MULTICONTACT CONNECTOR AND METHOD OF MAKING SAME

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This invention relates generally to an electrical apparatus and more particularly to an electrical connector of the type having contact elements with a split terminal portion imbedded in a molded body and a method of molding an electrical connector having such characteristics.

In providing multipoint electrical connectors, it is frequently desirable to provide a connector of the type having a molded body in which are imbedded a plurality of contact elements. If female contact elements having a split terminal portion and of the type adapted to receiveably engage a bayonet-type male contact element are provided, the problem of providing a molded body for the connector structure becomes especially difficult since it is essential that the hollow recesses provided in the connector be free and clear of any of the mold material used in the formation of the connector body.

We have overcome all such difficulties by providing in accordance with the present invention a connector contact member having a split terminal receiving portion surrounded by an enclosure member so that both the contact member and enclosure member may be integrally imbedded in a molded body. The enclosure member, together with the contact member, operates to completely isolate the split terminal-receiving portion of the contact member so that the material used in the formation of the connector body will not be displaced into the hollow recesses thereof.

According to the molding method contemplated by the present invention, the contact members of the connector structure form a part of a single assembly which is molded into the connector body. A portion of the subassembly is subsequently removed from the connector body and the connector contact members are integrally imbedded in the connector body.

It is an object of the present invention, therefore, to provide a connector with contact members of the type having a split terminal-receiving portion and a molded body integrally imbedding the contact members, but not interfering with the efficiency of the split terminal-receiving portion thereof.

Another object of the present invention is to provide a method of forming a connector with contact members having a split terminal-receiving portion and a molded body whereby the material used in forming the body will not enter the hollow recesses of the terminal-receiving portion.

A further object of the present invention is to provide improved contact terminal structures for a connector body.

A further object of the present invention is to provide a compound contact terminal for a molded connector body.

Many other advantages, features and additional objects of the present invention will become manifest to those skilled in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which the principles of the present invention are structurally applied by way of preferred embodiment.

On the drawings:

Figure 1 is an end elevational view of the electrical connector constructed in accordance with the principles of the present invention.

Figure 2 is a plan elevational view of a lower mold section with the electrical connector of Figure 1 positioned therein and shown in cross-section, the section being taken on line II—II of Figure 1.

Figure 3 is a fragmentary enlarged cross-sectional view taken on line III—III of Figure 2.

Figure 4 is a reduced cross-sectional view with parts shown in elevation and somewhat diagrammatic in part showing details of construction of additional molding components and taken substantially on the plane of line IV—IV of Figure 2.

Figure 5 is a cross-sectional view, fragmentary in part and with parts broken away and parts shown in elevation showing additional details of structure of the electrical connector of the present invention and also showing the method of assembling a sub-assembly of the connector structure with the molding components, the section of the connector member being taken substantially on line V—V of Figure 1.

Figure 6 is an exploded elevational view with parts shown in cross-section of a compound contact member provided in accordance with the present invention.

Figure 7 is a fragmentary cross-sectional view of a compound contact element provided in accordance with the present invention; and

Figure 8 is a fragmentary enlarged cross-sectional view of a single contact member indicated generally by the reference numeral 17.

In producing an electrical connector 10, the end of a cable 12 is first stripped to expose the conductors 14 and 15 and a retainer plate 18 preferably made of an electrically non-conductive material suitably apertured to position a plurality of contact members is employed to align the contact members 15 and 17 in spaced apart relation after which the ends of the conductors 14 and 15 are soldered to the contact members 16 and the ends of the conductors 15 are soldered to separate elements of the compound contact member 17.

It will be noted that each of the single contact members 16 is of generally cylindrical configuration and includes a medial annular rib 16a which is positioned proximally adjacent a terminal receiving portion split as at 16b to provide a pair of contact fingers 16c and 16d (Fig. 8). The opposite end of the contact members 16 is provided with a recess in which the end of the conductor 14 may be inserted for a solder connection.

As is particularly shown on Figures 6 and 7, the compound contact member 17 includes opposed cylindrical segments 19 and 20 each having a medial rib 19a and 20a, respectively. One end of each of the segments is provided with a recess 19b or 20b arranged to receive the end of one of the conductors 14 and the opposite ends 19c and 20c form a pair of separated terminal engaging portions.

A block of electrically non-conductive material 21 is inserted between the opposed segments 19 and 20 and a washer 22 also made of electrically non-conductive material is placed in engircling relationship relative to the segments 19 and 20 and the block 21.

After the contact members 15 and 17 have been soldered to the ends of the conductors 14 and 15 an enclosure assembly is assembled around the split terminal portion of each of the contact members.

In reference to the single contact members 16, a tubular sleeve 23 is placed in surrounding relationship to the contact fingers 16c and 16d and into abutting engagement with the annular rib 16a.

In the present invention to the compound contact member 17, a tubular sleeve 24, which could be made of an electrically non-conductive material or which, in any event, has the interior bore thereof rendered electrically non-conductive, for example, through the provision of an electrically non-conductive lining 25, is spaced in surrounding rela-
tionship to the terminal engaging portions 19c and 20c and into engaged engagement with the washer 22. The mold plate 26 is provided in accordance with the present invention and has a plurality of locator pins 27 extending from one face thereof, the locator pins 27 corresponding in number and size to the male prongs of the adapter, adapted to cooperate with the contact members 16 and 17 of the electrical connector 10. In the particular embodiment of the mold plate shown in Fig. 5, the locator pins 27 are firmly as-

ssembled with the mold plate 26 and are spaced in predetermined alignment relative to protruding portions 28 formed on the mold plate 26 to provide a recess 29 in the mold plate 26 to receive a rubber-like body 11 of the electrical con-

nector 10 (Fig. 1).

The mold plate 26 is further provided with an opening 30 which engages portion 31b and which is adapted to pass a bolt 31 having a threaded end portion 31a formed therein to receive the bolt 31. It will be noted upon making reference to Fig. 5 that the bolt 31 includes a threaded portion 31a which is reduced in diameter so as to provide a shoulder 31b against which the threaded end portion 31a may be seated, thereby to pre-

determine the aligned assembly of the retainer plate 18 with respect to the mold plate 26.

Having the structural features of the mold plate 26 in mind, it will be apparent that the contact members 16 and 17 may be connected to the mold plate 26 to form a sub-assembly by locating a washer of insulating material 32 on each of the locator pins 27 and cooperating with the washers 31 so that the contact members and their sleeves may be drawn up in firm assembly with the mold plate 26 by threading the bolt 31 in assembly with the retainer plate 18.

An upper mold section 33 and a lower mold section 34 are provided, each having a recess 33e and 34e, respectively, together forming a molding cavity of a shape complimentary to that of the body 11 of the electrical con-

nector 10 and into which molding material may be thereto.

A semi-cylindrical cable-receiving recess is also formed in each of the mold sections 33 and 34 and extends outwardly from the molding cavity to one edge of the mold plate 26 so that the cable 12 may have its end positioned within the molding cavity.

Along the length of the semi-cylindrical recess in each of the mold sections 33 and 34 is formed an enlarged recess 33f and 34f which together form a clamp-receiving recess 35.

A clamp indicated generally by the reference numeral 36 and made up of a pair of sideway con-

structed half-sections 36c and 36d is securely locked in position by the cable 12 and engages the clamp 36 together with said clamp 36 cooperating with the well 39 and the molding cavity. The sprues have outlets 41 which in this preferred embodiment, are situated near the back end of the molding cavity so that the plastic material may flow toward the mold plate 26 and into and around the conductors 14 and 15, as well as the contacts 16 and 17. The thermoplastic material preferably takes the form of a non-conductive and non-electrical insulating body (either natural or synthetic) or any other electrically insulating and heat resistant material used for forming the cable 12 and engaging the well 39 and the molding material used for forming the body 11 will be forced into the locale of the split terminal-receiving portions of the contacts 16 and 17.

After transfer of the molding material has been com-

pleted, the mold may be removed and the clamp 36 and the mold plate 26 removed from the connector 10, whereupon the contact members 16 and 17 will be integrally imbedded in the molded body 27, together with the washers 31 and the tubular sleeves 23 and 24. The finished connector 10 has all of the advantageous features available through the provision of a molded body end split terminal contact members in an integral article of manufacture.

Although we have resorted to detail in the description of the preferred structural embodiment of our invention, we believe the principles, it should be understood that every modification of this invention all such modifi-

The connector comprising a contact member having a split terminal-receiving portion, an annular rib extending radially outwardly on said contact member, said rib engaging the split terminal-receiving portion, a rigid insulator sleeve having one end abutting said rib and arranged to surround the split terminal-receiving portion, a washer engaging said rib sleeve, and a molded body integrally imbedding and bonded to the contact member and said sleeve, said washer engaging said rib sleeve and forming an opening free of molding material for said split terminal-receiving portion.

2. A connector comprising a contact member having a split terminal-receiving portion, a rigid insulator sleeve surrounding the split terminal portion and engaging said rib sleeve to provide a molding pressure resistant, insulating enclosure surrounding the contact member and said rib sleeve, and a molded body integrally imbedding and bonded to said contact member and said sleeve, said sleeve being positioned in a molded body integral to said molded body.

3. A connector comprising a cable having a plurality of conductors therein, a retainer plate having a plurality of spaced apart apertures, a contact member being formed with said retainer plate in the cable end of a mold plate recess, and a molded body integrally imbedding and bonded to said retainer plate together with said contact members, said cable being provided with an opening and said retainer plate having a plurality of apertures to hold said contact members and said enclosures in firm assembly during molding of said cable and having a plurality of apertures in said enclosure for receiving and locking means to hold said retainer plate, said contact members, and said enclosures in firm assembly during molding of said cable.

4. A connector comprising a generally cylindri-

conform contact means having a hollow rigid insulator sleeve.
sleeve with uninterrupted longitudinally extending walls and having a plug-receiving aperture at one end, a longitudinally split socket terminal means extending into said sleeve but terminating short of the opened end of said tubular portion, and means integrally imbedding and bonded to said contact means including a molded body enclosing all of said sleeve without closing the aperture in the end thereof.

6. A connector comprising a generally cylindrically conformed contact means having an enlarged medial portion and a longitudinally split socket terminal means extending away from one side of said medial portion, a rigid sleeve made of insulating material and having an uninterrupted wall portion sealingly engaging said enlarged portion and surrounding said socket terminal means in concentrically spaced relationship therewith, said sleeve being of greater length than the longitudinal extent of said socket terminal means, conductor wire means connected to said contact means on the other side of said medial portion, and a molded body integrally imbedding and bonded to said conductor wire means, said contact means and said sleeve, said molded body having a plug-receiving aperture in registry with the end of said sleeve and said socket terminal means.

7. A connector as defined in claim 6 wherein said contact means comprises a compound contact terminal having a plurality of segments together forming a generally cylindrical contact member.

8. A connector as defined in claim 7, and a block of electrically non-conductive material between a portion of each of said segments, whereby one end of said contact member comprises separated terminal-engaging portions.

9. A connector as defined in claim 2 wherein said contact member comprises means providing a plurality of segments together forming said contact member, a rib portion medially disposed on each of said segments and together with one another forming said medial annular rib.

10. A connector as defined in claim 9, and a block of electrically non-conductive material between a portion of each of said segments, whereby one end of said contact member comprises separated terminal engaging portions.

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