Sept. 4, 1956 R. J. MELCHER 2,762,025

SHIELDED CABLE CONNECTORS

Filed Feb. 11, 1953 2 Sheets-Sheet 1

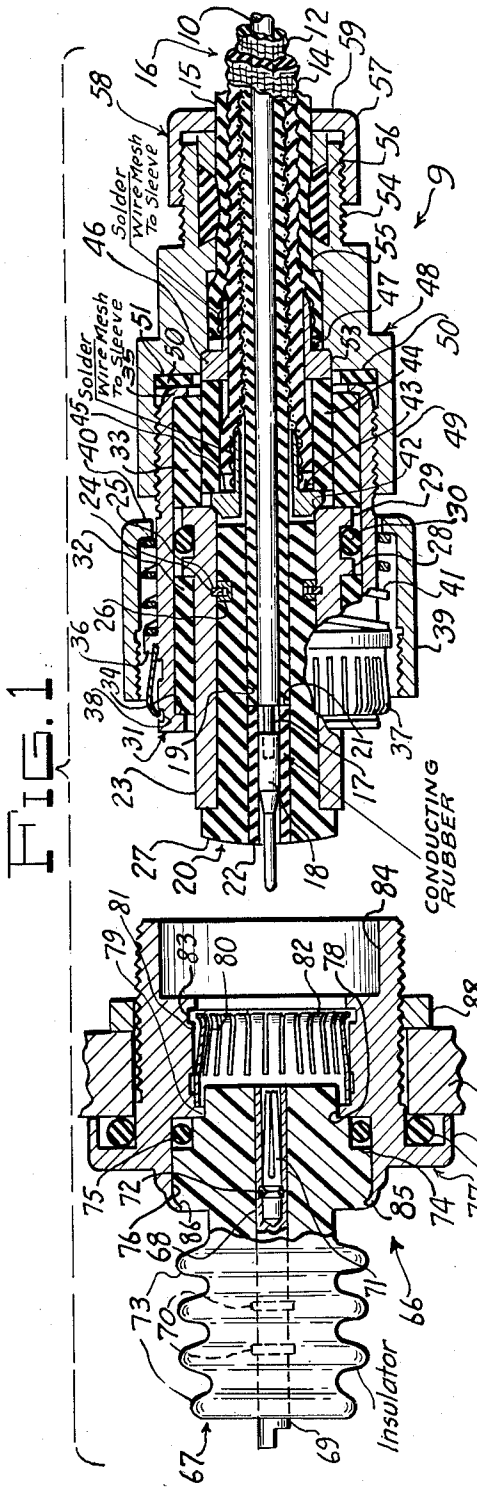

FIG. 1.

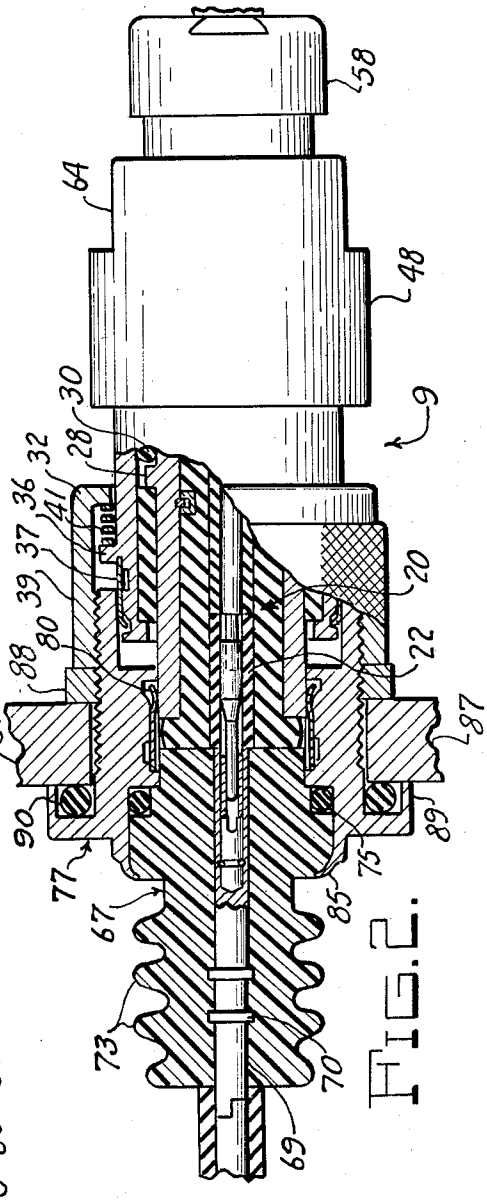

FIG. 2.

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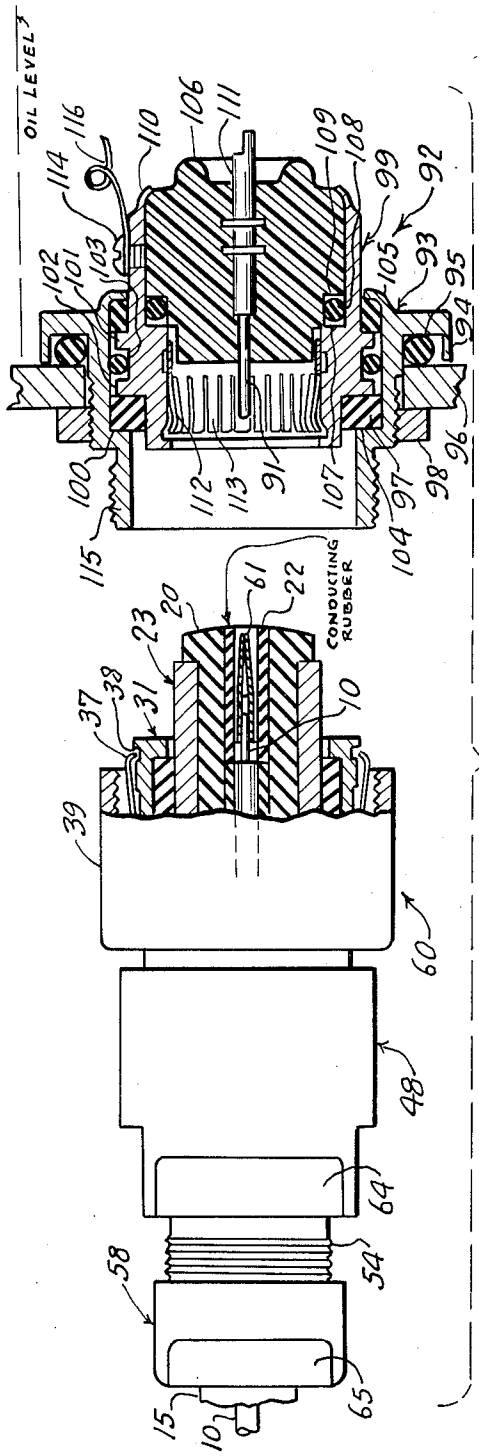

FIG. 2.

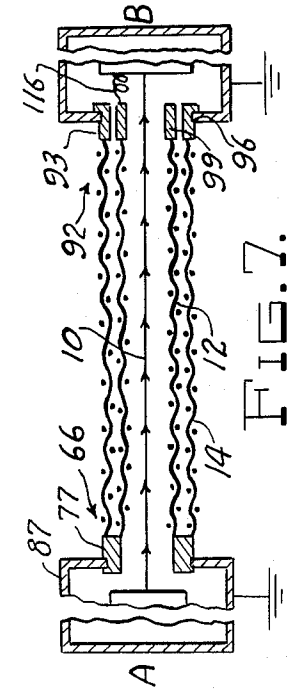

FIG. 7.

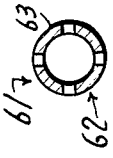

FIG. 6.

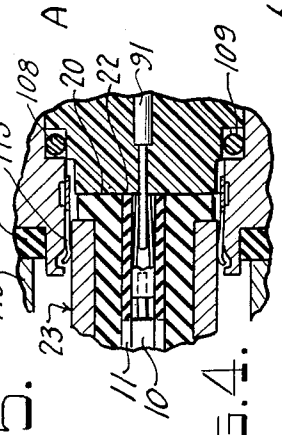

FIG. 4.

FIG. 5.

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2,762,025

SHIELDED CABLE CONNECTORS

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Application February 11, 1953, Serial No. 336,289

3 Claims. (Cl. 339—143)

This invention relates to cable connectors for rapidly connecting shielded electrical cables to cased units of radar and other electronic equipment, particularly such equipment as is connected by pulse carrying cables.

In many military and other electronic installations it is desirable that units be separately enclosed in protective and insulating or shielding casings not only to protect the operation of the equipment electrically but to prevent ingress of moisture and dirt and to facilitate the portability of the installation by breaking it up into smaller units. Where such units are to be connected by cables capable of handling very high voltage impulses, intricate electrical circuits are involved and the connecting cables must be not only physically tough and capable of handling the electrical loads but they should be provided with connectors which effectuate the electrical and physical connection rapidly and simply.

It is, therefore, the principal object of this invention to provide a connector set designed to facilitate rapid assembly, complete protection against moisture and dirt, and electrical shielding and insulation.

A connector set embodying the invention is illustrated in the attached drawings in a form particularly designed for use in a double shielding system sometimes called a "tri-axial" system and the connectors in their several elements are designed to make or break as many as three or more simultaneous circuits with two concentric shielding systems associated with a central conductor.

The purposes and construction of a cable connector embodying the invention will be more clearly understood from the specification and from the drawings, in which:

Fig. 1 is a vertical sectional view, with some parts broken away, of a connector plug and receptacle embodying the invention, the plug and receptacle being shown in their disconnected positions.

Fig. 2 is a view similar to Fig. 1 but showing the plug and receptacle in assembled position.

Fig. 3 is a view similar to Fig. 1 but showing a second plug and modified receptacle in disconnected position.

Fig. 4 is a fragmentary view in vertical section showing how the plug and receptacle of Fig. 3 make their connections.

Fig. 5 is a greatly enlarged view in perspective of a conductor connector pin of a type employed in the plugs and receptacles embodying the invention.

Fig. 6 is a further enlarged vertical sectional view on the line 6—6 of Fig. 5.

Fig. 7 is a simplified hookup diagram illustrating how the receptacle and plug of Fig. 1 are associated with the similar plug and modified receptacle of Fig. 3 to establish a double shielded system between two equipment units.

Pulse cables of the general type illustrated in the drawings and for which connector sets comprising a connector plug embodying the invention and generally indicated at 9 in Fig. 1 are designated, are of several general types. Among these types is a tri-axial cable which may comprise a central conductor 10 (Fig. 1) that is surrounded by a layer of electrical insulation 11 which, in turn, is

enclosed in a braided wire shield 12. Exteriorly of the shield 12 there are a second insulating layer 13, an outer braided wire shield 14 and a tough exterior jacket 15.

In the cable illustrated in the drawings the insulating layers 11 and 13 are shown as uniform in characteristics, but some pulse cables have corresponding layers which are double, i. e., which have a thin layer of conducting rubber, for example, immediately circumjacent the conductor 10 and a layer of insulating rubber around the conducting rubber and inside the metal shield 12. While such a conductor is not illustrated in the drawings, as will appear later in the description, the connector sets embodying the invention are adapted to be used either with the type of conductor specifically illustrated or with a conductor such as that just described.

The cable as a whole is generally indicated with the reference number 16 in Fig. 1 and the other figures and is, as a whole, reasonably flexible to allow it to be coiled and to be used to connect electronic units or pieces of equipment which do not lie in fixed or aligned positions. Cables of this general type, of course, are well-known in the art and their need for flexibility explains why the shielding layers 12 and 14 are fabricated from an open woven wire braid, for example, so that the cables possess a high degree of flexibility.

In preparing the end of a tri-axial cable such as the cable 16 of the drawings for attachment to a connector plug embodying the invention, the several concentric layers are cut at staggered points along the cable 16 near its end. Each of the layers nearer the center extends further toward the end, i. e., more of the jacket 15 is cut away than of the metal shield 14 and, similarly, each successive layer extends an appropriate further distance toward the end of the conductor.

Referring now specifically to Fig. 1, at the very end of a cable being prepared for assembly a short length of center metal conductor 10 is laid bare forming a projecting prong 17 which is inserted in a socket at the rear of, and soldered to, a connector pin 18. In Fig. 1, the connector pin 18 is shown as a male connector pin, i. e., having a single point.

In preparing the cable 16 to provide the extending prong 17 on the conductor 10, its insulating layer 11 is cut back a distance such that when the cable is thrust into an axial opening 19 in a spool-like insulator 20, a shoulder 21 cut on the end of the center insulation 11 abuts the end of a sleeve 22 inserted in the forward end of the opening 19 of the insulator 20. The sleeve 22 is of such length relative to the length of the prong 17 and connector pin 18 that a considerable length of the connector pin 18 protrudes beyond the end of the insulator 20. The sleeve 22 may be molded from conducting rubber when the connector set is used with a cable having a layer of conducting rubber adjacent the central conductor 10. Both the insulator 20 and sleeve 22 are flexible.

The insulator 20 is located interiorly of a generally tubular shell 23 being held therein by the engagement of a split expansion ring 24 in an undercut annular groove 25 in the wall of the shell 23, the ring 24 also engaging in an annular collar 26 which is molded in the body of the insulator 20. The insulator 20 has a disk-like head 27 formed on its forward end which engages tightly against the end of the shell 23 when the insulator 20 has been inserted sufficiently far into the shell 23 for the split ring 24 to expand into the groove 25.

The forward ends of the head 27 of the insulator 20 and sleeve 22 are spherical in shape, comprising the polar zone of a sphere of which the axes of the conductor 10 and connector pin 18 are the axis so that, as will later be explained with respect to assembly of a connector plug and a connector receptacle embodying the invention, engagement of the ends of the insulator 20 and sleeve 22

with parts of the connector receptacles results in flattening the insulator 20 and sleeve 22 axially, "wiping" air radially outwardly between their surfaces and the engaged surface in the receptacle.

The rear end of the shell 23 has a pair of outwardly radially extending flanges 28 and 29 which are axially spaced a distance sufficient to accept a conventional "O-ring" 30.

The shell 23 is fixedly positioned in and insulated from a tubular outer shell 31 by means of a pair of insulating sleeves 32 and 33. The sleeve 32 is positioned circumjacent the body of the shell 23 in front of the flange 28 and bears against a front lip 34 formed on the outer shell 31. The other insulating sleeve 33 bears against the rear edge of the flange 29, which also is the rear end of the inner shell 23 and the entire assemblage of the three units of sleeve 32, shell 23, including the insulator 20, and sleeve 33 is permanently associated by spinning over a lip 35 formed at the rear of the tube-like body of the outer shell 31.

It will be observed that the inner diameter of the lip 34 of the shell 31 is greater than and thus spaced from the outer wall of the inner shell 23 so there is no contact, either physical or electrical, therebetween.

The outer shell 31 has an outwardly directed flange 36 near its front edge. A plurality of spring fingers 37 formed either independently or from a comb shaped strip of resilient conducting metal are soldered or otherwise firmly secured to the flange 36. The fingers 37 extend generally forwardly around the exterior of the shell 31 being flared outwardly and then sharply returning with ends that are received in an annular groove 38 but in the exterior of the outer shell 31 near its front end. The annular groove 38 accommodates the bent inward ends of the fingers 37 when the fingers 37 are squeezed inwardly as by being forced into a cylindrical cup, for example, having an internal diameter less than the effective exterior diameter of the mass of fingers 37 in their outwardly flared position.

The outer shell 31 is provided with a coupling 39 which is generally cup shaped and surrounds a portion of the forward part of the shell 31, having an inwardly turned rear edge 40 between which and the rear side of the flange 36 on the exterior of the shell 31 there may be located either a simple coil spring 41 or a plurality of, for example, bent washers serving the same function. The front inner edge of the coupling 39 is interiorly threaded for assembly with a receptacle as will later be described.

At the rear tubular portion of the outer shell 31 which surrounds the sleeve 33, and immediately forwardly of the inwardly spun lip 35, the exterior of the body of the outer shell 31 is threaded.

The rear end of the bore of the inner shell 23 has a chamfered corner 42 for engagement with the beveled front end of a ferrule 43. The ferrule 43 loosely fits over the exterior of the layer of insulation 11 and has a thin tubular body which is adapted to slide between the surface of the layer of insulation 11 and the inner shield 12. When the ferrule 43 is thrust into the position illustrated in Fig. 1, it flares the shield 12 outwardly and also flares outwardly the end of the outer insulating layer 13. As can be seen in Fig. 1, the insulating layer 13 is cut away a little farther than the shield 12 leaving a short portion of the shield 12 extending beyond the insulation layer 13 on the exterior of the ferrule 43 so that it can be soldered thereto. When the cable is prepared for connection to the connector plug embodying the invention, the shield 12 and outer insulating layer 13 are both cut back distances chosen so that when the ferrule 43 is mounted thereon and soldered in place, its axial distance from the shoulder 21 of the inner insulation 11 aligns the ferrule 43 for positioning against the chamfered corner 42 of the inner shell 23.

The exterior of the end of the outer insulation mass 13 is surrounded by a tubular insulating sleeve 44 which fits snugly within the interior of the sleeve 33 and extends between the rear edge of a flange 45 on the ferrule 43 and the front edge of a flat flange 46 on a second ferrule 47. The ferrule 47 fits relatively snugly over the exterior of the outermost layer of insulation 13 similarly having its thin tubular body thrust between the exterior of the layer of insulation 13 and the outer shield 14. As is the case with the inner elements of the cable, the shield 14 and the outer jacket 15 are cut away at such distances from the end of the conductor 11 that upon assembly of the device, the ferrule 47 bears against the rear edge of the insulating sleeve 44.

The ferrule 47, sleeve 44 and ferrule 43 are all thrust tightly forwardly by the clamping action of a rear body member 48. The member 48 is generally cup shaped having a forward tubular wall 49 that is internally threaded to match the threads on the exterior outer shell 31. A flat washer-like sealing gasket 50 is positioned between an annular shoulder 51 on the member 48 and the turned over lip 35 of the outer shell 31.

Just rearwardly of the shoulder 51 of the member 48 a second step-down shoulder 52 engages the rear edge 53 of the flat flange 46 of the ferrule 47. Thus when the body member 48 is assembled on the rear of the outer shell 31 by engaging their respective threads, the sealing gasket 50 is tightly clamped between the shoulder 51 and the lip 35 of the outer shell 31 and the shoulder 52 engages the ferrule 47 to hold the sleeve 44 and ferrule 43 tightly in their respective positions.

The rear end of the member 48 is reduced in diameter and forms a throat 54 extending rearwardly from an inwardly directed lip 55. The lip 55 has an inner diameter such that it fits around the exterior of the cable jacket 15. The interior diameter of the throat 54 is, however, substantially larger than the exterior diameter of the jacket 15 and a beveled edge locking collar 56 is insertable therebetween. The rear edge of the lip 55 is beveled with a reverse bevel so that its inner edge extends rearwardly along the outside of the jacket 15 toward the locking collar 56 farther than does its outer edge. The beveled edge of the collar 56 is correspondingly shaped and its rear edge is oppositely shaped to match the cone shaped end of an axially movable thrust collar 57 which is held in place and may be thrust forwardly by a threaded cup 58, the cup 58 being threaded on the exterior of the throat 54 and having an inwardly directed lip 59 which bears on the rear edge of the thrust collar 57. When the cup 58 is threaded onto the exterior of the throat 54, the thrust collar 57 is slid forwardly causing the collar 56 to bulge inwardly and tightly grasp the exterior of the jacket 15 of the cable 16. The clamping collar 56 and its cooperating lip 55 and thrust collar 57 are more completely disclosed and claimed in Sprigg Patent 2,513,115 and do not constitute a part of the instant invention, being disclosed herein merely as illustrative of means for securely clamping the cable 16 in a connector plug embodying the invention.

As has been explained above, preparation of a triaxial cable 16 for assembly in a connector plug embodying the invention requires that each of the several concentric layers be cut back certain distances. The order of assembly of the parts is as follows: The cup 58 is first slid rearwardly into the cable followed by the following parts in the order recited: The thrust collar 57 (hard material such as metal or an inflexible plastic), the clamping collar 56 (resilient material such as natural or artificial rubber), and the body member 48. The jacket 15 and outer shield 14 are then cut back to provide an exposed portion of the shield 14 and the ferrule 47 is slid over the exterior of the insulating layer 13, forced into the position shown, and soldered to the end of the shield 14. The outer insulation 13 and inner shield 12 are then cut back to an appropriate length with respect to the position of the ferrule 47 and the ferrule 43 is slid over the inner insulation layer 11 and similarly sol-

dered to the inner shield 12. The sleeve 44 which may be made of a tube of resilient insulating material or of relatively stiff insulating material which has been cut axially, preferably the latter, is then positioned exteriorly of the cut back end of the outer insulation 13 and inner shield 12 in position between the two ferrules 47 and 43. As earlier explained, the end of the inner insulating layer 11 and the conductor 10 itself are then prepared and soldered to the connector pin 18. The sealing gasket 50 is then dropped into place in the bottom of the forward cup shaped portion of the member 48 against the shoulder 51.

With these several parts in position on the cable 16, its end is then thrust into the axial bore in the insulator 20 and the body member 48 threaded onto the exterior of the shell 31 until the members are clamped together with the gasket 50 tightly clamped between the spun over lip 35 and the shoulder 51. The clamping collar 56 and thrust collar 57 are then slid forwardly and the cup 58 threaded onto the exterior of the throat 54 tightly enough to clamp the cable 16 in position.

Similarly, a connector plug is assembled on the other end of the tri-axial cable to be used for connecting the two electronic units involved. In Fig. 3 there is illustrated, partly in elevation and partly in section, a connector plug generally indicated at 60 and identical with the connector plug just described in detail and shown in Fig. 1 with the single exception that it is equipped with a female connector pin 61 (see also Figs. 5 and 6) in place of the male connector pin 18 of Fig. 1. The female connector pin 61 is formed from a tube 62 which is split axially forming several fingers 63 which are bent inwardly toward each other and adapted to be spread upon the entry therebetween of a male connector pin 18. As is the case with the male connector pin 18 of the connector plug shown in Fig. 1, the female connector pin 61 of the plug 60 shown in Fig. 3, is soldered to the center conductor 10.

In all other respects the connector plug 60 illustrated in Fig. 3 may be identical with the connector plug shown in Fig. 1 and, therefore, corresponding parts in Fig. 3 have been given the same numbers as those same parts shown in Fig. 1. As can also be seen in Fig. 3, the rear outer surfaces of the member 48 and cup 58 may be formed with flats 64 and 65 respectively, for engagement by wrenches to facilitate their assembly.

Referring again to Fig. 1 and more specifically to the left side of Fig. 1, there is shown in cross section a connector receptacle generally indicated by the reference number 66 adapted to be assembled to a connector plug embodying the invention. The receptacle 66 has a main insulator 67 which preferably is molded from insulating material having little, if any, resiliency, for example a synthetic resinous material of high di-electric properties. As can be seen in Fig. 1, the insulator 67 is generally elongated and has a center bore 68 in which a conductor 69 is molded. The conductor 69, may, for example, be provided with flanges 70 at one or more places along its length which position it securely in the insulator 67.

The right or front end of the conductor 69 has a counterbore 72 of such size to receive, in this instance, a female connector pin 71. The connector pin 71 is retained in the counterbore 72 by sweating solder into annular grooves or openings cut in the exterior of the connector pin 71. The exterior of the rear portion of the insulator 67 may be molded to provide several conventional insulator flanges 73 to increase the creepage distance along the surface of the insulator 67.

At its forward end the insulator 67 has two step-down tenons. The first tenon 74 is of such diameter that a conventional O-ring 75 can be positioned between the exterior of the tenon 74 and the interior of a socket 76 in the rear of a receptacle shell 77. A second tenon 78 on the body 67 is of such diameter as to fit snugly in an annular lip 79 on the shell 77. A plurality of spring fingers 80 which, like the fingers 37 of the connector plug, may be individual or formed from a comb-like strip of metal, are soldered or otherwise secured to an inner wall 81 of the shell 77 and extend forwardly from the forward end of the insulator 67 being bent slightly inwardly with their ends 82 bent outwardly and receivable in an undercut annular groove 83 formed in the shell 77. The shell 77 has a tubular cylindrical rim 84 which extends forwardly from the fingers 80 and is of larger diameter.

The insulator 67 is fixed in place in the shell 77 by being inserted from the rear until the forward edge of the tenon 74 strikes the rear edge of the lip 79 whereupon a lip 85 protruding rearwardly from the main body of the shell 77 and surrounding the receptacle insulator 67 is spun downwardly around a shoulder 86 on the insulator 67.

The shell 77 is assembled in place in a bore in a unit panel 87 by means of a locking nut 88 engaged on the threaded exterior of the shell 77. The shell 77 has a radially spaced axially extending lip 89 which is tightened against one side of the panel 87 by the tightening of the nut 88 against the other side of the panel 87. The lip 89 and the exterior of the shell 77 form an annular groove for an O-ring 90.

Fig. 2 illustrates how the plug 9 and receptacle 66 separately illustrated in Fig. 1 are assembled to each other. The connection is made by axially moving the cable plug 9 to insert its male connector pin 18 into telescoping connecting relationship with the associated female connector pin 71. Simultaneously therewith the forward end of the inner shell 23 strikes the outwardly bent ends 82 of the fingers 80 and the edge of the rim 84 of the receptacle 66 strikes the inwardly directed ends of the fingers 37. The shell 23 enters between the fingers 80 flexing them outwardly and the fingers 37 enter the rim 84, flexing inwardly.

At this point the coupling 39 is slid toward the receptacle 66 compressing the spring or washers 41 until the threads on the coupling 39 are engaged with the threads on the exterior of the receptacle 66. Rotating the coupling 39 then compresses the spring or washers 41 further and moves the connector plug 9 into the receptacle 66 establishing considerable overlap between the elements making the three simultaneous and separate electrical connections. These three sets of elements are as follows: Conductor-connector pins 18 and 71; inner shield-shell 23 and fingers 80; outer shield-fingers 37 and rim 84. By reason of the contact between the clamping nut 88 and lip 89 with the panel 87, the shell 77 of the receptacle 66 is electrically connected to the panel 87. This establishes an electrical connection between the panel 87 and both the outer shield 14 and inner shield 12 of the tri-axial cable 16.

As the plug 9 seats home solidly in the receptacle 66 the end of the sleeve 22 engages the end of the insulator 67 which, it will be observed in Fig. 1, is planar and perpendicular to the axis of the plug and receptacle. Upon engagement of the spherically shaped end of the sleeve 22 and immediately thereafter, the spherically shaped end of the insulator 20 with the planar end of the insulator 67, the ends of the resilient insulator 20 and sleeve 22 are squeezed progressively outwardly against the end of the insulator 67. This displaces the resilient material from which the insulator 20 and sleeve 22 are made, gradually flattening their ends and "wiping" any air out from between the two engaged surfaces. As will be observed in Fig. 2, when the plug 9 and receptacle 66 are completely assembled, the ends of the insulator 20 and sleeve 22 all lie in a single plane and tightly engaged thus preventing corona effects.

As was earlier explained, in some co-axial and tri-axial pulse cables, the inner layer 11 of insulation is comprised of two concentric layers, the inner of these being conducting material and the outer non-conducting

material. If a cable of this type is employed, the diameter of the conductor 69 in the receptacle 66 is such that it is equal to the diameter of the conducting rubber layer on the exterior of the conductor 10. It is necessary therefore that the end of the conductor 69, which is coplanar with the end of the insulator 67, should come into firm contact with conducting material of the same size. In these instances the conducting rubber sleeve 22 establishes contact with the end of the conductor 69 and, at its other end, is in contact with the end of the conducting rubber layer exteriorly of the metal conductor 10 at the rear or right end of the sleeve 22, i. e., at the shoulder 21 (Fig. 1) cut on the inner layer 11 of insulating material. In order to permit the "wiping" action described above, the sleeve 22 which must under these conditions serve as a conductor, cannot be made of metal but, is made of resilient conducting material as set forth.

As has already been stated, the connector plug 60 of Fig. 3 is substantially identical with the connector plug as described in detail with reference to Figs. 1 and 2 except for the type of connector pin employed therein. In Fig. 3 the connector pin 61 is a female connector pin and and it makes connection with a male connector pin 91 which is positioned in a receptacle generally illustrated at 92 in Fig. 3. The receptacle 92, while generally similar to the receptacles of Figs. 1 and 2, is different in one important particular. The receptacle 92, like the plugs 9 and 60, has two concentric relatively insulated shells which take the place of the single shell 77 of the receptacle 66. The receptacle 92 shown in Fig. 3 has an outer shell 93 which is provided with an axially spaced lip 94 for compressing an O-ring 95 against a panel 96. The shell 93 has a tubular section 97 of larger diameter which is exteriorly threaded for receiving a locking nut 98 by means of which the receptacle 92 is clamped in place in the panel 96.

The receptacle 92 also has a generally tubular inner shell 99 which is spaced from the outer shell 93 by a pair of annular insulating washers 100 and 101. The inner shell 99 has a pair of spaced flanges 102 on the exterior of its body between which an O-ring 103 is positioned. When the inner shell 99, insulating washer 100, O-ring 103 and insulating washer 101 are all assembled in the tubular body of the outer shell 93, they are positioned by a shoulder 104 on the inside of the outer shell 93 and clamped in position by spinning over a lip 105 at the rear of the shell 93.

The inner shell 99 is generally tubular in shape. It has a rear bore of larger diameter which receives a molded insulator 106 that is held in place in the shell 99 against a shoulder 107, with an O-ring 108 in an annular groove formed by the shoulder 107 and an opposed shoulder 109 on the insulator 106. The insulator 106 is clamped into position by spinning over a lip 110 at the rear of the inner shell 99.

The male connector pin 91 is integral with or soldered in a conductor 111 which is molded in the insulator 106. The front or outer end of the insulator 106 extends into a tubular portion 112 of the inner shell 99 and a plurality of spring fingers 113 are mounted in the shell 99 in a manner identical to the mounting of the fingers 89 in the shell 77 of Fig. 1. The inner shell 99 additionally is provided with a connection screw 114.

Assembly of the plug 60 in the receptacle 92 is similar to assembly of the plug 9 in the receptacle 66 described above, i. e., the two are moved axially relative to each other until the connectors 61 and 91 engage and the fingers 113 slide over the end of the shell 23 of the plug 60 and the fingers 37 enter a rim 115 on the end of the outer shell 93. Continued axial movement of the plug 60 engages these pairs of elements and the coupling 39 is threaded onto the threaded exterior of the rim 115. This establishes three contacts as follows: Connector pins 61 and 91; inner shell 23 and inner shell 99; outer shell 31 and outer shell 93. In this instance only the outer shell 93, however, is electrically connected to the panel 96 and, therefore, the inner shell 23 of the connector plug 60 and, consequently, the inner shield 12 of the cable are connected only to the inner shell 99 of the receptacle 92.

As was the case when the connector plug 9 was assembled in the receptacle 66, the ends of the insulator 20 and sleeve 22 of the connector plug 60 of Fig. 3 are engaged with and "wiped" along the planar end of the insulator 106 of the receptacle 92.

The assembled position of parts of the connector plug 60 and receptacle 92 are illustrated in Fig. 4 where it can be observed that the ends of the insulator 20 and sleeve 22 have been flattened as described.

The screw 114 is provided on the inner shell 99 for making a connection between the inner shell 99 and a "pigtail" conductor indicated at 116 in Figs. 3 and 7.

In Fig. 3, a broken line bearing the legend "oil level" indicates that the receptacle 92 is assumed to be immersed in oil in the unit of which it is a part. Of course, the receptacle 92 may be employed in other units where it is not immersed in oil but in such a case it would be provided with conventional insulator flanges like the flanges 73 in Fig. 1.

Fig. 7 diagrammatically illustrates a cable and connector assembly for two electronic units indicated at "A" and "B." The unit "A" is the unit enclosed in the casing of which the panel 87 (Fig. 1) is a part and the unit "B" is a unit enclosed in the casing of which the panel 96 (Fig. 3) is a part. In Fig. 7 it is shown how the outer screen-like shield 14 is electrically connected to the single shell 77 of the receptacle 66 and to the outer shell 93 of the receptacle 92. The shell 77 of the receptacle 66 and the outer shell 93 of the receptacle 92 are respectively grounded to the casings 87 and 96 which, in turn, as indicated in Fig. 7, are connected to "Ground." The inner shield 12 is electrically connected to the shell 77 of the receptacle 66 and to the inner shell 99 of the receptacle 92. The inner shell 99 of the receptacle 92 is connected through the pigtail 116 to the unit "B" which, in this particular arrangement illustrating the type of grounded connections made, is insulated from its casing 96. In a circuit of this type the central conductor 10 carries a pulse of current in the direction of the arrows in Fig. 7.

In general, cable connectors embodying the invention are adapted for use with any tri-axial cable of the type generally referred to when used for providing the double shielding effect illustrated generally in Fig. 7. The circuit illustrated in Fig. 7, of course, and the electronic instruments necessitating their employment, do not constitute part of the instant invention.

Having described the pulse cable connectors embodying the invention, I claim:

1. A connector set for a cable having a central conductor, a first layer of insulation surrounding said conductor, a first metal shield concentric therewith and located externally of said first layer of insulation, a second insulating layer external if said first shield, a second shield external of said second insulating layer and an exterior jacket, said connector set comprising, in combination, a connector plug having a main body member, comprising, an elongated, generally tubular insulator, said insulator having an axial bore adapted to receive a protruding length of the conductor and the first layer of insulation, inserted therein from the rear, a tubular inner conducting shell surrounding said connector insulator, an external connector shell surrounding said inner shell and spaced therefrom, means insulating said external shell from said inner shell; a tubular shaped rear member removably connected to said body member coaxially therewith, said rear member having an axial bore adapted at the rear end to receive said cable, in-

cluding all of its elements and its jacket, and two conducting ferrules, the first of said ferrules having a thin tubular body portion adapted to slide axially over the first layer of insulation and beneath the first of said shields, the second of said ferrules having a similar body adapted to slide over the exterior of the second insulating layer and beneath said second shield, each of said ferrules being electrically connected to the associated one of said shields, the forward portion of each of said ferrule bodies having a radially extending portion engaged, respectively with said inner shell and said conductor shell when said rear member is fully assembled on said main body member; a receptacle for said connector plug comprising a generally tubular insulator having a central bore adapted to receive a length of central conductor engageable with the central conductor in said connector plug, an inner shell surrounding said insulator, a receptacle shell surrounding and insulated from said inner shell; and cooperating means on said connector plug and said receptacle for establishing electrical contact between said inner shells and between said connector shell and said receptacle shell for removably connecting said plug and said receptacle.

2. A connector set for a cable as defined in claim 1 in which the receptacle shell and the inner shell of the receptacle are electrically integral, whereby the inner and outer shields of the cable are commonly connected at the receptacle.

3. A connector set for a tri-axial cable having a central conductor, a first external metal shield concentric therewith, and spaced therefrom, a second external shield

spaced from said first shield and a layer of electrical insulation exterior of each of said elements, said connector set comprising, in combination, a connector plug having an inner insulator, said inner insulator having an axial bore adapted to receive a protruding length of the conductor and the first layer of insulation, an inner conducting shell surrounding said connector insulator, an external connector shell surrounding said inner shell and spaced therefrom, means insulating said external shell from said inner shell; a cable holding device removably connected to the rear of said body member; and two axially and radially extending conducting ferrules, each of said ferrules being of size and shape to be connected to one of said shields electrically and to contact electrically one of said shells; a receptacle for said connector plug comprising an inner insulator adapted to receive a length of conductor engageable with the central conductor in said connector plug, an inner shell, a receptacle shell and insulating means between said elements; and cooperating means on said connector plug and on said receptacle for establishing electrical contact between said inner shells and between said connector shell and said receptacle shell, respectively.

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