

March 26, 1968

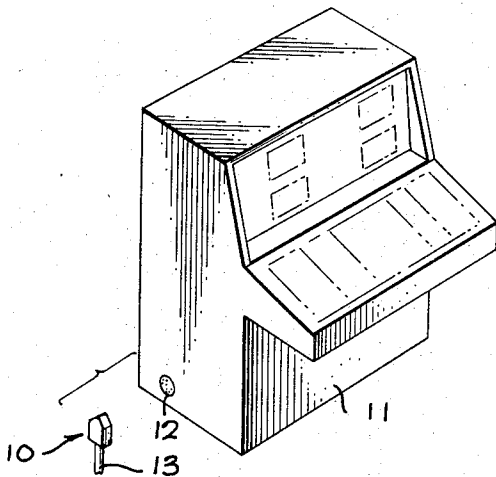
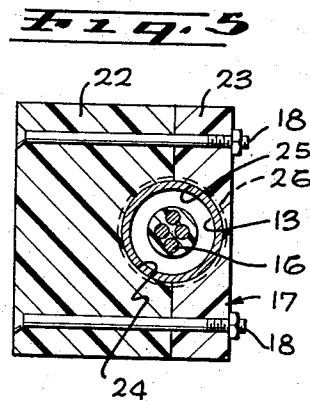
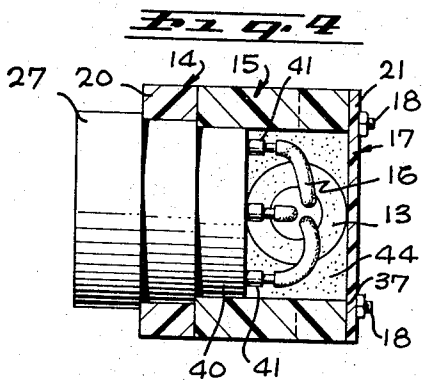
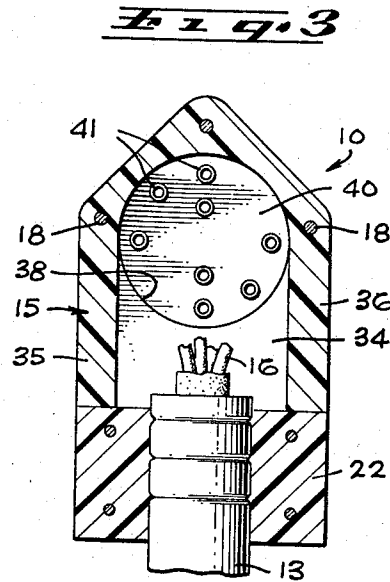
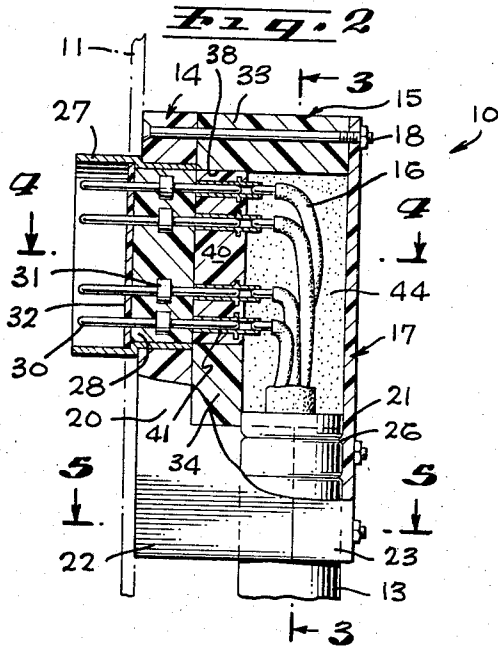
R. M. PARNELL

3,375,481

CABLE CONNECTOR

Filed April 1, 1966

2 Sheets-Sheet 1



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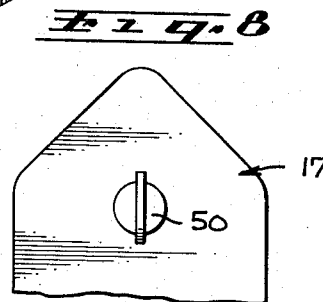
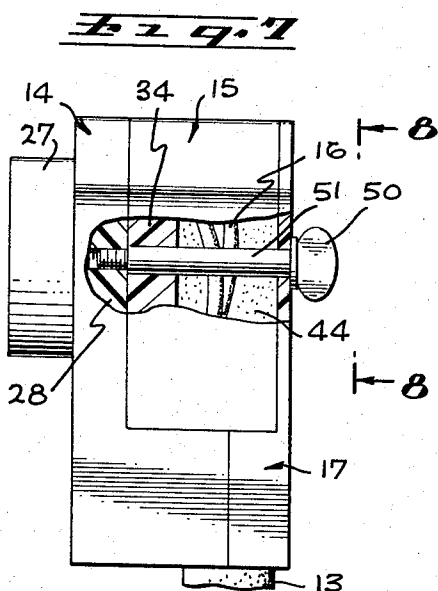
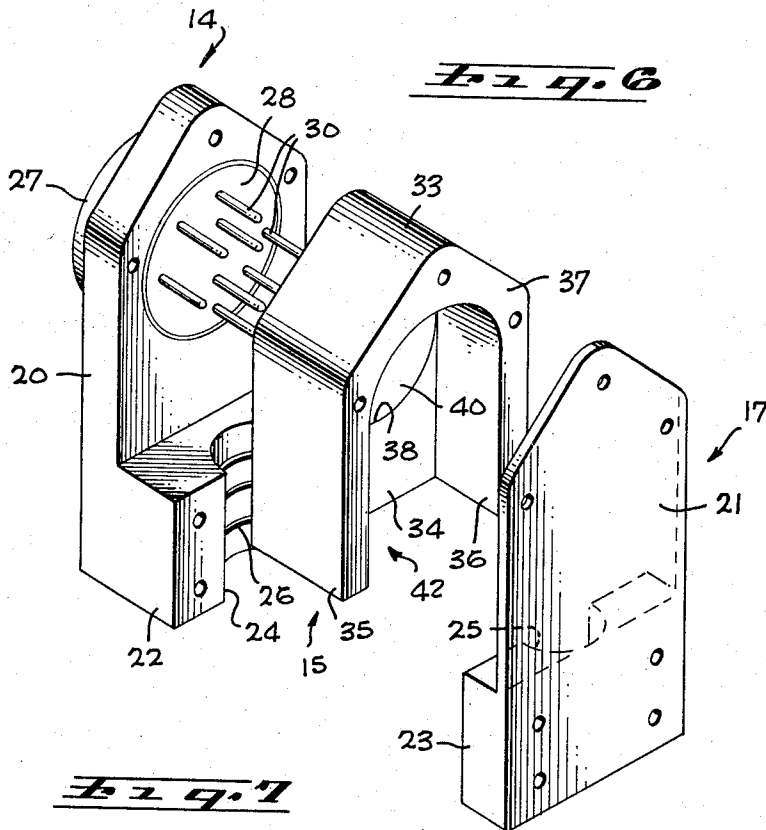
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R. M. PARNELL
CABLE CONNECTOR

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2 Sheets-Sheet 2



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3,375,481

CABLE CONNECTOR

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6 Claims. (Cl. 339-94)

ABSTRACT OF THE DISCLOSURE

A connector useful for connecting the lead ends of a multilead cable to a socket receptacle. The connector is comprised of a pin member having a wall supporting a plurality of contact elements extending therethrough. The first ends of the contact elements are intended to be received in the socket receptacle. The second ends of the contact elements extend into open first ends of tubular contacts in a socket member. The second ends of the tubular contacts are connected to the cable lead ends, as by soldering. A cover member is fastened to the pin member with the socket member and cable being clamped therebetween.

The invention herein described was made in the course of or under a contract or subcontract thereunder, with United States Army Engineer Research and Development Laboratories.

This invention relates to electrical connectors and more particularly to a novel pin type cable connector useful, for example, in coupling a multiple lead cable to a mating socket or receptacle carried on a cabinet enclosing electrical circuitry to which the cable leads are intended to be interconnected.

One type of conventional electrical cable connector employed in the electrical field is generally referred to as being of a pin and socket type wherein a plurality of straight connector pins projecting from a plug part are forcibly mated by means of an interference fit into a plurality of receptacles or sockets held by a receptacle part so that mechanical and electrical contact takes place between the mated parts. Generally, the wire or lead ends of electrical conductors comprising the cable are attached, such as by soldering, to one end of the pins of the plug part which leaves the opposite ends of the pins free for mating with the respective sockets carried by the receptacle part. The insertion and withdrawal forces necessary to overcome the frictional contact inherent in the joining of the pin and socket type connector is usually quite high. Individual pin alignment with a mating socket poses a problem in that the pins often become bent or broken, which causes misalignment that results in faulty contact between the connector elements.

It happens frequently that connectors having connector projecting pins become damaged in use because of rough handling and the like. Particularly during the assembly or mating of a connector pin member with a connector receptacle member, great care must be taken to avoid damaging the connector pins. In connectors having a great number of pins, damaged pins can only be corrected by replacing the entire connector pin member so that all the lead wire ends from the cable first have to be detached, such as by unsoldering, from all of the pins carried by the damaged connector pin member and subsequently attached or soldered to a replacement connector pin member. Replacing a connector pin member may require many hours depending upon the number of connections to be made between individual lead ends and individual pins.

The cable connector of the present invention obviates the problems and difficulties encountered with prior art

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pin and socket type connectors by providing an intermediate member having pin connections projecting from opposite sides of the member whereby the pin ends on one side of the member may be readily mated with a receptacle carried on the apparatus to which the cable is to be connected and whereby the pin ends projecting from the other side of the intermediate member may be mated with a female member having mating sockets. The opposite ends of the sockets from their ends adapted to receive the pins may be suitably connected to the lead ends of a plurality of lead wires comprising the cable so that the pins of the intermediate member are detachably connectable to the cable leads via the sockets. A cover member is provided as a third part of the connector for protecting the connections of the individual lead ends to the individual sockets carried by the female member as well as to effectively waterproof the connections and to provide for effective cable strain relief. An important feature of the device resides in the fact that a cable connector having a broken, bent, or damaged pin may be repaired without removing the cable wires from the connector by merely disassembling the intermediate member from the female member and replacing the damaged intermediate member as an integral part with a new intermediate member.

Therefore, it is a primary feature of the present invention to provide a novel cable connector having multiple pins in which broken, bent, or otherwise damaged pins may be readily repaired or replaced without necessitating the removal of cable lead wires from any of the multiple pins. The novel cable connector is of the pin and socket type wherein the connector includes an intermediate member having the opposite ends of a plurality of connector pins projecting from opposite sides of the member for the purpose of interconnecting a pair of female connector members, wherein one of the female connector members includes a plurality of pin receiving sockets which are connected to the lead ends of a plurality of electrical leads comprising a cable. Incorporated into the connector of the present invention are means for relieving cable strain so that the pins of the connector will not be damaged when the cable is subjected to strain. Such means includes a cover portion effective to grip or clamp about the cable so that the portion of the cable depending from the connector may be flexed or otherwise subjected to strain. The cover also is employed for waterproofing that portion of the connector wherein the lead wires are connected to the sockets. Additional means are provided which cooperate with the cover portion to encapsulate the lead end connections with the sockets to effect a positive seal therefor.

In other words, the novel cable connector of the present invention incorporates a double male pin section to interconnect a pair of female sections, wherein one of the female sections carries lead wires from the cable having the ends of the lead wires attached to sockets carried thereby, which provides for the convenience of assembling and disassembling of the male pin section from the female section without necessitating the stringing of hardware or the soldering of the cable leads to the connector. The novel cable connector provides a cable clamping action for making the connector of watertight construction and eliminating the need for separable cable strain relief for the protection of the multiple pins.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a cabinet having an electrical receptacle and illustrating the novel connector of the present invention in a position immediately prior to attachment therewith;

FIG. 2 is an enlarged cross-sectional view of the connector illustrated in FIG. 1;

FIG. 3 is a cross-sectional view of the connector shown in FIG. 2 as taken in the direction of arrows 3—3 thereof;

FIG. 4 is a cross-sectional view of the connector taken in the direction of arrows 4—4 of FIG. 2;

FIG. 5 is a cross-sectional view of the connector illustrated in FIG. 2 as taken in the direction of arrows 5—5 thereof;

FIG. 6 is an exploded perspective view of the cable connector housing employed in the connector shown in FIG. 2 as taken from one end of the connector;

FIG. 7 is a side elevational view, partially broken away, of another embodiment of the connector of the present invention illustrating a quick disconnect means for retaining the various components of the housing together; and

FIG. 8 is a partial end elevational view of the cable connector shown in the direction of arrows 8—8 of FIG. 7.

Referring to FIG. 1, a cable connector in accordance with the present invention is illustrated in the direction of arrow 10 preparatory to being attached to a suitable cabinet 11 via a receptacle 12. The cabinet is employed to enclose conventional electronic circuitry having a plurality of electrical wires which are communicated exteriorly of the cabinet by means of the receptacle 12 suitably mounted thereon. Receptacle 12 takes the form of a conventional female member wherein a plurality of elongated sockets are disposed within the confines of a ring guard so that one end of the sockets is exposed exteriorly of the cabinet while the opposite ends thereof are suitably connected to the lead ends of the electrical wiring comprising the enclosed electronic circuitry.

To effect communication with or make electrical connection with the wiring enclosed by the cabinet, the electrical connector 10 is employed from which a cable 13 downwardly depends. The cable 13 may be of any conventional type wherein a plurality of electrical conductors, such as wires for example, are grouped together and encased in any suitable manner. Therefore, when the cable connector 10 is properly mated with the receptacle 12, certain selected electrical conductors forming the cable 13 are electrically and mechanically connected to certain selected electrical wires disposed within the cabinet. Such external communication with the cabinet enclosed wiring may be necessary for purposes of supplying power thereto, interconnecting additional circuitry thereto from other equipment, or for any other similar purpose or application.

Referring now to FIG. 2, the connector 10 briefly comprises an intermediate pin member 14 detachably coupled to a socket member 15 which carries a multiplicity of lead wires, such as lead 16 extending from the encasement by cable 13, and a cover member 17 fitted over the lead wires for the protection thereof. The intermediate pin member, socket member, and cover are held together by means of suitable fasteners, such as bolt and nut arrangements 18. The pin member 14 and the cover member 17 are provided with wall portions 20 and 21, respectively, that extend upwardly from opposing base portions 22 and 23, as seen more clearly in FIG. 6. Base portions 22 and 23 present opposing abutting faces that are held together by the bolt and nut arrangements. The socket member 15 is seated on and supported by the abutting base portions 22 and 23 between the wall portions 20 and 21 so that a unitary structure results.

Each base portion of the pin member and cover member is formed with semicircular passages 24 and 25, respectively, that, when the members are fastened together, mate to form a composite passageway through which the cable 13 extends exteriorly of the connector.

In order to provide a strain relief means for the protection of the cable and lead wires from damage that may occur when the cable is flexed or pulled, the base portion semicircular passages 24 and 25 are formed with a series of ribs or projections 26 which grip or clamp the outer periphery of the cable when the pin member and cover are assembled about the socket member so that any tension developed in the cable due to handling will be transmitted to the connector and not to the lead wires and lead wire connections.

The pin member 14 is formed with a central bore through wall 20 which serves to seat a pin assembly which may be said to comprise an annular pin guard 27 that is suitably force-fitted within the bore and retained therein by such a fit as an integral part of the pin member and which is employed to hold a body 28 of packing material. Such material may be of any suitable elastic and electrically non-conductive material, for instance, rubber or plastic-like material, which when properly seated within the guard 27 forms an airtight seal therewith. The packing body 28 is employed for retaining a plurality of contact elements or pins, such as pin 30, which are centrally mounted in the packing body by means of an enlarged portion 31 so that the opposite ends of each pin project outwardly from opposite sides of the packing body. The pins may be arranged in any desired order or known location. The ends of the pins 30 which project exteriorly of the connector are adapted for detachable engagement with sockets of the receptacle 12. The exteriorly projecting ends of the pins 30 are protected by an annular flange member integrally formed with the guard 27.

The ends of the pin elements opposite to their ends projecting exteriorly of the connector are employed for detachable coupling with the socket member 15. The pin contact elements are non-displaceably and closely arranged in the body packing 28 with respect to each other and traverse the packing body from side to side. The packing is prevented from bulging in the region of the bore opening by the provision of a loosely inserted rigid plate 32 which bears against the external side of the packing. The plate 32 is preformed with a plurality of apertures through which the pin contact elements pass.

The socket member 15 comprises a body 33 having a forward wall 34 integrally formed on its opposite ends with a pair of substantially parallel side walls 35 and 36. The rear end of the socket member is open and presents a U-shaped face 37 against which the wall 21 of the cover member 17 engages when the connector is assembled. The forward wall 34 includes a bore 38 which is coaxial with the bore formed in wall 20 of the pin member 14 and which is employed for seating a socket assembly. The socket assembly, in the present embodiment, takes the form of a suitable packing body 40 that is of similar composition to the body packing 28 and which is employed for mounting a plurality of hollow tubes 41 which serve as receptacles for receiving the ends of the pins 30 on one side thereof and for receiving the ends of the wire leads 16 from the cable on their opposite ends. Each tube or receptacle 41 is formed with an integral flange that is embedded in the material of the packing body 40 to retain the tube receptacles in fixed spaced relationship so as to properly mate with the pins 30 of the pin member 14. The ends of the tube receptacles 41 which receive the pins 30 are arranged so as to be flush with the vertical surface of the packing body 40, while the opposite ends of the tube receptacles are arranged to project into an enlarged cavity, indicated in the general direction of arrow 42, defined by the forward wall 34 and the side walls 35 and 36.

The individual lead ends 16 of the wires extending from the cable 13 may be suitably fastened to the tube receptacles 41 by any suitable means such as soldering or by means of a conventional plug-in type arrangement. It is to be particularly noted that when the leads 16 extend

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from the cable 13 when the cable is clamped by the base portions of the pin member and the cover member, the lead ends of the extending wires are within the cavity 42, which permits leads 16 to be encapsulated by any suitable potting compound or material such as indicated by the numeral 44.

By encapsulating the lead wires 16, the wires are suitably waterproofed and the connector is maintained airtight. A feature of the present invention resides in the fact that such an encapsulation procedure can be employed inasmuch as access to the connection of the lead ends to the tube receptacles 41 are not required when it is desired to replace any damaged pins 30 in the pin member 14. After the lead end connections have been made, encapsulation thereof may take place. Once the encapsulating or potting compound has been poured or otherwise introduced within the cavity 42, the cover member 17 may be placed in position to completely seal and enclose the lead wires 16.

Referring now to FIG. 3, the ends of the tube receptacles 41 are shown projecting into the cavity defined by the socket member side walls 35 and 36. Cable 13 is illustrated as having its lead wires 16 terminating in the cavity immediately below the socket assembly carried within the cavity of the front wall 34. It is to be particularly noted that the socket member 15 seats on top of the base portion 22 of the pin member 14.

FIG. 4 further qualifies the fact that the ends of the lead wires 16 are connected to the tube receptacles 41 and that such a connection is made airtight and waterproof by the encapsulating or potting compound 44. It is also to be noted that the guard 27 and the packing body 40 are arranged coaxially so that the pin contact elements are properly indexed to mate or register with and interconnect with the tube receptacles 41.

Referring now to FIG. 5, it is more clearly seen that a suitable strain relief means is provided for imparting stress loads into the composite housing of the connector which may be encountered by the cable 13. The base portions 22 and 23 via the semicircular passages 25 and 26 serve to clamp the terminating end of the cable to the housing of the connector. The projection 26 operates to grip about the periphery of the cable when the fastener arrangement 18 is tightened down and made secure.

Referring now to FIGS. 7 and 8, another embodiment of the present invention is illustrated whereby the pin member 14, socket member 15, and cover member 17 are held together by means of a quick disconnect fastener, such as is illustrated by the winged bolt or screw 50. A shank 51 of the screw 50 extends through the wall 21 of the cover member 17, the encapsulation material 44, and the forward wall 34 and terminates in threaded engagement with the packing body 28 carried by the pin member 14. If desired, a suitable elongated sleeve may be incorporated into the encapsulation material through which the shank of the wing screw 50 can pass. The sleeve or the shank of the screw is disposed between the various lead wires 16 so as to be disposed between the various lead wires without interfering electrically therewith. Although a screw type fastener is shown in FIGS. 7 and 8 for joining the various members into a unitized connector, it is to be understood that other types of fastening mechanisms may be employed such as, for example, a bayonet type, an interference clip type, or the like.

In the event the outwardly projecting ends of the pin contact element 30 are damaged, replacement of the damaged pins can be readily accomplished by disassembling the connector housing by removing the fasteners 18. Next, the pin member 14 can be manually detached from the socket member 15 by forcibly separating the ends of the pin contact elements 30 from the tube receptacles 41. The pin member 14 carrying the damaged pin may now be discarded in any suitable fashion, and a replacement pin member 14 can be assembled with the socket member 15.

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During the time the pin member 14 is being replaced, the base portion 22 will not be clamped about the cable 13; however, the ends of the lead wires 16 attached to the tube receptacles 41 will be protected by the encapsulation material 44 and the lead wires will remain in position thereby during the replacement procedure.

Once the damaged pin member 14 has been removed and replaced by a pin member having undamaged pins 30, the connector may be forcibly urged into mating relationship with the female receptacle 12 carried on the cabinet 11. Preferably, the pin member 14, socket member 15, and cover member 17 may be composed of lightweight plastic materials which may be readily fabricated by molding procedures.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from this invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A connector adapted to be connected to the lead ends of wires extending from a multiwire cable, said connector comprising:

a pin member having a plurality of pin contact elements arranged so that the opposite ends thereof project outwardly from opposite sides of said pin member;

a socket member having a plurality of elongated contacts each having a first end extending outwardly from one side of said socket member for connection to one of said lead ends and a second tubular end opening to an opposite side of said socket member for detachably receiving an end of one of said pin contact elements to form an electrical connection therewith;

a cover member;

said pin member and said cover member each defining base portions projecting therefrom, each of said base portions defining a semicircular recess projecting inwardly from a face thereof; and

means for detachably fastening said pin and cover members together with said socket member disposed therebetween and with said respective semicircular recesses in opposed relation to thus form a passage for accommodating said cable.

2. The invention as defined in claim 1 wherein each base portion includes a plurality of projections extending into said semicircular recesses and being adaptable to forcibly engage with the periphery of the cable in a clamping relationship, whereby stress forces encountered by the cable are transferred into said pin member and said cover member to protect said coupling means.

3. The invention as defined in claim 1 wherein said socket member is bounded by a front wall and a pair of side walls so as to define a cavity in said socket member into which the wire lead ends and said contact first ends extend; and an encapsulating compound disposed within said socket member cavity occupying substantially the full volume thereof.

4. The invention as defined in claim 3 wherein said pin member includes an upright wall integrally formed on the end of said pin member base portion opposite to its face opposing said cover member base portion face, said pin member upright wall and said socket member front wall each being formed with a coaxial bore;

non-conductive packing material disposed in said pin member bore for retaining said pin contact elements in a predetermined arrangement; and

non-conductive packing material disposed in said socket member bore for retaining said contacts in a predetermined arrangement so as to register with said arrangement of pin contact elements.

5. The invention as defined in claim 1 wherein said fastening means comprises at least one elongated rotary member extending through said socket member and having means on the opposite ends thereof for gripping said pin member and said cover member for forcibly urging said base portions thereof into clamping relationship about the cable.

6. The invention as defined in claim 1 wherein said pin member, said socket member, and said cover members are composed of plastic-like material impervious to moisture and fluids so that a composite fluid-tight enclosure results when said pin and cover members are fastened together.

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