Oct. 4, 1960 L. C. COBBETT ET AL 2,955,275

INSULATED ELECTRICAL CONNECTOR

Original Filed June 24, 1955 2 Sheets-Sheet 1

Fig. 1

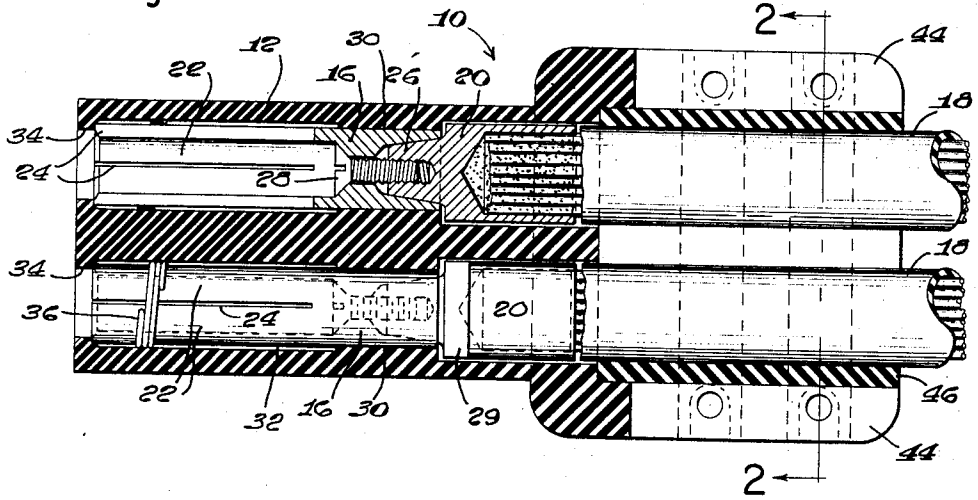


Fig. 2

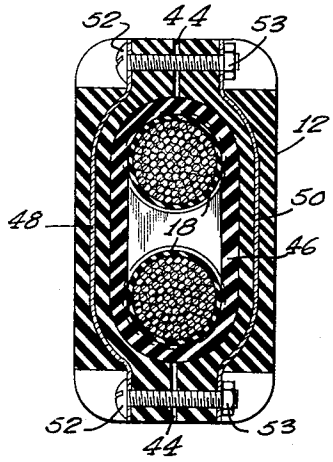


Fig. 3

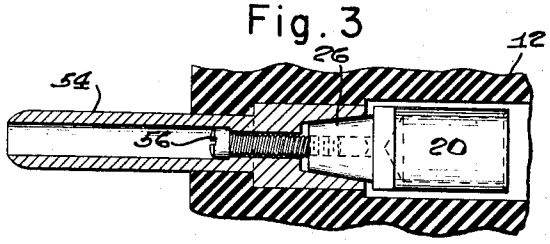
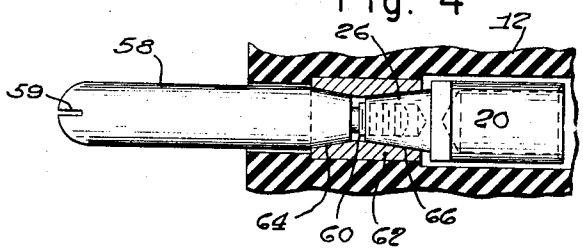


Fig. 4



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Fig. 5

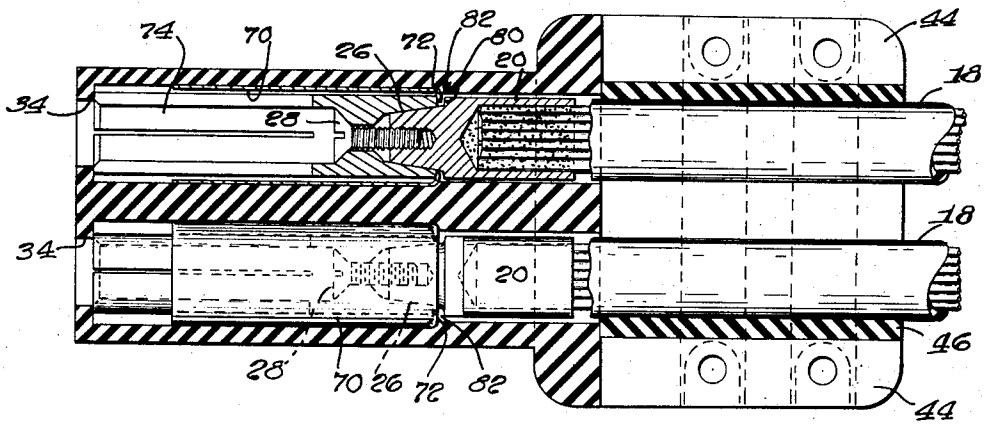


Fig. 6

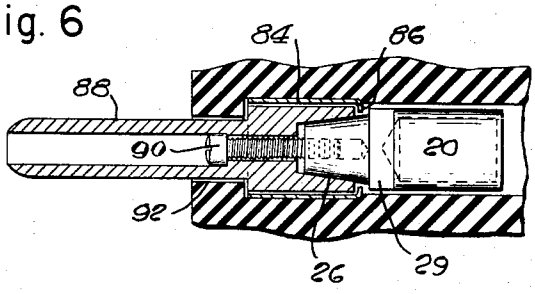
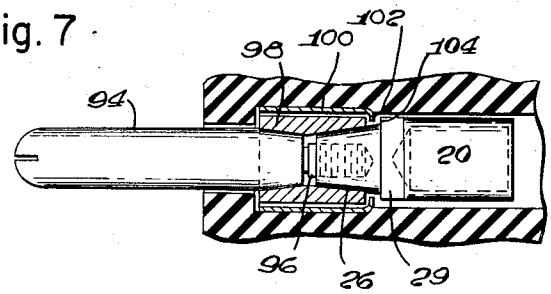


Fig. 7



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INSULATED ELECTRICAL CONNECTOR

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Original application June 24, 1955, Ser. No. 517,766, now Patent No. 2,917,722, dated Dec. 15, 1959. Divided and this application Feb. 26, 1957, Ser. No. 642,411

5 Claims. (Cl. 339—59)

This invention relates to an insulated electrical connector.

The invention has for an object to provide a novel and improved electrical connector of the type provided with one or more contacts which are connected to power cables and are mounted in an insulating housing characterized by novel structure for mounting the contact or contacts in the housing and for detachably securing the cable or cables to the contacts within the housing in a novel and convenient manner whereby to form a firm electrical contact and to permit easy removal and replacement of the contacts and/or attachment to cables as may be required.

The invention has for a further object to provide a novel and improved electrical connector of the character specified wherein provision is also made for mounting the contacts in a molded insulating housing in a manner such as to enable slight lateral movement of the contacts relative to the housing whereby to permit self-alignment of the contacts in a simple and efficient manner when joined with the contacts of a second connector.

With these general objects in view and such others as may hereinafter appear, the invention consists in the insulated electrical connector hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention:

Fig. 1 is a cross sectional view of a female electrical connector embodying the present invention;

Fig. 2 is a cross sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a detail view in cross section illustrating a male form of contact mounted in the present connector;

Fig. 4 is a detail view in cross section illustrating another male form of contact mounted in the present connector;

Fig. 5 is a view similar to Fig. 1 illustrating in cross section a female connector having a modified form of mounting for the contacts;

Fig. 6 is a detail view in cross section showing a male form of contact in the modified mounting; and

Fig. 7 is a detail view in cross section showing another form of male contact in the modified mounting.

In general the present invention contemplates a novel construction of electrical connector of the type having one or more contacts mounted within a resilient insulating housing, each contact being connected to the end of a power cable extended within the housing. In accordance with the invention provision is made for detachably connecting the power cables to the contacts within the molded insulating housing in a novel and simple manner whereby to permit easy removal and replacement of the contacts or cables as may be required.

The invention further contemplates novel structure for mounting the contacts within the housing and for attachment to the cables to permit self-alignment of the contacts when the connector is joined with another connector.

Referring now to the drawings, 10 designates one form of the present electrical connector which includes a resilient insulating housing or body portion 12 which may and preferably will comprise a molded rubber housing having longitudinally extended cored openings formed therein. As illustrated in Fig. 1, each cored opening has a contact member, herein shown as a female contact member 16 disposed in one end thereof, the other end of each cored opening having extended therein a cable 18 provided with an end cap 20 for connection to the inner end of its contact 16.

In the embodiment of the invention shown in Fig. 1 the contact member 16 comprises a cylindrical member of substantially uniform diameter throughout its length, the outer or connecting end of the contact having an elongated bore therein forming a tubular portion 22 provided with longitudinal saw cuts 24 to form a receptacle having flexing fingers for receiving the male contacts of a second connector. The inner end of the contact member 16 is provided with a tapered bore arranged to receive the tapered end of a projection 26 extended from the end cap 20 to connect the cable to the contact. As herein shown, the projection 26 is provided with a tapped hole in the end thereof for receiving a screw 28 extended through a clearance opening at the inner end of the elongated bore formed in the contact member, thus detachably securing the parts in firm electrical engagement.

In the Fig. 1 embodiment of the invention a portion of the inner end of the contact member 16 is preferably securely bonded into the housing as indicated at 30, a cored out clearance portion 32 being provided at the contact end to permit flexing of the contact fingers when joined with a second connector. It will be observed that the contact end of the housing extends beyond the ends of the contacts, and each cored opening is reduced in diameter for a short distance between the end of the contact and the end of the housing, as indicated at 34, so that the end of the housing extends a short distance over the end of the contact, thus enclosing the contacts within the housing. A spring 36 coiled about the fingers of the contact serves to flex the fingers inwardly to effect a firm grip on the cooperating contact member of a second connector.

With this construction it will be seen that in assembling the connector the end of the cable 18 is soldered or otherwise secured within the bore provided in the end cap 20, and this assembly is then inserted into the cable end of its cored opening in the housing with the tapered end 26 of the cap 20 extended within the tapered bore in its contact member. It will be observed that the cored opening provides sufficient clearance to permit insertion of the cable within the housing as illustrated. Thereafter, the screw 28 may be inserted through the elongated bore in the contact and engaged with the tapped hole in the cap member, and upon tightening of the screw by means of a screw driver extended into the longitudinal bore of the contact member the tapered projection 26 may be drawn up tightly within the tapered bore to provide a firm electrical connection. The undersurface of the head of the screw 28 is preferably conical and is seated in a countersunk portion formed at the inner end of the elongated bore in the contact member as illustrated. It will also be observed that the body of the end cap 20 is preferably cylindrical for a major portion of its length and is provided with a square shoulder portion 29 adjacent the tapered end thereof to prevent rotation of the contact in the housing.

As illustrated in Figs. 1 and 2, the cable end of the housing 12 may be slightly enlarged and provided with an enlarged cored opening to receive the two cables, the enlarged opening communicating with the two cored contact and cable end openings as shown. The cable end of

the housing may also be longitudinally slit as indicated at 44. After the cables have been inserted and secured to their contacts, a cable packing 46, preferably of a resilient material, may be wrapped about the cables while flexing apart the slit halves of the resilient housing. In order to firmly clamp the cables in assembled relation to the housing, the cable end of the housing may be provided with clamp straps 48, 50, the intermediate portions of which are preferably molded into the housing as shown. The free ends of the straps are provided with openings for the reception of bolts 52 extended through the slit halves of the housing. Thus, after the packing 46 is inserted, the slit halves may be brought together and firmly clamped about the cables and the packing by the bolts 52 and nuts 53. From the description thus far it will be observed that the novel construction of the present electrical connector is such as to permit detachment of the cables from their contact members within the insulating housing in a simple and convenient manner whereby the contacts and/or cables may be easily removed and replaced when required without damage to the insulating housing.

As shown in Fig. 3, in a modified form of the invention a male contact member 54 is shown as being securely bonded to the housing within the contact end of the cored opening thereof. The inner end of the contact 54 may be enlarged in diameter and provided with a tapered bore for the reception of the tapered projection 26 of the cable end cap 20 in the manner above described. The outer end of the contact 54 may be provided with an enlongated bore of a diameter such as to receive the head of a screw 56, a clearance opening being extended beyond the end of the bore through which the threaded shank of the screw is inserted to be received in the tapped opening formed in the projection 26. Thus, by extending a screw driver through the elongated bore in the male contact the screw may be tightened to draw the tapered end of the cable cap tightly into engagement with the end of the contact within the housing in a manner similar to the manner above described in Fig. 1 whereby to provide a detachable connection within the molded insulating housing.

In another modified form of the invention, as shown in Fig. 4, the male contact member 58 may comprise a solid cylindrical member tapered at its inner end and provided with a threaded stem 60 extended beyond the tapered portion. In this embodiment of the invention the resilient insulating housing may be provided with an adapter 62 securely bonded in the cored opening thereof, the adapter having tapered openings 64, 66 at each end for the reception of the tapered ends of the male contact member 58, and the cap projection 26 respectively, as illustrated, rotation of the contact effecting tightening of the tapered ends in their respective bores. It will be observed that in this embodiment of the invention the contact member 58 is also detachable to enable the same to be removed and replaced when necessary, the cored opening providing a clearance about the contact 58 as shown. A screw slot 59 may be provided at the outer end of the contact 58 for the reception of a screw driver.

In the embodiments of the invention illustrated in Figs. 1 and 3 the contact members are shown as having portions thereof securely bonded to the housing in the cored openings thereof, and the contact member shown in Fig. 4 is rigidly secured to an adapter which is also bonded to the housing in the cored opening. In practice under normal conditions the resiliency of the housing material permits slight movement of the contacts to enable alignment of the contacts with the contacts of a second connector when making the electrical connection. However, when such resilient rubber connectors are subjected to subzero temperatures, such as occur in the arctic regions, the rubber loses its resilient characteristics, and difficulty may be encountered in attempting to align the contacts of two connectors being joined if one of the contacts is slightly misaligned.

Referring now to Fig. 5, the electrical connector therein shown provides a floating mounting for the connector in a resilient insulating housing wherein the contacts are capable of slight lateral movement in the housing to permit self-alignment of the contacts when joined with the contacts of a second connector irrespective of such severe climatic conditions, or of the resiliency of the housing. As herein shown, the modified form of connector may be similar to that illustrated in Fig. 1 in all respects except that instead of bonding the contact members rigidly to the housing, a relatively thin walled tabular member 70 having inwardly crimped edges 72 at one end is securely bonded to the housing in each cored opening. The contact member 74, similar to the female contact member shown in Fig. 1, may then be inserted through the reduced diameter end 34 of the cored opening of the housing by stretching the edges of the opening, the contact coming to rest against the inner wall of the crimped opening, as shown, and the edges of the reduced diameter opening are then permitted to spring back to their original condition to enclose the contact within a chamber defined by the tubular member and the cored opening, which is of a diameter such as to provide lateral clearance for the contact inserted therein. Thereafter, the cable may be inserted into the other end of the cored opening to fit the tapered portion 26 of its end cap 20 into the tapered bore of the inner end of the contact. The end cap is provided with a shouldered portion, as indicated at 80, for engagement with the outer wall of the crimped opening, whereupon the screw 28 may be inserted as described to secure the contact member to the cable end. It will be understood that the parts are of such size that when the screw 28 is tightened to bring the tapered portions into tight engagement a grooved space 82 is provided between the shoulder formed by the inner end of the contact member and the shoulder 80 of the end cap 20 into which the crimped edges 72 of the tubular member 70 loosely extend. In other words, the contact and the end cap are not clamped to the edges 72 but are merely restrained from longitudinal movement within the insulating housing, and the opening defined by the crimped edges being of a size such as to permit lateral movement of the members within the housing. With this construction it will be seen that when the contacts of a second connector are inserted into the contacts of the illustrated connector, the floatingly mounted contacts may move laterally into alignment with their cooperating contacts to form the connection. Upon assembly of the parts within the housing the extended ends of the cables may be clamped in the housing in the manner above described.

The modified form of connector shown in Fig. 6 illustrates a floating mounting for a male contact member in an insulating housing wherein a tubular member 84 having an inwardly crimped edge 86 is securely bonded to the housing within the cored opening thereof. The male contact member 88 is enlarged at its inner end and provided with a tapered bore for the reception of the tapered end of the cable end cap member 20. The outer end of the contact member 88 is provided with an elongated bore and an extended clearance opening for the reception of a screw 90 for detachably securing the contact to the cable end cap. Thus, it will be seen that in the embodiment of the invention shown in Fig. 6, the inlarged end of the male contact may be inserted into the chamber defined by the tubular member 84 by stretching the reduced diameter portion 92 of the cored opening at the outer end of the resilient housing and then permitting the same to return to its initial position, as shown, the chamber providing a clearance space to permit lateral movement of the contact in the housing. It will also be seen that the inwardly crimped edges 86 of the tubular member 84 extend into the groove defined by the inner end of the contact and the shoulder formed on the cable end cap 20 in a manner similar to that shown in Fig. 5 whereby to restrain the parts from longitudinal displacement

while providing clearance to permit lateral self-aligning movement when engaged with the contacts of a second connector.

The embodiment of the invention shown in Fig. 7 provides a floating mounting for a solid male contact member **94**, tapered adjacent its inner end and provided with a threaded extension **96**. The tapered portion of the contact cooperates with a tapered bore formed in one end of an adapter **98** inserted into a chamber defined by a tubular member **100** securely bonded to the housing in the cored opening of the housing. The other end of the adapter is provided with a tapered bore for the reception of the tapered end of the cable cap member **26**, and the parts are detachably secured together by extending the threaded end of the contact through the adapter and into the tapped hole in the end of the cap member, as illustrated, rotation of the contact member effecting tightening of the tapered ends in their respective tapered bores. The inwardly crimped edges **102** of the tubular member extend into the grooved space defined by one end of the adapter **98** and the shoulder **104** formed on the end cap **20** whereby to restrain the parts from longitudinal displacement and providing clearance to permit self-alignment of the contacts when engaged with the contacts of a second connector.

Thus, in practice it will be seen that in the embodiment of the invention illustrated in Figs. 5, 6 and 7 the contacts are capable of slight lateral movement to permit self-alignment thereof with the contacts of a second connector when the electrical connection is made and that the contacts and the cables detachably connected within the resilient insulating housing may be removed and replaced without damage to the insulating housing.

While the preferred embodiments of the invention have been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

This application is a division of our copending application, Serial No. 517,766, filed June 24, 1955, now Patent No. 2,917,722.

Having thus described the invention, what is claimed is:

1. An insulated electrical connector comprising an insulating housing having at least two cored openings extended longitudinally therethrough, a contact element extended within one end of each cored opening, an electrical cable having an end cap secured thereto and extended within the other end of each cored opening, means for detachably connecting the ends of the cables to the inner ends of their respective contact elements within the housing, the connected ends of said contact elements and their cable caps providing a grooved portion therebetween, said cored openings providing an annular clearance about said cable caps, and means for floatingly mounting the contact elements within their respective cored openings to permit slight lateral self-aligning movement of the contact elements when engaged by the contact elements of a second connector, said mounting means including a sleeve rigidly secured in the contact end of each cored opening and forming enlarged chambers providing annular clearances about said contact elements, and means formed on said sleeves and cooperating with the grooved portions formed between their respective contact elements and connected cable caps for preventing longitudinal displacement of the contacts in the housing while permitting said lateral movement.

2. An insulated electrical connector as defined in claim 1 wherein the contacts comprise female contact elements and wherein the insulating housing extends beyond the ends of the contact elements, the cored openings being reduced in diameter beyond the ends of the contact elements, providing a protective shouldered portion extending inwardly a short distance over the outer edges of the contact elements.

3. An insulated electrical connector as defined in claim 1 wherein the contacts comprise male contact elements extending beyond the ends of the insulating housing.

4. An insulated electrical connector as defined in claim 1 wherein the means for detachably connecting the ends of the cables to the inner ends of their contact elements within the housing includes screw fastening elements accessible from the contact end of the connector.

5. An insulated electrical connector comprising an insulating housing having at least two cored openings extended longitudinally therethrough, a contact element extended within one end of each cored opening, an electrical cable having an end cap secured thereto and extended within the other end of each cored opening, means for detachably connecting the ends of the cables to the inner ends of their respective contact elements within the housing, the connected ends of said contact elements and their cable caps providing a grooved portion therebetween, said cored openings providing an annular clearance about said cable caps, and means for mounting the contact elements within their respective cored openings to permit slight lateral self-aligning movement of the contact elements when engaged by the contact elements of a second connector, said mounting means including a sleeve rigidly secured in the contact end of each cored opening and forming chambers providing lateral clearances for said contact elements, and means formed on said sleeves and cooperating with their respective contact elements and connected cable caps for preventing longitudinal displacement of the contact elements in the housing while permitting said lateral movement, said last named means including an inwardly turned wall portion provided at the inner end of each sleeve and loosely engaged in the grooved portion formed between the contact element and its connected cable cap.

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