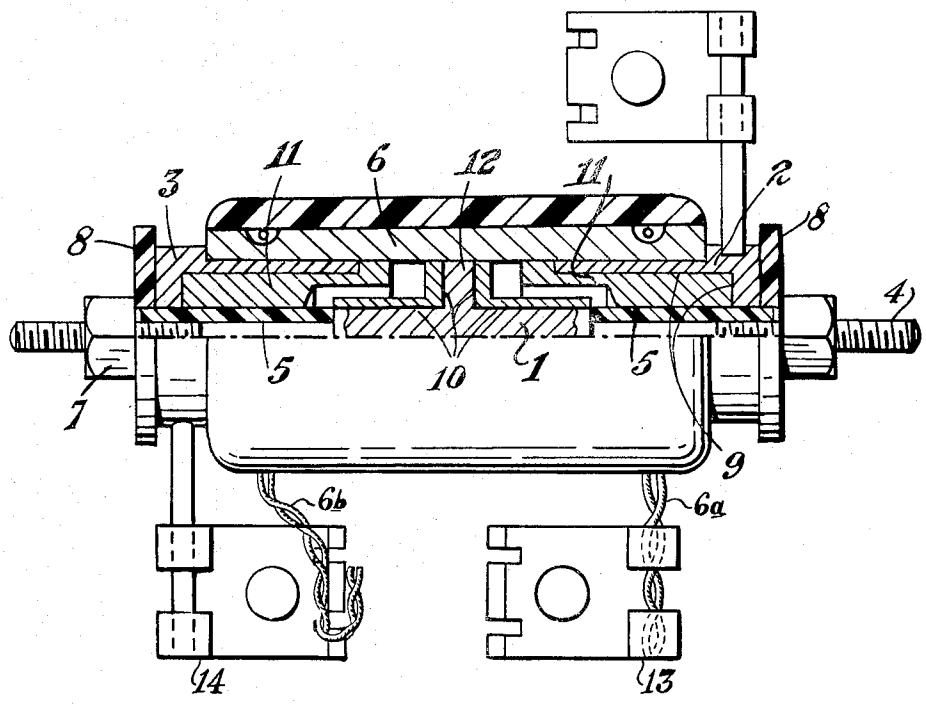
Aug. 25, 1964 B. F. THORNE 3,146,326

FUSIBLE MULTI-CONTACT ELECTRICAL CONNECTOR

Filed May 28, 1962



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United States Patent Office 3,146,326 Patented Aug. 25, 1964

3,146,326

FUSIBLE MULTI-CONTACT ELECTRICAL CONNECTOR

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Filed May 28, 1962, Ser. No. 198,006
Claims priority, application Great Britain June 2, 1961
12 Claims. (Cl. 200—123)

This invention relates to electrical connectors of the kind in which permanent electrical connection between at least two spaced electrodes is establishable by the application of heat to fusible material disposed on surfaces of said electrodes.

Such a connector may be utilised in a submarine cable repeater amplifier for the purpose of establishing altered and permanent circuit connections within the amplifier consequent on failure of a component therein and for isolating that part of the amplifier circuit containing the defective component. When installed in a submarine cable repeater amplifier which is laid possibly on an uneven sea bed it is particularly important that the connector should operate reliably in any attitude in which the repeater may have come to rest.

It is an object of the present invention to provide a connector of the type set forth which will in operation, establish the required connections between electrodes, irrespective of the attitude of the connector.

The single figure of the drawing illustrates by way of example only, an electrical connector according to the invention.

Referring to the drawing, an electrical connector comprises a cylindrical tubular centre electrode 1 and cylindrical cup shaped and electrodes 2 and 3, the electrodes 1, 2 and 3 being axially aligned upon an electrically conductive electrode support member constituted by a rod 4. The centre electrode 1 is attached to the rod 4, for example, by brazing to ensure good electrical contact therewith and is provided with a dividing means, as shown a radial, circumferential flange 12 about its mid portion, the diameter of the flange 12 being equal to that of the end electrodes 2 and 3.

The end electrodes 2 and 3 are radially spaced from the rod 4, and are each arranged to overlap the adjacent extremity of the centre electrode 1, the external diameter of the centre electrode 1 (except for the flange 12), being less than the internal diameter of the end electrodes 2 and 3. The rod 4 is insulated from the end electrodes 2 and 3 by sleeves 5 of insulating material.

The electrodes 1, 2 and 3 are enclosed within and thermally connected to a tubular heating resistor 6, each end of which abuts against a flange formed around the circumference of the outer end of each end electrode 2 and 3, which flanges in conjunction with clamping nuts 7 and insulating washers 8 serve to determine the axial spacing of the end electrodes 2 and 3, relative to the centre electrode 1. The spaced electrodes when fitted within the resistor 6 thus define two closed chambers isolated from each other by the circumferential flange 12 on the centre electrode 1. In the illustrative embodiment, the end electrodes 2 and 3 are connected to terminal tags 13 and 14 respectively.

The internal surfaces 9 of the end electrodes 2 and 3 and external surfaces 10 of the centre electrode 1, each have disposed thereon a layer 11 of a eutectic alloy solder. The thickness of the layers 11 is so arranged as to leave an air gap between the layers of solder on adjacent electrodes, sufficient to prevent electrical continuity therebetween. At the same time the thickness is sufficient to ensure that, on melting of the solder, a conductive bridge

is formed in each chamber between centre electrode 1 and the adjacent end electrodes 2 and 3.

The solder is heated by the resistor 6 which is connected through conductors 6*a* and 6*b* and terminal tags 13 and 14 respectively to a source of heating current (not shown). Conveniently the normal value of the current is arranged to be such as to cause generation of insufficient heat in the resistor 6 to cause melting of the solder. Should the current exceed this normal value, the increased heat generated by the resistor 6 melts the solder which then flows into the intervening space in each chamber between the adjacent electrodes 1, 2 and 3 and forms conductive bridges therebetween. Subsequently if the current returns to the normal value, the solder solidifies and forms permanent connections.

The electrical connector of the present invention has particular utility in submerged cable repeater equipment; for example, the heating resistor 6 may be connected in parallel with the repeater amplifier valve heating current, the current through the heating resistor 6 being insufficient under normal conditions to cause melting of the solder.

If the current through the resistor 6 increases consequent for example, on a valve failure causing an open circuit, the solder is melted and bridges the electrodes 1, 2 and 3 which, by connection within an appropriate circuit, can be arranged to short circuit that half of the amplifier which is defective and also to prevent further flow of current through the resistor 6, thus permitting the solder to cool and solidify to form permanent connections between the electrodes.

Preferably the layers 11 of eutectic alloy solder are applied to the electrodes 1, 2 and 3 under conditions of vacuum in a closed vessel thereby avoiding the formation of air pockets within the solder layers 11.

What I claim is:

1. An electrical connector of the type in which permanent electrical continuity is established between spaced electrodes in response to the application of heat to fusible material; said connector comprising a centre electrode, two end electrodes; means supporting said centre and end electrodes in spaced relationship from each other and from said centre electrode so as to define a cavity; means insulating said end electrodes from said centre electrode; fusible material disposed on said electrodes; resistance means thermally connected to said electrodes for heating said fusible material; and means for subdividing said cavity into two chambers, each containing fusible material, and preventing flow of fusible material from one chamber to the other; the spacing of said electrodes being such as to ensure the establishment of electrical continuity between each of the said end electrodes and said centre electrode on melting of said fusible material, irrespective of the attitude of the connector.

2. A connector as claimed in claim 1 in which the centre electrode is telescopically fitted within the end electrodes.

3. A connector as claimed in claim 1 in which each of the electrodes is cylindrical, the fusible material being disposed over at least an inner surface of the end electrodes and over spaced external surfaces of the centre electrode.

4. A connector as claimed in claim 1 in which said means supporting said centre and end electrodes comprises a conductive rod, and in which the centre electrode is attached to the conductive rod and is in electrical contact therewith.

5. An electrical connector of the type in which permanent electrical continuity is established between spaced electrodes in response to the application of heat to fusible material; said connector comprising a centre electrode,

two end electrodes; means supporting said centre and end electrodes in spaced relationship from each other and from said centre electrode so as to define a cavity; means insulating said end electrodes from said centre electrode; fusible material disposed on said electrodes; resistance means comprising a tubular heating resistor within which said electrodes are fitted for heating said fusible material; and means for subdividing said cavity into two chambers, each containing fusible material, and preventing flow of fusible material from one chamber to the other; the spacing of said electrodes being such as to ensure the establishment of electrical continuity between each of the said end electrodes and said centre electrode on melting of said fusible material, irrespective of the attitude of the connector.

6. A connector as claimed in claim 1 in which the centre electrode comprises a tube, each of the end electrodes being formed by a cylindrical cup, the open end of which faces the centre electrode and wherein said dividing means comprises a radial flange disposed about the centre part of the tube.

7. A connector as claimed in claim 6 in which the external diameter of the end electrodes equals that of the radial flange of the centre electrode, the diameter of the tube of the centre electrode being less than the internal diameter of the end electrodes.

8. A connector as claimed in claim 1 in which the fusible material is a eutectic alloy solder.

9. An electrical connector comprising a centre and two axially spaced end electrodes, an electrode support member upon which said electrodes are assembled, means carried by the centre electrode dividing the space within the connector into two parts, means insulating each of the end electrodes from the support member and from the centre electrode, fusible material disposed over the surfaces of the electrodes within each part, said electrodes being fitted within a tubular resistor connectable to a source of heating current, said resistor being effective in response to a predetermined value of the heating current to cause melting of the fusible material in each part of said connector, and the electrodes being so spaced as to ensure the establishment of electrical continuity between said electrodes, on melting of the fusible material, irrespective of the attitude of the connector.

10. An electrical connector of the kind in which permanent electrical connection between spaced electrodes is established by application of heat to melt fusible material disposed thereon, comprising a centre support member of conductive material, two electrodes spaced axially from one another and radially from said support member, said electrodes being insulated from said support member, means carried by said support member for dividing the connector into two parts, layers of fusible material disposed on said electrodes and the support member, and a resistance element thermally connected to the electrodes and arranged to generate sufficient heat in response to a heating current exceeding a predetermined value to melt the fusible material, said fusible material being so disposed relatively to said electrodes that irrespective of the attitude of the connector, electrical connection between the support member and the electrodes will be established when the fusible material is melted.

11. An electrical connector of the type in which permanent electrical continuity is established between spaced electrodes in response to the application of heat to fusible material; said connector comprising a tubular insulating cover and disposed within said cover an axial rod, and mounted on said rod a cylindrical, central electrode and a pair of axially spaced tubular end electrodes, means insulating said end electrodes from said rod; fusible material disposed on the exterior of the central electrode and on the interiors of the tubular end electrodes, said end and central electrodes, together with part at least of the fusible material disposed thereon, being radially spaced to define a cavity and said central electrode having a radial flange constituting a partition subdividing said cavity into two fusible material containing chambers and preventing flow of said material, when fused, from one chamber into the other; and the dimensions of said chambers and the quantities of fusible material therein contained being such as to ensure electrical continuity between each of the end electrodes and the central electrode on fusing of the fusible material, irrespective of the attitude of the connector; and means responsive to open-circuiting of a shunt across the end electrodes for heating said fusible material to melting point.

12. A connector as claimed in claim 11, in which said last mentioned means is a resistor interconnecting said end electrodes.

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