United States Patent [19]

Krumreich et al.

[11] **3,850,497**

[45] **Nov. 26, 1974**

[54] **CONNECTOR**

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[73] Assignee: **Bell Telephone Laboratories, Incorporated,** Murray Hill, N.J.

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[21] Appl. No.: **346,724**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 232,804, March 8, 1972, abandoned.

[52] **U.S. Cl.**..... **339/126 R,** 339/176 M, 339/221 M, 339/276 T

[51] **Int. Cl.** **H01r 11/08,** H02b 1/02

[58] **Field of Search**..... 339/17 F, 17 L, 17 LM, 339/91, 119 R, 119 L, 125, 126, 128, 107, 176 M, 176 MF, 176 MP, 208, 221, 223, 58, 276; 179/100; 248/27

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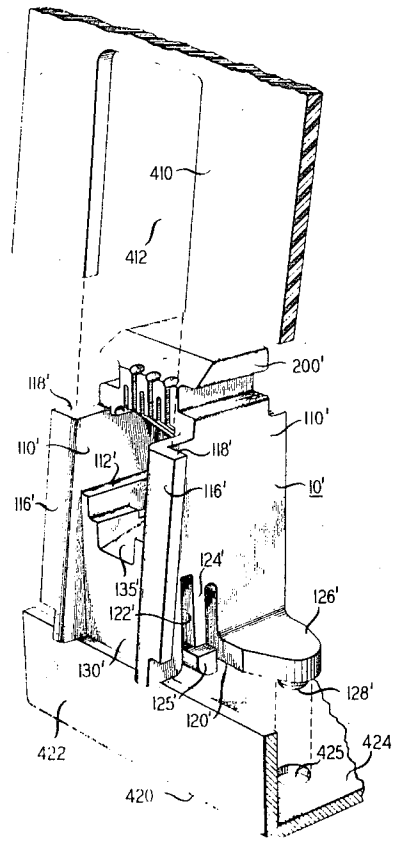
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Assistant Examiner—Lawrence J. Staab
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[57] **ABSTRACT**

A dielectric enclosure having a plug receiving cavity, one wall of which includes a multiplicity of spaced orifices extending generally parallel to the depth of the cavity and a like multiplicity of grooves each of which extends from the front end of an individual orifice to the cavity. Each orifice accommodates a splicing member, the rear portion of which embraces an insulated conductor and the forward portion of which clamps the bared end of the conductor into engagement with the end of a wire spring contact. The other end of each insulated conductor is terminated by a cord tip, and the remainder of each wire spring contact comprises a first portion that is positioned within the associated groove and a second portion that extends rearwardly cantilever fashion within the plug receiving cavity.

12 Claims, 6 Drawing Figures



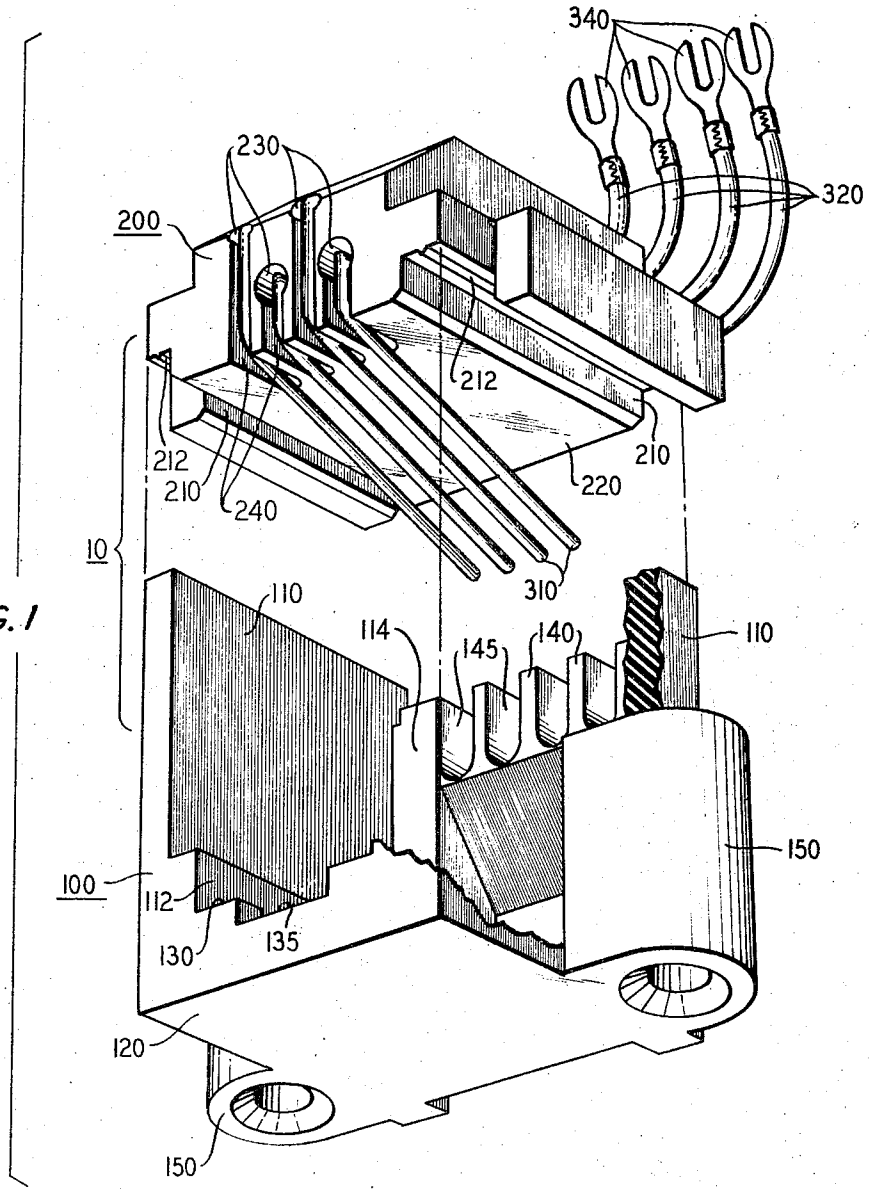

340
320
230
200
212
210
240
212
210
220
10
310
110
114
145
140
110
150
100
112
130
135
120
150

FIG. 1

FIG. 2

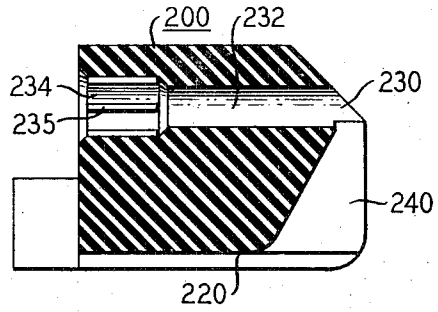


FIG. 3

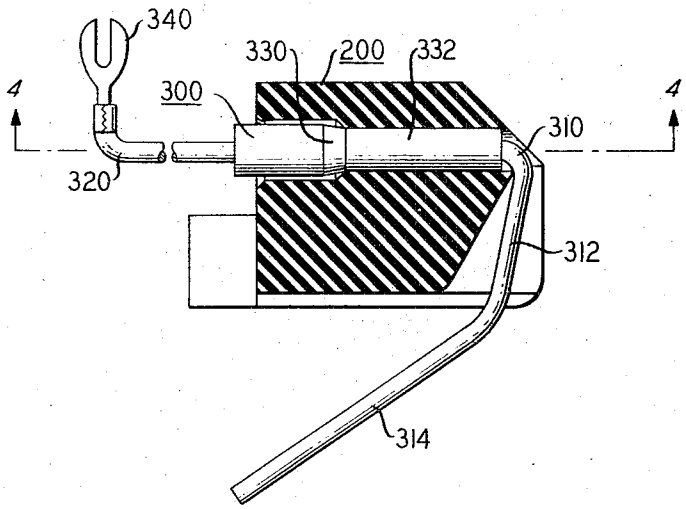


FIG. 4

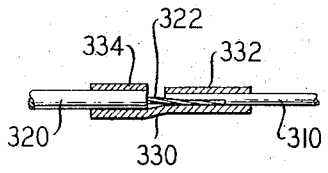


FIG. 6

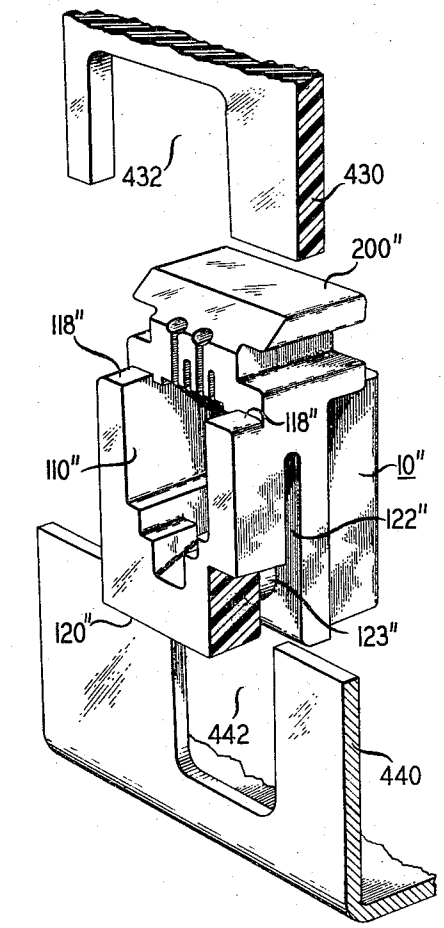
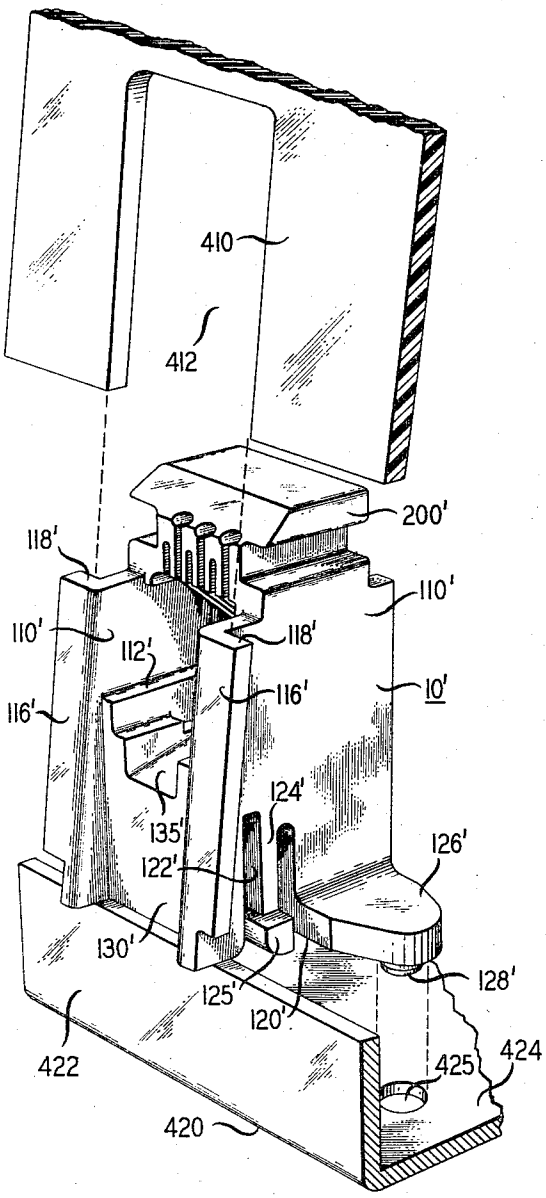

432
430
200"
118"
118"
110"
10"
122"
120"
123"
442
440

FIG. 5


410
412
200'
118'
110'
110'
112'
118'
116'
116'
10'
124'
135'
126'
122'
130'
128'
125'
120'
422
425
424
420

CONNECTOR

CROSS REFERENCE TO RELATED APPLICATION

This application is a continuation-in-part of copending application, Ser. No. 232,804, filed Mar. 8, 1972, and now abandoned.

FIELD OF THE INVENTION

This invention relates to the field of electrical connectors and to subassemblies thereof.

BACKGROUND OF THE INVENTION

The direction of electrical technology today is toward smaller and smaller components, and this is no less true with respect to electrical connectors than it is with respect to other discrete components. However, one major problem in this movement toward miniaturization of connectors is manufacturability. As connectors become smaller, they typically become more difficult and consequently more expensive to manufacture.

SUMMARY OF THE INVENTION

The connector of the present invention lends itself to miniaturization, but in addition, it is designed so that elements of the connector can be assembled by automated machinery.

An illustrative embodiment of the connector comprises a dielectric enclosure having a plug receiving cavity at the front end thereof. One of the walls that defines the cavity includes a multiplicity of orifices that are spaced both from one another and from the cavity and extend from the front to the rear of the enclosure. The front end of this wall also includes a multiplicity of grooves, each of which is exposed to the exterior of the enclosure and extends from an individual orifice to the plug receiving cavity.

Each orifice accommodates a splicing member that is essentially the same size as the orifice. The rear portion of each splicing member embraces an insulated conductor while the forward portion clamps the bared end of the conductor into engagement with the end of a wire spring contact. The other end of each insulated conductor is terminated by a cord tip, and the remainder of each wire spring contact comprises a first portion that is positioned within the associated groove and a second portion that extends rearwardly cantilever fashion within the plug receiving cavity.

One method of assembling the connector is to cut off a preselected length of insulated conductor fed from a reel, and simultaneously strip the insulation from both ends. One bared end is then placed in a strip fed cord tip, while the other bared end is placed in a strip fed splicing member concurrently with a reel fed length of wire spring contact. The cord tip is thereafter crimped to join it to the insulated conductor, and the splicing member is crimped to join the conductor to the wire spring contact, after which the contact is cut to length. A multiplicity of such contact assemblies are formed simultaneously, and the splicing member of each is inserted into one of the orifices with the wire spring contact extending out of the forward end. The assembly is completed by the wire spring contacts being formed to the desired configuration.

DESCRIPTION OF THE DRAWING

FIG. **1** is an exploded perspective showing the connector of this invention;

FIG. **2** is a sectional view showing one of the orifices of the connector;

FIG. **3** is a similar view to FIG. **2** showing a contact assembly positioned within the orifice;

FIG. **4** is a sectional view taken along line **4—4** of FIG. **3** showing the manner in which the splicing member of the contact assembly connects the insulated conductor to the wire spring contact; and

FIG. **5** and **6** are exploded perspective views showing alternative embodiments of the connector of the invention, these embodiments being adapted to be secured in place between two adjacent holding walls.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIG. **1** of the drawing, a connector in accordance with the present invention comprises a dielectric enclosure **10** consisting of a base **100** and a top **200.** The base **100** includes a pair of side walls **110** upstanding from a bottom **120,** and the inside of each side wall has a ledge **112** that extends from the front of the wall to an inwardly extending flange **114** at the rear of the wall. The base **100** further includes a front wall **130** upstanding from the bottom **120** and a rear wall **140** extending between the side walls **110** adjacent to the upper ends thereof. The front wall **130** has a single notch **135** formed in its upper surface while the rear wall **140** has four parallel slots **145** formed in its upper surface. Finally, the base **100** has hollow cylindrical bosses **150** at the sides thereof for accommodating fasteners that secure the connector in place.

The top **200** of the enclosure **10** has a pair of recesses **210** formed in the underside **220** thereof, the recesses being of a size and space so as to accommodate the upper ends of the side walls **110** of the base **100.** In addition, the top **200** has four staggered orifices **230** that are spaced both from one another and from the underside **220.** As shown in FIG. **2,** each orifice **230** extends from the front to the rear of the top **200** and includes a bore portion **232** at the forward end thereof and a counterbore portion **234** at the rear end thereof. Furthermore, the interior of the counterbore portion **234** includes a plurality of spaced axially extending ribs **235.**

Referring now to both FIG. **1** and **2,** the front of the top **200** includes four parallel grooves **240,** each of which extends from the front end of an individual orifice **230** to the underside **220.** The entire length of each groove **240** is exposed to the exterior of the top **200** and the bottom surface of each groove is inclined rearwardly. The spacing between the grooves **240** is the same as the spacing between the slots **145** in the rear wall **140** in the base **100,** and the location of the grooves with respect to the recesses **210** is the same as the location of the slots with respect to the side walls **110.** Consequently, when the top **200** is placed on the base **100,** the grooves **240** are in registration with the slots **145.**

Turning to FIG. **3** and **4,** the connector further includes four contact assemblies **300,** each of which comprises a wire spring contact **310** joined to an insulated lead wire **320** by a splicing member **330.** The wire spring contact **310** is formed from a high tensile strength spring material such as spring temper phos-

phor bronze, while the splicing member **330** is formed from a relatively malleable material such as brass. The splicing member **330** comprises a U-shaped channel having a bottom and two side walls extending in generally the same direction from the bottom, and a first portion **332** at one end of the channel is smaller in cross-section than a second portion **334** at the other end. The larger portion **334** accommodates the insulated lead wire **320** while the smaller portion **332** accommodates the tail end of the wire spring contact **310** and the bared end **322** of the lead wire. The channel when crimped around these elements is formed into a sleeve that tightly grips the elements and prevents them from being displaced with respect to one another. The high pressure direct engagement of the bared end **332** of the lead wire **320** with the wire spring contact **310** provides a good electrical connection therebetween. The other end of the insulated lead wire **320** is terminated by a cord tip **340.**

Referring also to FIG. **2,** each splicing member **330** is accommodated by an individual orifice **230** in the top **200** by first inserting the unformed wire spring contact **310** through the orifice and then inserting the splicing members into the orifice. The crimping portion **332** of each splicing member **330** is slightly smaller than the bore **232** of each orifice **230,** but the crimped portion **334** of each splicing member, while slightly smaller than the counter-bore **234,** is slightly larger than the spacing between the tops of the ribs **235.** Hence, there is an interference fit therebetween, and when each splicing member **330** is inserted into its associated orifice **230,** the ribs **235** clamp it in place.

Once the splicing members **330** are secured within the orifice **230,** each wire spring contact **310** is formed to provide a first portion **312** that is positioned within the associated groove **240,** the groove being slightly wider than the diameter of the contact. In addition, each wire spring contact **310** is formed to provide a second portion **314** that extends rearwardly cantilever fashion beneath the underside **220** of the top **200,** and the second portion is of a length so that when the top is positioned on the base **100** (FIG. **1**), the free end of the contact is accommodated by the corresponding slot **145** in the rear wall **140** of the base. The slots **145** serve to maintain the second portions **314** of the contacts **310** in parallel alignment.

Referring again to FIG. **1,** the top **200** is advantageously joined to the base **100** by ultrasonic bonding, energy directors **212** being provided in the recesses **210** of the top to facilitate this operation. The enclosure **10** thereby formed includes a plug receiving cavity that is bounded by the underside **220** at the top, the side walls **110** at the side, and the upper surfaces of the ledges **112** at the bottom. The notched front wall **130** serves as a catch for the latch of the plug accommodated by the opening, and the flanges **114** serve as stops for limiting the rearward motion of the plug.

An example of a plug adapted to mate with the connector of this invention is disclosed in the copending application Ser. No. 232,803, filed the same day as the present application, now U.S. Pat. No. 3,761,869. Furthermore, when the connector is mated with a plug of this type, the slotted rear wall **140** may be eliminated inasmuch as the plug itself serves to capture the portions **314** of the wire spring contacts **310** and locate them in registration with the contacts of the plug.

Referring to FIGS. **5** and **6,** it is seen that the enclosure of the connector of this invention may take many different shapes and rather than being formed by the joining of multiple parts it may be advantageously formed as a unitary member. Furthermore, rather than being secured in place by means of fasteners, the connector may be simply slipped into place and secured between the edges of two adjacent walls.

Thus, in the embodiment shown in FIG. **5** the enclosure **10'** includes side walls **110'** that extend forward of the front wall **130',** the forward ends of the side walls being inclined and having outwardly extending flanges **116'.** In addition, the upper ends of the side walls **110'** extend forward of the top **200'** to provide ledges **118'.**

The bottom **120'** of the enclosure **10'** includes a slot **122'** that extends the entire width of the enclosure, and the rear wall of the slot comprises a cantilevered vane **124'** that has a forwardly protruding foot **125'** at the lower end and side extremities thereof. In addition, the bottom **120'** includes a laterally extending tab **126'** having a depending stud **128'.**

The connector shown in FIG. **5** is secured between a holding wall **410,** which is inclined at the same angle as the forward ends of side walls **110',** and a holding wall **420** having an upstanding portion **422** and a horizontal portion **424.** The lower end of the holding wall **410** has an opening **412** formed therein, and the sides of the opening are spaced from one another the same distance as and having the same configuration as the external surfaces of the side walls **110'** adjacent to the flanges **116'.** The upstanding portion **422** of the holding wall **420** has a thickness that is slightly less than the width of the slot **122',** while the horizontal portion **424** has a hole **425** therein that conforms to the shape of the stud **128'.**

The connector is secured in place by positioning the enclosure **10'** so that the slot **122'** overlies the upstanding portion **422** of the holding wall **420** and the stud **128'** overlies the hole **425** in the horizontal portion **424.** The connector is then moved downward causing the foot **125'** of the vane **124'** to engage the edge of the upstanding portion **422.** Continued downward movement of the connector results in the rearward deflection of the vane **124'** and the insertion of the upstanding portion **422** into the slot **122'.** This is followed by the insertion of the stud **128'** into the hole **425** as the bottom **120'** of the enclosure **10'** moves into engagement with the horizontal portion **424.**

The positioning of the stud **128'** in the hole **425** serves to properly locate the connector with respect to the holding wall **420** while the deflected vane **124** acts to press the foot **125'** against the upstanding wall portion **422** to provide frictional engagement therewith. With the connector in position, the holding wall **410** is moved downward to place the sides of the opening **412** astride the side walls **110'** immediately behind the flanges **116'** and to place the top of the opening in engagement with the ledges **118'.**

Referring now to FIG. **6,** in this embodiment the enclosure **10''** includes side walls **110''** that extend forward of the top **200''** to provide ledges **118''.** In addition, the bottom **120''** includes a slot **122''** that extends the entire width of the enclosure **10''** and has a tongue **123''** positioned therein.

The connector is secured between holding walls **430** and **440.** The holding wall **430** has an opening **432** in

the lower end thereof of a size and shape to embrace the exterior of the side walls **110''** at the forward end of the enclosure **10''**. The holding wall **440** has an opening **442** in the upper end thereof that is of a size and shape to embrace the tongue **123''**, the wall having a thickness that is slightly less than the width of the slot **122''**.

The connector is secured in place by positioning the enclsoure **10''** so that the slot **122''** overlies the wall **440** and the tongue **123''** is in alignment with the opening **442**. The connector is then moved downward to place the tongue **123'** into the opening **442** and to move the portion of the wall **440** immediately adjacent the opening into the slot **122''**. The wall **430** is thereafter moved downward to place the sides of the opening **432** astride the side walls **110''** and the top of the opening in engagement with the ledges **118''**.

As can be surmised from FIGS. **5** and **6**, the walls **410** and **430** respectively overlap the walls **420** and **440**, and in the usual situation the walls are the sides of a pair of structures that are secured together to form an enclosure for electrical components, the connector serving to provide electrical connection to those components.

Although three embodiments of the invention have been shown and described, it will be understood that these are only illustrative and that various modifications may be made therein without departing from the scope and spirit of this invention as defined in the appended claims.

What is claimed is:

1. A connector comprising:

a dielectric enclosure including a plurality of spaced orifices that extend from the front to the rear of the enclosure, each orifice comprising a bore portion at the forward end thereof and a counter bore portion at the rear end thereof, the enclosure further including a plurality of grooves at the front end thereof, each groove being associated with an individual orifice and extending transversely to the longitudinal axis of that orifice, the grooves being exposed to the exterior of the enclosure; and

a plurality of contact assemblies, each of which comprises a spring contact, an insulated conductor, and a splicing member the rear portion of which embraces the insulated conductor and the forward portion of which clamps a bared end of the conductor to an end of the spring contact, the forward portion of each splicing member being accommodated in the bore portion of an individual orifice and the rear portion being accommodated in the counter bore portion of the orifice, the spring contact extending from the front end of the orifice and including a first portion positioned within the transverse groove associated with the orifice and a second portion extending rearwardly from the first portion.

2. A connector as in claim **1** wherein each spring contact comprises a wire spring contact formed of high tensile strength spring metal and the splicing member comprises a U-shaped channel formed of relatively malleable metal, the rear portion of the splicing member being crimped about the insulated conductor and being larger in cross section than the forward portion which is crimped about the bared end of the conductor and an end of the wire spring contact in such manner as to form a high pressure direct electrical connection between the conductor and the wire spring contact.

3. A connector as in claim **1** wherein the enclosure further includes a plug receiving cavity open to the front of the enclosure, the second portion of the spring contacts extending rearwardly cantilever fashion within the cavity.

4. A connector as in claim **3** wherein the enclosure further includes a slotted wall at the rear of the plug receiving cavity, the free ends of the second portion of each spring contact being accommodated within an individual slot in the slotted wall.

5. A connector as in claim **4** wherein the enclosure comprises a base and a top, the top comprising one wall of the plug receiving cavity and including the orifices in which the contact assemblies are supported, and the base comprising walls defining the remainder of the plug receiving cavity and including the slotted wall.

6. A connector as in claim **5** wherein the base includes a pair of spaced side walls and the top includes a pair of recesses formed in the underside thereof adapted to accommodate the upper ends of the side walls.

7. A connector adapted to be held in place between the edges of a pair of adjacent holding walls, the edge of a first of the walls including an opening the periphery of which is shaped to embrace a portion of the connector, the connector comprising:

a dielectric enclosure having a plug receiving cavity open to the front of the enclosure, a first of the walls defining the plug receiving cavity including a plurality of orifices that extend from the front to the rear of the enclosure, the orifices being spaced both from one another and from the plug receiving cavity, the first wall further including a plurality of grooves at the front end thereof, each groove being associated with an individual orifice and extending transversely to the longitudinal axis of that orifice, the grooves extending to the plug receiving cavity and being exposed to the exterior of the enclosure, the exterior of the enclosure including a ledge engaged by the first holding wall and a slot for accommodating an edge of the second holding wall, the slot having a tongue located there within that is accommodated by a complementary opening in the edge of the second holding wall for locating the connector with respect to the second holding wall; and

a plurality of contact assemblies, each of which comprises a spring contact having a splicing member at one end, the splicing member of each contact assembly being accommodated by an individual orifice, the spring contact extending from the front end of the orifice and including a first portion positioned within the transverse groove associated with the orifice and a second portion extending rearwardly cantilever fashion within the plug receiving opening.

8. A connector adapted to be held in place between the edges of a pair of adjacent holding walls, the edges of a first of the walls including an opening the periphery of which is shaped to embrace a portion of the connector, the connector comprising:

a dielectric enclosure having a plug receiving cavity open to the front of the enclosure, a first of the walls defining the plug receiving cavity including a plurality of orifices that extend from the front to

the rear of the enclosure, the orifices being spaced both from one another and from the plug receiving cavity, the first wall further including a plurality of grooves at the front end thereof, each groove being associated with an individual orifice and extending transversely to the longitudinal axis of that orifice, the grooves extending to the plug receiving cavity and being exposed to the exterior of the enclosure, the exterior of the enclosure including a ledge engaged by the first holding wall and a slot for accommodating an edge of the second holding wall, one of the surfaces defining the slot including a protrusion for providing frictional engagement with the second holding wall; and

a plurality of contact assemblies, each of which comprises a spring contact having a splicing member at one end, the splicing member of each contact assembly being accommodated by an individual orifice, the spring contact extending from the front end of the orifice and including a first portion positioned within the transverse groove associated with the orifice and a second portion extending rearwardly cantilever fashion within the plug receiving opening.

9. A slip-on connector adapted to be secured in place between the edges of a pair of adjacent holding walls, the edge of a first of the holding walls including a shaped opening, the connector comprising an enclosure having a plug receiving cavity that is open to the front of the enclosure and a plurality of contacts that are exposed to the interior of the cavity, the front end of the enclosure including external side surfaces that are spaced from one another the same distance as and have the same configuration as the sides of the opening in the first holding wall, the front end of the enclosure also including a ledge extending on each side of the plug receiving cavity for engagement by the first holding wall, the enclosure further including a slot for accommodating an edge of the second holding wall, the slot having a tongue located therewithin, the tongue being accommodated by a complementary opening in the edge of the second holding wall for locating the connector with respect to the second holding wall.

10. A slip-on connector adapted to be secured in place between the edges of a pair of adjacent holding walls, the edge of a first of the holding walls including a shaped opening, the connector comprising an enclosure having a plug receiving cavity that is open to the front of the enclosure and a plurality of contacts that are exposed to the interior of the cavity, the front end of the enclosure including external side surfaces that are spaced from one another the same distance as and have the same configuration as the sides of the opening in the first holding wall, the front end of the enclosure also including a ledge extending on each side of the plug receiving cavity for engagement by the first holding wall, the enclosure further including a slot for accommodating an edge of the second holding wall, the surfaces defining the slot including a protrusion for providing frictional engagement with the second holding wall.

11. A slip-on connector adapted to be secured in place between the edges of a pair of adjacent holding walls, the edge of a first of the holding walls including a shaped opening, the connector comprising an enclosure including external side surfaces that are spaced from one another the same distance as and have the same configuration as the sides of the opening in the first holding wall, the enclosure also including a ledge for engagement by the first holding wall and a slot for accommodating an edge of the second holding wall, the slot having a tongue located therewithin, the tongue being accommodated by a complementary opening in the edges of the second holding wall.

12. A slip-on connector adapted to be secured in place between the edges of a pair of adjacent holding walls, the edge of a first of the holding walls including a shaped opening, the connector comprising an enclosure including external side surfaces that are spaced from one another the same distance as and have the same configuration as the sides of the opening in the first holding wall, the enclosure also including a ledge for engagement by the first holding wall and a slot for accommodating an edge of the second holding wall, the surfaces defining the slot including a protrusion for providing frictional engagement with the second holding wall.

* * * * *