United States Patent [19]

Deal

[11] **3,861,776**

[45] **Jan. 21, 1975**

[54] **ELECTRICAL CONNECTOR WITH TERMINAL LOCK MEANS**

[75] Inventor: **Robert S. Deal,** Mountain View, Calif.

[73] Assignee: **Multilam Corporation,** Los Altos, Calif.

[22] Filed: **Jan. 15, 1973**

[21] Appl. No.: **323,541**

[52] **U.S. Cl.** ..... **339/74 R,** 339/95 R, 339/256 R

[51] **Int. Cl.** **H01r 13/20**

[58] **Field of Search** ..... 339/74, 95, 256, 258, 253; 174/84 R, 88 R, 94 R

[56] **References Cited**

UNITED STATES PATENTS

3,161,451	12/1964	Neidecker	339/74 R
3,182,281	5/1965	Salz, Sr.	339/95 D
3,453,587	7/1969	Neidecker	339/256 RT

Primary Examiner—Joseph H. McGlynn

[57] **ABSTRACT**

An electrical connector of the type having a tubular array of spaced, angled louvers resiliently connected to a pair of axially spaced, generally circular end bands. The connector is adapted to be inserted into a tubular first terminal and to receive a jack-like second terminal so that the louvers will be in bridging electrical contact with the terminals. The connector has a number of teeth integral with one of the bands for engaging a portion of the second terminal after the latter has been inserted into the connector for holding the second terminal against removal therefrom.

6 Claims, 5 Drawing Figures

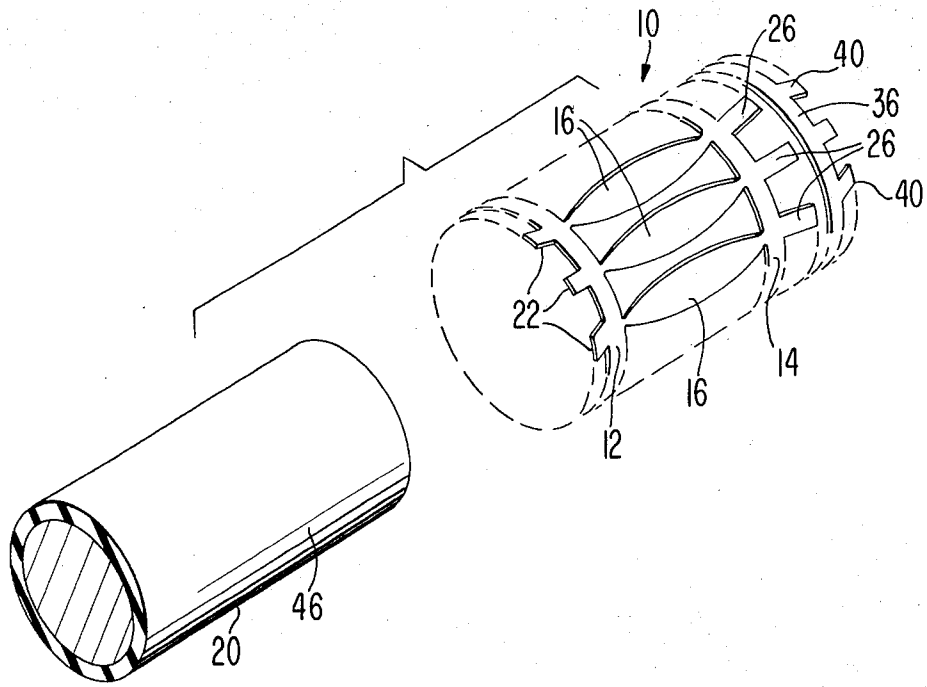

FIG. 1

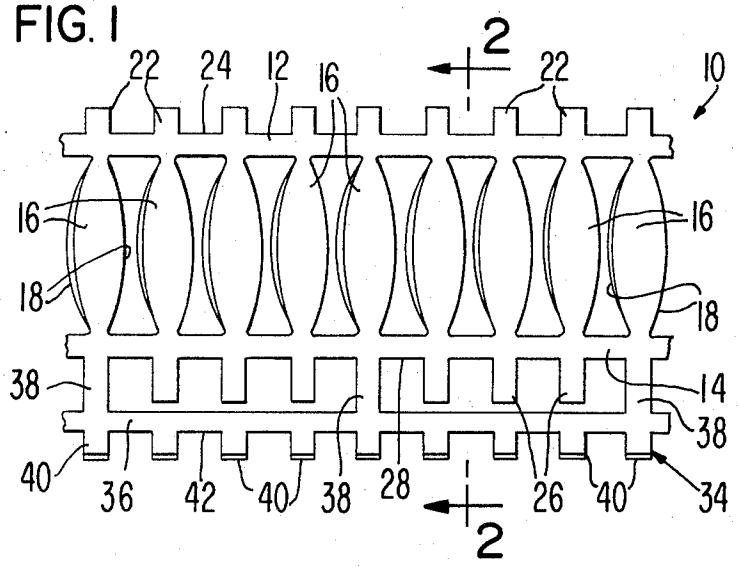

FIG. 2

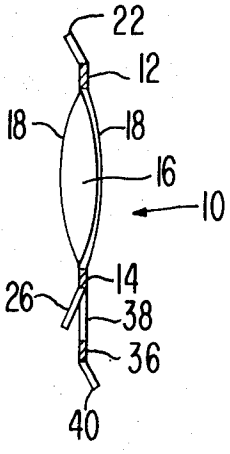

FIG. 3

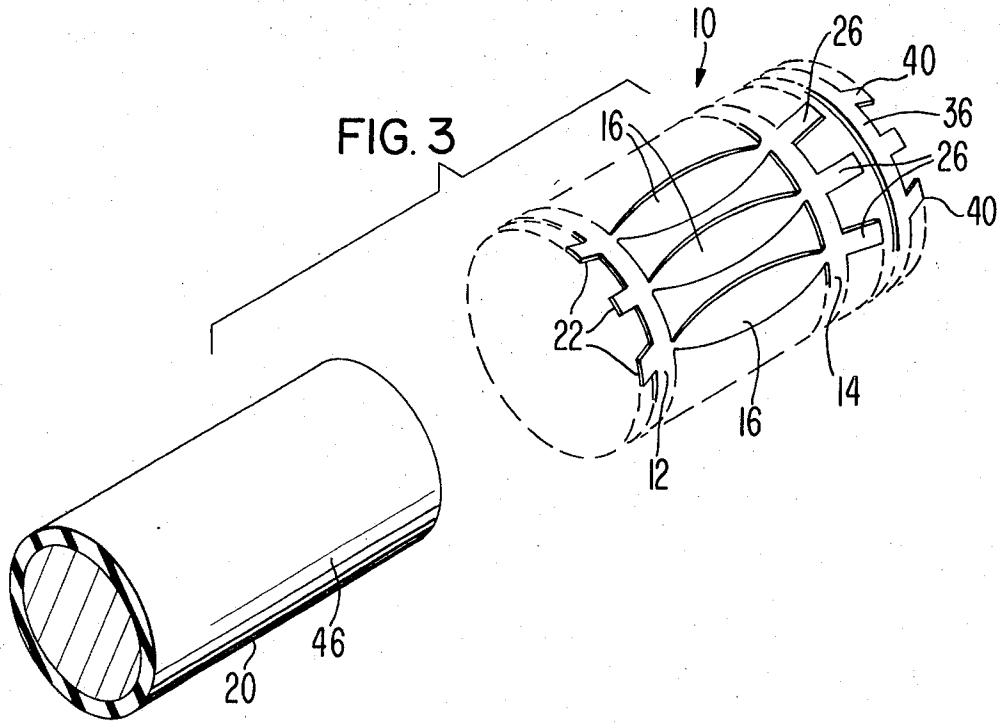

FIG. 4

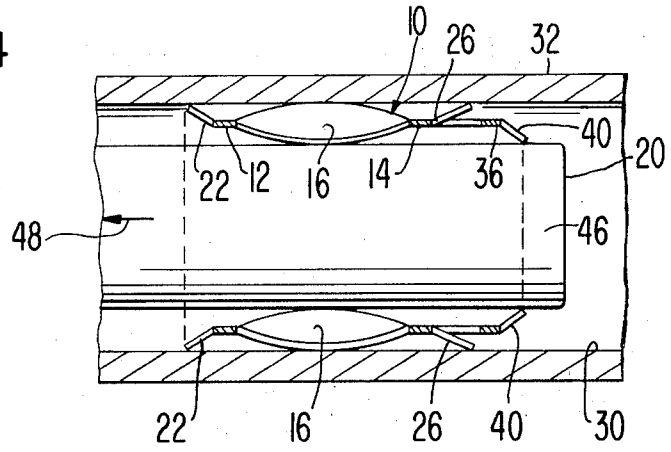
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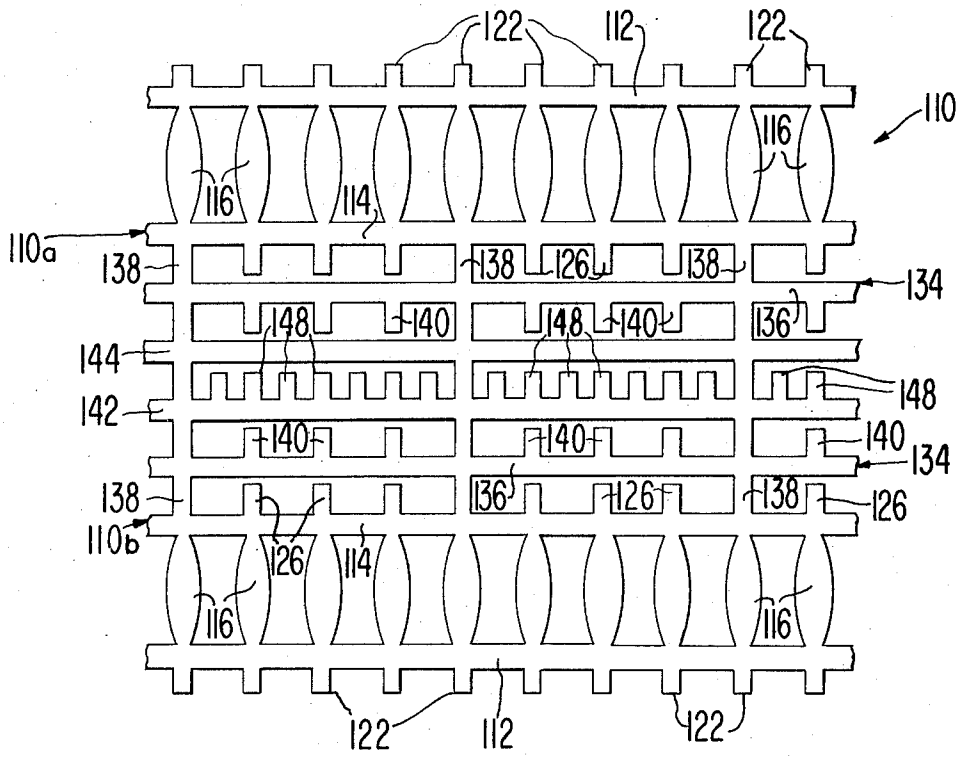
FIG. 5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ELECTRICAL CONNECTOR WITH TERMINAL LOCK MEANS

This invention relates to improvements in devices for enhancing the electrical contact between a pair of electrical terminals and, more particularly, to an electrical connector of the type having a plurality of electrically conducting louvers arranged in a tubular array.

BACKGROUND OF THE PRIOR ART

In U.S. Pat. No. 3,426,587, there is disclosed a tubular electrical conductor comprised of a pair of spaced, generally circular bands between which are disposed a number of spaced, electrically conducting, oblique louvers arranged about the common, central axis of the bands. The connector is adapted to be inserted into a tubular first terminal and to receive a second jack-like terminal. The louvers are adapted to engage both terminals as they resiliently bear against the inner surface of the first terminal and the outer surface of the second terminal. In this way, maximum current transfer between the terminals can be achieved yet the second terminal can be pulled out of the first terminal and reinserted many times.

In some situations, it is desirable that the terminals be permanently connected together. For instance, in the wiring of houses, buildings and the like, it is desirable to have a permanent connection between each wire and a terminal to a junction box. At the present, plastic-covered screw-type connectors are used to lock several spliced wires together. While the conventional screw-type connector has proven satisfactory to some extent, it has certain limitations in that time and effort are required to couple it to a pair of wires and breakage of the plastic cover sometimes occurs.

In U.S. Pat. No. 3,161,451, an electrical connector is disclosed wherein the connector has a number of circumferentially spaced contact springs arranged in a tubular array for making bridging contact between a first, tubular terminal and a second, jack-like terminal. The patent further discloses a releasable holding means removably carried by the first terminal and engageable with the second terminal to releasably hold the latter in the first terminal. However, the holding means, being separate from either terminal, requires assembly time and effort. Moreover, the second terminal must be of a special construction. Specifically, it must be provided with an annular groove for receiving portions of the holding means. Because of its special character, the connector of this patent would be expensive to make and would be limited to a special type of terminal.

SUMMARY OF THE INVENTION

The present invention is directed to an improved electrical connector of the type adapted to be carried in a first, tubular terminal having a plurality of louvers in a tubular array. The connector is adapted for use in receiving one or more second terminals and for permanently holding the same against removal therefrom as the louvers make bridging electrical contact between the terminals. In a preferred embodiment of the invention, the connector is provided with spaced teeth integral with the normally innermost of the two circular bands to which the louvers are connected. The teeth extend inwardly of the tubular array of louvers and downstream with respect to the normal direction of insertion of the second terminal thereinto. Thus, the teeth, when the second terminal has been inserted, will engage and "bite" into the outer surface of the second terminal and prevent its retrograde movement out of the connector thereby holding the second terminal in a substantially permanent operative position.

The present invention has a wide variety of applications. Moreover, a number of second terminals, such as several wires twisted or spliced together, can be held permanently in place in the connector of this invention, yet the louvers of the connector will provide the desired electrical contact between the second terminals and the first terminal in which the connector is mounted.

The primary object of this invention is to provide an improved electrical connector of the type adapted to be mounted in a first, tubular terminal and having a plurality of electrically conductive louvers arranged in a tubular array for receiving a second terminal for making bridging electrical contact between the terminals, wherein the connector is provided with means thereon for permanently holding a second terminal therein to thereby assure a permanent connection between the terminals merely by inserting the second terminal in the connector.

A further object of this invention is to provide a connector of the type described wherein the connector has a plurality of spaced teeth along the innermost, circular edge thereof with the teeth being oriented to grip and hold a terminal against movement out of the array once the terminal has been inserted thereinto so as to permanently maintain the terminal in its normal operative condition in electrical contact with the louvers.

Other objects of this invention will become apparent as the following specification progresses, reference being had to the accompanying drawing for an illustration of the invention.

In the drawings:

FIG. **1** is a side elevational view of a part of one embodiment of the connector of this invention with the connector flattened out and before the same is moved into a configuration in which the louvers thereof form a tubular array;

FIG. **2** is a cross-sectional view taken along line **2—2** of FIG. **1**;

FIG. **3** is a perspective view of the connector in its operative configuration, and illustrating the way in which it receives a jack-like terminal;

FIG. **4** is a cross-sectional view of the connector, showing the way in which the locking teeth thereof engage a terminal therein; and

FIG. **5** is a view similar to FIG. **1**, but showing a second embodiment of the connector.

One embodiment of the electrical connector of this invention is broadly denoted by the numeral **10** and is shown in FIGS. **1–4**. Connector **10** is formed in integral fashion from a sheet of suitable electrically conducting material, such as beryllium copper or the like. Connector **10** is formed in any suitable manner, such as by a stamping process. It includes a pair of spaced bands **12** and **14** to which a number of spaced louvers **16** are coupled in spanning relationship therebetween. Each louver has a pair of opposed, curved sides **18**, the sides being convex so that the end connections of each louver to bands **12** and **14** have reduced widths, thereby rendering the louvers resiliently connected to the bands and capable of twisting or rocking slightly about the longitudinal axis of the louver.

Bands 12 and 14 are adapted to be formed into circular configurations as shown in FIG. 3 so that louvers 16 will be arranged in a tubular array. Moreover, the louvers are formed so that they are oblique to bands 12 and 14 as shown in FIG. 2. Thus, one side 18 of each louver 16 will engage an outer, first, tubular terminal, such as an electrically conducting sleeve and the opposite side 18 of each louver will be in a position to engage the outer surface of a second, jack-like terminal 20 when the latter is inserted within connector 10. Thus, louvers 16 will enhance the electrical contact between the terminals to minimize losses and to optimize the energy transfer therebetween.

Connector 10 is provided with a plurality of spaced tongues 22 integral with and projecting outwardly from the outer side edge 24 of band 12. Similarly, a plurality of spaced tongues 26 are integral with and project outwardly from the outer side edge 28 of band 14. Tongues 22 and 26, when connector 10 is in the configuration of FIG. 3, are inclined with respect to respective bands 12 and 14 as shown in FIG. 2 and are adapted to engage the inner surface 30 of the tubular terminal 32 in which connector 10 is carried. Thus, tongues 22 and 26 provide standoff means to properly position louvers 16 so that first sides 18 thereof properly make electrical contact with inner surface 30.

Device 10 includes lock means 34 thereon adjacent to band 14. Lock means 34 includes a third band 36 integral with band 14 by means of a number of connector elements 38 parallel with and adjacent to tongues 26.

Band 36 has a number of spaced teeth 40 integral therewith and projecting laterally from the outer margin 42 thereof. Teeth 40 are adapted to be formed so that they are inclined with respect to band 36 as shown in FIGS. 2 and 4. Each tooth 40 has an outer edge 44 adapted to engage and thereby "bite" into the outer surface 46 of terminal 20 to hold the latter against movement in the direction of arrow 48 out of connector 10 after the terminal has been inserted thereinto.

In operation, connector 10 is formed into the configuration of FIG. 3, then inserted into an operative position in terminal 32 with first sides 18 of louvers 16 in electrical contact with inner surface 30 of terminal 32. When the connector is in such position, louvers 16 are oblique with respect to the central axis of the connector and tongues 22 and 26 also engage surface 30 as shown in FIG. 4. The opposite sides 18 of louvers 16 thus project into the tubular space surrounded by bands 12 and 14 and thereby in position to engage the outer surface 46 of terminal 20 when the latter is inserted therewithin. Also, teeth 40 are inclined, i.e., they extend into the aforesaid tubular space and downstream with respect to the direction of insertion of terminal 20 into connector 10.

When terminal 20 is inserted in connector 10, teeth 40 engage and "bite" into surface 46 while louvers 16 also engage the same. Teeth 40 are arranged so that they prevent retrograde movement of terminal 20 out of the connector, i.e., in the direction of arrow 48. Thus, terminal 20 is permanently connected to connector 10.

While terminal 20 has been shown as being formed of a single member, it may be formed of several members, such as a pair of wires twisted and spliced together. In such a case, the spliced wires will have a composite outer surface and louvers 16 and teeth 40 will engage such composite surface in the manner described above with respect to surface 46.

The teachings of the invention can be applied to a connector for insertion into a first, tubular terminal wherein the terminal has a pair of open ends to permit second terminals to be inserted thereinto from opposite ends thereof. To this end, a connector 110 (FIG. 5) is formed by a stamping process or the like from a single sheet of electrically conducting material, the forming operation being such that a unitary construction is achieved which, in effect, comprises two connectors 10 (FIG. 1) integral with each other. Thus, connector 110 includes a first connector section 110A and a second connector section 110B, each section being identical with the other and comprised of a pair of spaced bands 112 and 114, a plurality of spaced louvers 116 spanning the distance between bands 112 and 114 and standoff tongues 122 and 126 on respective bands 112 and 114. Each connector section further includes terminal locking means 134 comprised of a third band 136 provided with spaced, laterally projecting teeth 140 thereon. Each band 136 is connected to the adjacent band 114 by integral connecting elements 138. Also, a pair of central bands 142 and 144 are connected by connecting elements 146 to respective bands 136, band 142 having a plurality of spaced standoff tongues 148 which serve the same purpose as tongues 122 and 126. Thus, tongues 148 support the central portion of connector 110 when the latter is in a tubular configuration and inserted into a tubular open end terminal.

In operation, connector 110 is formed into a tubular configuration with tongues 122, 126 and 148 being inclined with respect to the various circular bands 112, 114, 136, 142 and 144 so that these tongues engage the inner cylindrical surface of a tubular, open end terminal (not shown) such as terminal 32 (FIG. 4). Thus, the various louvers 116 will be in operative positions, similar to those shown with respect to louvers 16 of FIG. 4. Also, teeth 140 on bands 136 will be inclined inwardly and extend toward each other so that they will be in positions to engage and "bite" into terminals inserted into respective connector segments from the corresponding open ends of the tubular terminal in which connector 110 is carried. Thus, teeth 140 will function in the same manner as that described above with respect to teeth 40 (FIG. 4) to prevent retrograde movement of corresponding terminals from connector 110, once the terminals have been inserted thereinto. The terminals are, therefore, permanently coupled to connector 110 yet the various louvers 116 engage the terminals to enhance the electrical contact between the inserted terminals and the tubular terminal surrounding connector 110.

The ends of the terminals in connector sections 110A and 110B can butt up against each other if tongues 148 are not inclined or if the tongues are removed altogether. Moreover, the terminal-engaging teeth 140, like teeth 40 of connector 10, bite deeper into the corresponding terminals when there is a tendency to pull outwardly on the terminals. Thus, they are permanently locked in place in the connector.

The present invention, therefore, provides an improved connector of one-piece construction or enhancing the electrical contact between two terminals yet serves to lock one of the terminals within the tubular array of resilient louvers to provide a permanent connection therebetween. The connector can be of any di-

ameter and can be formed from various types of electrically conducting materials.

I claim:

1. An electrical connector comprising: an electrically conducting, unitary body having a pair of spaced, annular bands having a common central axis, a plurality of spaced louvers integral with the bands and extending therebetween, the louvers being disposed about said central axis, being at respective inclined positions relative to diametral planes passing therethrough, and projecting laterally from the connections thereof with said first bands, whereby one side of each louver will engage the inner surface of a first, tubular terminal in which said body is positioned and the opposite side of each louver will be disposed to engage the outer surface of a second, jack-like terminal inserted into the body; a third annular band spaced from one of said pair of bands and being concentric to said axis; means connecting the third band to said one band; and a plurality of spaced teeth integral with the third band and being inclined relative thereto, the teeth extending inwardly of the third band and in a direction away from said one band, said teeth adapted to engage the outer surface of said second terminal after the latter has been inserted in one direction into said body to thereby lock said second terminal against movement in the opposite direction out of said body.

2. An electrical connector as set forth in claim **1,** wherein said connecting means includes a plurality of spaced connecting elements integral with said one band and said third band.

3. An electrical connector as set forth in claim **1,** wherein said bands, said louvers and said teeth are formed from an initially flat sheet of electrically conducting material, said bands being initially flat and being moved into circular configurations about said axis.

4. An electrical connector as set forth in claim **1,** wherein is provided a second body substantially identical to said first body and being axially spaced therefrom, said second body including a pair of spaced, annular bands concentric to said axis, a plurality of spaced louvers integral with the last-mentioned bands and spanning the distance therebetween, said louvers being disposed about said central axis at an angle relative to diametral planes passing therethrough, a fourth band spaced from the last-mentioned pair of louvers and from the third band a plurality of spaced teeth integral with said fourth band and projecting therefrom at an angle toward the teeth of the third band, and means integral with the third and fourth bands for interconnecting the same and thereby said bodies, each body having an open, terminal-receiving end.

5. An electrical connector as set forth in claim **4,** wherein said interconnecting means comprises a fifth band between and spaced from said third and fourth bands, and means integral with said fifth band for connecting the same to said third and fourth bands.

6. An electrical connector comprising: a tubular, electrically conducting body having a central axis, a pair of spaced, circular bands, and a plurality of spaced, longitudinally extending, outer peripheral louvers disposed about said central axis and spanning the distance between and being integral with said bands, said body adapted to receive a terminal therewithin and said louvers adapted to engage the terminal when the latter is received within said body; and means on the body for holding said terminal received therein against removal therefrom, said holding means including a third band spaced from and coupled to one of said pair of bands near one end of the body, and a plurality of spaced teeth integral with and extending laterally from said third band in a direction away from said pair of bands, said teeth being inclined and disposed for engaging the outer surface of said terminal after the latter has been inserted into the body through the opposite end thereof.

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