

United States Patent

[11] 3,588,783

[72] Inventor **Albert P. Newman**
Springfield Township, Hamilton County,
Ohio
[21] Appl. No. **761,254**
[22] Filed **Sept. 20, 1968**
[45] Patented **June 28, 1971**
[73] Assignee **KDI Sealtron Corporation**

FOREIGN PATENTS

232,573 12/1959 Australia 339/256
603,975 6/1948 Great Britain 339/60

Primary Examiner—Ernest R. Purser
Assistant Examiner—Joseph H. McGlynn
Attorney—Burton Perlman

[54] **MULTIPLE CONDUCTOR CABLE CONNECTOR**
5 Claims, 17 Drawing Figs.

[52] U.S. CL. 339/59,
174/135, 339/89, 339/103, 339/256

[51] Int. CL. H01r 13/14

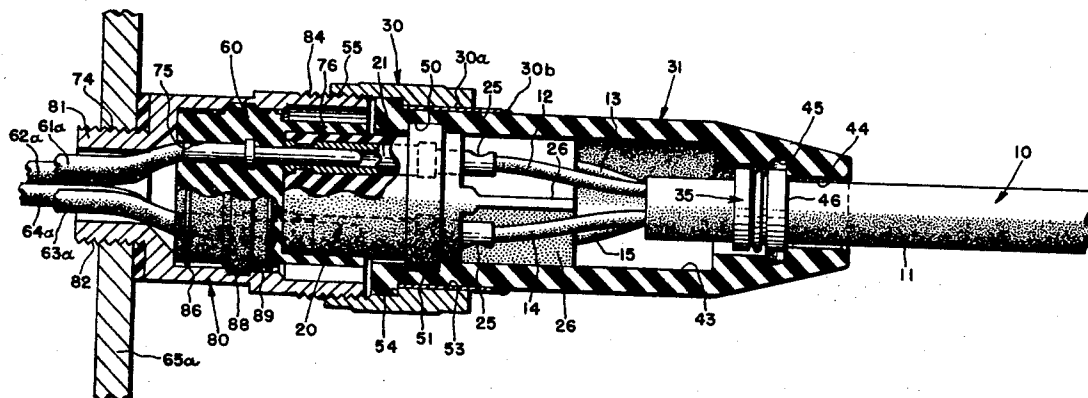
[50] Field of Search 339/59-
—61, 63, 89, 90, 103, 104, 107, 256, 206, 207,
211, 213, 196; 174/135

[56] References Cited

UNITED STATES PATENTS

1,965,087 7/1934 Sharp 339/89
2,140,867 12/1938 Wilmot 339/103
3,181,105 4/1965 Roach et al. 339/94

ABSTRACT: A terminal connector for a multiple conductor electrical cable is provided which may readily be applied to the cable by the user rather than being integrally molded to the cable by a connector manufacturer. Union of leads to contacts is made, such contacts being within a contact holder, and the contact holder is then bodily incorporated into an insulating sleeve of resilient material. Despite the resiliency of the material of the sleeve, once the contact holder and sleeve are integrated, separation is prevented by providing a rib in one which extends into a groove in the other, and disposing a close fitting rigid jacket about the sleeve so that flexibility of the resilient sleeve is diminished. Retention of cable within sleeve by means of a partial ring, and of a female contact which spring loads an entering male contact, are both also contemplated.



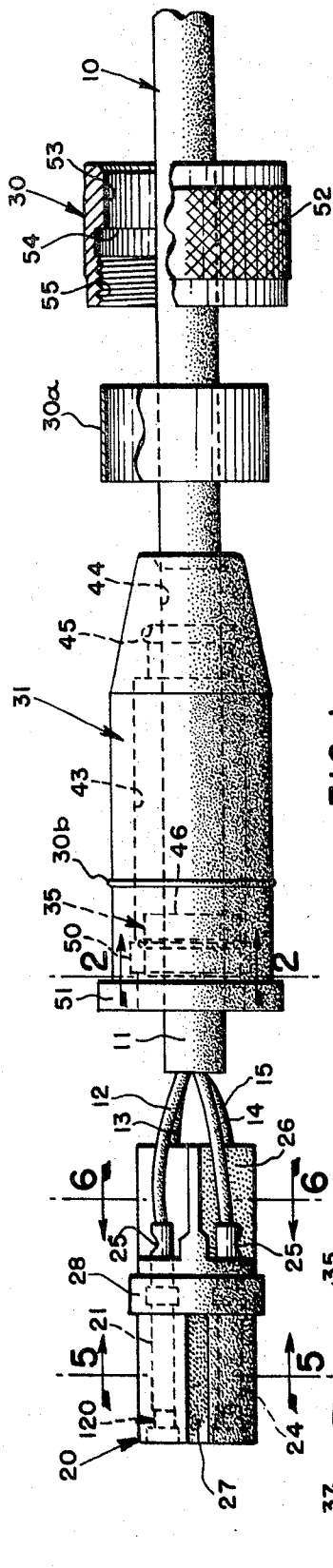


FIG. 1

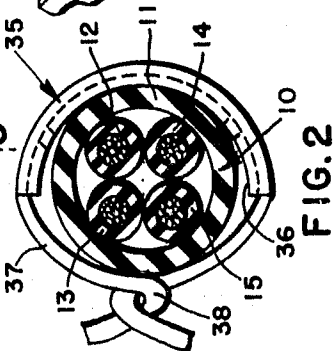


FIG. 2

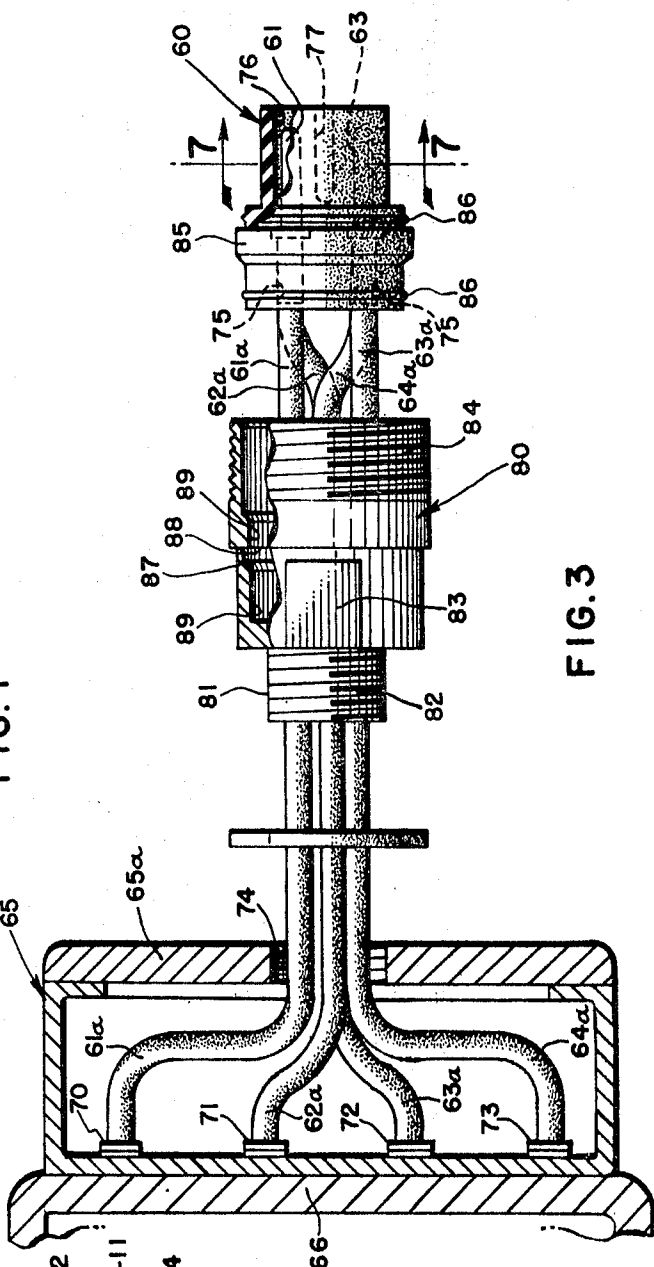
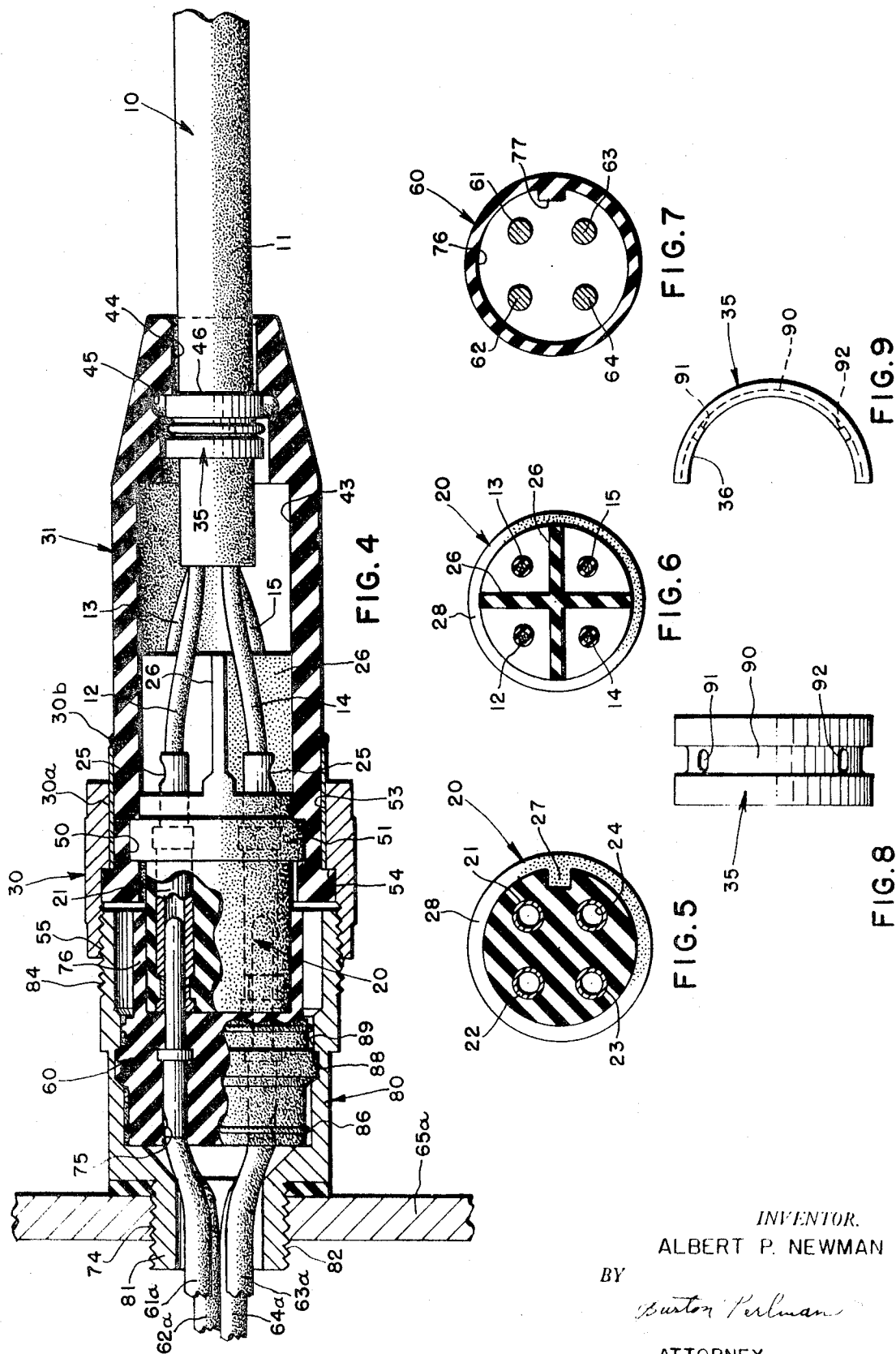


FIG. 3

INVENTOR.
ALBERT P. NEWMAN
BY
Burton Perlman
ATTORNEY



INVENTOR.
ALBERT P. NEWMAN
BY
Burt Perlman
ATTORNEY

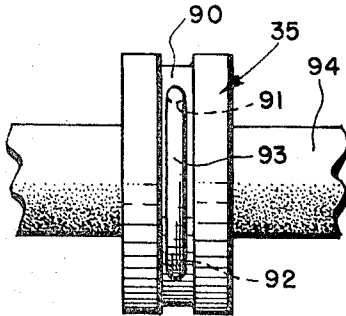


FIG. 10

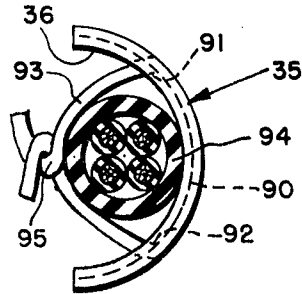


FIG. 11

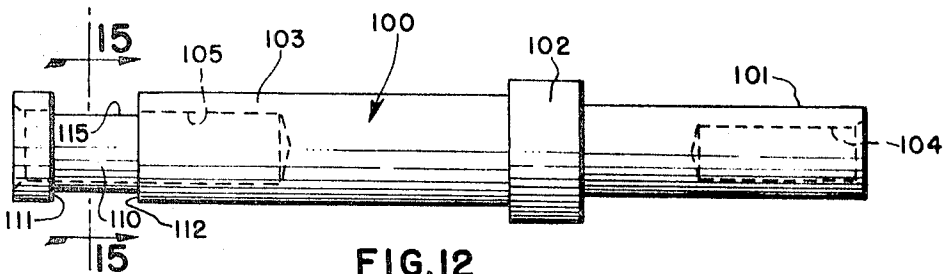


FIG. 12

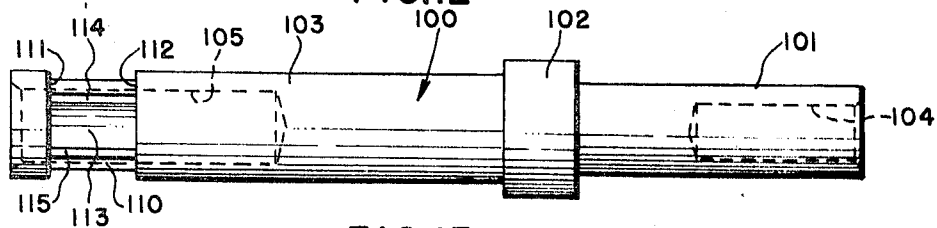


FIG. 13

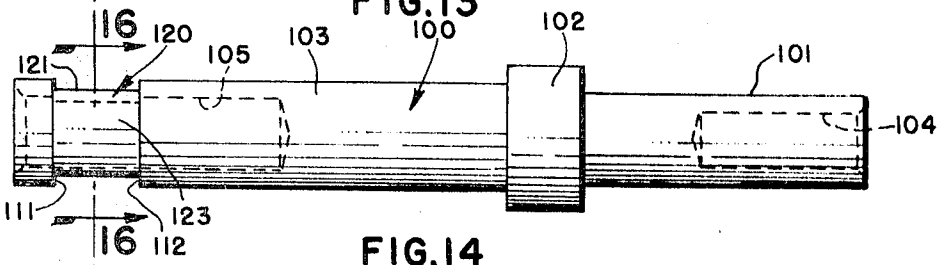


FIG. 14

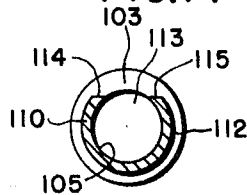


FIG. 15

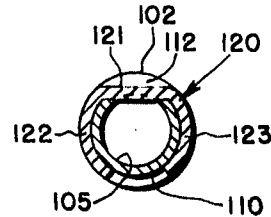


FIG. 16

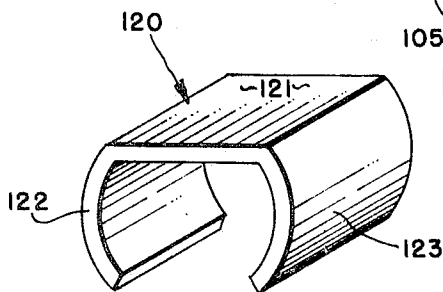


FIG. 17

INVENTOR.
ALBERT P. NEWMAN
BY
Burton Perlman
ATTORNEY

MULTIPLE CONDUCTOR CABLE CONNECTOR

This invention relates to electrical connector means terminating an electrical cable by which means a cable portion may be put into electrical contact with another cable portion, and more particularly to an electrical cable connector to be employed where the cable contains a plurality of separately wrapped conductors.

DESCRIPTION OF THE PRIOR ART

It has in the past been possible to releasably connect separate portions of cable containing a plurality of separate conductors. For the most part this has been accomplished by connectors molded integrally to the cable before it reaches the user. While this has achieved the end of permitting interconnection of separate lengths of cable, a drawback has been that when the connector or the cable suffers damage, the entire cable and connector may have to be discarded. It is true that connectors have heretofore been available for use and assembly in the field, but such connectors have not met with general acceptance because the connectors have not been sufficiently moisture proof or because of the tediousness involved in their assembly. Tediousness occurs in the use of some prior art structure because of the necessity for first assembling wire leads to contact members, and then introducing the contact members into the holder therefor.

SUMMARY OF THE INVENTION

The present invention is directed to the curing of the drawbacks attendant upon the use of prior art structures as terminal connectors for cable portions where multiple conductor cables are used. By the phrase "multiple conductor cables" is meant a single electrical cable within which occurs a plurality of individual conductors or leads, each insulated from the other. An electrical connector assembly for multiple conductor cables is provided which need not be assembled at the factory because it is not integrally molded with the cable. Rather are separate elements provided which may be conveniently applied in the field by the cable user. Moreover the novel connector herein provided is convenient to use and easy to assemble, for it is contemplated that contacts will be already assembled into a holder and the user need merely connect the leads in the cable to the contacts in the holder. Protection to users is fully provided by an enveloping sleeve which covers both the holder and the exposed connections between leads and contacts. A resilient insulative material is employed for contact holder and sleeve to permit easy assembly of the holder into the sleeve. Retention of the holder within the sleeve despite such resiliency is then achieved by disposing a closely fitting tubular jacket of rigid material about the sleeve. The rigidity conferred by the tubular jacket prevents flexing of the sleeve and withdrawal of the holder. Further objects within the purview of the present invention are to provide contact holders compatible after assembly with those already in use, to provide for positive retention of male and female connector assemblies in electrical union, following assembly of the components of each, and also provision for firm electrical contact between individual contact members.

In addition, it is an object herein to limit movement of the holder and of the cable within the sleeve by the interaction between a partial ring member, which is affixed to the cable insulation, and an internal shoulder in the sleeve past which the partial ring cannot readily move. The partial ring has simple means for affixing it to the cable. There is thereby provided means to prevent separation of holder, cable, and sleeve following assembly, all of which means can readily be assembled by the user in the field to give a unitized assembly.

How these and many other objects of this invention are to be implemented will become clear through a consideration of the accompanying drawings wherein:

FIG. 1 is a view showing the components, prior to assembly, of a female connector for multiconductor application according to the present invention;

FIG. 2 is a section view taken at 2-2 in FIG. 1, such section view being enlarged from the scale of FIG. 1, showing the partial ring cable retaining means of the present invention in place upon the electrical cable of FIG. 1;

FIG. 3 is a view of the components, prior to assembly, of a male connector suitable for mating with the female connector shown in FIG. 1;

FIG. 4 is an assembly view in which the components of FIG. 1 have been assembled into a unitized female connector, the components of FIG. 3 have been assembled into a unitized male connector, and the two units have been interengaged to make connection between a power tool or other power driven device and the separate leads within an electrical cable connected to a power source, such components being shown partially in section;

FIG. 5 is a section taken at 5-5 in FIG. 1;

FIG. 6 is a section taken at 6-6 in FIG. 1;

FIG. 7 is a section taken at 7-7 in FIG. 3;

FIG. 8 is an elevation view of partial ring used to prevent withdrawal of electrical cable from within sleeve;

FIG. 9 is a side view of the partial ring of FIG. 8;

FIG. 10 is an elevation view of the partial ring illustrated in FIGS. 8 and 9 in place upon a smaller cable than is shown in FIG. 2;

FIG. 11 is an end view of the subject matter seen in FIG. 10;

FIG. 12 is a side elevation view of a female contact such as those employed in FIG. 1, but shown alone and on an enlarged scale;

FIG. 13 is a top view of the female contact of FIG. 12;

FIG. 14 is a side elevation view of a female contact as seen in FIG. 12 but with spring member in place thereon;

FIG. 15 is a section at 15-15 in FIG. 12;

FIG. 16 is a section at 16-16 of FIG. 14; and

FIG. 17 is a perspective view, alone and enlarged, of the spring member employed with female contact member shown assembled in FIG. 14.

Electrical cable 10 carries within its insulating sheath 11 four separate electrical leads indexed 12, 13, 14 and 15 which lead to a power source.

Female contact holder 20 has therein one female contact 21-24 for each of the respective leads 12-15. It will be understood that the respective leads 12-15 are each assembled to one of the female contacts 21-24 by crimping or soldering in the manner depicted in FIG. 1 where lead 14 is crimped to female contact 24 at point 25.

Female contact holder 20 which is designed to accommodate four separate leads is formed with a partitioned back end 26 which provides for separated compartments insulated from each other by such partitioning 26. Each of the leads 12-15 is contained separately within one of the compartments. This may best be seen in FIG. 6. Axial keyway 27 the utility of which will be hereafter described in connection with the assembly of the female connector to the male connector, is present in female contact holder 20 and an annular rib 28 is present on the surface of female contact holder 20.

As is suggested by FIG. 1, prior to assembly of the leads 12-15 to the female contacts 21-24, and thus to female contact holder 20, first collar member 30, then tubular jacket 30a, and then sleeve 31 must be disposed about cable 10.

Partial ring 35 is disposed with its concave side 36 against cable 10, and wire 37 is wrapped about such partial ring 35 and cable 10. The ends of wire 37 are twisted together as at 38 (FIG. 2) to tighten such wire in position on cable 10. The construction and operation of partial ring 35 will hereafter be described separately and in greater detail.

Following assembly of leads 12-15 to contacts 21-24 and of partial ring 35 to cable 10, the female connector components may be assembled. Female contact holder 20 is pulled into the interior of sleeve 31. In such assembly, with reference to FIG. 1, contact holder 20 will move to the right as will cable 10, while sleeve 31 remains stationary. Sleeve 31, which is tubular, has an internal wall 43 of major diameter and a rearward internal wall portion 44 of reduced diameter. Shoulder

45 is present at the interior end of internal wall reduced diameter 44. As cable 10 moves to the right in FIG. 1 one side 46 of partial ring 35 will come to rest in abutment against shoulder 45, such rest position being clearly indicated in FIG. 4. Cable 10 may not thereafter be further withdrawn from within sleeve 31.

Annular groove 50 is present in internal wall 43 of major diameter within sleeve 31. Sleeve 31 as herein provided is made of resilient deformable neoprene, and the same is true for female contact holder 20. On assembly female contact holder 20 is forced to the right in FIG. 1 until annular rib 28 moves into annular groove 50.

While there will be a tendency for the mating of rib 28 and groove 50 to cause the retention of contact holder 20 within sleeve 31, because of the resiliency of the material involved, it is possible for rib 28 to be withdrawn from groove 50. Such separation, however, will no longer be possible following the next step of assembly. Tubular jacket 30a of rigid material, metal or plastic, which will fit closely about the external surface of sleeve 31 is moved to the left in FIG. 1 while sleeve 31 remains stationary, until it overlies the position of groove 50. Rib 30b will then serve to retain such jacket in position. At this point jacket 30a overlies the portion of the external surface of sleeve 31 interiorly of which groove 50 lies, as best seen in FIG. 4. Because the close fitting jacket 30a is rigid, after it is in place, sleeve 31 cannot thereafter readily deform, and rib 28 will be trapped therein. The unitized female connector may then readily be pushed home to engage a male connector without separation of components in the female.

It will be apparent also that integration of contact holder and sleeve in this manner will result in a structure which will not permit entry of moisture into the interior of the connector from the larger end of sleeve 31. At this point integral flange 51 at one end of sleeve 31 is identified because such flange interacts with collar 30 following the next step in assembly of the female connector assembly. Collar 30 has an external knurled surface 52 for ease in grasping such collar and rotating it. Interiorly, collar 30 has an internal surface 53 of minimum diameter, a shoulder 54, and a threaded internal surface 55 of larger diameter. When now it is desired to interengage the female connector assemblage (contact holder 20, sleeve 31, and tubular jacket 30a) with a male connector assemblage, hereafter to be detailed, collar 30 is moved to the left in FIG. 1 while sleeve 31 remains stationary, until shoulder 54 engages flange 51 at the end of sleeve 31. Threads 55 in collar 30 will engage the hereafter described threaded member so that electrical contact will be retained.

Male contact holder 60 in the embodiment here illustrated is made of resilient insulative material and has four male contacts therein 61, 62, 63, and 64. Interiorly of contact holder 60, as may best be seen in FIG. 3, each of the contacts 61-64 has crimped thereto a lead, 61a, 62a, 63a, and 64a respectively. Box 65 having removable cover 65a is located on the housing wall 66 of a device such as a motor or the like which is otherwise not known. Four electrical terminals 70, 71, 72 and 73 for appropriate connection to the motor are present and each lead 61a-64a electrically connected to one of the terminals 70-73. Leads 61a-64a pass through a threaded aperture 74 in removable cover 65a. A crimp connection between lead 61a and male contact 61 at point 75 is illustrated in FIG. 3, it being understood that the remaining leads and contacts are similarly joined. Depression 76 in male contact holder 60 has a polarizing key 77 in its wall for purposes of mating with keyway 27 in female contact holder 20.

Leads 61a-64a are shown in FIG. 3 passing through a housing or cup member 80. Cup member 80 has a portion of reduced diameter 81 upon which threads are present. Portion 81 may be threaded into removable cover 65a of box 65. Cup member also has external surface of major diameter upon which flats 83 occur to provide a place for a wrench to grip cup member 80 and facilitate the tightening of such cup member into receptacle 65. (While only one flat is illustrated in FIG. 3, it will be understood that there is a corresponding

flat portion on the opposite side of external surface 82 of cup member 80.) Cup member 80 has threads on its external surface at 84.

To assemble the male connector assembly it will be understood that threads at 81 are engaged within aperture 74 in removable cover 65a. Male contact holder 60 is then moved to lie interiorly of cup member 80. (This may be accomplished either by moving the cup member 80 to the right in FIG. 3 while contact holder 60 remains stationary, or male contact holder 60 to the left in FIG. 3 while cup member 80 remains stationary.) When male contact holder 60 is completely within the cup member 80, annulus 85 will have snapped into groove 87 to retain the male contact holder 60 in position, such retention obtaining because square wall 88 of groove 87 will prevent withdrawal of annulus 85. Ribs 86 will then sealingly bear against surface 89 within cup member 80.

Heretofore we have described the components in the male connector assembly and also a female connector assembly, and have further described the steps in integrating the components of each of these assemblies. To use the separate assemblies, they are then connected together in the manner shown in FIG. 4. Male and female contacts are brought into engagement, this being done by interengaging the contact holders 20 and 60. Such overall assembly is held together by moving rotatable collar 30 until it is disposed over tubular jacket 30a with its internal threads 55 engaging external threads 84 on cup member 80. When this overall assembly is made, protection is afforded against breaking the circuits so made because cable 10 is anchored firmly within sleeve 31. Partial ring 35 performs this function, not permitting cable 10 to be displaced axially with respect to sleeve 11 under normal circumstances.

An enlarged view of partial ring 35 is shown in elevation in FIG. 8 and a side view is shown in FIG. 9. The partial ring may preferably be made of metal or other rigid material. As has heretofore been described such partial ring 35 may be firmly bound to a cable such as cable 10 seen in FIG. 1 by wrapping a wire 37 around partial ring 35, such wire being confined within channel 90, and then such wire being passed up over cable 10 and twisted to tighten down upon the insulation of cable 10 as can be seen in FIG. 2.

Holes 91 and 92 pass through partial ring 35. Such holes are present for the purpose of permitting use of a partial ring of standard size with cables of different sizes. It will be readily appreciated that use of a partial ring of a standard size, which is dimensioned to interengage with the shoulder in a sleeve of standard size, is of great utility for it permits use of the same sleeve with cables of different size.

Use of partial ring 35 with a cable 94 of smaller size than the cable 10 seen in FIG. 1 and 2, is illustrated in FIGS. 10 and 11. As there seen if the wire 93 were passed all the way around channel 90 and partial ring 35, in the manner shown in FIGS. 1 and 2, and the ends of the wire then twisted, no action on cable 94 will result for the reason that the diameter of cable 94 is less than the distance between the wire and bottom of the arc of partial ring 35. Where this is the case, instead of passing completely about partial ring 35 and channel 90, the ends of wire 93 are passed through holes 91 and 92. When the ends of the wires are then twisted together as at 95 in FIG. 11, the cable 94 will be securely bound to partial ring 35 and withdrawal of a smaller cable such as cable 94 from sleeve 31 is equally as difficult as withdrawal of a larger cable 10 would be from sleeve 31.

Except for the mention earlier that electrical leads are crimped or soldered to male or female contacts, the foregoing description has, in the main, been concerned with mechanical problems arising in integrating the independent male and female connector assemblies, and also their retention when one such connector has been brought into electrical contact with the other. The discussion has also dealt with the protection of the united assemblies against damage or possibility of disconnection when an outward force is exerted upon the cable 10. Now a structural consideration relating to electrical connection will be described.

It is vital when male contacts such as those shown at 61—64 are introduced into female contacts such as 21—24, that good electrical connection result, and female contacts calculated to achieve this end are here provided. While new index numbers are employed in connection with the discussion of an individual female contact as is illustrated in FIGS. 12—17 with associated spring, it will be understood that counterparts of this contact may be used as the female contacts 21—24 employed in FIGS. 1, 4 and 5.

Female contact 100 as illustrated in FIG. 12—16 has crimp tube portion 101, shoulder portion 102, and mating portion 103. The crimp tube portion has an internal passageway 104 into which the strands of a lead may be introduced and such crimped portion deformed to hold such lead in place. Shoulder portion 102 serves the function of assisting retention of the female contact 100 within the female contact holder such as that shown at 20 in FIG. 1, following seating of such contact therein.

Mating portion 103 has a recess 105 into which a male contact can enter. Because of the construction of the female contact provided here, a male contact entering such recess will be subjected to a spring load which will urge such male contact into close engagement with the internal wall of recess 105.

To achieve this purpose a portion 110 of the outer diameter of mating portion 103 is reduced between shoulders 111 and 112. The portion of reduced outer diameter 110 is then milled across the top to cut through the wall between portion of reduced outer diameter 110 and recess 105, and an opening 113 between milled surfaces 114 and 115 thereby results. Spring member 120 having a flat portion 121 from which concave portion 122 and 123 depend, is then snapped into place within the confines of shoulders 111 and 112 which bound portion of reduced outer diameter 110. When in place, flat portion 121 overlies opening 113, while concave portions 122 and 123 mechanically engage the outer surface of portion 110 of reduced outer diameter of the mating portion 103. Spring member 120 may be made of spring quality brass or other suitable conductor. By such provision it is apparent that means have been provided whereby upon the entry of a male contact into recess 105, flat portion 121 of spring member 120 will bear upon such male contact and urge it into close contact with the internal wall of recess 105. While spring member 120 is shown with a flat portion 121 overlaying opening 113, it is apparent that the essential purpose is locally to reduce the cross section of recess 105 by means capable of yielding in the manner of a spring upon introduction of a male contact. Consequently a convex portion, for example, or other expedient might be used in place of flat portion 121.

While I have described specific structures in connection with this disclosure of my invention, it is apparent that changes and modifications may be made therein, and though so changed the resulting structure may still fall within the bounds of my invention. For example, but without limitation, a male contact holder could readily be substituted for the female contact holder within the sleeve 31 and a male contact

holder for the female contact holder within cup member 80.

I claim:

1. A multiconductor cable connector assembly comprising: an electrical cable including a plurality of conductors; contact holder means having an annular rib, said rib having substantially square corners; a plurality of electrical contacts in said contact holder means, electrically united to said conductors; an insulating sleeve of resilient material having an internal circumferential groove, the wall of said sleeve being of smallest dimension at the bottom of said groove, said groove having substantially square corners to conform to the contour of said rib, said annular rib being disposed within said groove; and tubular jacket means closely fitting about said sleeve and overlying said annular groove for securing said contact holder means within said sleeve prior to connection with a mating connector assembly.
2. A multiconductor cable connector assembly as claimed in claim 1 wherein said contact holder means is of resilient insulative material.
3. A multiconductor cable connector assembly as claimed in claim 1 wherein said electrical cable has external insulation, and said contact holder means and said external insulation of said electrical cable are disposed at least in part within said sleeve.
4. A multiconductor cable connector assembly as claimed in claim 1 including: a flange at one end of said sleeve; collar means having an internal shoulder for engaging said flange and an internally threaded portion; a mating connector assembly comprising: second contact holder; a plurality of second electrical contacts within said second contact holder; a housing having an externally threaded portion, said second contact holder means being within said housing; means for retaining said second contact holder within said housing; a second plurality of conductors electrically united to said second electrical contacts, said electrical contacts being in electrical engagement with said second electrical contacts, and said collar means being in threaded engagement with said housing, whereby said contacts are releasably locked together.
5. A multiconductor cable connector assembly as claimed in claim 1 wherein each of said electrical contacts has a conductor connecting portion, and a mating portion, said mating portion having an internal recess, an opening communicating between the external surface of said mating portion and said internal recess, and spring means having a recess cross section reducing portion overlaying said opening, mounted on said mating portion, whereby a male contact entering said internal recess will be urged by said spring means into close contact with the internal wall of said recess.