

Nov. 14, 1967

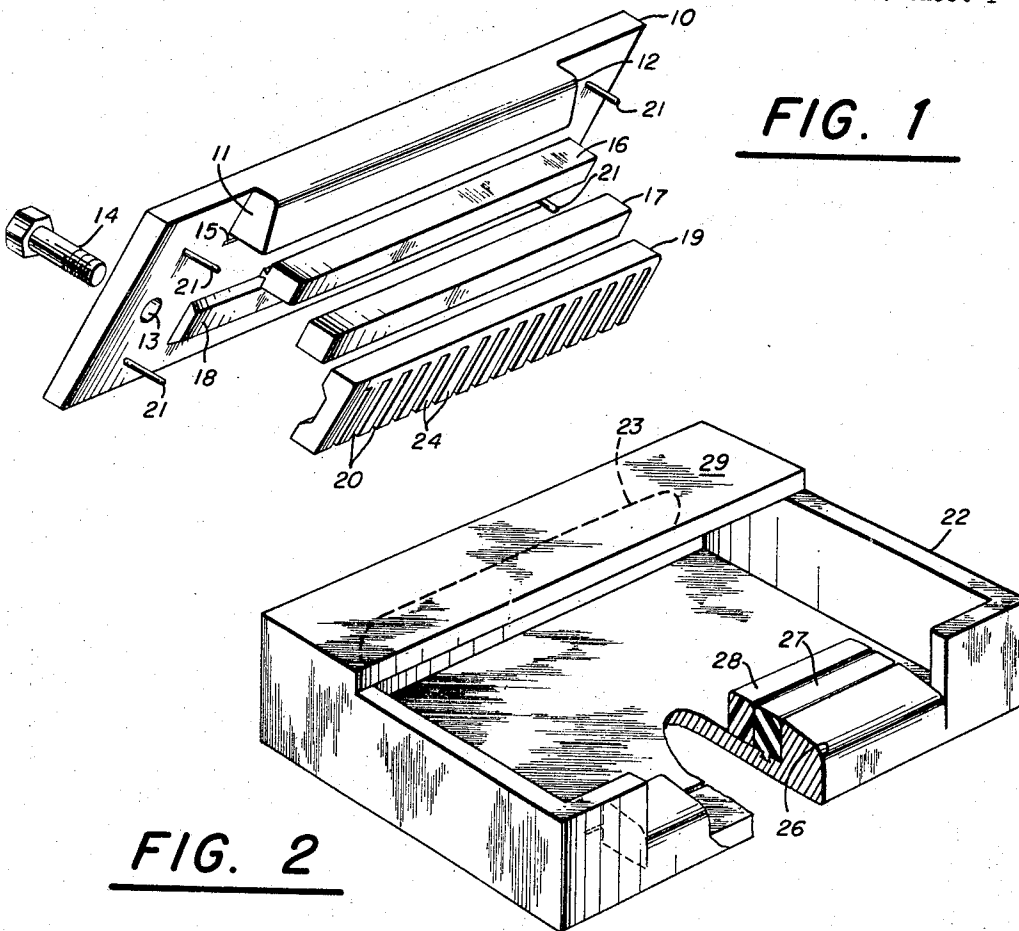
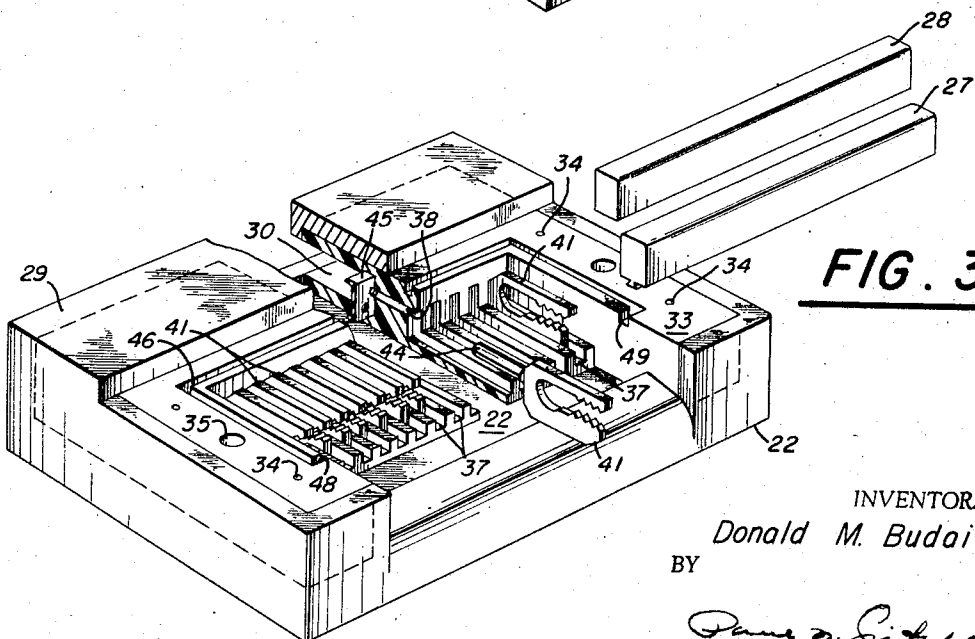
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3,353,141

FLAT CABLE CONNECTOR

Filed March 22, 1966

2 Sheets-Sheet 1



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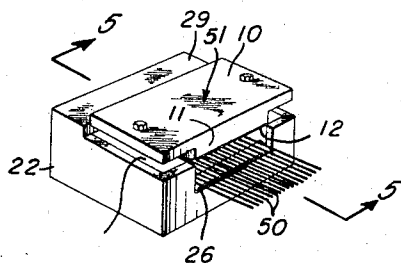


FIG. 4

FIG. 5

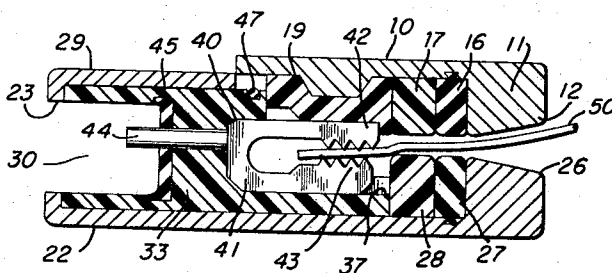


FIG. 6

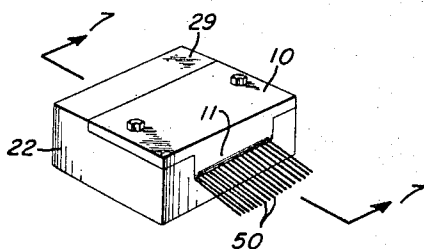


FIG. 7

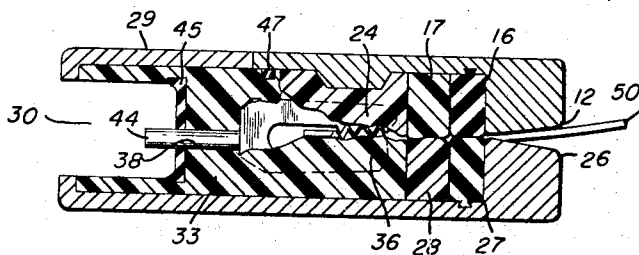
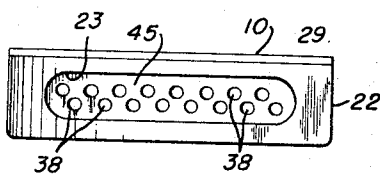


FIG. 8



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3,353,141

FLAT CABLE CONNECTOR
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This invention relates to electrical connectors and, more particularly, to an electrical connector which is sealed and adapted to connect a plurality of flat cables to a plurality of sockets.

In existing electrical connectors it is well known to provide a connector which utilizes a deformable element which makes electrical contact with a conductor or which pierces the insulation covering a conductor to make electrical connection with the conductor contained therein. The obvious disadvantage of the known connectors of this type is that the connection is unprotected from the ambient environment which could affect the effectiveness of the connection by reason of corrosion of the elements. Another well known disadvantage of existing connectors is that the existing connectors fail to provide a means by which stress transmitted through the conductor to the connecting element is relieved from the connector element. That is to say, the forces transmitted by a conductor cable to the engaging piece of a connector element could tear the conductor from between the jaws of the element. A connector which engages a plurality of flat conductors each enclosed in respective insulating member usually consists of a plurality of discrete connecting elements, or if the connector for the plurality of conductors is enclosed within a common housing, usually the technician or electrician must assemble a plurality of elements within the housing to make the connection with a plurality of conductor cables.

It is therefore an object of this invention to provide an improved sealed electrical connector for connecting a plurality of conductor cables to a plurality of sockets.

Another object of the invention is to provide a sealed electrical connector for securing the connector to the cable, the connection being impervious to the ambient environment.

It is an object of the present invention to provide a connector for connecting a plurality of cables to a plurality of sockets whereby the connecting means is of integral construction.

It is a further object of the invention to provide an electrical connector having stress-relieving means for relieving stresses on the connecting elements which are transmitted to the element through the conducting cable inserted therebetween.

Another object of the invention is to provide an electrical connector for making an electrical connection with a flat insulated cable without requiring stripping of the insulation on the conductor.

It is a further object of the invention to provide an electrical connector specially suited for interconnecting a plurality of flat insulated conductors to a plurality of sockets.

It is an object to provide a sealed connector which isolates a plurality of cavities from each other by reason of the cooperation of a slotted insulating cover and the insulated housing.

Another object of the invention is to provide an electrical connector which is rugged and suitable for use under adverse conditions, for example, such as those found aboard ship.

Briefly, the invention is directed to a sealed connector for electrically connecting the cable to a socket, the connector having a housing being provided with a cavity therein. Within the cavity a deformable electrically conductive means having a pair of opposed members and

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a conductor leading therefrom is positioned in the cavity and formed to receive a cable between a pair of opposed members. The conductor extends from the electrically conductive means through the housing to the housing exterior in what we will hereafter term as a socket well. A conductor seal, disposed between the conductor and the housing, seals the socket well from the respective cavities. A slotted insulating cover covers the plurality of cavities, with the inner surface side of said slotted insulating cover abutting one of each of the set of opposing members. After forcibly depressing said slotted cover and deforming the deformable electrically conductive means, said cavities are substantially isolated from each other. The cover is then secured by means for securing the cover to the housing. Sealing means mounted with opposed portions adjacent the cover and the housing provide a common sealing means which permit insertion of said plurality of cables therebetween. Immediately adjacent the sealing means, stress relieving means are positioned oppositely on said cover and said housing to provide a passageway for the plurality of cables inserted therebetween. In addition to the aforementioned sealing means, a cover seal is disposed between said cover and said housing whereby, upon insertion of said plurality of cables into respective ones of said plurality of cavities and forcibly depressing and securing said cover with said plurality of conductive means being deformed for forcing opposed members into electrical connection with respective ones of said plurality of cables inserted therebetween, said electrical connections are thereby sealed within said cavity by reason of the compression of said seal means and said cover seal.

The above and other features of this invention will be fully understood from the following detailed description and the accompanying drawings in which:

FIG. 1 is an exploded view in perspective of the outer cover;

FIG. 2 is a perspective of the outer housing;

FIG. 3 is a perspective phantom view partially in section of the insulated housing showing the mounting of the deformable electrically conductive means therein;

FIG. 4 is a perspective view of the sealed connector after inserting the plurality of conductor cables into the plurality of deformable electric conductors but prior to deformation of the electrical conductor means;

FIG. 5 is a sectional view taken along 5-5 shown in FIG. 4 showing a conductor inserted between the jaws of a single electrical conductor means;

FIG. 6 is a perspective view of the sealed connector after deformation of the plurality of electrical conductor means;

FIG. 7 is a sectional view along line 7-7 as shown in FIG. 6 of one such deformable electrically conductive means with the conductor cable inserted therebetween;

FIG. 8 is a view of the sealed connector taken along lines 6-6 as shown in FIG. 4.

Referring now to the drawings, FIG. 1 shows an outer cover 10 which may be constructed out of any rigid material for example, metal. Cover 10 has a downward projecting portion 11 which forms an upper lip section 12, for guiding a cable as will be explained below. Extending from cover 10 are four projections 21 molded integrally with the cover. At opposite ends of cover 10 holes 13 are provided to receive screw members 14, only one of the two members being shown, which secure the cover. An upper seal 16, e.g. rubber, is mounted in a corresponding groove 15 and extends longitudinally across housing 10. Parallel to seal 16 and extending across housing is a stress relieving means 17 which is constructed of any rigid insulating material. Parallel to stress relieving means 17, longitudinal projection 18 provides an abutment on which slotted cover insulator 19 is mounted. Cover

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insulator 19 with the plurality of slots 20 is adapted to enclose a portion of the electrical conductors as will be explained below. Here it should be noted that seal 16, stress relieving means 17 and the insulator 19 are preferably adhered mounted on cover 10.

In the perspective view of outer housing 22, lower lip section 26 is formed for guiding a cable in cooperation with lip 12. Longitudinally extending lower seal 27 and longitudinally extending lower stress relieving means 28 are mounted so as to respectively oppose upper longitudinally extending seal 16 and upper longitudinally extending stress relieving means 17 when the cover 10 is placed on the outer housing as shown by FIG. 4. At the opposite end of outer housing 22 from lower lip section 26 there is provided a socket housing opening 23 which will permit insertion of sockets as explained below. It should here be noted that housing 22 preferably is integrally molded, it being understood that the housing itself could be prefabricated in any one of a variety of well known means.

FIG. 3 shows insulated housing 33 mounted within outer housing 22. Insulated housing 33 is preferably molded within outer housing 22 although if it is desired to mold or construct the insulated housing in a different environment and then to place it in housing 22, a removable section, for example, top section 29 would be provided so that the insulated housing can be mounted within the outer housing 22. Insulated housing 33 is formed provided with a plurality of pin wells 34 adapted to receive the corresponding mounting pins 21 which are located on outer cover 10 when the outer cover is positioned on the housing sections 33. Threaded wells 35 are adapted to receive the securing means 14 when the cover 10 is to be secured to the housing 33. The wells themselves could be threaded or in a preferred form could have a threaded nut embedded in the insulated housing 33 to provide a solid anchoring means for the securing means 14.

Within the insulator block 33 are provided a plurality of juxtaposed cavities 37. The cavities are each formed with a conductor conduit 38 which permits a communication from the cavity 37 to a socket recess 30. Socket well recess 30 is enclosed preferably by an extension of insulated housing 33 as shown in FIGS. 5 and 6. FIG. 8 shows conductor conduits 38 being alternately staggered, that is to say, that the conductor conduits from adjoining juxtaposed cavities are staggered so that the conductor conduit from one cavity extends from the upper end of the cavity whereas the conductor conduit from the adjoining cavity extends from the lower end of the cavity. This feature of staggering the conduits provides a greater distance between adjacent conductors 44 to thereby minimize the possibility of arcing between adjacent conductors 44.

On the top surface of insulator block 33 there is provided a substantially U-shaped channel 46 in which cover seal 47 is mounted to extend above the surface of block 33 from an end 48 to an end 49 of U-shaped channel 46. Cover seal 47 consists of a resilient durable compound which deforms and creates a seal upon the forceful depression of the cover 10.

Within each of the cavities 37 is positioned a deformable electrically conductive means 41 having a pair of opposed members 42 and 43 and a conductor 44 extending therefrom. The conductive means 41 is positioned within its respective cavity 37 so that shoulder 40 of the conductive means 41 abuts a wall of the cavity 37 and conductor 44 extends through the conductor conduit 38 to socket well recess 30. A conductor seal 45 extends across inner side of the socket well recess 30 to seal the cavities from the socket well recess when conductors 44 have been inserted therethrough.

In using the sealed connector, the connector appears assembled as shown in FIG. 4 with the outer cover 10 mounted onto the outer housing 22 by means of the co-

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operation between the mounting pins 21 and pin wells 34 and the securing means 14 and the threaded wells 35. A plurality of cables are inserted into the assembled sealed connector. A single one of the plurality (shown as cable 50 in FIG. 5) is inserted between upper lip section 12 and lower lip section 26 and upper seal portion 16 and lower seal portion 27 and upper stress relieving elements 17 and lower stress relieving elements 28 and between the upper opposed member 42 and lower opposed member 43 of the deformable electrical conductive means 41. The cable 50 is preferably of the flat conductor type wherein a sheet of conductive material is enclosed by an outer plastic insulator. When deformed, the jaw of the opposing members 42 and 43 will pierce the outer surface of the plastic insulator and make electrical contact with the metallic conductor enclosed therein.

Forcible depression of cover 10, for example by a C clamp, at a point designated generally by numeral 51 forces the plurality of deformable electrical conductive means 41 to deform as shown in FIG. 7. The opposing teeth mounted on the respective upper and lower opposed members 42 and 43 pierce the insulation on the flat cable conductor and make electrical contact with the conductive material enclosed therein. After depression of the cover 10, when the sealed connector assumes the appearance as shown in FIG. 6 and FIG. 7, the opposing seals 16 and 27 seal the opening formed by upper lip 12 and lower lip 26 from the cavities 37 of the connector. The opposing stress relieving means 17 and 28 grip the inserted conductor 50 to prevent any stresses transmitted from the cable conductor from being transmitted to the deformable electrically conductive means 41. The depressed cover 10 also forcefully deforms the cover seal 47 to seal the cover-housing connection. By cooperation of the conductor seal 45, the cover seal 47, seals 16 and 27, the cavity within which the electrical connection is made between the deformable electrically conductive means and the flat cable conductor is sealed from the ambient environment of the connector. Stress relieving means also protect the electrical connection within the cavity in the manner stated above. The sealed electrical connection within the cavity is maintained by tightening the securing means 14 into their respective threaded wells 35.

When the cover 10 has been deperessed FIG. 7 shows that divider portions 24 of the cover insulator 19 and separating walls 36 of the insulated housing 33 abut each other to isolate adjacent cavities 37. This feature insures that there will be no potential breakdown between adjacent connections.

Although the invention discloses an outer housing 22 fitted with a molded insulated housing 33, it would be well within the scope of the invention to provide a unitized molded insulated housing which would also serve as its outer housing. Similarly, the cover 10 and cover insulator could be molded as a unitized insulating cover.

What has been described has been a new and novel seal connector whereby the electrical connection itself is entirely sealed from the ambient environment of the sealed connector and which is a simple, compact, integral, sealed connector which requires no special tools for its use.

It will be obvious to those skilled in the art that various changes and modification may be made without departing from the scope of the invention and therefore in the claims seek to cover all such changes and modifications that falls in the true scope of the invention.

What is claimed is:

1. A sealed connector for electrically connecting a cable to a socket comprising;
 - a) an insulated housing having a cavity therein,
 - b) a deformable electrically conductive means positioned in said cavity and having a pair of opposed members and a conductor, said opposed members being

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formed to receive said cable therebetween and said conductor extending to the housing exterior,
 a conductor seal disposed between said conductor and said housing,
 an insulating cover covering said cavity and abutting 5
 one of said opposing members, said cover being adapted to be depressed onto said housing and secured thereon,
 means for securing said cover to said housing,
 sealing means having opposed portions adjacent said cover and said housing, said opposed portions being 10
 formed to permit insertion of said cable therebetween, stress relieving means having opposed elements adjacent said cover and said housing, said opposed elements being formed to permit insertion of said cable 15
 therebetween and said stress relieving means positioned between said sealing means and said cavity, and
 a cover seal disposed between said cover and said housing whereby, upon insertion of said cable into said cavity between said opposed members and forceably depressing and securing said cover, said conductive means is deformed forcing said opposed members into electrical connection with said cable, said electrical connection being sealed within said cavity by compression of said seal means and said cover seal by said cover and said housing. 20
 2. A sealed connector according to claim 1 wherein; upon forceably depressing and securing said cover, said opposed elements are forced together and firmly 30
 secure said inserted cable from transmitting stresses to said engaging means.
 3. A sealed connector according to claim 2 and adapted to connect a plurality of cables to a plurality of sockets further including;
 a plurality of cavities juxtaposedly spaced in said housing,
 a plurality of said conductive means mounted one in each of said cavities for each connecting one of said cables, and 40

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wherein said conductor seal is disposed to seal each conductor of said plurality of engaging means from said housing.
 4. A sealed connector according to claim 3 wherein; said sealing means and said stress relieving means are longitudinally extending to provide common sealing means and common stress relieving means for said plurality of cables inserted therebetween.
 5. A sealed connector according to claim 4 in which; conductors extending from said plurality of engaging means are positioned in an alternately, staggered manner when they extend to the housing exterior to thereby minimize arcing between adjacent conductors.
 6. A sealed connector according to claim 5 in which said plurality of cables are cables in which a plurality of flat conductors are each enclosed by one of a plurality of flat insulators,
 said connector further including penetrating teeth oppositely mounted on said opposed members for piercing said insulators and making electrical connection with said flat conductors therein.
 7. A sealed connector according to claim 6 further including;
 an outer housing adapted to fit said insulating housing therein,
 an outer cover adapted to fit said insulating cover thereon and said securing means mounting said outer cover on said outer housing.

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