Dec. 31, 1968 E. SCHMUED 3,419,844

ELECTRICAL CONNECTOR

Filed July 12, 1965

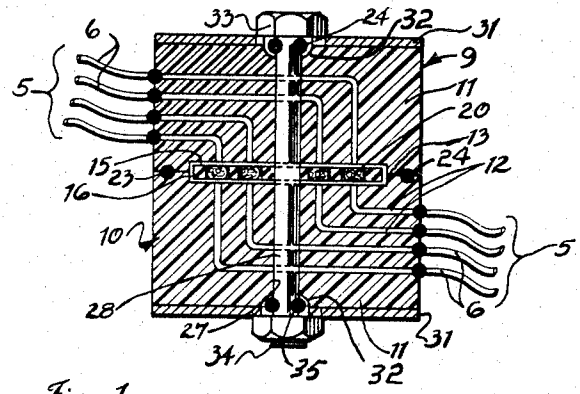


Fig. 1

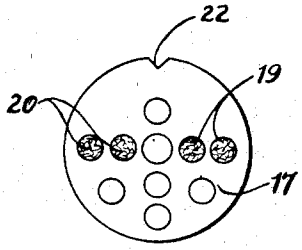


Fig. 3

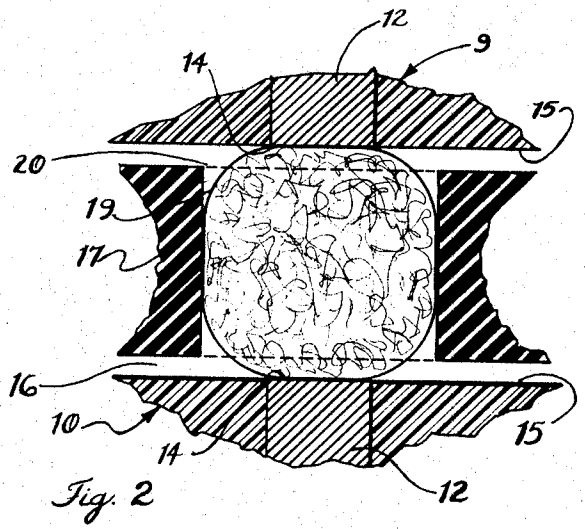


Fig. 2

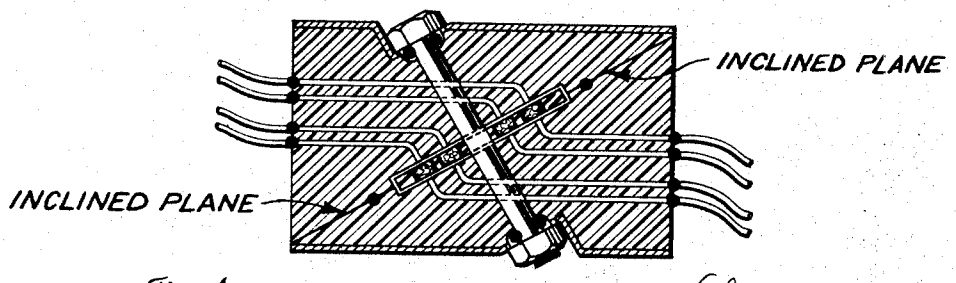


Fig. 4

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ELECTRICAL CONNECTOR

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ABSTRACT OF THE DISCLOSURE

A multi-pin connector formed of a pair of mutually connectable terminal blocks in which lead wires are embedded, the terminal ends of the lead wires in one block being electrically joined with the terminal ends of the lead wires in the other block by ball shaped pellets of electrically conductive metal wire positioned and insulated from each other in an intermediate cavity provided between the two terminal blocks.

My invention relates to electrical connectors and more particularly to an improved pressure electrical connector that is substantially invulnerable to severe vibration and shock. My invention is directed principally to electrical connectors of the multi-pin type in which plug or pin-connector terminals are joined or coupled together by means of female connectors, i.e., split sleeves of relatively ductile electrical conducting metal such as brass, copper or like material; the male pins of one connector being inserted through one end of corresponding female connector and the male pins of the other connector being inserted through the opposite ends thereof to form multiple electrical joints.

While these connectors work well enough in stationary equipment, vast numbers of multi-pin connectors are currently being employed in missiles, rockets and advanced aircraft, for example, wherein reliability of each and every system is of paramount importance. A split-second interruption in a single circuit can abort or cause a vital mission to end in disaster. Frequently such failures can be traced to a multipin connector in which the female connector sleeve has spread apart or fractured due to extreme vibration and shock during launch and subsequent operation, causing a short or break in a circuit that is vital to the operation or guidance of the vehicle. Moreover, such vehicles are occasionally subjected to extremely high G-loads under which forces of destructive proportions are exerted upon the vehicle systems and components.

It is therefore a primary object of my invention to provide a pressure connector that is reliable and substantially invulnerable to severe vibrations and shock over prolonged periods.

It is another object of my invention to provide a pressure connector for use in aerospace vehicles and the like, which can be hermetically sealed against the intrusion of moisture and corrosive chemicals and may easily be internally pressurized for use in unusual environmental conditions.

It is still another object of my invention to provide a pressure electrical connector that is ideally suitable for use in aerospace vehicles, yet relatively simple in construction and economical to manufacture.

Briefly, the pressure connector of my present invention, in one preferred form, comprises a pair of mutally connectable terminal blocks, each electrically connected at one end thereof to a plurality of conductors to be joined. Corresponding leads for the conductors are embedded in the terminal blocks, the leads terminating in an internally disposed chamber that is defined between the terminal blocks when mutually connected together.

Positioned in the chamber are a plurality of resilient connectors, one disposed between each of the distal or terminal ends of the terminal block leads, in electrical conduction contact therebetween, and means for retaining and insulating each of the resilient connector means from one another.

My invention will be more easily understood, and other objects and advantages more readily seen, by reference to the ensuing detailed description and appended drawings in which:

FIGURE 1 is a side elevational view in cross-section showing a preferred form of my invention,

FIGURE 2 is a fragmentary enlarged view showing the plate, aperture and resilient connector of my present invention,

FIGURE 3 is a plan view showing the plate, apertures, resilient connectors, and indexing notch of my invention, and

FIGURE 4 is a side elevational view of a modified form of my invention.

A preferred form of my invention is shown in FIGURE 1 in which two groups **5** of electrical wires or conductors **6** bundled together in a cable sheath, or by harness straps (not shown), are joined together at their distal ends in terminal blocks **9** and **10** respectively. Each terminal block is formed of a body **11** cast or molded of epoxy resin or other suitable dielectric potting material having embedded therein a plurality of lead wires **12**. In all respects, terminal blocks **9** and **10** are identical.

For convenience and ease of assembly the terminal blocks **9** and **10** are adapted to be assembled and fastened together in overlapping relationship as shown, the faying or mutually connectable surfaces **13** thereof being accurately planed and ground to sufficient flatness to form a void-free, flush interface at their joint.

Wire leads **12**, joined with appropriate conductors **6** of each bundle **5**, are arranged in predetermined relationship in their respective terminal blocks, being cut to appropriate lengths and bent at right angles so that their distal ends are coterminus along a common plane adjacent to the faying or interfacial surfaces **13** of the terminal blocks.

A recess or cavity **15** is provided in the faying surfaces **13** of each terminal block, being formed or machined therein in any convenient manner, and aligned with each other to define a unitary internally disposed chamber **16** between the terminal blocks when assembled and fastened together.

The cavities **15** extend a desired distance into each body **11**, exposing along the aforementioned common planes the terminal ends **14** of the prealigned lead wires **12** for interconnection. If desired, the ends **14** of the terminal block leads **12** in the chamber **16** may be somewhat flattened and soldered to increase their contact area, or may be provided with standard terminals (not shown) if desired.

In the chamber **16**, intermediate the aligned lead wire terminals **12** of each terminal block **9** and **10**, I provide a flat insulating wafer or plate **17**, fabricated of a durable dielectric material, the dimensions and shape around the edges being such as to produce a sliding fit within the chamber **16**. Preferably, the thickness of plate **17** is slightly less than the depth of chamber **16** to provide a small clearance therein.

A plurality of apertures **19** are provided through plate **17**, each of the apertures **19** being prearranged and located to correspond with the aligned terminal ends **14** of the terminal block leads **12** as shown.

In each aperture **19**, I mount a ball or pellet **20**, preferably formed of springy or resilient metal wool, i.e., filaments of a metal having good electrical conducting prop-

erties, such as copper, beryllium-copper, or like material. The diameter of the conductor pellet **20** can be made slightly greater than the depth of chamber **16**, and hence the distance between the aligned terminal ends **14** of the terminal block leads **12**. Thus, when the terminal blocks **9** and **10** are joined together and fastened, the resilient pellets **20** are compressed between the terminals urging the pellet material into tight electrical contact beween each pair of terminal ends **14**.

It will also be seen that by flattening the pellets **20** between the terminals, the pellets will correspondingly expand in width and become firmly wedged within the confines of their respective apertures **19**. Thus it is readily apparent that an electrical union is formed between the aligned terminal block leads, the nature of which is not subject to weakening, deforming or rupturing under prolonged or even indefinite periods of severe vibration, shock or G-loads.

To insure proper alignment of the apertures **19** in plate **17**, an indexing notch **22** is provided in one edge of plate **17**; a corresponding protuberance or pin (not shown) being provided in the edge of one or both cavities. Each aperture may be coded, i.e., marked with identification means, as is well known in the art.

All that is necessary to hermetically seal the interior chamber **16** against moisture and chemical intrusion is to provide aligned continuous seats or grooves **23** in the faying surfaces **13**, or terminal block interfaces, between the terminal blocks **9** and **10**, and intermediate the chamber **16** and the block exterior. An elastic O-ring **24** is provided, seated in the grooves **23** in the well known manner.

The terminal blocks **9** and **10** may be fastened together in any convenient manner, one preferred manner being shown wherein a central bolt bore **27** is drilled through the terminal block bodies **11** and a bolt **28** inserted therethrough, a nut **29** being threaded on the bolt end extending through the opposite side substantially as shown. To strengthen the assembly washers **31** are provided at each end of bolt **28**. To seal the bolt bore **27** circumferential grooves **32** are provided in the terminal block body **11** around the head **33** of bolt **28** and around the threaded end **34** thereof; an O-ring **35** being seated in each groove **32** as shown.

Where it is necessary to pressurize the internal chamber **16**, space (not shown) may easily be provided within plate **17** for a small rupturable capsule of CO_2.

The foregoing example of the pressure connector of my invention will satisfy most requirements. However, where space is a primary problem, the dimensions around the combined terminal blocks may be substantially reduced by designing the faying surfaces of the terminal block bodies in the form of inclined planes substantially as shown in FIGURE 4. In all other respects, the internal organization and arrangement of the terminal block leads, chamber, insulating plate, pellet connectors, O-ring grooves and seals remain substantially the same as in the embodiment descirbed above with reference to FIGURES 1–3.

If desired, the bodies forming the terminal blocks may be confined within shells or receptacles made of insulating material; these forms being well known to those skilled in the art.

Obviously the pressure connector of my invention is susceptible of numerous other forms and embodiments and I do not regard it as necessary to exhaustively describe and show all or a part of the modified embodiments that will occur to those skilled in the art; such forms and modifications being deemed to fall within the spirit and scope of my invention, the gist of which is set forth in the following claims.

I claim:

1. In an electrical connector, the combination comprising:

(a) a pair of substantially identical terminal blocks cast of dielectric material, each of said blocks having one side surface adapted to be joined with the corresponding side surface of the other,

(b) a plurality of lead wires embedded in parallel relationship in each of said blocks, each of said lead wires having one end thereof extending from one end of its block which end is adjacent to said joining surface thereof, each of said lead wires being bent at an angle in said block to position the opposite end thereof at the surface of said side defining the joining surface with said other block, said joining sides of said blocks extending in a plane that is coextensive with the direction of the ends of said lead wires extending from said end of said block,

(c) means defining an airtight shallow chamber of uniform depth between said joining surfaces of said terminal blocks, the ends of each of said lead wires terminating in said chamber and aligned for interconnection therein,

(d) a compressible ball of electrically conductive wool positioned in said chamber and compressed therein between said aligned ends of said lead wires,

(e) a relatively thin flat plate of insulating material in said chamber, said plate having apertures therethrough located and arranged in alignment with said ends of said lead wires to position and retain said compressible conductive balls between said aligned ends of said lead wires,

(f) a seal extending around said chamber between said joining surfaces of said terminal blocks,

(g) aligned bores extending transversely through each of said terminal blocks, and

(h) a fastening bolt extending through said aligned bore to fasten said blocks together.

2. The electrical connector combination in claim **1** in which said terminal block surfaces adapted to join in overlapping relationship are inclined planes.

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