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(54) Electrical terminals

(57) An electrical terminal assembly (10) includes a male electrical terminal (14) having a forward contact end (24) with a given cross-sectional dimension. An interference section (26) is disposed rearwardly of the forward contact end and has a cross-sectional dimension greater than that of the forward contact end. At least a portion of only the forward contact end (24) of the male terminal is selectively plated with a conductive material. A female terminal (12) has a forward mating end (20) for establishing a tight interference fit with the interference section (26) of the male terminal (14). The female terminal (12) has a contact section (22) rearwardly of the forward mating end (20) for receiving the forward contact end (24) of the male terminal (14) with a minimal interference fit.

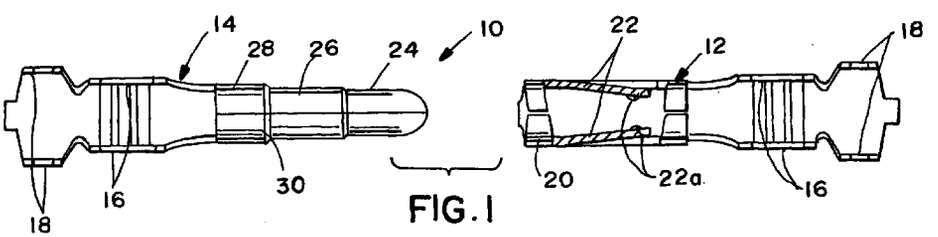

FIG. 1

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Description

Field of the Invention

[0001] This invention generally relates to the art of electrical connections and, particularly, to an electrical terminal assembly.

Background of the Invention

[0002] Generally, an electrical connector typically includes an insulating or dielectric housing mounting one or more conductive terminals, such that the connector is mateable with a complementary mating connector or other connecting device. In turn, the terminals of the connector are engageable with the terminals of the complementary mating connector or other connecting device. The terminals of the connectors are terminated to a variety of electrical components which are to be connected, such as electrical wires, flexible circuits, printed circuit boards or the like.

[0003] The terminals of electrical connectors can take a wide variety of configurations. For instance, a female terminal typically has a socket or receptacle for receiving a pin contact or male terminal. The male and female terminals are telescoped to establish an electrical connection therebetween. There often is a balancing between a desire for a good, positive electrical connection between the mating terminals and a desire to minimize the insertion forces involved in mating the terminals. In other words, if a pair of mating terminals have a high degree of interference fit therebetween, the electrical connection is very positive. On the other hand, the high interference fit results in high insertion or mating forces and, when a connector has an increased number of mating terminals, the total insertion forces may be undesirably high.

[0004] Another problem in designing electrical terminals of the character described arises when it is desirable to plate the contacting portions or surfaces of the terminals with a highly conductive plating material to increase the conductivity between the terminals. When a male terminal is mated with a female terminal, the interference or friction fit therebetween has a tendency to scrape the plating material off of the contacting portions of the terminals. In order to alleviate this problem, more expensive plating can be used which reduces the frictional forces. For instance, while a tin-based plating might be adequate to establish increased conductivity, tin is a soft material and is prone to be easily scraped off of the terminal. A harder plating material, such as gold or palladium/nickel, can be used, but these plating materials add considerably to the costs of the terminals. Lubricants also have been used to reduce the frictional forces, but the application of lubricants also adds considerable costs by adding fabrication steps, and the lubricant can evaporate or become solidified and lose its lubricating properties.

[0005] The present invention is directed to solving this myriad of problems in an electrical terminal assembly which has various sections to control the insertion forces between the mating terminals, and with only portions of the terminals plated that have minimal interference or friction fits therebetween.

Summary of the Invention

[0006] An object, therefore, of the invention is to provide a new and improved terminal assembly, including a male electrical terminal, of the character described.

[0007] In the exemplary embodiment of the invention, the electrical terminal assembly is shown to include a female terminal having a forward mating end of a given cross-sectional dimension. The female terminal has a contact section rearwardly of the forward mating end, the contact section having a cross-sectional dimension smaller than that of the forward mating end. As disclosed herein, the forward mating end is generally cylindrical, and the contact section is formed by a pair of flexible contact arms on diametrically opposite sides of the female terminal.

[0008] A male terminal has a forward contact end of a given cross-sectional dimension and which is adapted for engagement within the contact section of the female terminal. The male terminal has an interference section rearwardly of the forward contact end, the interference section having a cross-sectional dimension greater than that of the forward contact end for establishing an interference fit within the forward mating end of the female terminal. As disclosed herein, the forward contact end and the interference section of the male terminal are generally cylindrical. The invention contemplates that at least a portion of only the forward contact end of the male terminal be plated with a conductive material.

[0009] By plating only the forward contact end of the male terminal, the interference section rearwardly of the forward contact end can have a high interference fit with the forward mating end of the female terminal without creating a problem of scraping the plating material off of the male terminal. In other words, the interference fit between the plated forward contact end of the male terminal and the contact section of the female terminal can be considerably less than the interference fit between the interference section of the male terminal and the forward mating end of the female terminal.

[0010] Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of the Drawings

[0011] 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 under-

stood 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 a top plan view of an electrical terminal assembly according to the invention, including a male terminal and a female terminal in unmated condition, and with a portion of the female terminal broken away to facilitate the illustration;
FIGURE 2 is a side elevational view of the terminal assembly of Figure 1, again in unmated condition;
FIGURE 3 is a side elevational view of the assembly, with a section through the female terminal, and with the terminals in mated condition;
FIGURE 4 is a top plan view of the terminals in mated condition, with a section through the telescoped area of the terminals;
FIGURE 5 is a vertical section taken generally along line 5-5 of Figure 3; and
FIGURE 6 is a vertical section taken generally along line 6-6 of Figure 3.

Detailed Description of the Preferred Embodiment

[0012] Referring to the drawings in greater detail, and first to Figures 1 and 2, an electrical terminal assembly, generally designated 10, is shown according to the invention. The assembly includes a female terminal, generally designated 12, and a male terminal, generally designated 14. Each of the terminals includes two pairs of crimp arms 16 and 18. Crimp arms 16 are adapted for clamping onto the conductors of a respective electrical cable, and crimp arms 18 are adapted for clamping onto the outer insulating cladding of the cable to provide strain relief therefore.

[0013] Female terminal 12 has a forward, generally cylindrical mating end 20 of a given cross-sectional dimension or diameter. Generally, a contact section is provided rearwardly of forward mating end 20 and having a cross-sectional dimension smaller than that of the forward mating end. Specifically, a pair of flexible cantilevered contact arms 22 define the contact section of the female terminal. Distal ends 22a of the flexible contact arms define contact portions which engage the male terminal, as described hereinafter. In essence, the distance between distal ends 22a of flexible contact arms 22 define the cross-sectional dimension of the contact section which is less than the cross-sectional dimension or diameter of forward mating end 20. Female contact 12 is stamped and formed of conductive sheet metal material, and the inside surfaces of distal ends 22a of flexible contact arms 22 can be plated with a highly conductive plating material.

[0014] Male terminal 14 includes a forward contact end 24, an interference section 26 rearwardly of the forward contact end, and a stop section 28 rearwardly of the interference section. The male terminal is stamped and formed of conductive sheet metal material and each of the forward contact end 24, interference section 26 and stop section 28 are generally cylindrical. As can be seen clearly in Figures 1 and 2, interference section 26 has a cross-sectional dimension or diameter greater than that of forward contact end 24, and stop section 28 has a cross-sectional dimension or diameter greater than that of the interference section. For mating purposes described hereinafter, the different diameters between interference section 26 and stop section 28 defines a stop shoulder 30 therebetween, circumferentially about the male terminal.

[0015] Figures 3 and 4 show female terminal 12 and male terminal 14 in mated condition. When mated, forward contact end 24 of the male terminal engages distal ends 22a of flexible contact arms 22 of the female terminal, and interference section 26 of the male terminal establishes an interference or friction fit within forward mating end 20 of the female terminal. Stop section 28 of the male terminal has a greater diameter than contact end 20 of the female terminal, so that stop shoulder 30 of the male terminal abuts against the forward end of the female terminal to define the limit position of insertion or mating between the terminals.

[0016] The invention contemplates that at least a portion of only the forward contact end 24 of male terminal 14 be selectively plated with a conductive material to increase the conductivity between the mating terminals. Although it is contemplated that at least a portion of contact end 24 be selectively plated, the entire forward contact end can be plated so that the terminals can be omni-directionally mated.

[0017] By selectively plating only the forward contact end 24 of the male terminal, an interference or friction fit between interference section 26 of the male terminal and forward mating end 20 of the female terminal can be as high as is desired or practical, without having the plating on contact end 24 of the male terminal scraped off of the terminal during mating. This can be seen in comparing Figures 5 and 6. It can be seen in Figure 5 that forward mating end 24 of male terminal 14 is spaced inwardly from the interior of the female terminal, except for engagement with distal ends 22a of flexible contact arms 22 of female terminal 12. These engaging forces can be considerably less than the interference fit between interference section 26 of the male terminal and mating end 20 of the female terminal as is shown in Figure 6. With this unique structural combination, the insertion forces operating between the terminals during mating can be controlled or varied as desired, without regard to the highly conductive plated portions of the terminals which, in essence, are remote or divorced from the interference portions of the terminals.

[0018] 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. An electrical terminal assembly (10), comprising:

   a stamped and formed female terminal (12) having a forward mating end (20) of a given cross-sectional dimension, and
   a contact section (22) rearwardly of said forward mating end (20) and having a cross-sectional dimension smaller than that of the forward mating end; and
   a stamped and formed male terminal (14) having a forward contact end (24) of a given cross-sectional dimension and adapted for engagement within the contact section (22) of the female terminal (12),
   an interference section (26) rearwardly of said forward contact end (24) and having a cross-sectional dimension greater than that of the forward contact end for establishing an interference fit within the forward mating end (20) of the female terminal (12), and
   wherein at least a portion of only said forward contact end (24) of the male terminal (14) being selectively plated with a conductive material.

2. The electrical terminal assembly of claim 1 wherein said forward contact end (24) of the male terminal (14) is generally cylindrical.

3. The electrical terminal assembly of claim 2 wherein said contact section of the female terminal (12) includes at least one flexible contact arm (22) for engaging the cylindrical contact end (24) of the male terminal (14).

4. The electrical terminal assembly of 3, including a pair of said flexible contact arms (22) on diametrically opposite sides of the female terminal (12).

5. The electrical terminal assembly of claim 1 wherein said forward mating end (20) of the female terminal (12) and said interference section (26) of the male terminal (14) are generally cylindrical.

6. The electrical terminal assembly of claim 5 wherein said forward contact end (24) of the male terminal (14) is generally cylindrical.

7. The electrical terminal assembly of claim 6 wherein said contact section of the female terminal (12) includes at least one flexible contact arm (22) for engaging the cylindrical contact end (24) of the male terminal (14).

8. The male electrical terminal of claim 1, including a stop section (28) on the male terminal (14) rearwardly of the interference section (26) thereof and having a cross-sectional dimension greater than that of the interference section and greater than that of the forward mating end (20) of the female terminal (12).

9. The electrical terminal assembly of claim 8 wherein said forward contact end (24), said interference section (26) and said stop section (28) of the male terminal (14) all are generally cylindrical.

10. The electrical terminal assembly of claim 9 wherein said contact section of the female terminal (12) includes at least one flexible contact arm (22) for engaging the cylindrical contact end (24) of the male terminal (14).

11. The electrical terminal assembly of 10, including a pair of said flexible contact arms (22) on diametrically opposite sides of the female terminal (12).

12. The electrical terminal assembly of claim 11 wherein the forward mating end (20) of the female terminal (12) is generally cylindrical.

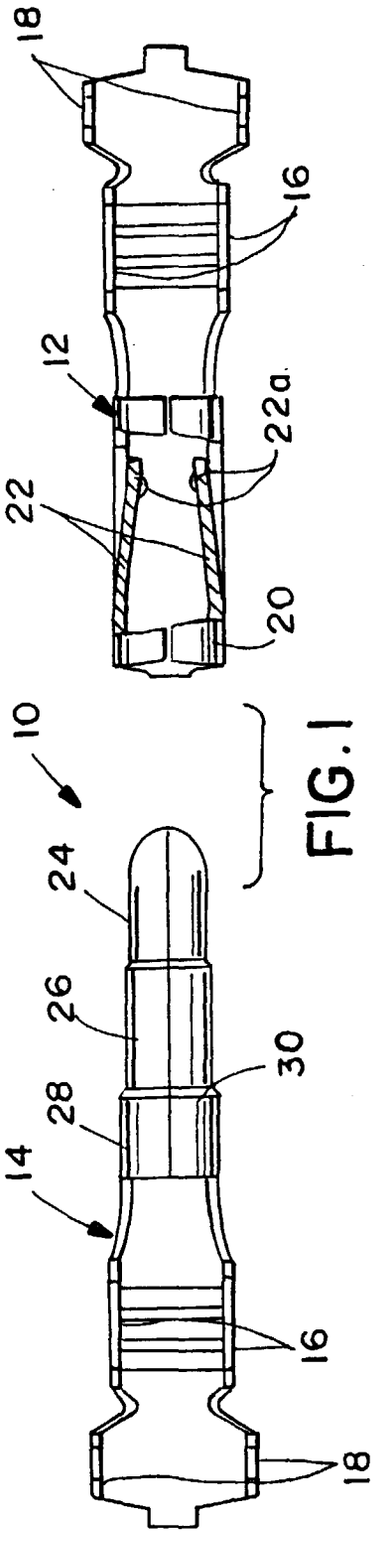
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FIG. 1

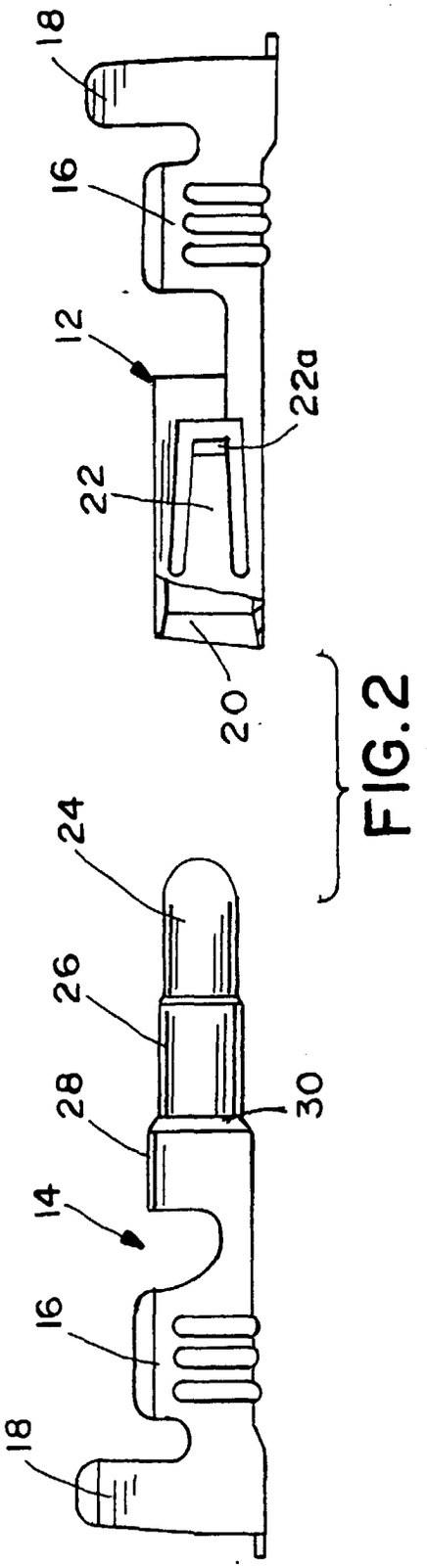
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FIG. 2

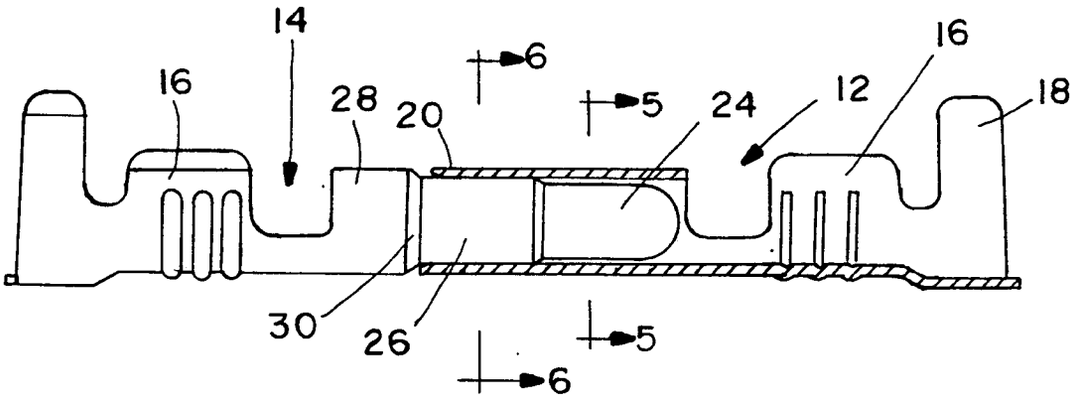

FIG.3

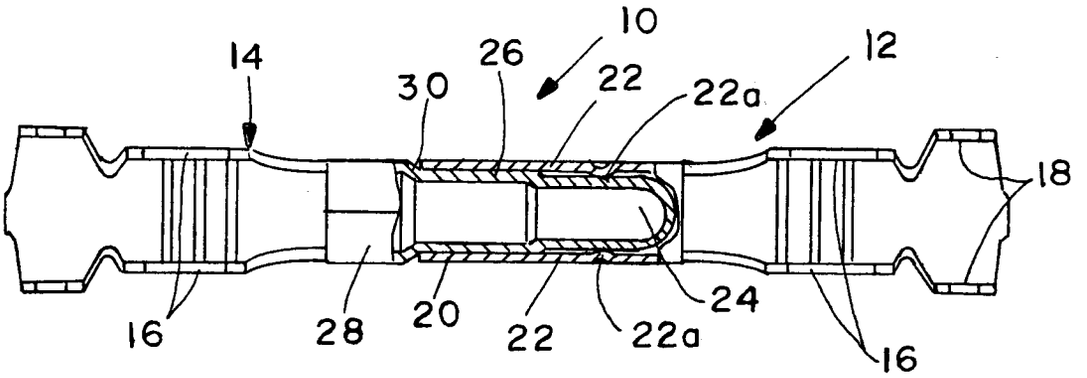

FIG.4

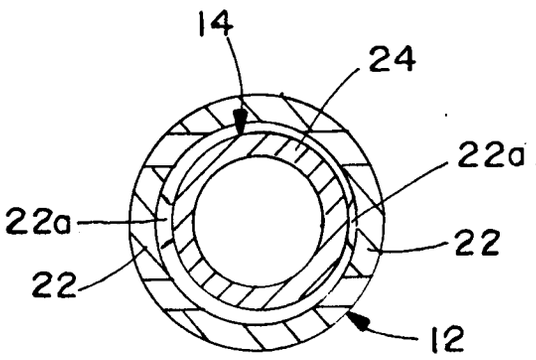

FIG.5

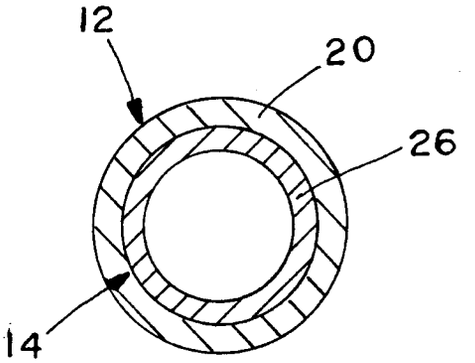

FIG.6