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(54) Electrical terminal assembly with terminal lock.

(57) An electrical power connector assembly (12,14) includes a dielectric housing (16,54) having at least one terminal receiving passage (18,60) defined by at least a pair of opposite side walls. At least one elongate terminal (20,62) is positionable in the passage and has a front mating section (30,70), an intermediate section (32,72), and a rear terminating section (34,74). The terminal is unitary and the front mating section includes at least one forwardly extending spring contact arm (30a,84a,84b). The cross sectional area along substantially the entire length between the upwardly extending side wall (32b,72b) and the spring arm (30a,84a,84b) is generally uniform. The intermediate section includes a base (32a,72a) and at least one upwardly extending side wall (32b,72b) integral with the spring arm. A locking shoulder (42,76) is formed in an upper edge of the side wall of the intermediate section of the terminal. A complementarily engageable locking surface (52,78) is formed on an adjacent solid wall of the housing passage. The width (E) of the side wall of the terminal at the locking shoulder is at least substantially equal to that of a juncture (F) of the side wall and the spring contact arm which is integral therewith.

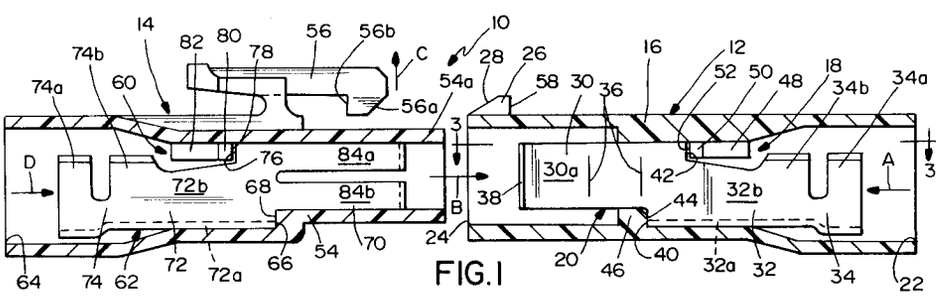

FIG.1

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Field the Invention

This invention generally relates to the art of electrical connectors and, particularly, to an electrical connector assembly which has complementary locking means between a housing and a terminal of the assembly.

Background of the Invention

There are a wide variety of electrical connector assemblies available of the type which are designed to removably connect with complementary mating electrical connectors, electronic components, conductors and the like. The connectors conventionally are provided in the form of male and female connectors having interengaging terminals such as a rigid pin or male terminal interengageable within a flexible socket or female terminal.

A common type of terminal for use in electrical connector assemblies of the type described above, is provided as a stamped and formed sheet metal component which is elongated and has a front mating section, an intermediate section and a rear terminating section. The front mating section includes one or more spring contact arms; the intermediate section may be generally U-shaped with upwardly extending side walls integral with the spring contact arms; and the rear terminating section may have crimping means for clamping onto a conductor, for instance.

One of the features of such electrical connector assemblies is the provision of means for locking the terminals within a housing of the connector assembly. The housing often is integrally molded of dielectric material, such as plastic or the like, and includes terminal receiving passages each defined by at least a pair of side walls. The most common type of locking means between the terminals and the housing involves the use of locking tabs which are stamped out of the sides of the terminals, usually out of the side walls of the intermediate sections of the terminals. In essence, the locking tabs form cantilevered spring arms bent outwardly from the terminal and which snap behind locking surfaces formed in the side walls of the terminal receiving passage in the housing. Of course, there are other types of locking means, such as slits through the terminals side walls of the terminal, detents cut out of the side walls, and the like, for engaging locking surfaces on the housing within the terminal receiving passages.

Such locking tabs are prone to cause various problems. For instance, the locking tabs are susceptible to damage or breaking during handling. The locking tabs reduce the cross-sectional area available through a terminal for conducting electricity from the front mating section to the rear terminating section. The locking tabs also do not provide the strength as might be desired in some applications.

This invention is directed to solving the above problems by providing an improved locking means between electrical terminals and connector housings of the character described above.

Summary of the Invention

An object, therefore, of the invention is to provide a new and improved locking means for holding resilient electrical terminals within a connector housing.

In the exemplary embodiment of the invention, the locking means are disclosed in an electrical connector assembly which includes a dielectric housing having at least one terminal receiving passage defined by at least a pair of opposite side walls. At least one elongate terminal is positionable in the passage and has a front mating section, an intermediate section and a rear terminating section. The terminal is unitary, the front mating section includes forwardly extending spring contact arms, and the intermediate section includes a base and at least one upwardly extending side wall integral with one of the spring arms.

The invention contemplates a locking shoulder on an upper edge of the side wall of the intermediate section of the terminal and means defining a complementarily engageable locking surface on an adjacent continuous solid wall of the housing passage presenting a reduced cross section area transverse to the direction of insertion of the terminal. The width of the side wall of the terminal at the locking shoulder is substantially equal to that of a juncture of the side wall and the spring contact arm which is integral therewith.

In the preferred embodiment of the invention, the terminal is stamped and formed from sheet metal material, and the locking shoulder is formed by a notch stamped out of the upper edge of the side wall of the terminal. The locking surface in the housing passage is provided by an angled boss for camming the side wall of the terminal inwardly and terminating in the locking surface behind which the locking shoulder of the terminal side wall engages. The spring contact arm is of generally uniform width along substantially the entire length thereof. The cross sectional area of the forwardly extending spring arms of the forward mating section and the upwardly extending walls of the intermediate section are consistently equal from the free end of the spring arms to the rear portion of the intermediate section.

Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the ac-

companying drawings.

Brief Description of the Drawings

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings in which like reference numerals identify like elements in the figures and in which:

FIGURE 1 is an axially section through an electrical connector assembly including mating plug and receptacle connectors embodying the concepts of the invention, the connectors being in unmated condition;

FIGURE 2 is a view similar to that of Figure 1, with the connectors in mated condition; and

FIGURE 3 is a horizontal section taken generally along line 3-3 of Figure 1.

Detailed Description of the Preferred Embodiment

Referring to the drawings in greater detail, and first to Figure 1, the invention is illustrated in an electrical connector assembly, generally designated 10, which includes a receptacle connector, generally designated 12, and a plug connector, generally designated 14.

Receptacle connector 12 includes a unitarily molded housing 16 of dielectric material, such as plastic or the like. The housing has one or more through passages, generally designated 18, into which a male terminal, generally designated 20, is inserted in the direction of arrow "A", through an open rear end 22 of passage 18. The passage has an open front end 24 for receiving plug connector 14, as described hereinafter. Housing 16 includes a latch detent 26, having a chamfered front surface 28, for latching the receptacle and plug connectors in mated condition, as seen in Figure 2 and as described hereinafter.

Male terminal 20 is elongated and has a front mating section 30, an intermediate section 32 and a terminating section 34. The terminal is unitary and fabricated of stamped and formed sheet metal material. Terminating section 34 includes a pair of crimp arms 34a at the rear distal end of the terminal and a second pair of crimp arms 34b forwardly of crimp arms 34a. The crimp arms are provided for clamping onto an electronic component, such as an insulated electrical wire. Crimp arms 34a would clamp onto an insulated portion of the wire, and crimp arms 34b would crimp onto a stripped or exposed conductor core of the wire.

Referring to Figure 3 in conjunction with Figure 1, front mating section 30 of male terminal 20 is generally flat and formed by forwardly extending spring contact arms 30a bent, as at 36, so that the spring contact arms are back-to-back to form the flat mating male section of the terminal. The distal ends of spring contact arms 30a are chamfered, as at 38, for guiding the male terminal into a mating female terminal, as described hereinafter.

Intermediate section 32 of male terminal 20 is generally U-shaped and includes a base or bottom wall 32a and a pair of upstanding side walls 32b. The side walls are integral with and form substantial continuations of spring contact arms 30a of front male section 30. As seen best in Figure 1, front mating section 30 (comprising spring contact arms 30a) are offset upwardly of side walls 32b of intermediate section 30 to define a forwardly facing notch 40 immediately in front of bottom wall 32a of the intermediate section, along with a rearwardly facing notch 42 formed in an upper edge of side walls 32b of the intermediate section. When male terminal 20 is inserted into through passage 18 of housing 16 in the direction of arrow "A", lower notch 40 of the terminal eventually abuts against a positioning shoulder 44 defined by a lower rib 46 molded integrally with the housing and projecting into the through passage. As the terminal is inserted into the through passage, side walls 32b of intermediate section 30 are biased inwardly toward each other by angled surfaces 48 of a pair of locking bosses 50 molded integrally with housing 16 and projecting inwardly from opposite side walls of through passage 18. Once the terminal reaches its fully inserted position whereat lower notch 40 abuts against shoulder 44 of the housing, the side walls of the intermediate section snap outwardly into locking engagement behind locking shoulder shoulders 52 in front of bosses 50. Therefore, the terminal is locked against forward or rearward movement by lower notch 40 abutting against shoulder 44 of the housing and upper notches 42 engaging behind locking shoulder 52.

Plug connector 14 is constructed similarly to receptacle connector 12 in that it includes a housing 54 unitarily molded of dielectric material, such as plastic or the like. The housing has a front plug end 54a for insertion into front open end 24 of through passage 18 in receptacle connector housing 16. A latch arm 56 is molded integrally with and fixed to the top of housing 54 for latching behind latch detent 26 of receptacle connector 12. Specifically, when plug connector 14 is inserted into receptacle connector 12 in the direction of arrow "B" (Fig. 1), a chamfered surface 56a on the front end of latch arm 56 engages chamfered surface 28 on latch detent 26. This cams the latch arm upwardly in the direction of arrow "C", whereupon the latch arm rides over the latch detent until a latching hook 56b on the latch arm snaps behind a latching

shoulder 58 formed by latch detent 26. The connectors then will be in a fully latched and mated condition as shown in Figure 2.

Housing 54 of plug connector 14 has a through passage, generally designated 60, into which a female terminal, generally designated 62, is inserted or loaded in the direction of arrow "D" through a rear open end 64 of the through passage. The terminal is inserted into the through passage until a lower notch 66 engages a shoulder 68 of the housing, similar to that described above in relation to receptacle connector 12.

Female terminal 62, like male terminal 20, includes a front mating section 70, an intermediate section 72 and a rear terminating section 74. Intermediate section 72 and rear terminating section 74 are substantially identical to rear terminating section 34 and intermediate section 32 of male terminal 20 and, therefore, will not be described in great detail. Suffice it to say, rear terminating section 74 includes a rear pair of crimp arms 74a and a second pair of crimp arms 74b forward of crimp arms 74a. Intermediate section 72 is generally U-shaped and includes a base or bottom wall 72a and upstanding side walls 72b. Notches 76 are formed in the upper edges of side walls 72b for snapping behind locking shoulders 78 of a pair of bosses 80 molded integrally with and projecting inwardly of the side walls of through passage 60. Angled surfaces 82 bias side walls 72b of the terminals inwardly toward each other when the terminal is inserted into through passage 60, in the direction of arrow "D", until notches 76 in the upper edges of the side walls snap back outwardly behind locking shoulders 78 of bosses 80.

Lastly, front mating section 70 of female terminal 62 is formed by upper and lower pairs of spring contact arms 84a and 84b, respectively. The two spring contact arms of each pair 84a and 84b thereof are spaced apart less than the width of front male mating section 30 of male terminal 20 so that, upon mating of the connectors, and insertion of the male terminal into the female terminal, front male mating section 30 of the male terminal establishes electrical contact with spring contact arms 84a, 84b by spreading the arms outwardly against their own spring bias.

As stated in the "Background", above, one of the problems with electrical terminals of the type shown and described herein, is that the terminals are locked into the housing by means of cut-outs, slits and the like in the metal material of the terminals, such as in side walls 32b of male terminal 20 or side walls 72b of female terminal 62. These cut-outs, slits or the like effectively reduce the cross-sectional area of the terminal, through the intermediate section, and into the spring contact arms of the front mating sections of the terminal. This effectively reduces the cross-sectional area available for conducting electricity from the rear terminating end of the terminal to the front mating end of the terminal. The cut-outs often are used to form cantilevered spring tabs for locking purposes. These tabs are prone to damage or breakage, and the tabs are not as strong as the terminal body or terminal side walls themselves.

With the above problems of the prior art in mind, and looking at the side elevational views of male and female terminals 20 and 62, respectively, in Figures 1 and 2, it can be seen that the cross-sectional area of the side walls of the terminals at locking shoulders 42 and 76 is at least equal to the cross-sectional area of the terminal forwardly thereof, for conducting electricity to and through the front mating sections 30 and 70 of the terminals. In other words, looking at male terminal 20 in Figure 2, the width of side walls 32b of intermediate section 32, at the point of locking shoulder 42, as indicated by double-headed arrow "E", is at least equal to the width of a juncture, as indicated by double-headed arrow "F", where the side wall continues into the forward mating section of the terminal. Furthermore, by providing the locking shoulders by means of a step or notch in the upper edges of the side walls of the intermediate section, when the terminals are inserted into their respective passages in their respective housings, and are cammed inwardly by angled surfaces 48 and 82, the entire "bodies" of the terminal side walls flex inwardly. The entire side walls are not prone to damage or breakage as is prevalent with locking tabs or other cut-out locking means of the prior art.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

Claims

1. In an electrical power connector assembly (12,14) for connecting a plurality of wires to another connector assembly which includes a dielectric housing (16,54) having at least one elongated terminal receiving passage (18,60) defined by at least a pair of opposite side walls, at least one elongate terminal (20,62) positionable in the passage and having a front mating section (30,70) for mating to a complementary terminal of said other connector assembly, an intermediate section (32,72) and a rear terminating section (34,74) adapted to be terminated to said wire, the terminal being unitarily stamped and formed and the front

mating section including at least one forwardly extending spring contact arm (30a,84a,84b), and the intermediate section including a base (32a,72a) and at least one upwardly extending flexible side wall (32b,72b) integral with the spring arm of the front mating section, wherein the improvement comprises a locking shoulder (42,76) in an upper edge of the terminal side wall of the intermediate section generally parallel to said sidewall and means defining a complementarily rigid engageable terminal locking surface (52,78) formed on an adjacent continuous solid wall of the housing passage (18,60) defining an area having a reduced dimension transverse to the direction of insertion of the terminal, whereby, upon insertion of the terminal into its passage an upper portion of said upwardly extending side wall (32b,72b) contacts said reduced dimension area and said sidewall is biased so as to fit through said reduced dimension and return to its unbiased position after passing through said area to lock said terminal to said housing.

2. In an electrical power connector assembly (12,14) for connecting a plurality of wires to another connector assembly which includes a dielectric housing (16,54) having at least one elongated terminal receiving passage (18,60) defined by at least one side wall, at least one elongate terminal (20,62) positionable in the passage and having a front mating section (30,70) for mating to a complementary terminal of said other connector assembly, an intermediate section (32,72) and a rear terminating section (34,74) adapted to be terminated to said wire, the terminal being unitarily stamped and formed and the front mating section including at least one forwardly extending spring contact arm (30a,84a,84b), and the intermediate section including at least one flexible side wall (32b,72b) integral with the spring arm of the front mating section, wherein the improvement comprises a locking shoulder (42,76) in an upper edge of the terminal side wall of the intermediate section generally parallel to said sidewall and means defining a complementarily rigid engageable terminal locking surface (52,78) formed on an adjacent continuous solid side wall of the housing passage (18,60) defining an area having a reduced dimension transverse to the dimension of insertion of the terminal,

whereby upon insertion of the terminal into its passage an upper portion of said upwardly extending side wall (32b,72b) contacts said reduced dimension area and said sidewall is biased so as to fit through said reduced dimension area and return to its unbiased position after passing through said area to lock said terminal to said housing.

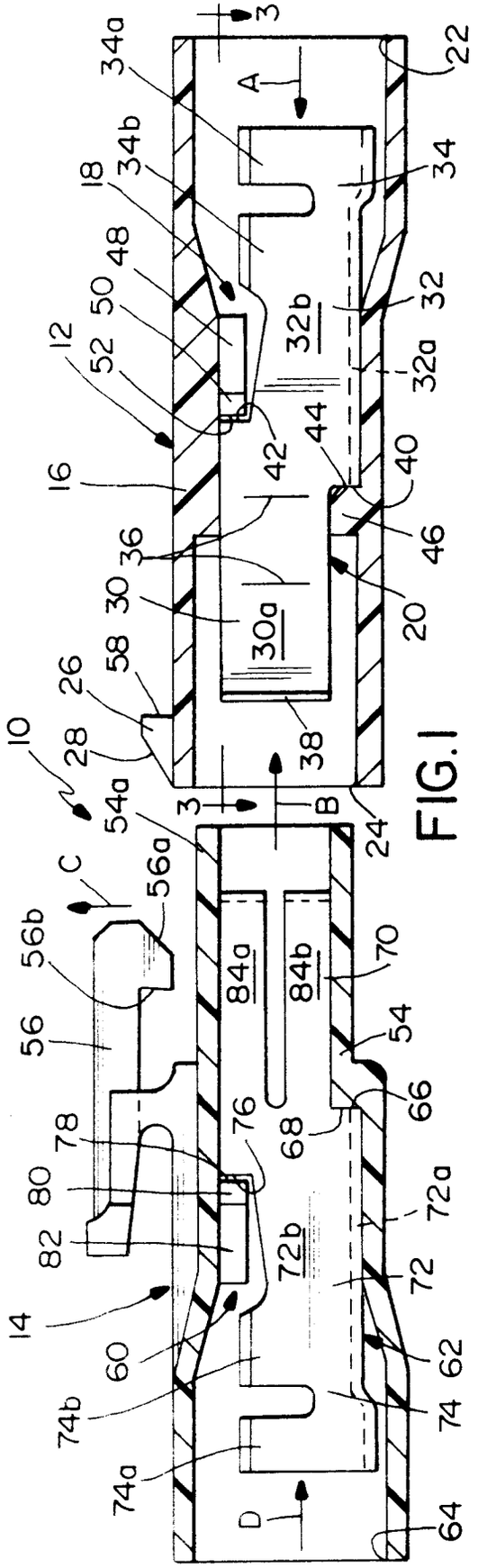
3. In an electrical connector as set forth in claim 2, wherein said terminal is stamped and formed of sheet metal material, and said locking shoulder (42,76) comprises a notch stamped out of the upper edge of the side wall (32b,72b) of the terminal.

4. In an electrical connector as set forth in claim 2, wherein said locking surface comprises an angled boss (42,48,80,82) for camming the side wall of the terminal inwardly and terminating in said locking surface behind which said locking shoulder of the terminal side wall engages.

5. In an electrical connector as set forth in claim 4, wherein said terminal is stamped and formed of sheet metal material, and said locking shoulder (42,76) comprises a notch stamped out of the upper edge of the side wall (32b,72b) of the terminal.

6. In an electrical connector as set forth in claim 2, wherein said spring contact arm (30a) and said upwardly extending side wall (32b,72b) of the intermediate section have a generally uniform cross sectional area along substantially the entire length thereof.

7. In an electrical connector as set forth in claim 6, wherein said terminal is stamped and formed of sheet metal material, and said locking shoulder (42,76) comprises a notch stamped out of the upper edge of the side wall (32b,72b) of the terminal.


34a
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34b
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52
32b
32
32a
42
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30a
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B
24
54a
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C
56b
84a
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70
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62
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74
74a
D
64

FIG.1

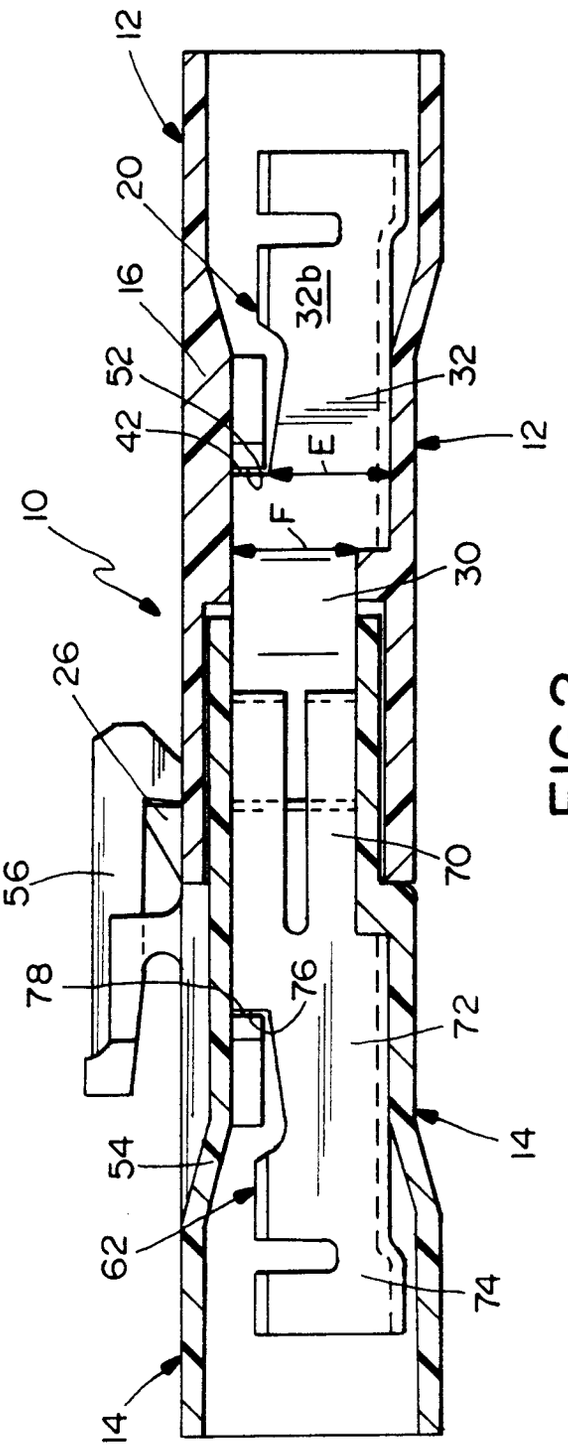
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FIG.2

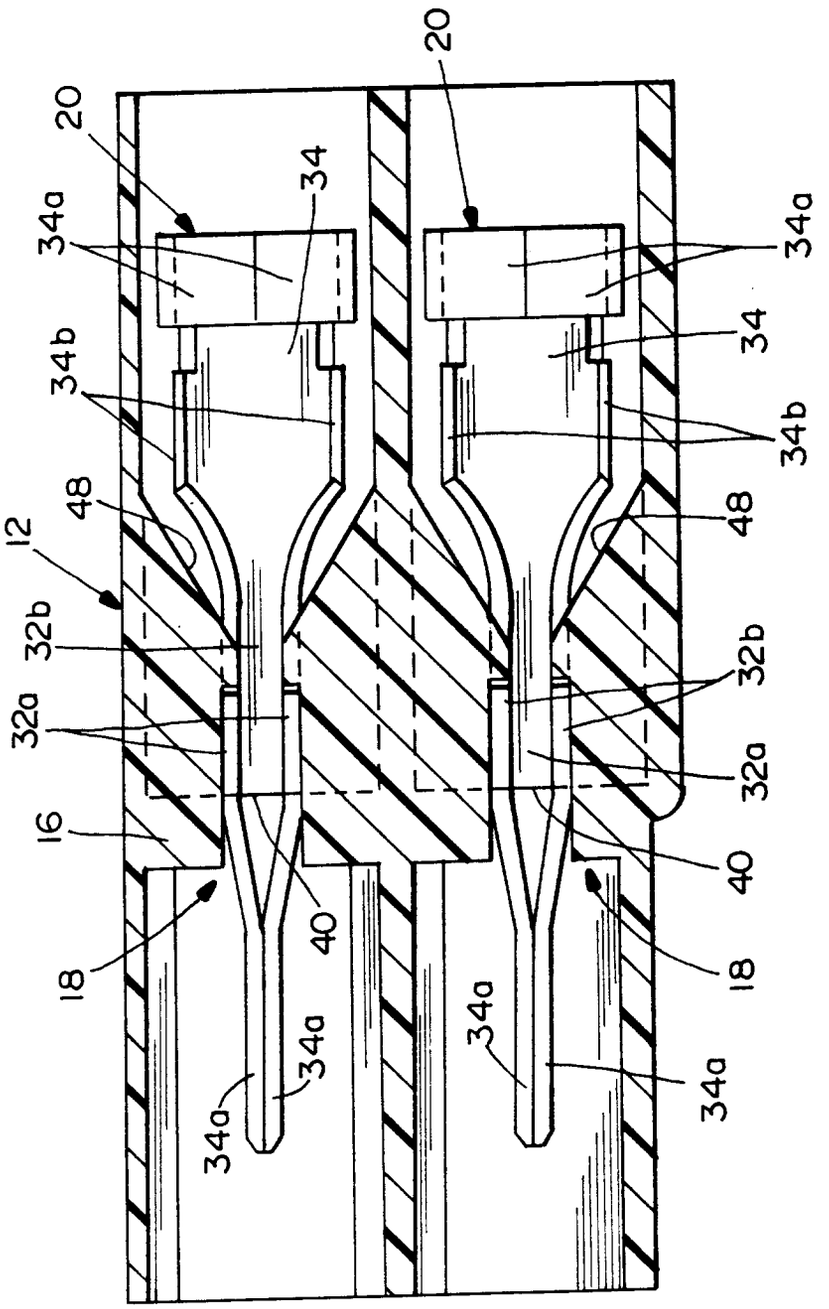
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FIG.3