture and was formed into approximately a semicircular stress relief loop and passed downwardly through the next aperture. The ribbon was then flattened against the bottom surface of the cushioning member to the next aperture. The ribbon then passed upwardly through this next aperture and the end of the ribbon was formed flat along the top surface of the cushioning member.

Another piece of flat silver metal ribbon, shorter than the first piece of metal ribbon, was then threaded to the next series of apertures in the cushioning member. A flat tab was formed at one end of the ribbon and the rest of the ribbon was threaded downwardly through one aperture until the flat tab was lying flat on the top surface of the cushioning member. The ribbon was then formed flat against the bottom surface of the cushioning member to the next aperture in the series. The ribbon was then passed upwardly through the aperture and the end of the ribbon was formed into a flat tab along the top surface of the cushioning member.

A first silver electrical lead was affixed to the stress relief loop of the first piece of silver ribbon. A second silver electrical lead was affixed to a tab of the second silver electrical lead, the tab being closest to the center of the cushioning member.

The resulting structure was the pressure multiple contact assembly shown in FIGS. 1, 2 and 3.

The contact assembly was then disposed within the integral case and weld ring assembly and positioned on top of the semiconductor element. The cushioning member was translucent enough to allow the positioning of the silver metal ribbon electrical contacts on the two aluminum electrical contacts of the semiconductor element.

An apertured ceramic washer was then placed over the silver electrical leads and disposed on the top surface of the cushioning member. The outer periphery of the mica washer conformed with the inner periphery of the integral case and weld ring assembly.

A first steel apertured thrust washer was then disposed about the electrical conductors from the contact assembly and on top of the ceramic washer. The outer periphery of the thrust washer conformed to the inner periphery of the integral case and weld ring assembly. Two apertured steel spring washers and a second steel thrust washer were respectively then disposed about the electrical conductors from the element and on top of the first steel thrust washer. The outer periphery of the spring washers and the second steel thrust washer conformed to the inner periphery of the integral case and weld ring assembly.

Force was then applied to the second steel thrust washer and a steel retaining ring was snapped into an annular groove in the integral case and weld ring assembly to keep the spring washers in compression. The theoretical pressure on the surface of the element was in excess of 800 p.s.i. based on an absolutely smooth surface.

An apertured polytetrafluoroethylene washer was disposed on top of the steel retaining ring. The silver electrical leads passed through the respective apertures of the washer. The outer periphery of the washer conformed to the inner periphery of the case and weld ring assembly.

After one hour, the polytetrafluoroethylene washer retaining ring was removed and the device was unloaded. The pressure multiple contact assembly was removed from the device. Examination of the polytetrafluoroethylene cushioning member revealed that the member had cold flowed under pressure and molded itself about the irregularities in the surface of and portions of the electrical contacts on the element. An outline of the structure of the element was clearly impressed in the surface of the member. The surfaces of the member had also molded themselves flush with the ribbon contacts contained therein. The semiconductor element, upon visual inspection, was still structurally satisfactory.

The device was reloaded except for a hermetic seal. The calculated pressure on the theoretically smooth surface area of the element was approximately 1020 p.s.i. The device was heated to a temperature of about 200° C. for a period of 68 hours. The device was then cooled, the retaining ring and polytetrafluoroethylene washer removed and the pressure multiple electrical contact assembly removed for an examination.

The cushioning member of the contact assembly had been permanently deformed about 10%. The outline of the semiconductor elements surface and portions of the electrical contacts attached thereto was clearly embossed in the surface of the cushioning member. The surfaces of the member were still molded flush with the ribbon contacts contained therein. Visual examination of the semiconductor element showed no defects.

The device was reloaded again except for a hermetic seal. A new pressure multiple electrical contact assembly was substituted for the permanently deformed assembly previously used. The pressure applied to the semiconductor element surface was a calculated 1400 p.s.i. The device was heated to a temperature of 200° C. and held at temperature for approximately two hours. The device was then cooled, the retaining ring and the polytetrafluoroethylene washer were removed and the pressure multiple electrical contact assembly removed for examination.

The thrust member had been permanently deformed approximately 10%. The structure of the semiconductor element and portions of the electrical contacts attached thereto was again clearly embossed in the surface of the thrust member. Visual examination of the semiconductor element still revealed no damage to the element.

Employing a new polytetrafluoroethylene thrust member, 15 mils in thickness, the device was again reassembled. A calculated pressure of 1000 p.s.i. was impressed on the surface of the semiconductor element. An apertured molecular sieve was disposed about electrical leads connected to the pressure multiple electrical contact assembly and on the polytetrafluoroethylene washer. The hermetic enclosure shown in FIG. 5 was attached to the integral case and weld ring assembly to form a complete electrical device within which the semiconductor element was hermetically sealed.

The hermetically sealed electrical device was then electrically cycled through a theoretical operating cycle, typical of what the device would encounter during normal usage. The device continually performed satisfactorily and well within its design limits.

The device was carefully disassembled and the pressure multiple electrical contact assembly was examined. The polytetrafluoroethylene cushioning member had been permanently deformed about 10%. The member had molded itself about all the surface irregularities which had been in contact with the member. The stress relief portion of the one silver metal ribbon had been deformed slightly by the movement of the cushioning member, but the electrical lead was still firmly attached to the stress relief portion.

A visual examination of the semiconductor element showed the element to be still in satisfactory condition.

It was also noted that during all these tests and evaluations, the apertured polytetrafluoroethylene washer reduced the accidental fracturing of the slender silver electrical leads to the pressure multiple contact assembly. The washer had reduced considerably the lateral movement of the slender electrical leads.

A trifluoromonochloroethylene cushioning member and an apertured trifluoromonochloroethylene washer were employed in the same type of electrical devices in lieu of their polytetrafluoroethylene counterparts. Equally satisfactory results were obtained when the same tests were repeated using these substituted materials.

Although the member **12** has been described as being a circular disk, other geometrical shapes may be employed as configurations for the member **12** and will work equally as well. The geometrical shape required is determined only by the encapsulating member components, and particularly the design of the semiconductor element employed therein, as well as the number, and type, of electrical connections required to be made to the wafer.

While the invention has been described with reference to particular embodiments and examples, it will be understood of course, that modifications, substitutions and the like may be made therein without departing from its scope.

We claim as our invention:

1. A pressure multiple electrical contact assembly comprising (1) a partially deformable cushioning member having two major opposed surfaces, the member having a plurality of apertures, each aperture extending completely between the opposed surfaces, (2) at least two electrical contacts, each electrical contact being threaded through a separate portion of the plurality of apertures, (3) at least one contact having an integral expansion portion contained therein, (4) an electrical lead affixed to the expansion element of each electrical contact having an integral expansion element, and (5) an electrical lead affixed to each of the other electrical contacts.

2. The pressure multiple electrical contact assembly of claim **1** in which the material comprising the partially deformable cushioning member is one selected from the group consisting of polytetrafluoroethylene and trifluoromonochloroethylene.

3. The pressure multiple electrical contact assembly of claim **1** in which the material comprising the electrical contacts is at least one metal selected from the group consisting of copper, gold, nickel, silver, tin, indium and base alloys thereof.

4. The pressure multiple electrical contact assembly of claim **1** in which the material comprising the partially deformable cushioning member is one selected from the group consisting of polytetrafluoroethylene and trifluoromonochloroethylene and the material comprising the electrical contacts is at least one metal selected from the group consisting of copper, gold, nickel, silver, tin, indium and base alloys thereof.

5. The pressure multiple electrical contact assembly of claim **1** in which the material comprising the partially deformable cushioning member is one selected from the group consisting of polytetrafluoroethylene and trifluoromonochloroethylene and the material comprising the electrical contacts is silver.

6. A semiconductor device comprising (1) a semiconductor element having at least two electrical contacts affixed to one major surface of the element (2) a pressure multiple electrical contact assembly in electrical contact with each electrical contact on the one major surface of the element, the assembly comprising a partially deformable cushioning member having two major opposed surfaces, the member having a plurality of apertures, each aperture extending completely between the opposed surfaces, at least two electrical contacts, each electrical contact being threaded through a separate portion of the plurality of apertures, each of the electrical contacts being in electrical contact with an electrical contact affixed to the semiconductor element, at least one of the contacts having an integral expansion element contained therein, the electrical contacts each comprising a metal selected from the group consisting of copper, gold, nickel, silver, tin, indium and base alloys thereof, an electrical lead affixed to the expansion elements of each electrical contact having an integral expansion element and an electrical lead affixed to each of the other electrical contacts, (3) a means for applying a constant force on the pressure multiple electrical contact assembly whereby each of the electrical contacts of the pressure multiple electrical contact assembly are maintained in thermal and electrical conductive relationship with each respective electrical contact affixed to the semiconductor element.

7. The semiconductor device of claim 6 in which the material comprising the partially deformable cushioning member is one selected from the group consisting of polytetrafluoroethylene and trifluoromonochloroethylene.

8. The semiconductor device of claim 6 in which the material comprising the partially deformable cushioning member is one selected from the group consisting of polytetrafluoroethylene and trifluoromonochloroethylene and each electrical contact of the pressure multiple electrical contact assembly is made of silver.

9. The semiconductor device of claim 6 in which an apertured electrically non-conducting member is disposed on the means for applying a constant force on the pressure multiple electrical contact assembly, the apertured member restricting the lateral movement of an electrical lead passing through an aperture of the member.

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