

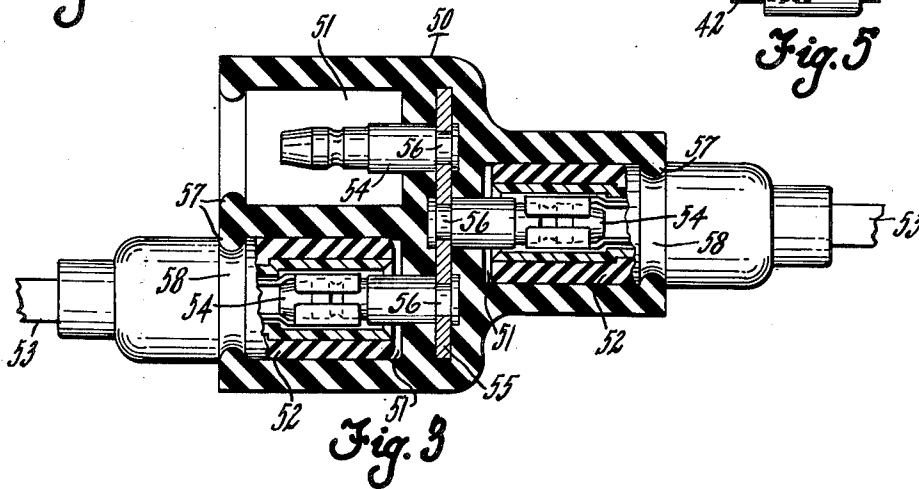
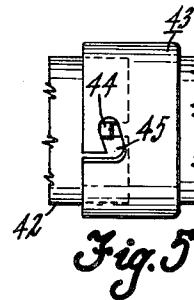
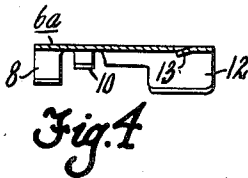
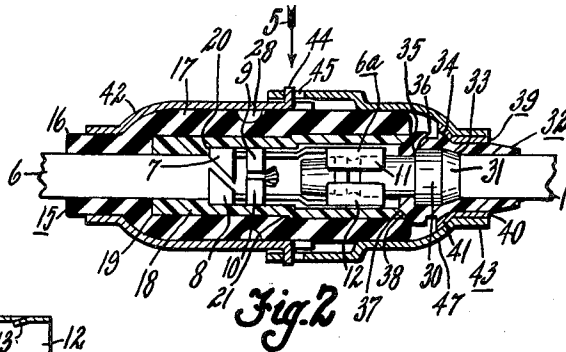
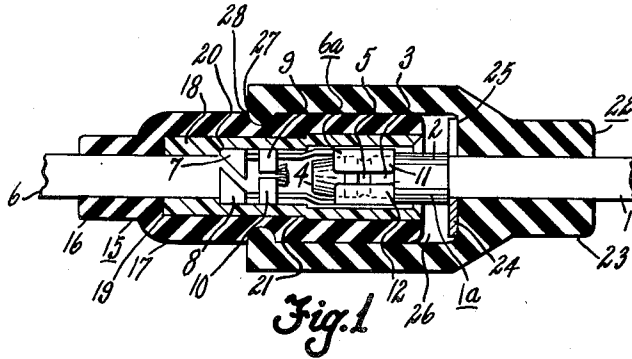
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2,782,391

WATERPROOF LINE CONNECTOR

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WATERPROOF LINE CONNECTOR

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2 Claims. (Cl. 339—211)

This invention relates generally to electrical connectors primarily for use in automotive vehicles which are usually known as line connectors or Y connectors and are generally adapted to receive plug connector terminals of the snap type.

At the present time certain automotive vehicles, particularly vehicles for military use, are designed to operate under conditions where such vehicles are partly submerged and some of the electrical conducting wires for carrying current to lamps and other instrumentalities are entirely submerged in water so that under some conditions connectors used to connect some of these wires together are also submerged.

Therefore, it is the primary object of the present invention to provide electrical connectors of the type referred to which are completely waterproof, are inexpensive, easy to manufacture, which can be readily connected and disconnected but which, when connected are held together with sufficient force to prevent any accidental separation or any water from reaching the terminals which are attached to the conducting wires.

According to the present invention, these objects are attained by the provision of telescoping sleeves of suitable waterproof and resilient insulating material which surround the male and female terminals that are secured to the conducting wires and which have a leakproof fit with each other and also a sufficiently tight fit with the outer surface of the covering of said conducting wires to prevent any leakage of water along such surface into the space within said sleeves in which the terminals are positioned. These sleeves also have, respectively, an external groove and cooperating internal bead which are in engagement when the terminals are connected and are of such dimensions that said bead holds the sleeves together with such force that accidental separation is substantially impossible, and also the bead and groove comprise a substantially leakproof joint when the parts of the connector are in properly assembled or connected position, and aid in preventing any water reaching the connecting terminals. Also, a sleeve of substantially rigid insulating material may be positioned around such terminals and between said terminals and the inner surface of the inner telescoping sleeve for protective purposes.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Figure 1 is a section through a line connector constructed according to the present invention;

Figure 2 is a similar section of a modified form of the invention;

Figure 3 is a similar section through a connector of the Y type.

Figure 4 is a fragmentary section showing the construction of a part of the female terminal.

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Figure 5 is a fragmentary view of the form of connector shown in Fig. 2 seen in the direction of the arrow.

Referring to Fig. 1 of the drawings, the outer surface of one of the conducting wires is indicated at 1. Conducting wires have various types of covering including insulating material of various kinds and any conventional type of conductor may be used, so long as the outer surface thereof is smooth enough to form a leakproof joint with certain sleeves, later described, which fit tightly on the outer surface of such conducting wires. To this wire is connected the male terminal 1a which has a skirt portion 2 surrounding the outer surface of the conductor 1 and a smaller portion 3 which extends into the female terminal and is indicated in dotted lines in the drawings. This part of the terminal has a tapered surface 4 to facilitate connection of the terminal with its cooperating terminal and a groove 5 which is engaged by a tongue on the cooperating terminal, when the terminals are connected, to hold them in such position.

The outer surface of the conducting wire which is connected in electrical contact with the wire 1, is designated at 6 and to the end of this wire is connected, in the usual way, the female terminal 6a, which receives the male terminal previously referred to and is of well known construction, not forming any part of the present invention. This terminal comprises tangs 7 and 8 which are crimped around the outer surface of the conductor 6, tangs 9 and 10 which are bent down to clamp the conducting wire itself as indicated in Fig. 1 and parts 11 and 12 which are bent so as to form a sort of cut-away sleeve into which the male terminal projects. As shown in Fig. 4 a spring tongue is cut out of the terminal at a point substantially opposite the space between the parts 11 and 12. This tongue projects inwardly as indicated in Fig. 4 and is adapted to engage the groove 5 when the terminals are connected together in proper position, to hold the terminals in that position. This finger 13 exerts sufficient pressure generally to prevent any accidental separation of the terminals and to manually pull the terminals apart requires the exertion of considerable force.

The conductors and connecting terminals which have been described are of well-known construction and do not constitute any part of the present invention, and any suitable specific form of terminals and conducting wires can be used.

According to the present invention, there is provided an inner sleeve designated generally at 15, which is carried by the conducting wire 6 and surrounds the female terminal, when properly positioned on the conducting element. This sleeve is formed of any suitable resilient waterproof insulating material, preferably a synthetic rubber compound such as Buna N, but other materials of a generally similar nature can be employed. This sleeve has a reduced portion 16 which has a tight enough fit on the outer surface of the connector 6 to prevent passage of water between it and the conductor, and a larger portion 17, which surrounds the female terminal and the inside diameter of which is greater than that of the terminal so that a space is provided between the terminal and the inner surface of the sleeve. Positioned in this space is an insulating and protective sleeve 18 of some suitable hard plastic material, preferably nylon. When the parts are in properly assembled position, as shown in the drawings, the left end of the sleeve 18 is in engagement with the shoulder 19 formed on sleeve 15. The sleeve 18 has three different internal diameters, the smallest being at the left end where the diameter is such as to have a relatively tight fit with the outer surface of conductor 6, while the diameter of the middle portion of the sleeve is somewhat greater. This portion of the sleeve is large enough to receive the smaller part of the female terminal which includes

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the tangs by means of which the terminal is secured to the conductor. A shoulder 20 is formed on the sleeve 18 where the above-described diameters meet and this shoulder engages the tangs 7 and 8 when the parts are in assembled position and the conducting wires are connected.

As illustrated, at the right end of the sleeve 18, where the female terminal surrounds the male terminal, the inner diameter of the sleeve has to be somewhat larger than that part of the sleeve immediately to the left thereof in order to receive the larger part of the female terminal. Accordingly, both the inside and outside diameters of the sleeve 18 are somewhat enlarged at its right end. A shoulder 21 is formed at the left end of the enlarged part of the sleeve 18 and this shoulder is engaged by a cooperating shoulder on the inner surface of the sleeve 15 when the various parts, particularly sleeves 15 and 18 are in properly assembled position.

When the parts of the connector are assembled as shown in the drawings, the sleeve 15 is received within an outer sleeve 22 of the same kind of resilient and water-proof insulating material, and has a tight enough fit therewith to prevent leakage between the two sleeves. This sleeve 22 has a reduced portion 23 similar to the part 16 of sleeve 15 which has a tight enough fit with the outer surface of conductor 1 to prevent admission of water to the space within the sleeve 22. Positioned on the conductor 1 adjacent the skirt 2 of the male terminal is a washer 24 which, when the parts are in the assembled position shown in Fig. 1, is clamped between the skirt 2 and a shoulder 25 on the sleeve 22.

The left end of sleeve 22 is enlarged to form the chamber 26 in which the outer surface of the enlarged part 17 of sleeve 15 fits tightly, as described, and at the left end of sleeve 22 there is formed an inwardly projecting bead 27 which is adapted to snap into a cooperating groove 28 formed on the outer surface of the sleeve 15. The size of this bead is such that when the parts are assembled as shown in Fig. 1, a substantially leak-proof joint is formed between the bead and groove and the sleeves are held together with such a force that a very considerable pull upon the sleeves is necessary to separate them.

Under some circumstances, both male and female parts of the complete connector above-described may not be available, and it would be desirable, for example, to use the female half of such connector and the male half of another connector of different design and at the same time form a waterproof connection. A device of this kind is shown in Fig. 2, in which the female half of the connector already described is used with the cooperating or complementary male half of a Douglas type connector to form a waterproof connecting means for two conducting wires. In this form of connecting means the conductor 6, the female terminal, sleeves 15 and 18 are of exactly the same construction shown in Figure 1 and need not be further described, but what might be called the male half of the connecting means is considerably different, as will be apparent upon consideration of the drawings.

In the device of Fig. 2, the conducting wire 1 is secured in any desirable way to a male terminal which is very similar to that shown in Fig. 1 but the skirt 30 of such terminal, which corresponds to the skirt 2 and which extends over the outer surface of the conductor 1, is of somewhat different design while the outer sleeve 22 and the collar 24 are not used. The outer surface of the skirt 30 is tapered, as indicated at 31 and the skirt is surrounded by a grommet 32 of suitable flexible and waterproof insulating material. At the right end the inner surface of this grommet is of cylindrical form and of such diameter as to have a leakproof fit with the outer surface of the conductor 1, while an intermediate part of the grommet is tapered as indicated at 33 to cooperate with the tapered surface 31 of the terminal

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skirt, and the outer surface of the grommet, at this point in its length, is also tapered as at 34 for a purpose later set forth. The grommet extends to the left of the skirt 30 where its inner diameter is reduced to fit closely around the terminal at the left of the skirt, as indicated in Fig. 2. At the right end of this reduced diameter is a shoulder 35 which engages a cooperating shoulder 36 formed by the left end of skirt 30 when the parts are assembled as shown. The outer surface of the grommet is tapered at the left end thereof as indicated at 37 and this surface engages the beveled surface 38 on the right end of the sleeve 18 with sufficient pressure to form a leakproof joint when the parts are held together in the assembled position of Fig. 2 by means later described.

Surrounding the grommet 32 is a short metal sleeve 39 the right end 40 of which is of cylindrical form and of a diameter substantially that of the outer diameter of the grommet while the left end 41 is flared, for a purpose that will be apparent.

As already stated, the outer sleeve 22 of Fig. 1 is not present and the groove 28 of the inner sleeve 15 is without function in the device shown in Fig. 2. To hold the parts in assembled position and to prevent admission of any water to the space surrounding the connected terminals, two metal shells 42 and 43 are provided which are held together by any suitable means, for example, the bayonet joint shown in Fig. 5 comprising the lug 44 projecting from the shell 42 and the cooperating slot 45 formed in shell 43. The shell 42 is of the same shape as the outer surface of sleeve 15 and of such size that it will fit closely on the outer surface of the sleeve, as shown in the drawings. The shell 43 has a cylindrical portion which fits around the cylindrical part 40 of sleeve 39 and a tapered part 47 which engages the flared portion 41 of sleeve 39. When the shells 42 and 43 are pressed toward each other and locked in position by means of the previously described bayonet joint, sufficient pressure is exerted by such shells on the sleeve 15 and the flare 41 that leakage is prevented between shell 42 and sleeve 15, between shell 43 and flare 41, between flare 41 and the grommet 32 and between the tapered surfaces 37 and 38. Also, the pressure exerted by the shells prevents leakage between the tapered surface 33 of the grommet 32 and the tapered surface 31 of the male terminal, as well as tending to increase the tightness of the fit between sleeve 15 and the conductor 6.

The Y connector shown in Fig. 3 has an outer sleeve 50 which is so shaped as to have three chambers 51 formed therein and each of these chambers is adapted to receive a sleeve 52 corresponding to the sleeve 15 and surrounding a female terminal of the same type as shown in Fig. 1, and connected in the same way to a conducting wire 53 as the female terminal of Fig. 1 is connected to the conductor 6. The construction and arrangement of these parts need not be fully described, as each is just the same as shown in Fig. 1 and previously fully described.

It will be noted that in the device of Fig. 3 no one of the conducting wires 53 is connected with a male terminal but, instead, each of the three wires 53 (only two of which are shown), is connected to a female terminal and the three cooperating male terminals 54 are supported by a plate 55 which, with the terminals 54 secured thereto, is molded in the outer sleeve 50 when such sleeve is formed. Each of the terminals 54 has a reduced portion 56 extending through a suitable opening in the plate 55 and the terminals are secured in position on the plate by riveting as shown, or in any other suitable way. It will be noted that one of the terminals 54 projects to the right of plate 55 while the other two extend to the left, so that by means of the connector illustrated, the single conducting wire 53 extending to the right is electrically connected to two wires 53 extending to the left.

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The sleeve 50 at the open end of each of the chambers 51 is provided with a bead 57 which is similar to the bead 27 and which is adapted to engage a groove 58, similar to groove 28, on each sleeve 52 when such sleeves are inserted in the chambers 51 as shown in Fig. 3. These cooperating beads and grooves perform the same functions in the device of Fig. 3 as do the corresponding bead and groove in the device of Fig. 1.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A leakproof electrical connector adapted to be held together with sufficient force to prevent any accidental separation, comprising, a plurality of electrical conducting elements having an insulating covering, a male terminal with an annular skirt attached to an end of one of said conducting elements, an outer resilient insulating sleeve having a chamber in one end and an opening in the other end sealingly engageable with the insulating covering of said one conducting element, a washer engageable between a wall of the chamber about the opening and the skirt of said male terminal to hold said male terminal in position securely against separation through the opening of said insulating sleeve, a female terminal connected to an end of a second conducting element and engageable by said male terminal, an insulating and protective sleeve member having multiple internal diameters of which one forms a shoulder engaging one end of said female terminal to hold said terminal entirely within said sleeve member against separation through one end thereof, a sleeve body having an opening in one end sealingly engageable with the insulating covering of the second conducting element and having a chamber in the other end, a shoulder formed inside said sleeve body at one side of the chamber engageable by said protective sleeve member holding said sleeve member with said female terminal securely against separation through the opening of said sleeve body, said sleeve body having an annular groove formed on the outer surface thereof intermediate opposite ends of said body, and an inwardly projecting bead formed on said outer sleeve at the chamber end remote from the opening at one side, said bead being adapted to snap into and cooperate with the annular groove of said sleeve body, said washer and said sleeve member cooperating with said outer sleeve and said sleeve body respectively together with said bead and groove to lock said male and female terminals together in leakproof relationship and protected from accidental separation.

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2. A waterproof electrical connecting means adapted to connect together in electrically conducting relation a plurality of electrical conducting elements in combination, comprising, a first resilient sleeve having a chamber formed therein, a first conducting element extending into the chamber in sealing engagement with one end thereof, a male terminal connected with said conducting element, means including a terminal skirt cooperable with a wall of said first sleeve securing said male terminal against separation from the chamber through an end opening of said first sleeve, a second resilient sleeve, a second conducting element sealingly engaged with said second resilient sleeve through an opening at one end thereof, a female terminal connected with said second conducting element and positioned within said second sleeve to be engageable with said male terminal, said second resilient sleeve having a chamber forming a shoulder adjacent the opening engaged by said second conducting element, a sleeve member of non-resilient protective material entirely surrounding said female terminal within the chamber of said second resilient sleeve, said sleeve member being formed to occupy the full length of the chamber of said second sleeve and with multiple internal diameters, one of the internal diameters forming a shoulder engaging one end of said female terminal to hold said terminal entirely within said sleeve member against separation through one end thereof which abuts against the shoulder formed by the chamber adjacent the opening engaged by said second conducting element in said second sleeve, and holding means cooperating between said first and second resilient sleeves as well as with said skirt against the wall of said first sleeve and said female-terminal-engaged sleeve member abutting the shoulder of said second sleeve to facilitate prevention of leakage between the sleeves to said male and female terminals.

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