

Feb. 15, 1966

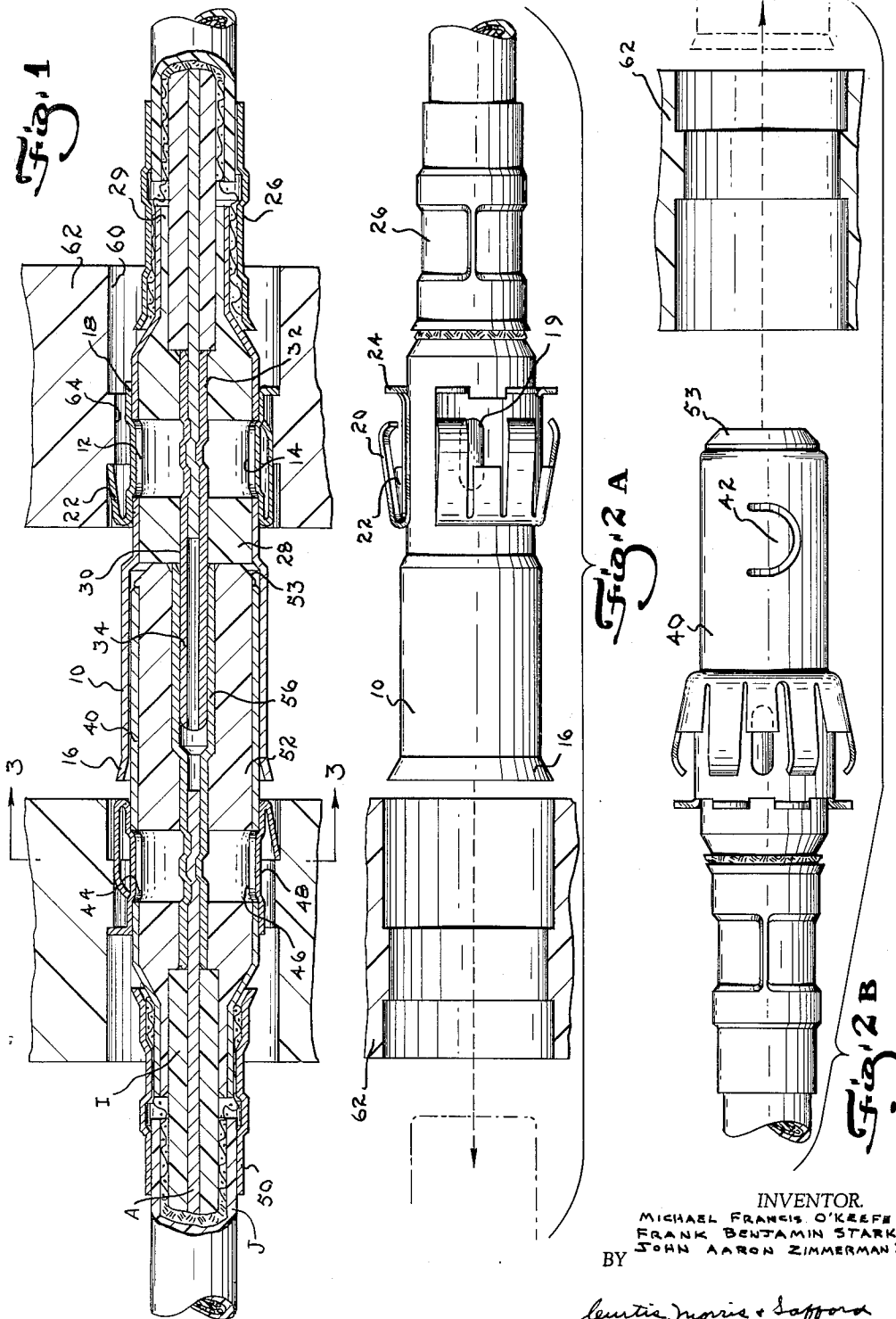
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3,235,834

SHIELDED BRAID PIN AND SOCKET CONNECTOR

Filed Jan. 10, 1964

4 Sheets-Sheet 1



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SHIELDED BRAID PIN AND SOCKET CONNECTOR

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4 Sheets-Sheet 2

Fig. 8

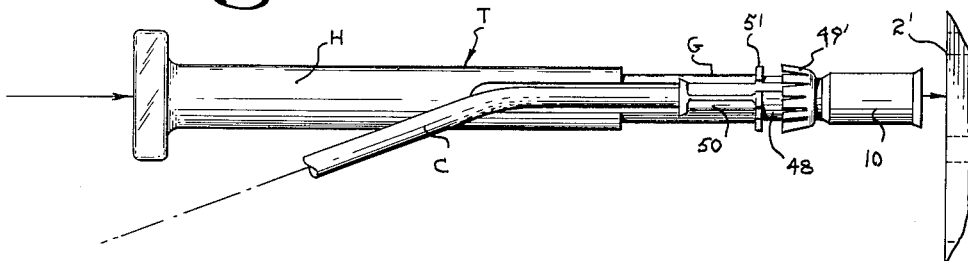


Fig. 9

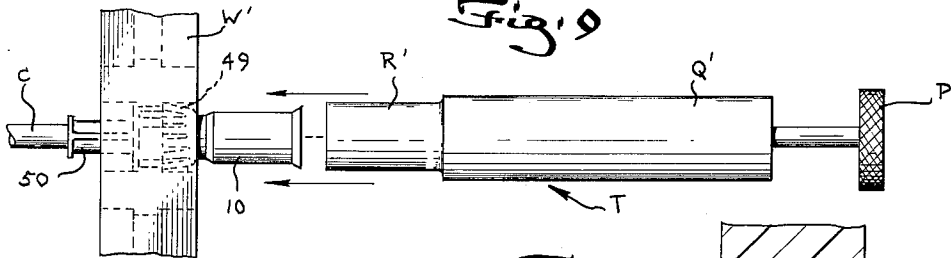


Fig. 10

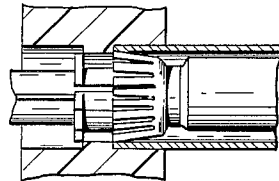


Fig. 11

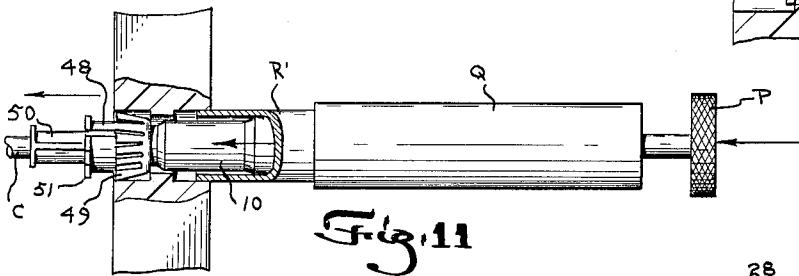
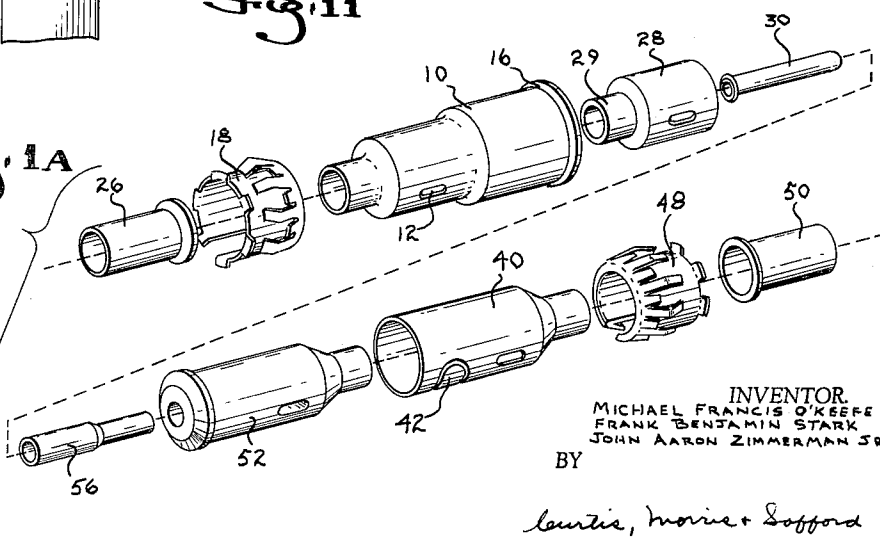


Fig. 1A



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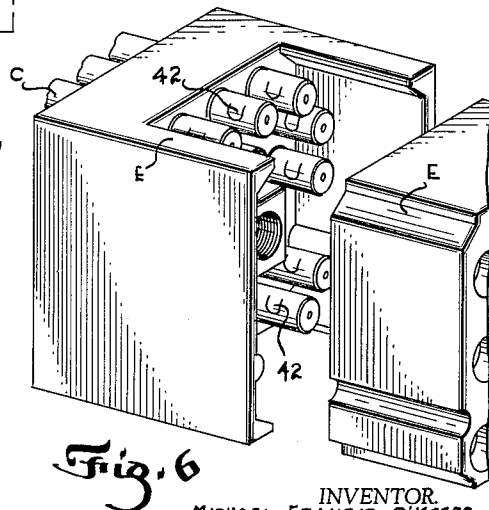
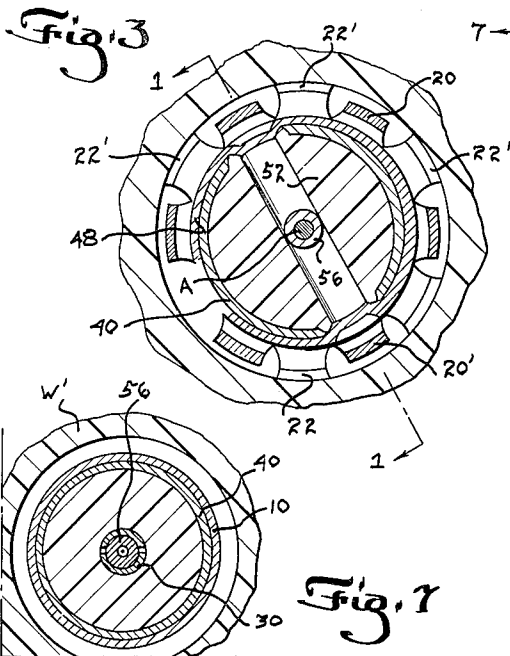
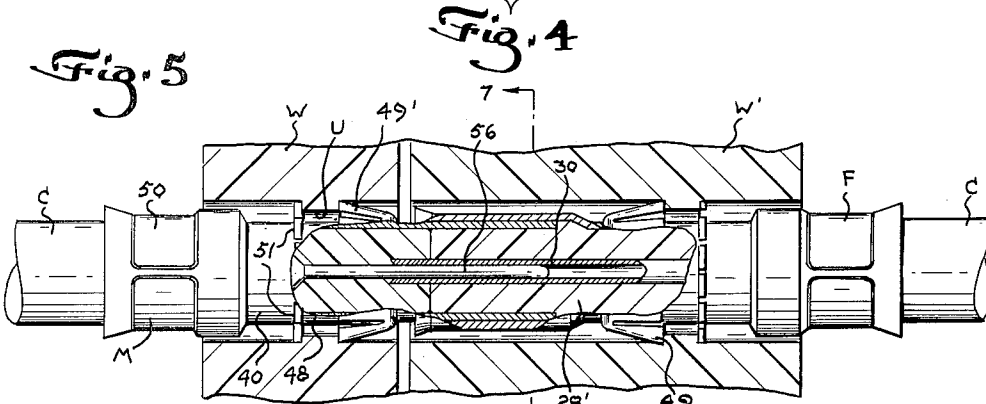
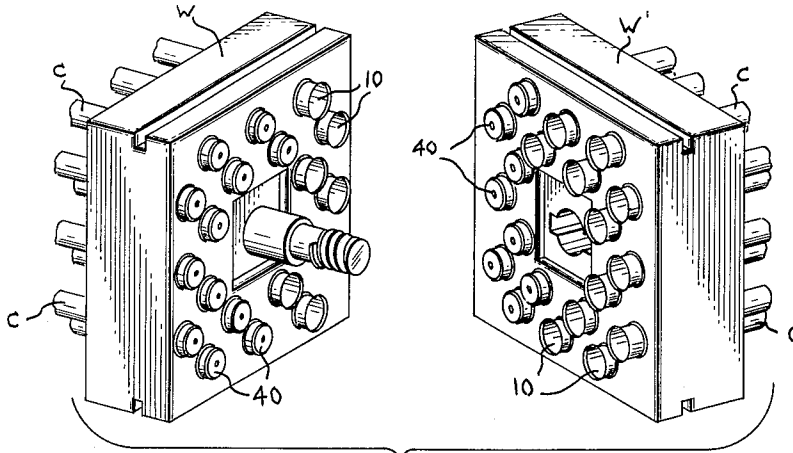
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SHIELDED BRAID PIN AND SOCKET CONNECTOR

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4 Sheets-Sheet 3



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SHIELDED BRAID PIN AND SOCKET CONNECTOR

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4 Sheets-Sheet 4

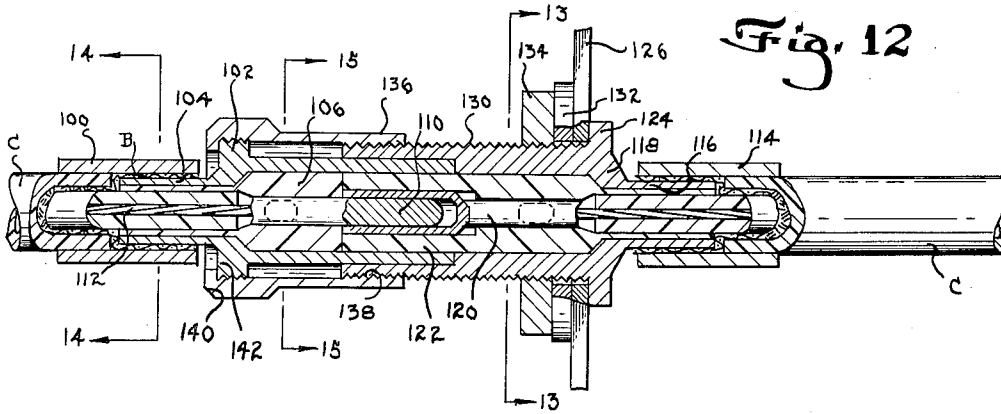


Fig. 12

Fig. 13

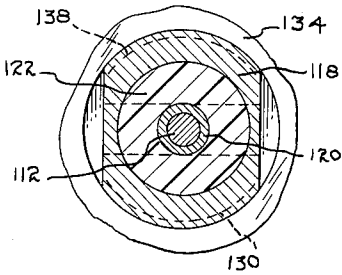


Fig. 14

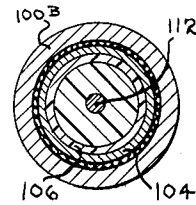
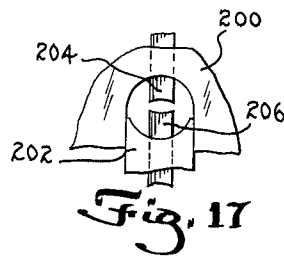
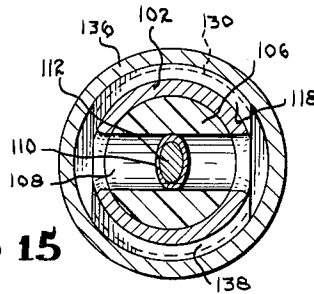


Fig. 15



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3,235,834

SHIELDED BRAID PIN AND SOCKET CONNECTOR

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6 Claims. (Cl. 339-177)

This application is a continuation-in-part of our earlier filed application, Serial No. 77,114 filed December 20, 1960, and now abandoned.

Electrical conductors for special applications are frequently designed to preclude interference from outside sources with the signal on the conductor. This is particularly true in cables transmitting R.F. energy, communication wire, TV cable, radio, etc., wherein distortion of the signal will destroy the intelligibility of the message. A common practice in overcoming this problem is the use of shielded wire. This wire commonly comprises an inner central conductor adapted to carry the signal, surrounded by insulating material which, in turn, is surrounded by a metallic braided material. Any interference or static will be screened out by the outer metallic braid, and thus the central conductive core will not brook interference.

Another type of similar cable is that commonly called "coaxial cable" and which incorporates the advantages of shielded wire, but which, through careful selection of the material and specialized construction, has an inherent and controllable electrical impedance characteristic. This characteristic is utilized in high-frequency circuits and becomes a critical part of the equipment.

It is an object of this invention to provide a means for joining the length of such conductors in a fashion whereby they can easily be connected and disconnected. It is also an object of this invention to provide a means for joining a plurality of shielded conductors. Whereby the central core of the one conductor is joined to the central core of the other, simultaneously the outer metallic sheathing of the first conductor is joined to the outer metallic sheathing of the second conductor.

Another object of this invention is to provide a juncture of the type whereby the connectors preserve the fidelity of the signal by screening out outside signals through the connector portion.

It is also an object of this invention to maintain, through careful design considerations, a suitable control of the connector inherent impedance.

Also, it is an object of this invention to make such a connection in a fashion whereby the connector is secured to the central core and the outer metallic braid at the same time by use of one crimped connection.

It is also an object of this invention to provide a plurality of connectors which may be housed in a polarized block and joined to a mating block of identical conductors.

Other objects and attainments of the present invention will become apparent to those skilled in the art upon a reading of the following detailed description when taken in conjunction with the drawings in which there are shown and described illustrative embodiments of the invention; it is to be understood, however, that these embodiments are not intended to be exhaustive nor limiting of the invention but are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify it in various forms, each as may be best suited to the conditions of a particular use.

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In the drawings:

FIGURE 1 is a cross-sectional view taken through plane 1-1 of FIGURE 3, showing one embodiment of a device incorporating the principles of this patent application;

FIGURE 1A is an exploded view of the device shown in FIGURE 1;

FIGURE 2A is a view of one of the connector members of FIGURE 1 adapted to be inserted into a connector block;

FIGURE 2B is a side view of a pair of connector members adapted to be inserted into a block;

FIGURE 3 is a sectional view taken through plane 3-3 of FIGURE 1;

FIGURE 4 is a perspective view of a pair of open blocks embodying the connectors shown in FIGURES 1-3;

FIGURE 5 is a sectional view similar to FIGURE 1 illustrating a second embodiment of a device employing the principles of the invention;

FIGURE 6 is a perspective view of a pair of mating blocks having a plurality of the connectors of FIGURE 5 positioned therein and polarized;

FIGURE 7 is a sectional view taken through plane 7-7 of FIGURE 5;

FIGURE 8 illustrates a device for inserting the connectors into the block;

FIGURES 9-11 illustrate a device for extracting the connectors from the block;

FIGURE 12 is an illustration of a third species of this invention;

FIGURES 13-15 are sectional views taken through planes 13-13, 14-14 and 15-15, respectively, of FIGURE 12;

FIGURE 16 illustrates a set of dies useful in crimping the connectors onto the conductors; and

FIGURE 17 is a sectional view taken along plane 17-17 showing the dies of FIGURE 16 in connector-crimping position.

As shown in the drawings, FIGURES 1 and 1A illustrate the connector assembly which includes a female shell member 10. This shell is generally cylindrical and tapers from a large diameter portion at one end to an intermediate diameter portion in the center, and then to a small diameter portion at the opposite end. The intermediate center diameter portion has a port hole 12 and an opposing port hole 14 on the opposite side. The large diameter portion has a lip or flange member 16 at the free end. A panel mount 18, comprising a split ring having an indent 19, leaf springs 20 extending from the front end thereof, and another set of leaf springs 22 intermediate the longer leaf springs 20, is adapted to be slipped over the intermediate section of the female shell. A plurality of tabs 24 extend outwardly from the opposite end of the panel mount to form a flange. A dimpled section enters the port holes for retention by inherent spring action.

The end ferrule 26 has two different diameters, the larger diameter being bell-mouthed at one end to receive the small diameter of the female shell.

A spacer insert 28 is adapted to fit inside of the large diameter of the female shell. This spacer insert is comprised of any suitable insulating plastic, and tapers at one end to be received snugly by the female shell 10. In the preferred embodiment the material of spacer 28 extends from the tapered end to form a cylindrical portion 29 having an inner diameter to receive the insulation I of cable C. The insert 28 is preferably continuous and integral from end to end, as better shown in FIGURE 1A, and this operates to prevent moisture or other contaminants from entering the connector. Additionally, the portion 29 serves to better accommodate the insertion of cable and to preclude the accidental insertion of the

strands of jacket J to short against the center conductor A.

In each embodiment there is included a further feature which has been found to improve the electrical characteristics of the connector. As shown in FIGURES 1 and 12, the portion of each shell having the taper between the small diameter portion and the forward portion is positioned relative to the insulation inserts such that the rear end of each connector center contact and the end of the associated primary insulation I of the cable lie thereunder. This has been found to provide less energy loss at the point of electrical discontinuity of diameter change in the shell to accommodate the added diameter of the center contact. A male contact 30 comprises an elongated tubular member having a section 32 to accommodate the central core of the conductor and a forward section 34 to engage the complementary member of the opposing connector member.

The male shell 40 is similar to the female shell, except that it only has two diameter sections rather than three. As shown in FIGURE 2B, one section of the large diameter has a U-shaped cut to provide a radial spring member 42. Ports 44 and 46 in the male shell are equivalent of the ports 12 and 14 of the female shell. A panel mount 48, identical to the panel mount 18, is fitted over the male shell 40, and the end ferrule 50 is identical to the end ferrule 26.

Spacer insert 52 corresponds to insert 28, but extends the full length of 40 to protrude from the end thereof as at 53. The portion 53 is beveled as indicated to facilitate easy insertion of 40 within 10, and its extension axially is such that upon engagement of 40 within 10 the face thereof meets and abuts the face of insert 28. The rear portion of 52 includes a sleeve extension identical in structure and function to 29 of insert 28, and the insert 52 is preferably of one piece from end to end, as better shown in FIGURE 1A. The shell 40 includes a male contact member including an elongated tubular pin 56 at one end to receive the conducting member of the wire cable.

In assembling the device, the shielded braid conductor, generally designated "C" (FIGURE 1), has shielding braid B, primary insulation I and an outside jacket J stripped back with the center conductor A exposed. Considering first the female section, the end ferrule 26 is slipped back over the outside jacket J of the braided conductor. The center conductor is disposed centrally of the male contact 32. The insulation I is fitted into the female shell and the small end of the female contact is located exteriorly of the central conductor A. The panel mount 18 can also be slipped back over the outside jacket J behind the end ferrule 26. The end ferrule is then shoved forwardly so that it grips the braid portion between the tapering surface of the female shell and the inner surface on the end ferrule. In this position a pair of dies (FIGURE 16) is impressed upon the assembly so that a small die enters each of the ports 12 and 14 to crimp the female contact 32 onto the conductor. Simultaneously, a part of the die compresses the end ferrule 26 onto the shielded braid to squeeze the braid between the end ferrule 26 and the smallest diameter portion of the female shell 10. After the crimp is made, the panel mount assembly is moved forwardly over the central portion of the female shell so that the detents 19 latch onto the ports 12 and the dimpled section fits into the port holes and remains in place due to inherent spring action.

It is now possible to slip the assembled contact panel mount into an aperture 60 in a board 62 (FIGURE 1). The aperture has an internal section of smaller diameter 64 so that the resilient spring members 22 may contract to slip through and lock the assembly into the board between the short springs 22 and the flanges 24. The long springs 20 tend to bow outwardly to firmly hold the device in position. A tool T, as shown in FIGURE 8, having a ferrule-holding member G and handle H may be used in making the assembly.

The male member is similarly assembled and slipped into an equivalent opening in the opposite board member 62'. It is now possible to join the shielded conductor at one side to the shielded conductor on the other by mating the male and female portions.

As shown in FIGURES 9-11, an extraction tool T', having a spring compressing sleeve R' which is attached to a barrel member Q', is used in removing the connector. A plunger P' assists the operation.

As shown in FIGURE 4, a number of these male/female contacts are inserted into a pair of block members W and W'. The male and female contacts are matched so that when the blocks are brought together, the connectors are oriented to form a connection. The male and female connectors on each block can be staggered so that half of the connectors in a single block is male and the other half is female. A jack screw S located in the center of the one block fits into an aperture having screw threads N in the opposite block. The jack screw is pivotable so that mating the two blocks together and rotating the jack screw will cause the connectors to be drawn together and locked.

A variation of the connector of FIGURE 1 is shown in FIGURE 5. In this embodiment the connector has a spacer insert on the female member only, extending along its length and relieved about its forward end. Also, the spring members are of equal length and bear against the flange in the block to retain the connector therein. Each of the blocks W and W' have male connectors M, as well as female connectors F, respectively, located therein. The male connector has an end ferrule 50 which is crimped onto a braid portion B of a connector C. This secures the braid to a male shell 40 having a central male contact 56 crimped therein. The panel mount member 48 has a series of leaf springs 49', all of equal length, and flanges 51 emanate from the opposite end of the panel mount. Thus, it is seen that the male connector may be inserted into the block and the springs 49' will be retracted when they pass the recessed portion U. Having passed this portion, they will flare out again to retain the connector in the block by means of the cooperation between the leaf springs 49' and the flanges 51 bearing against the shoulders formed by the recessed portion. It is observed that there is a spacer insert in the male shell, as shown at 52 in the prior embodiment which extends over the half of the contact 56, such that with M and F engaged there is no air space left therebetween.

The female connector is identical with the male connector, except that the female contact 30 comprises a hollow split pin rather than a solid cylindrical member, and the spacer insert 28' extends the full length of the female contact 30. Thus, the connection is entirely surrounded by insulation. The connectors F and M both include apertures in the outer shells as well as in the inserts in the same manner as the embodiment of FIGURE 1. The panel mount members are also indented to engage the connector apertures. As shown in FIGURE 6, an embodiment of this type may be set into blocks which are recessed at their jointure (note E). When the blocks are connected together, the block housing completely insulates the connection.

As shown in FIGURES 12-15, another embodiment suitable for connecting to a panel includes an end 100 which is crimped onto the braid connector B and a male shell 102 having a reduced portion 104. The reduced portion fits under the braid so that the end ferrule 100 crimps the braid between itself and the end portion. A spacer insert 106 is located centrally of the male shell 102. This spacer insert includes an aperture 108 (FIGURE 15) which permits crimping through the insert to crimp the central male contact 110 to the central conductor core 112. The female portion has an end ferrule 114 which crimps the braid B to the end portion 116 of a female shell 118. An internal female shell 120 is located within the spacer insert 122. One end of the female

shell 118 has a flange 124 which abuts against a plate or chassis panel 126. The exterior surface of the female shell has a threaded portion 130. A washer 132 abuts the panel 126 on the inside and a lock nut 134 secures the female shell to the panel. The lock nut threads onto the outside surface of the female shell. A locking cylinder 136 is slidable over the male shell and has an inner threaded surface 138. The back end of the locking cylinder has a shoulder 140 which bears against a shoulder 142 on the outside back surface of the male shell. When the male and female contact members are secured together, threading the cylinder 136 onto the female shell pulls the two members into tight engagement and holds them there.

A set of dies for crimping the braid to the connector and simultaneously crimping the central core is shown in FIGURES 16 and 17. A first die 200 bears against the upper surface of the end ferrule and a complementary die 202 is impressed against the lower surface. A second upper die 204 is secured to the first upper die and the die 204 is disposed from the die 200 at a distance equal to the location of the port in the spacing insert. A similar die 206 is secured to the bottom die 202. Thus, when the upper and lower dies 200 and 202 are brought to bear against the end ferrule, the core crimping dies 204 and 206 are simultaneously impressed on the central conductor of the wire. This effects a one-stroke crimping operation to secure the central conductor to its ferrule, as well as securing the braid to the shell. An extension of the outer ferrule provides strain relief at the point where the cable enters the shell. Also, this arrangement locates the conductor crimping dies with respect to the braid crimping dies.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only.

We claim:

1. An improved connector for interconnecting electrical signal cables of the type having a center conductor surrounded by an insulating sheath with an outer metallic braid thereover surrounded by a protective jacket, comprising in combination, a pair of metallic shell members each having rear sleeve extensions which each have a diameter approximating that of the braid of the cable to be interconnected such as to be fitted between cable braid and over the cable insulating sheath with the insulating sheath and center conductor extending within each shell member, a ferrule for each said extension of a diameter to permit said ferrule to be fitted over the cable jacket and crimped inwardly to grip the said cable and force said braid into electrical contact with each extension, each shell member having a forward portion of a diameter such that the shell members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide electrical connection therebetween, a conductive pin member coaxially disposed in forward portions of each shell member, each of said pin members having a bore at one end adapted to receive cable center conductor and be deformed inwardly thereagainst, apertures in each said shell member overlying said pin bores to permit die insertion for deforming said pin members, the pin members having forward portions which are of diameters such that the members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide an electrical connection therebetween, each pin member supported by an insulating member secured to said shell and in form fitting contact with the pin members along a substantial portion proximate said one end, the insulating member of one shell member extending over the entire length of the pin member of the same shell member and the insulating member of the other shell member extending over the length of the associated

pin member less the length of the telescopic engagement whereby air voids within said shell members are minimized, each said insulating member including an integral portion extending along and in contact with the inner surface of said rear extension and beneath the area to be crimped and including a bore adapted to receive and support the insulating sheath of said cable along the length of the extension.

2. An improved connector for interconnecting electrical signal cables of the type having a center conductor surrounded by an insulating sheath with an outer metallic braid thereover surrounded by a protective jacket, comprising in combination, a pair of metallic shell members each having rear sleeve extensions which each have a diameter approximating that of the braid of the cable to be interconnected such as to be fitted between cable braid and over the cable insulating sheath with the insulating sheath and center conductor extending within each shell member, a ferrule for each said extension of a diameter to permit said ferrule to be fitted over the cable jacket and crimped inwardly to grip the said cable and force said braid into electrical contact with each extension, each shell member having a forward portion of a diameter such that the shell members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide electrical connection therebetween, a conductive pin member coaxially disposed in forward portions of each shell member, each of said pin members having a bore at one end adapted to receive cable center conductor and be deformed inwardly thereagainst, apertures in each said shell member overlying said pin bores to permit die insertion for deforming said pin members, the pin members having forward portions which are of diameters such that the members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide an electrical connection therebetween, each pin member supported by an insulating member secured to said shell and in form-fitting contact with the pin members along a substantial portion proximate said one end, the insulating member of one shell member extending over the entire length of the pin member of the same shell member and the insulating member of the other shell member extending over the length of the associated pin member less the length of the telescopic engagement, the insulating members of each shell member further including as an integral portion a sleeve extension beneath the area to be crimped and positioned in and engaging the rear sleeve extension of the shell member along its length whereby air voids within said shell members are minimized, a C-shaped spring member for each shell member with each spring member of a diameter adapted to snap fit over each shell member, each spring member including an inner projection of a configuration to fit within a shell aperture to orient and secure said spring member on said shell member, each spring member including prongs extending radially and adapted to cooperate with projections of insulating blocks for mounting said connectors.

3. An improved connector for interconnecting electrical signal cables of the type having a center conductor surrounded by an insulating sheath with an outer metallic braid thereover surrounded by a protective jacket, comprising in combination, a pair of metallic shell members each having rear sleeve extensions which each have a diameter approximating that of the braid of the cable to be interconnected such as to be fitted between cable braid and over the cable insulating sheath with the insulating sheath and center conductor extending within each shell member, a ferrule for each said extension of a diameter to permit said ferrule to be fitted over the cable jacket and crimped inwardly to grip the said cable and force said braid into electrical contact with each extension, the outer portion of each shell member including threading of the same diameter and there is included a further shell member adapted to extend over both shell members, said further

shell member including internal threading engaging the said shell member threading to hold said shell members together, each shell member having a forward portion of a diameter such that the shell members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide electrical connection therebetween, a conductive pin member coaxially disposed in forward portions of each shell member, each of said pin members having a bore at one end adapted to receive cable center conductor and be deformed inwardly thereagainst, apertures in each said shell member overlying said pin bores to permit die insertion for deforming said pin members, the pin members having forward portions which are of diameters such that the members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide an electrical connection therebetween, each pin member supported by an insulating member secured to said shell and in form fitting contact with the pin members along a substantial portion proximate said one end, the insulating member of one shell member extending over the entire length of the pin member of the same shell member and the insulating member of the other shell member extending over the length of the associated pin member less the length of the telescopic engagement, the insulating members of each shell member further including a sleeve portion extending along the length of the shell rear sleeve extension beneath the area to be crimped and having a bore adapted to receive and support the insulating sheath of the cable along the length of the extension whereby air voids within said shell members are minimized.

4. An improved connector for interconnecting electrical signal cables of the type having a center conductor surrounded by an insulating sheath with an outer metallic braid thereover surrounded by a protective jacket, comprising in combination, a pair of metallic shell members each having rear sleeve extensions which each have a diameter approximating that of the braid of the cable to be interconnected such as to be fitted between cable braid and over the cable insulating sheath with the insulating sheath and conductor extending within said shell member, a ferrule member for each said extension of a diameter to permit said ferrule member to be fitted over the cable jacket and crimped inwardly to grip the said cable and force said braid into electrical contact with each extension, the pair of shell members having forward portions which are of different diameters such that the members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide an electrical connection therebetween, a pair of conductive pin members coaxially disposed in forward portions of each shell member, each of said pin members having a bore at one end adapted to receive a cable center conductor and be deformed inwardly thereagainst, the said shell members having apertures positioned over said bore portions of said pins to accommodate the insertion of dies to deform said pins inwardly, the pin members having forward portions which are of diameters such that the members are adapted to be telescopically engaged one within the other in a sliding frictional fit to provide an electrical connection therebetween, each pin member supported by an insulating member secured to said shell and extending from the outer end of said shell extension along the inner bore of said shell member overlying the said bore of said pin member and in form fitting contact

with the pin members along a portion of such length and in form fitting contact with the insulating sheath of the cable along a substantial portion of the length inserted within the shell member, the insulating member of one shell member extending over the entire length of the pin member of the same shell and the insulating member of the other shell member extending the length of the associated pin member less the length of the telescopic engagement and the insulating members of both shell members extending beneath the area to be crimped whereby air voids are minimized.

5. The connector of claim 4, wherein the said insulating member of each shell is of one piece.

6. In an improved connector assembly for interconnecting electrical signal cables of the type having a center conductor surrounded by an insulating sheath with an outer metallic braid thereover surrounded by a protective jacket, the combination including connector halves comprising relatively thin conductive material shell members each including a forward contact portion, an intermediate portion and a rear sleeve extension of a diameter approximating that of the cable braid, a dielectric insert fitted within each shell member and of a length to extend along a substantial portion of the shell member and of a diameter to be in form-fitting engagement with the inner surface of said shell member along a substantial portion of the insert length, each said insert including a sleeve portion extending along the full length of said shell member extension, a malleable ferrule adapted to be fitted over said shell member extension and crimped inwardly against the outer metallic braid of said cable to terminate said braid to said extension, the said insert sleeve extension extending beneath the area to be crimped and including a first bore adapted to engage and support the insulating sheath of the cable inserted within said shell member and forwardly thereof a second bore of smaller diameter adapted to engage and support a center contact member adapted to receive and be crimped to the cable center conductor, the said insert by the said engagement with the inner surface of the shell member and the engagement with the end of the contact member and the insulating sheath inserted within the shell member operating to seal the end of the pin member and preclude the engagement therewith with any portion of the braid of said cable.

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JOSEPH D. SEERS, *Primary Examiner.*