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Panek et al.

[11] **3,887,257**

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[54] **ELECTRICAL CONNECTOR**

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[52] **U.S. Cl.** ..... **339/45 M**; 339/46; 339/49 B

[51] **Int. Cl.**[2] **H01R 13/62**; H01R 25/00

[58] **Field of Search** ..... 339/45 R, 45 M, 46, 48, 339/49 B, 92, 75 R, 75 M; 200/61.08

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[57] **ABSTRACT**

A switching electrical connector, which may be in the form of an umbilical type connector, including a flat movable insulator containing electrical contacts. The movable insulator is slidable in a plane parallel to a pair of flat fixed insulators. The fixed insulators carry a pair of aligned contacts. A pair of spring biased movable contacts are mounted in a bore in the movable insulator which extends perpendicular to the path of movement of the insulator. When the bore is aligned with the fixed contacts, the spring biased contacts in the movable insulator "butt" engage the fixed contacts. Shear screws hold the movable insulator so that its contacts engage the fixed insulator contacts. Suitable means, such as a squib, is employed for shifting the movable insulator to fracture the shear screws and thereby disengage the contacts.

15 Claims, 4 Drawing Figures

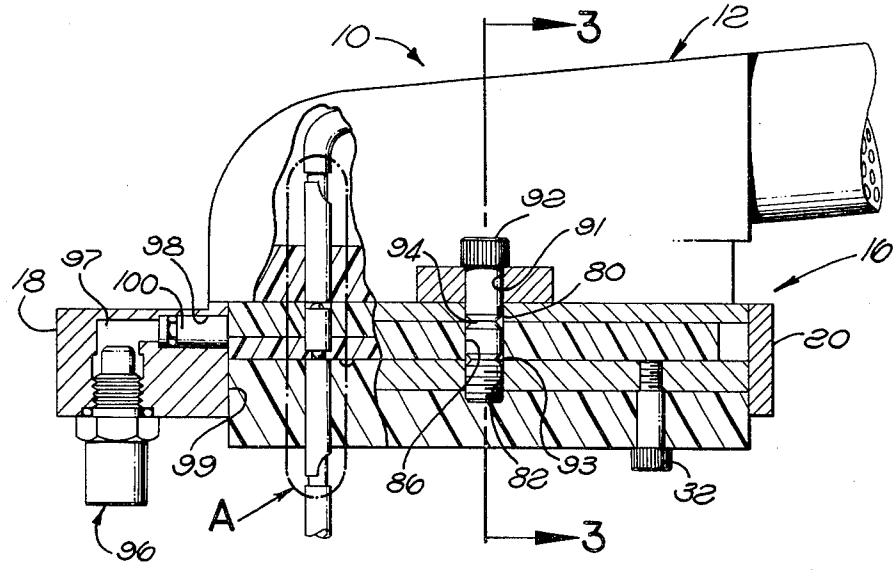


FIG. 1.

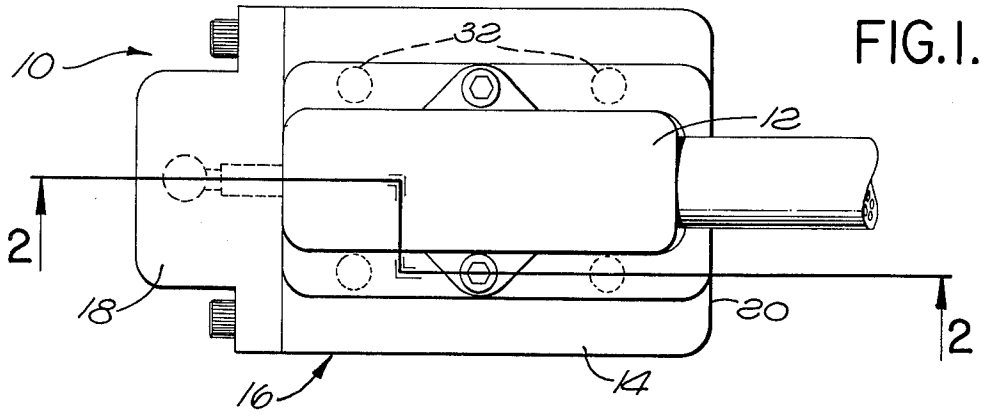


FIG. 2.

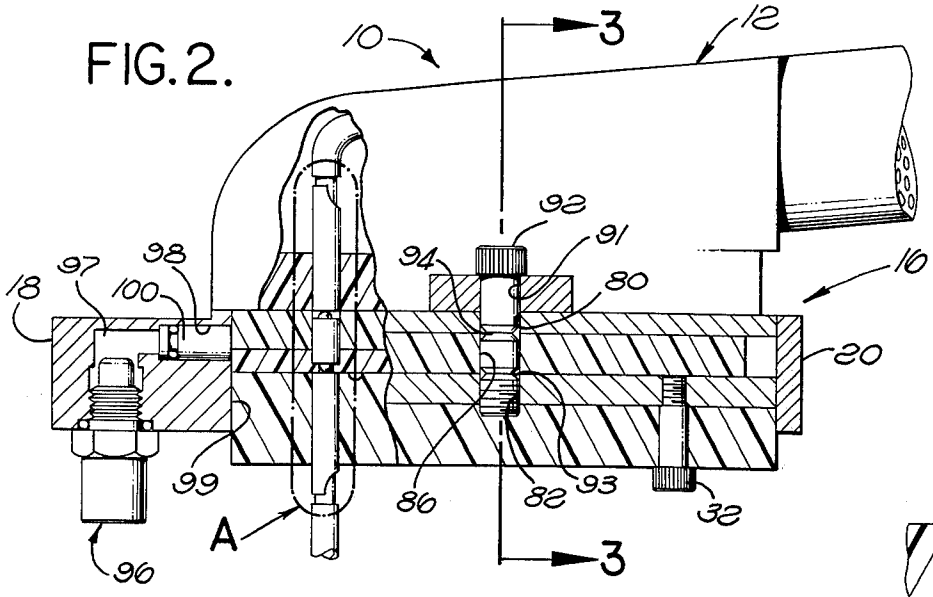


FIG. 3.

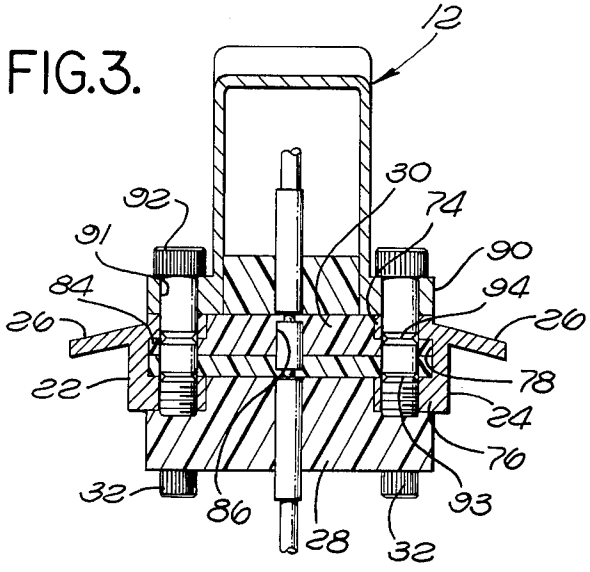
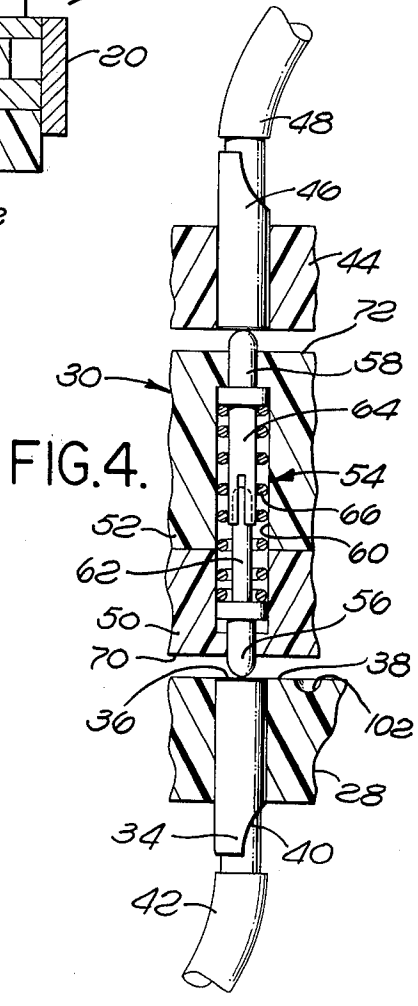


FIG. 4.



ELECTRICAL CONNECTOR

BACKGROUND OF THE INVENTION

This invention relates generally to electrical connectors and, more particularly, to a switching electrical connector having a movable insulator therein for making and breaking a multiplicity of independent electrical circuits through the connector.

The present invention will be described specifically as being applied to an umbilical type electrical connector; however, it will be appreciated that the switching features of the connector could be employed in other types of connectors if desired. Umbilical type electrical connectors are employed for various purposes. One principal use is to provide electrical communication with a guided missile prior to launching, the umbilical separating upon launching of the missile. It is a requirement of such umbilical connectors that they have releasable locking structure which positively locks the plug and receptacle connector members together and is virtually immune to accidental release induced by vibration or shock, yet which is quickly and positively released upon the application of a release impulse, such as an electrical impulse. A variety of umbilical connectors meeting these requirements are known in the art. For example, U.S. Pat. Nos. 3,043,925 to Wilson and 3,335,391 to Prow, Jr., disclose umbilical connectors which utilize fixed pin and socket contacts with a switching insert in the receptacle carrying contacts which electrically connect the pin and socket contacts. These connectors utilize a central spring loaded piston carrying a detent arrangement which is actuated by axially shifting a cylinder by means of a lanyard to shift the switching insert and disengage the electrical circuits through the connector. Due to the use of the pin and socket contacts, the switching insert must be moved axially to achieve the disconnect and switching functions. This results in a connector receptacle member with a great deal of depth. In addition, the detent arrangements employed in the prior art connectors are relative complex mechanisms, requiring numerous parts thus adding to the expense of the connector. Another form of switching connector is disclosed in U.S. Pat. No. 3,344,249 to Thomas. This connector employs fluid pressure for axially shifting the switching insert within the connector, thus also resulting in an assembly which has substantial depth.

For some applications it is desirable that the umbilical electrical connector have a relatively low profile, that is, a short depth. It is also desirable that the connectors be simpler in construction and thus less expensive. Further, it is desirable to provide a dead face for the receptacle contacts, that is, an insulation covering for said contacts after the plug connector member has been released from the receptacle connector member. The purpose of the present invention is to provide an elelctrical connector having the foregoing features.

SUMMARY OF THE INVENTION

According to the principal aspect of the present invention, there is provided a switching electrical connector which may be in the form of an umbilical type connector, including a movable insulator containing electrical contacts for making and breaking a multiplicity of independent electrical circuits through the connector. The movable insulator is slidable in a plane parallel to a pair of fixed insulators. The fixed insulators carry a pair of aligned contacts. A pair of spring biased movable contacts are mounted in a bore in the movable insulator which extend perpendicular to the path of movement of the insulator. When the bore is aligned with the fixed contacts, the spring biased contacts in the movable insulator "butt" engage the fixed contacts. Shear screws hold the movable insulator so that its contacts normally engage the fixed insulator contacts. Suitable means, such a squib, is employed for shifting the movable insulator to fracture the shear screws and thereby disengage the contacts in the connector. By this arrangement, relatively flat insulators may be utilized in the connector, resulting in an overall assembly having a relatively low profile. In addition, the connector is relatively simple in construction requiring only a minimum number of parts. Further, since the movable insulator is shifted laterally rather than axially to disengage the contacts, the insulator will provide a dead face or insulation covering for the fixed contacts in the receptacle connector member.

A BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a top plan view of an umbilical connector constructed in accordance with the present invention;

FIG. 2 is a partial vertical sectional view taken along 2—2 of FIG. 1;

FIG. 3 is a transverse partial vertical sectional view taken along line 3—3 of FIG. 2; and

FIG. 4 is an enlarged sectional view of the contact arrangement encompassed by circle A in FIG. 2, showing the plug and receptacle connector members prior to full engagement.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings in detail, the umbilical electrical connector of the present invention, generally designated **10**, includes a plug connector member **12** and receptacle connector member **14.** The receptacle connector member is mounted in a housing, generally designated **16**, including a pair of end walls **18** and **20** and side walls **22** and **24.** Outwardly extending mounting flanges **26** are formed on the side walls **22** and **24** for securing the housing to a panel or mounting structure, not shown.

The receptacle connector member includes a relatively flat fixed insulator **28** and a relatively flat elongated movable insulator, generally designated **30.** The insulator **28** is fixed to the bottom of the housing **16** by means of locking screws **32,** as best seen in FIG. **2.** A plurality of contacts are mounted in the insulator **28,** only one of such contacts **34** being shown in the drawing. The forward portion of the contact **34** terminates in flat circular contacting surface **36** which is flush with the face **38** of the insulator **28.** The rear portion of the contact **34** extends beyond the rear face of the fixed insulator and is formed as a crimp barrel or solder pot **40,** as shown, to which there is connected an insulated conductor **42.**

The plug connector member **12** also includes a fixed insulator **44** carrying a plurality of contacts, only one such contact **46** being shown which is identical to the contact **34** and axially aligned therewith. An insulated conductor **48** is connected to each contact **46.**

The movable insulator **30** has a length less than the distance between the opposed surfaces of the end walls

18 and 20 of the housing 16 so that it is free to slide lengthwise in the housing. The movable insulator is comprised of two insulator members 50 and 52 which may be secured together by a suitable adhesive, or by heat bonding or the like. A plurality of contact assemblies, generally designated 54, are mounted in the movable insulator for providing electrical connection between the respective pairs of fixed contacts 34 and 46 in the insulators 28 and 44, respectively. Each such contact assembly includes a pair of "butt" contacts 56 and 58 mounted for sliding movement in a bore 60 which extends perpendicular to the planes of the flat fixed and movable insulators, that is, perpendicular to the path of movement of the movable insulator. The contact 56 is formed with a rearwardly extended pin 62 which is slidably engaged in a slotted socket 64 on the rear portion of the contact 58. The two "butt" contacts are biased apart by means of a coil spring 66 surrounding the pin and socket. The forward portions of the contacts 56 and 58 are sufficiently long so as to extend beyond the opposite faces 70 and 72, respectively, of the movable insulator. The spring 66 maintains the "butt" contacts in such extended position. Thus, as best seen in FIG. 4, when the movable insulator 30 is positioned so that the bore 68 is aligned with the fixed ocntacts 34 and 46, the "butt" contacts 56 and 58 will engage the fixed contacts completing an electrical circuit through the connector. Preferably the outer ends of the butt contacts are rounded, as shown. As illustrated in FIG. 4, the plug and receptacle connector members are not fully engaged, so that the "butt" contacts are shown in their extended position. When the plug connector member is fully engaged with the receptacle connector member, the opposed faces of the fixed insulator will be sufficiently close to the fixed insulator so that the "butt" contacts will be slightly retracted within the movable insulator, yet the spacing between the fixed insulators will be sufficient to allow the movable insulator to slide laterally between the fixed insulators for the purpose which will be described later.

Referring now to FIG. 3, it is seen that inwardly extending upper and lower flanges 74 and 76 are formed on the side walls 22 and 24 of the housing 16, defining therebetween opposed slots 78. Aligned holes 80 and 82 are provided in each set of flanges 74 and 76. The lower hole 82 is threaded. The movable insulator 30 is formed with outwardly extending tongues 84 extending along its sides which are slidably engaged in the slots 78. A hole 86 is also provided in each of these tongues. When the movable insulator is positioned adjacent to the end wall 18 of the housing, the "butt" contacts therein are axially aligned with the holes 80 and 82 in the flanges. The plug connector member 12 is formed with a pair of outwardly extending flanges 90 having holes 91 therein aligned with the holes 80 and 82. A shear screw 92 is mounted through each set of aligned holes 91, 80, 86 and 82. The lower portion of the shear screw is threadably engaged with the hole 82. Annular grooves 93 and 94 are cut in the surface of the shear screw 92 aligned with the faces 70 and 72 of the movable insulator. Thus, the shear screws 92 hold the movable insulator in position to align the movable "butt" contacts with the fixed contacts in the connector assembly to complete electrical circuits therethrough.

Means, generally designated 96, is provided for shifting the movable insulator in the rightward direction to fracture the shear screws at the grooves 93 and 94. Such means is shown in FIG. 2 as being a pyrotechnic squib mounted in a chamber 97 in the end wall 18. A bore 98 communicates the chamber 97 with the surface 99 of the end wall 18 adjacent to the left end of the movable insulator. A piston 100 is slidable in the bore 98. When the squib is fired, the explosively generated gas pressure will act upon the piston 100 to shift the insulator 30 in the rightward direction simultaneously breaking the electrical circuits through the connector and disconnecting the plug connector member from the receptacle connector member.

Preferrably, a plurality of recesses 102 (only one being visible in FIG. 4) are formed in the face 38 of fixed insulator 28 which are engaged by the "butt" contacts 56 when the movable insulator is shifted to its circuit breaking position whereby the spring loaded "butt" contacts and recesses function as detents to hold the movable insulator in such position. With the movable insulator so located, a dead face is provided for the contacts 34 in the receptacle connector member. Although the movable insulator has been described as being shifted by an explosively generated gas pressure, it will be appreciated that it can also be shifted by pneumatic or hydraulic pressure, if desired. Also, a spring could be utilized to shift the movable insulator by utilizing a suitable detent mechanism which releasably retains the movable insulator adjacent to end wall 18. Release of the detent mechanism would allow the spring to shift the movable insulator to its circuit breaking position.

Also, while the connector of the present invention has been described with the fixed contacts being mounted in the fixed insulators 28 and 44, it will be appreciated that the spring loaded movable "butt" contacts could be mounted in the fixed insulators and a single flat faced contact pin could be mounted in the movable insulator. In addition, although the present invention has been described as being embodied in an umbilical type connector, it will be appreciated that the switching contact feature of the invention could be employed to disengage contacts in a connector without disconnecting the plug connector member from the receptacle connector member. For example, the mounting flanges 90 and 92 on the plug connector member could be fixed to mounting flanges 26 on the housing 16 independent of the shear screws 92, so that when the shear screws are fractured, the switching function will be achieved without disconnecting the plug connector member 12 from the receptacle member 14. Other modifications and variations within the scope of the invention will be apparent to those skilled in the art.

What is claimed is:

1. A switching electrical connector comprising:

plug and receptacle connector members;

a fixed insulator in each of said connector members carrying aligned "butt" contacts;

a movable insulator in one of said connector members mounted for sliding movement laterally between said fixed insulators from a first position to a second position;

a bore in said movable insulator extending perpendicular to the path of movement of said movable insulator, in said first position of said movable insulator said bore therein being aligned with said "butt" contacts and in said second position of said

movable insulator said bore being out of alignment with said "butt" contacts;

a pair of movable contacts in said bore;

means biasing said movable contacts apart urging said movable contacts to extend outwardly beyond the opposite faces of said movable insulator so that when said movable insulator is in said first position, said movable contacts will engage said "butt" contacts; and

means on said one connector member for shifting said movable insulator from said first position to said second position to break the engagement between said movable contacts and said "butt" contacts.

2. A switching electrical connector as set forth in claim **1** wherein:

said movable insulator and fixed insulator in said one connector member are relatively flat elements; and

said movable insulator is slidable in a plane parallel to the plane of said fixed insulator.

3. A switching electrical connector as set forth in claim **1** including:

detent means for releasably retaining said movable insulator in second position after being moved thereto by said shifting means.

4. A switching electrical connector as set forth in claim **3** wherein:

said detent means includes one of said biased movable contacts and a recess in the fixed insulator adjacent to said one contact positioned to receive said one contact when said movable insulators is in said second position.

5. A switching electrical connector as set forth in claim **1** wherein:

said shifting means comprises pressure producing means.

6. A switching electrical connector as set forth in claim **5** wherein:

said pressure producing means comprises an electrically ignited squib.

7. A switching electrical connector as set forth in claim **1** wherein said receptacle connector member comprises:

a housing including a pair of end walls and a pair of side walls;

a pair of inwardly extending flanges formed on said side walls defining slots opening into the interior of said housing;

said movable insulator being an elongated member formed with outwardly extending tongues along the longer sides thereof slidably engaged with said slots;

the length of said movable insulator being less than the distance between said housing end walls;

in said first position one end of said movable insulator is in juxtaposition to one of said end walls;

said shifting means being mounted in said one end wall, whereby actuation of said shifting means causes said movable insulator to be moved toward the other end wall; and

one of said fixed insulators being connected to said housing.

8. A switching electrical connector as set forth in claim **7** including:

fracturable means for holding said movable insulator in said first position, actuation of said shifting means causing said fracturable means to be fractured.

9. A switching electrical connector as set forth in claim **8** wherein:

said fracturable means is mounted in said housing flanges and in said tongues on said movable insulator.

10. A switching electrical connector as set forth in claim **8** wherein:

said fracturable means also connects said plug connector member to said receptacle connector member whereby actuation of said shifting means releases said plug connector member from said receptacle connector member.

11. A switching electrical connector as set forth in claim **7** including:

at least one shear screw extending through said plug connector member, said housing flanges and said tongues on said movable insulator for connecting said plug connector member to said receptacle connector member and for holding said movable insulator in said first position, actuation of said shifting means severing said shear screw to release said plug connector member and to allow said movable insulator to be shifted to said second position.

12. A switching electrical connector as set forth in claim **1** including:

fracturable means for holding said movable insulator in said first position, actuation of said shifting means causing said fracturable means to be fractured.

13. A switching electrical connector as set forth in claim **12** wherein:

said fracturable means also connects said plug connector member to said receptacle connector member whereby actuation of said shifting means releases said plug connector member from said receptacle connector member.

14. A switching electrical connector comprising:

plug and receptacle connector members;

a fixed insulator in each of said connector members and a movable insulator in one of said connector members mounted for sliding movement between said fixed insulators in a plane parallel to the planes of said fixed insulators;

a first pair of contacts, one contact of said first pair being mounted in one of said fixed insulators and the other contact of said first pair being mounted in one side of said movable insulator;

a second pair of contacts, one contact of said second pair being mounted in the other of said fixed inculators and the other contact of said second pair being mounted in the other side of said movable insulator;

said one contacts of said first and second pairs of contacts being axially aligned;

said other contacts of said first and second pair of contacts being axially aligned with each other and being in axial alignment with said one contacts of said first and second pairs when said movable insulator is in one position;

means for shifting said movable insulator to a second position wherein said other contacts are out of alignment with said one contacts;

the contacts of each said first and second pairs of contacts being fixed and axially movable, respectively;

means biasing each said movable contacts toward its corresponding fixed contact for "butt" engagement therewith when said movable insulator is in said first position; and

means on said one connector member for shifting said movable insulator from said first position to said second position to break the engagement between said movable contacts and said "butt" contacts.

15. In a switching electrical connector comprising plug and receptacle connector members, a fixed insulator in each of said connector members carrying aligned contacts, an insulator between said fixed insulators movable from a first position to a second position, said movable insulator carrying a contact engageable with said fixed insulator contacts when said movable insulator is in said first position and being disengaged from at least one of said fixed insulator contacts when said movable insulator is in said second position and means for shifting said movable insulator from said first position to said second position, the improvement which comprises:

said movable insulator being slidable in a plane parallel to the planes of said fixed insulators;

a bore in said movable insulator extending perpendicular to said planes, said bore being aligned with said fixed insulator contacts when said movable insulator is in said first position and being out of alignement with said fixed insulator contacts when said movable insulator is in said second position;

said movable insulator contact comprising two parts slidably mounted in said bore, said parts being in telescoping engagement with each other;

means biasing said movable contact pairs apart urging said parts to extend outwardly beyond the opposite faces of said movable insulator so that when said movable insulator is in said first position, said parts will "butt" engage said fixed insulator contacts; and

said shifting means being mounted on one of said connector members, movement of said movable insulator by said shifting means to said second position breaks engagement of said parts with both said fixed insulator contacts.

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