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(54) **ELECTRICAL CONNECTOR AND METHOD OF PREPARING THE SAME**

ELEKTRISCHER STECKVERBINDER UND VERFAHREN ZUR VORBEREITUNG DAVON

CONNECTEUR ÉLECTRIQUE ET SON PROCÉDÉ DE PREPARATION

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Description

Background of the Present Invention

[0001] This application describes a male type RJ45 connector, into which eight wires from a cable are inserted, and associated crimping and shearing tool. When the connector housing is crimped to secure the internal position of the wires, its internally contained electrical contact blades also assume the positions in which they will matingly engage the blades of corresponding contacts in the receptacle of an associated female RJ45 connector. For more than the past decade the eight-wire connector system disclosed the referenced patents has been sold under my trademark EZ-RJ45 and used in ethernet cable systems throughout the world. The uniqueness and novelty of these items has not been challenged.

[0002] One important feature is that the wires are arranged inside the connector in such a way as to minimize interference or cross-talk between data streams being transmitted on respective wire pairs. Another important feature is the method in which color-coded wires inserted into the connector are allowed to protrude out from its front end so that a technician may view the color coded wires to verify their correct relative positions before shearing off their protruding ends. A further feature is the arrangement of the connector assembly and its associated crimping and shearing tool such that the driven engagement of metallic contacts into the wires inside the connector housing, and the shearing and cutting off of the protruding wire ends, is done concurrently with the crimping of the plastic connector to secure the wires in their places inside the connector.

[0003] As electrical components for high-speed data transmission are made smaller and smaller, the data rates, packets, frequencies, and speed increase, and the corresponding wires get larger and larger, it has become necessary to establish rigorous standards to ensure their proper performance. Precise configurations and dimensions are required by FCC regulations and other industry standards. A connector housing must be made of a moldable injected material which is sufficiently moldable and deformable, such as GE Lexan material, to capture and retain the wires inside it. At the same time, the housing must have sufficient rigidity to reliably support the wires and their associated contact blades in precisely correct positions, in order to mate with associated contact elements in the receptacle of a female RJ45 connector. A further requirement is that the moldable material utilized must meet a fire safety standard of the Underwriters Laboratory and other international physical, electrical, quality and performance testing standards.

[0004] Drawings of said previous patents show many important details of the EZ-RJ45 connector as it has been and is presently being sold, those figures being identical in all three of said three prior patents. For convenient reference, certain figures of said prior patents are reproduced here as follows:

This Application	Patent No. 6,017,237
Figure 1	Figure 8
Figure 2	Figure 9
Figure 3	Figure 5
Figure 4	Figure 6

There are also other important details shown in drawings of said prior patent that are not fully replicated here, but understood. A more detailed description of the prior art figures may therefore be gathered from the corresponding prior art document.

[0005] Connector 20 as shown in Fig. 5, 6, 8, and 9 of said prior patents (reproduced here as Fig. 1-4) has an elongated hollow plastic housing 22-1. Insulated wires 16-1 enter its open rearward end 24-1 and extend in guided pathways inside and through the housing. Within the housing metal contact plates 36-1 having sharpened lower ends are poised to pierce the insulation of and make firm electrical contact with corresponding wires. The upper jaw 50-1 of an associated crimping and shearing tool has a downward protrusion 56 that will drive the metal contact plates 36-1 down into the correct position for their forward edges to matingly engage corresponding contacts, not shown, in the receptacle of the female RJ45 connector. The ends of wires 16-1 will not engage any contacts in female receptacle.

[0006] As shown in Fig. 4 of this application [Fig. 6 of said prior patents] the crimping and shearing tool has a lower jaw 70-1 which provides support underneath the housing 22-1 during a crimping and shearing operation. Figs. 1 and 2 of this application show a control tab 30-1 which extends lengthwise underneath the housing 22-1. The forward end of control tab 30-1 must meet shape and dimension standards prescribed by FCC standards in order to correctly position the connector within the receptacle of a female connector (not shown). The outer end portion of the control tab 30-1 also provides a small anvil 42-1 at the forward end of housing 22-1 against which six of the protruding wire ends are sheared and cut when the crimping and shearing tool 50-1 is pressed downward.

[0007] In the EZ-RJ45 as shown in said previous patents the forward end wall of housing 22-1 is largely closed but has openings 42-1 for the eight wires to protrude. There are also slots or grooves in the forward end wall that are partially occupied by the contact blades 36-1, but the lateral edges of the blades 36-1 at the forward end of the housing do not extend to the front face of the housing. Instead, they are recessed back from the front end surface. This is necessary to allow the contact blades of a female receptacle (not shown) to be guided into those slots or grooves for making face-to-face contact with the lateral edges of contact blades 36-1. The mating contacts of the female receptacle (not shown) are protruding contact blades which will enter those slots or grooves to complete the electrical circuitry of the connector. The bared

ends of wires 16-1 after they are cut do not engage any contacts in the female connector.

[0008] When tool 50-1, 70-1, is actuated for the crimping and shearing operation its cutting blade 60-1 wipes the front end of housing 22-1. In the EZ-RJ45 connector as shown in the prior patents, six of the eight protruding wires 16-1 -- wires numbers 2 through 7 -- are freely floating over the anvil 42-1 and are reliably cut off in concert by the crimping and shearing tool 50-1, 70-1. The reason for this is that the connector control tab 30-1 must have exactly correct dimensions in order to precisely fit within a receptacle whose shape and dimensions are prescribed by an FCC or industry standard. The control tab 30-1 is wide enough to provide a supporting anvil only for wires 2-7. It has therefore been a practice in the field for the technicians using the EZ-RJ45 system to finish cutting off the ends of wires 1 and 8 by hand, after the connector housing has been crimped and the other wires have already been cut off. The wires used in the EZ-RJ45 connector are typically of the AWG size 24 in CAT 5 cable, with a proven data transmission rate per respective standards.

[0009] As shown in the prior patents, openings 44-1 through which the eight wires 16-1 will protrude are in a lower portion of the forward end face of housing 20-1. The slots or grooves for the contact blades are in the upper area of the forward end wall of connector housing 20-1, and there is a vertical separation between the horizontal row of openings 44-1 for the wires and the slots or grooves for the contact blades 36-1.

[0010] PRIOR ART also includes Taiwan Patent No. CN2854844Y, U. S. Patent No. 5,601,447 issued in 1997, and U. S. Patent No. 6,905,359 issued in 2005.

[0011] It is necessary for the contact blades, not shown, of a female RJ45 connector to precisely mate with the forward edges of contact blades 36-1. The field experience and complaints with the EZ-RJ45 connector system have shown a need for improved performance. The operation of the shearing and crimping tool 50-1, 70-1, often tends to cause a distortion in the plastic housing 20-1, so that the wires and contacts are not maintained precisely in their desired dimensionally stable positions. There are several different forces that contribute to this result:

1. sliding contact force overcoming friction for seating blades 36-1;
2. insulation displacement force IDC. This is the force it takes to push the gold connector contact blades 36-1 into the wire insulation plastic coating and mate with the copper wires.
3. cut wire force - the shearing force needed to cut the wires 2-7;
4. any dullness of the cutting blade exacerbates the problem.
5. since the blade 60-1 as shown in my prior patents is free-floating, any misalignment of the blade also exacerbates the problem.

[0012] All of these forces tend to push, twist, and deform the connector housing in an undesired manner. This may lead to an FCC non-compliant connector that has to be discarded, causing loss of time and money.

[0013] Since the presently available products requires hand cutting of wires 1 and 8, it would also be desirable to have all eight of the wires cut and sheared by the crimping and shearing tool, to avoid an extra hand working step by the technician.

[0014] US 5 772 465 A discloses a connector including a body having an interior space for receiving de-twisted wires of a cable therein. The body has a plurality of channels for the insertion of the wires. The channels have openings formed on a front end face of the body so as to allow a portion of the wires to expose outside the front end face of the body to be pulled by an operator's hand to the desired position. The body also has a plurality of slots each receiving a metal contact therein. The metal contacts have piercing ends to penetrate into the wires for holding them in position. The exposed portions of wires are then cut off after being held by the metal contacts and a retainer for retaining the connector to a counterpart connector is removably attached to the body.

[0015] WO 99/17406 A1 discloses a modular plug electrical connector for terminating a plurality of wires which are associated as signal pairs in a communications system including a dielectric housing having a cavity and a load bar which is mountable in the cavity. The load bar has opposite major surfaces with plural grooves in the major surfaces. Each of the grooves is configured to receive one of the wires. The grooves are arranged at respective spaced apart locations which are selected to enable compensating crosstalk in the connector.

[0016] US 2007/113401 A1 discloses a wiring block for forming an end of a cable having insulated twisted wires for installation of a plug on the cable in which the insulation of the cable end is stripped. A back of the block leads to a cavity arranged within the block. The block back receives the cable such that a portion of the cable adjacent to the cable end sits inside the cavity. A front of the block has holes leading to troughs extending through the block between the cavity and the block front. The troughs receive the wires at the cable end such that the wires are arranged in a proper configuration with the wire ends protruding out from the block through the holes.

Summary of the Present Invention

[0017] The present invention is provided by appended claims 1 and 9. Beneficial embodiments are provided in the dependent claims. Accordingly, an electrical connector is provided, comprising an integrally thickened forward end wall portion that is adapted to mechanically support the housing while the thickened wall portion is being sheared off.

[0018] The electrical connector as described above has an hollow elongate shape and the integrally thickened forward end wall portion has a generally continuous

forward end wall with upper and lower surface areas, and the lowermost surface area of the wall having an integrally thickened wall portion which is adapted to be sheared off to make the connector operable. The thickened wall portion has a plurality of openings through which wires placed inside the housing project outward beyond its forward end wall.

[0019] The electrical connector as described above comprises the thickened forward end wall portion having at least one opening through which wires placed inside the housing may project outward beyond its forward end wall.

[0020] The electrical connector as described above may comprise the upper surface of the forward end wall having a plurality of slots formed therein for receiving contact blades of a mating connector.

[0021] The electrical connector as described above may comprise the at least one opening including an upper row of openings and a lower row of openings, and the thickened wall portion surrounds the at least one opening.

[0022] The electrical connector as described above may comprise the upper row of openings and the lower row of openings merging into one another.

[0023] The electrical connector as described above may comprise the thickened wall portion having a groove formed therein for guiding the movement of a cutting blade to shear off the thickened wall portion.

[0024] In one embodiment, the present invention also provide a method of forming an electrical connector comprising providing a housing as described above, forming at least one opening through the thickened forward end wall portion, feeding a plurality of wires respectively through the at least one opening, and then shearing off the thickened wall portion together with the wires contained therein.

[0025] In one embodiment, the present invention also provide a method of forming an electrical connector comprising a housing as described above, feeding a plurality of wires respectively through the at least one opening, and then shearing off the thickened wall portion together with the wires contained therein.

[0026] The method as described above may comprise that the at least one opening is formed in an upper horizontal row and a lower horizontal row, the wires in the upper row of openings are sheared off first, and then the wires in the lower row are sheared off.

[0027] The first main concept of the present invention is using wires having thicker insulation, of AWG size 23, and keeping each twisted pair in its twisted state as close as possible to the pair of metal contacts that will conductively engage its respective wires, in order to improve the electrical performance and data transmission rate of the connector.

[0028] A second main concept of the present invention is to provide a thickened end wall (herein also referred to as External Load Bar or Stiffener). The outer dimensions of the connector housing must be limited to comply with legal and industry standards, and the larger wires necessarily require a reduction in the amount of plastic material forming the connector housing. The thickened wall portion mechanically supports both the connector housing and the wires it contains, and is then sheared off along with the protruding wire ends in order to allow the male connector to properly mate with an associated female connector.

[0029] A third main feature of the present invention is a method which not only allows the outer ends of the protruding wire pairs to project from the front of the connector for color comparison purposes, but also allows the wires to be pulled and tightened in their still-twisted condition and brought as close as possible to their respectively associated contact blades before being sheared off. This method helps to improve the quality of electrical performance and to increase the data transmission rate.

[0030] According to the present invention, holes for the protruding wires, as well as slots or grooves for the contact blades, are provided in the thickened forward end wall in generally the same way as shown in the prior parents. However, the thickened wall portion of the forward end wall (also denoted as "thickened wall portion", "Stiffener", or "External Load Bar"), which does include the area where the horizontal openings for the protruding wires are formed, does not include the slots or grooves that will receive the contact blades of a female receptacle.

[0031] When the modified crimping and shearing tool of the present invention cuts off the protruding ends of the wires it simultaneously shears off the unwanted thickness of the forward end wall. The thickened wall portion is formed integral with the forward end wall of the housing. Therefore, when the blade acts to cut off the thickened wall portion, that thickened wall portion continues to provide a stabilizing support for the forward end wall of the housing until the action of the cutting blade is fully completed and the thickened wall portion has become fully severed from the connector housing.

[0032] With this thickened wall portion of the forward end wall, the housing better supports both the wires, and the slots or grooves for receiving the contacts blades, before, during, and after the wires are cut off.

[0033] Thus in shearing off the exposed ends of the wires, now at the same time the thickened wall portion of the end wall is cut off, still leaving a thin forward end wall for the connector housing that is sufficient to maintain the correct spatial locations of both the wires and the contact blades. The connector then fits correctly within its allotted space in an associated female receptacle or terminal board.

[0034] In other words, by thickening the forward end wall of housing, now the connector is initially made too long to fit within its prescribed space in a receptacle or panel board. But by cutting off the excess thickness of the forward end wall while the connector housing is being crimped and the contacts are being forced into their conductive engagement with the associated wires, the con-

nector housing length may be reduced so that it does correctly fit, and also improves the end result of correctly terminating the connector.

[0035] Horizontal guideways are provided inside the connector housing to permit two horizontal rows of four wires each, in a staggered relationship, to be inserted into and through the connector. The holes or openings in the forward end wall of housing are then in two separate rows, four in each row. Adjacent holes then tend to slightly overlap or merge into each other.

[0036] Another and related feature of the present invention is modifying the crimping and shearing tool so that it very positively cuts off all the protruding wire ends concurrent with the crimping operation. This is accomplished by adding a pair of short posts to the lateral ends of the lower jaw of crimping tool. These posts together with the control tab then provide an expanded and adequate anvil surface for cutting off all of the wire ends that are encased in plastic; first the four in the upper horizontal row, and then the four in the lower horizontal row.

[0037] A still further feature of the present invention is that a set of guides is also provided to control downward movement of the cutting blade, and a groove extending laterally across the upper surface of the External Load Bar adjacent to the forward end wall of the connector housing, to guide the edge of cutting blade when the blade is pushed down in its cutting action.

[0038] The objective of these improvements is to provide a connector that is suitable for use with CAT 6, CAT 6A and other ethernet cable and future larger wires and standards, in order to reliably operate at a data transmission rate of ten gigahertz and future transmission rates and applications.

Brief Description of the Drawings

[0039]

Figs. 1 through 4 are provided as exact copies of certain figures in prior patents, which is necessary in order to provide a proper basis for describing my present invention.

Fig. 5 is a front end elevation view of a modified connector housing and External Load Bar, showing the empty connector not loaded with wires;

Fig. 6 is an elevational cross-section taken on Line 6 - 6 of Fig. 5 showing the empty connector housing with the External Load Bar on its forward end wall;

Fig. 7 is a side elevational view of the connector housing loaded with wires;

Fig. 8 is a view like Fig. 7, but additionally with schematic indications showing how the crimping and shearing operation, and the separation of the External Load Bar with its encased wires, will be done;

Fig. 9 is a side elevational view showing the External Load Bar after it has been separated from the connector housing, and still retains its accompanying load of the insulated wires which still remain encased in it and protrude from it; and

Fig. 10 is a front end elevation of the loaded connector housing after the External Load Bar has been shorn off, exposing the bare ends of the insulated wires.

DETAILED DESCRIPTION

[0040] As shown in Figs. 5 and 6, the modified connector housing 122 has a thickened wall portion 100 (otherwise known as the Stiffener or External Load Bar) formed as an integral lower part of its forward end wall 128. A horizontal row of four upper holes 145 and a horizontal row of four lower holes 144 are formed through the solid material of the thickened wall portion. As best seen in Fig. 5, the holes of the rows are staggered, and tend to blend or merge together. Thickened wall portion 100 preferably has a flat bottom surface identified by numeral 104. During the shearing operation, thickened wall portion 100 will be supported from that bottom surface 104, which will in turn rest upon an anvil. Optionally, the thickened wall portion 100 may also comprise one or more supporting ribs (not shown) extending from the bottom surface 104 towards control tab 30 extending from the front portion of a bottom wall 124 of connector housing 122. There is a thin layer of plastic material underneath the lower holes 144, which forms the bottom surface 104.

[0041] On the forward end wall of housing 122 as best seen in Fig. 5, there is an upper vertical area 132, above the thickened wall portion 100, where the slots or grooves 130 for contact blades 36 are located. There are eight of these slots to accommodate the eight contact plates 36. The cross-section view of Fig. 6 shows one contact blade 36 occupying the corresponding slot or groove 130.

[0042] As shown in Fig. 6, the bottom wall of connector housing 122 is designated 124 and its bottom surface as 126. When the connector is loaded with wires, they will be in suitable guideways extending the length of the hollow connector housing, and will also extend through the holes 144, 145, and protrude outward from the front side of the thickened wall portion 100.

[0043] Since Fig. 6 is a cross-section view, it shows one of the contact blades 36 occupying a corresponding one of the slots 130.

[0044] As also indicated in Fig. 6, the plastic material of thickened wall portion 100 is formed integral with forward end wall 128 of housing 122. That is preferable, because when the thickened wall portion 100 and the encased wires it contains are sheared off, the thickened wall portion continues to mechanically support the forward end wall 128 until the shearing is fully complete.

[0045] As shown in Fig. 6, the upper surface of thickened wall portion 100 has a small groove 102 that is

immediately adjacent the flat upper face 132 of the connector housing. The purpose of that groove is to guide the action of cutting blade 60 when the thickened wall portion and wire ends are to be sheared off.

[0046] Reference is now made to Fig. 7 which shows the connector housing when loaded with insulated wires. Wires 16 are unsheathed from an incoming cable with a length sufficient to protrude at least several inches of gripping length from the front side of thickened wall portion 100. This allows the technician to pull the wires tight before doing the crimping and shearing operation. Tightness of the wires inside the connector housing improves the electrical performance of the connector.

[0047] Fig. 8 reproduces the loaded housing of Fig. 7 on a smaller scale, to provide space to schematically illustrate how the crimping and shearing will be done. A hand tool 300 above the housing drives arrows 301, 302, and 303 downward. Arrow 301 represents the crimping of the plastic housing, in the manner shown in my prior patents. Arrow 302 represents the blade driver that drives all of the blades 36 into electrical engagement with the corresponding contact blades. And arrow 303 represents the cutting blade 60 that will shear off both the thickened wall portion 100 and its encased wires. A block 42 shown in the lower left corner of the drawing represents an anvil that supports the bottom surface 104 of the thickened wall portion 100, and that the blade 60 will engage at the end of its cutting stroke. The optional one or more supporting ribs (not shown) extending from the bottom surface towards the control tab are preferably completely removed from the plastic housing by the shearing process.

[0048] As shown in Fig. 9, the thickened wall portion 100 after separation from forward end wall 128 of the housing still retains its load of insulated wires 16 protruding from its front side. It is then no longer needed, and may be disposed of.

[0049] As shown in Fig. 10, removal of the thickened wall portion has left the bare forward end wall in which the bared ends 146 of the insulated wires are clearly visible. The wire ends 146 do not and must not protrude, or there would be a risk of electrical engagement with the female connector. To accomplish the appropriate electrical function of the connector, that must not be tolerated. Removal of the thickened wall portion brings the size and shape of the housing back to the industry and FCC standard, so as to correctly mate with a female RJ45 connector.

[0050] As described above, the modified connector housing of the present invention is made with the thickened wall portion as an integrally formed part of it. Four pairs of insulated wires are inserted into and through the housing 122, and through the upper and lower holes 144, 145, in the thickened wall portion. The manner of guiding the wire pairs is such that one wire of each pair protrudes through an upper hole 145, and the other wire of each pair protrudes through the adjacent lower hole 144.

[0051] Before shearing the thickened wall portion and encased wire ends the technician will check the color coding of the wires to verify their correct locations. He then preferably stretches each of the wire pairs by pulling its protruding ends. The purpose of that is to bring each wire pair, inside the connector, as close as possible to the respectively associated contact blades. This is essential to maximize the electrical performance of the connector.

[0052] The crimping and shearing tool 50, 70 may be modified, to provide two small posts that extend the ends of anvil 42, so that all eight of the wires will be cut in a single pass of the cutting blade 60. The thickened wall portion sits directly on the anvil, with no space between its bottom surface and the anvil. There is a measurable thickness of plastic material below the bottom row of holes. When the shearing takes place, the blade 60 first cuts all of the wires in the upper row 145, and then all wires in the lower row 144. After the shearing is done the thickened wall portion - which is now detached from the forward end wall 128 - may be disposed of. Connector housing 122 is then moved into mating engagement with an associated female receptacle, bringing the contact prongs of the female receptacle into engagement with the contact blades 36. Performance tests, if necessary or desired, may then be conducted.

[0053] Although the invention was described in detail in order to comply with requirements of the patent laws, it will be understood that the scope of my protection is to be adjudged only in accordance with the appended claims.

Claims

1. Electrical connector, comprising:

an elongated hollow housing (122) having a continuous forward end wall (128) with upper and lower surface areas, the electrical connector being **characterized in that** it comprises a lowermost surface area of the forward end wall (128) having an integrally thickened wall portion (100) which is adapted to be sheared off to make the connector operable, and **in that**
the thickened wall portion (100) has a plurality of openings (144, 145) configured such that wires (16) are placed through the plurality of openings (144, 145) inside the housing to project outward beyond the forward end wall (128).

2. Electrical connector according to claim 1, wherein the upper surface of the forward end wall (128) has a plurality of slots (130) formed therein receiving contact blades (36) of the electrical connector.

3. Electrical connector according to one of claims 1 and 2, wherein the openings (144, 145) include an upper row of openings (145) and a lower row of openings (144), and the thickened wall portion (100) has a

measurable amount of plastic material beneath the lower row of openings (144).

4. Electrical connector according to Claim 3, wherein a plurality of openings (144, 145) are formed in the thickened lowermost surface of the wall (128).

5. Electrical connector according to Claim 4, wherein the openings (144, 145) are formed in two horizontal rows, an upper row (145) and a lower row (144).

6. Electrical connector according to Claim 5, wherein the openings in the upper row (145) are of larger diameter than those in the lower row (144).

7. Electrical connector according to Claim 5, wherein the openings in the two rows (144, 145) are in staggered relationship.

8. Electrical connector according to Claim 5, wherein the openings of the two rows (144, 145) are partially merged together.

9. Method of preparing an electrical connector, comprising the steps of:

selecting an elongated hollow plastic housing (122) having an open rearward end and an continuous forward end wall (128), a lower portion of the forward surface of the forward end wall (128) being integrally thickened, and the forward end wall (128) including the thickened lower portion (100) comprising a set of openings (144, 145) therethrough, the upper portion of the forward end wall (128) having slots (130) receiving contact blades of the electrical connector; the method being **characterized in** comprising
inserting a plurality of wires (16) into the open rearward end of the housing (122) into and through corresponding ones of the set of openings (144, 145) in the forward end wall (128) so that the plurality of wires (16) project forwardly beyond the forward end wall (128); and
shearing off the thickened portion (100) of the forward end wall (128) and concurrently with it the projecting ends of the wires flush with the then remaining forward end wall surface (128) of the housing (122).

10. The method according to claim 9, wherein two parallel rows of openings (144, 145) are formed in the forward end wall (128), an upper row (145) and a lower row (144).

11. The method according to claim 10, wherein the openings (144, 145) in the upper row (145) are larger than the openings in the lower row (144).

12. The method according to one of claims 9-10, wherein the wires (16) are electrically insulated.

13. The method according to one of claims 9-12, wherein a plurality of slots (130) are formed in the upper surface of the front end wall (128) receiving the contact blades (36) of the electrical connector, and wherein the plastic housing (122) is mechanically supported while the thickened wall portion (100) and protruding wires (16) are being sheared off, so as to preserve the dimensional stability of the upper portion of the forward end wall (128) and the slots (130) therein.

14. The method according to claim 9, further comprising forcing metal contact plates into conductive engagement with respective ones of the plurality of wires (16).

15. The method according to claim 14, wherein forcing metal contact plates into conductive engagement with respective ones of the plurality of wires (16) comprises forcing metal contact plates through an insulation coating of respective ones of the plurality of wires (16) and into conductive engagement with respective ones of the plurality of wires (16) while shearing off the thickened portion (100) of the forward end wall (128) and the projecting ends of the wires (16).

16. The method according to claim 15, further comprising crimping the connector housing (122) while forcing metal contact plates into conductive engagement with respective ones of the plurality of wires (16) and shearing off the thickened portion (100) of the forward end wall (128) and the projecting ends of the wires (16).

Patentansprüche

1. Elektrischer Verbinder, umfassend:

ein längliches hohles Gehäuse (122), aufweisend eine durchgehende vordere Endwand (128) mit oberen und unteren Flächenbereichen, wobei der elektrische Verbinder **dadurch gekennzeichnet ist, dass** er einen untersten Flächenbereich der vorderen Endwand (128) umfasst, aufweisend einen integral verdickten Wandabschnitt (100), der angepasst ist, abgeschert zu werden, um den Verbinder betreibbar zu machen, und, dass
der verdickte Wandabschnitt (100) eine Vielzahl von Öffnungen (144, 145) aufweist, die konfiguriert sind, sodass Drähte (16) durch die Vielzahl von Öffnungen (144, 145) innerhalb des Gehäuses angeordnet sind, um nach außen über die vordere Endwand (128) zu ragen.

2. Elektrischer Verbinder gemäß Anspruch 1, wobei die obere Fläche der vorderen Endwand (128) eine Vielzahl von darin ausgebildeten Schlitzen (130) aufweist, die Kontaktklingen (36) des elektrischen Verbinders aufnehmen.

3. Elektrischer Verbinder gemäß irgendeinem der Ansprüche 1 und 2, wobei die Öffnungen (144, 145) eine obere Reihe von Öffnungen (145) und eine untere Reihe von Öffnungen (144) beinhalten, und der verdickte Wandabschnitt (100) eine messbare Menge an Kunststoffmaterial unterhalb der unteren Reihe von Öffnungen (144) aufweist.

4. Elektrischer Verbinder gemäß Anspruch 3, wobei eine Vielzahl von Öffnungen (144, 145) in der verdickten untersten Fläche der Wand (128) ausgebildet ist.

5. Elektrischer Verbinder gemäß Anspruch 4, wobei die Öffnungen (144, 145) in zwei horizontalen Reihen, einer oberen Reihe (145) und einer unteren Reihe (144), ausgebildet sind.

6. Elektrischer Verbinder gemäß Anspruch 5, wobei die Öffnungen in der oberen Reihe (145) einen größeren Durchmesser als die in der unteren Reihe (144) aufweisen.

7. Elektrischer Verbinder gemäß Anspruch 5, wobei die Öffnungen in den beiden Reihen (144, 145) in versetzter Anordnung sind.

8. Elektrischer Verbinder gemäß Anspruch 5, wobei die Öffnungen der beiden Reihen (144, 145) teilweise ineinander übergehen.

9. Verfahren zur Herstellung eines elektrischen Verbinders, umfassend die Schritte von:

Auswählen eines länglichen, hohlen Kunststoffgehäuses (122), aufweisend ein offenes hinteres Ende und eine durchgehende vordere Endwand (128), wobei ein unterer Abschnitt der vorderen Fläche der vorderen Endwand (128) integral verdickt ist und die vordere Endwand (128), einschließend den verdickten unteren Abschnitt (100), einen Satz von Öffnungen (144, 145) dadurch hindurch umfasst, wobei der obere Abschnitt der vorderen Endwand (128) Schlitze (130) aufweist, die Kontaktklingen des elektrischen Verbinders aufnehmen; wobei das Verfahren **dadurch gekennzeichnet ist, dass** es umfasst

Einsetzen einer Vielzahl von Drähten (16) in das offene hintere Ende des Gehäuses (122) in und durch Entsprechende des Satzes von Öffnungen (144, 145) in der vorderen Endwand (128), so dass die Vielzahl von Drähten (16) nach vorne über die vordere Endwand (128) ragt; und

Abscheren des verdickten Abschnitts (100) der vorderen Endwand (128) und gleichzeitig mit diesem, die vorstehenden Enden der Drähte mit der dann verbleibenden vorderen Endwandfläche (128) des Gehäuses (122) bündig machen.

10. Verfahren gemäß Anspruch 9, wobei zwei parallele Reihen von Öffnungen (144, 145), eine obere Reihe (145) und eine untere Reihe (144), in der vorderen Endwand (128) gebildet werden.

11. Verfahren gemäß Anspruch 10, wobei die Öffnungen (144, 145) in der oberen Reihe (145) größer sind als die Öffnungen in der unteren Reihe (144).

12. Verfahren gemäß irgendeinem der Ansprüche 9-10, wobei die Drähte (16) elektrisch isoliert sind.

13. Verfahren gemäß irgendeinem der Ansprüche 9-12, wobei eine Vielzahl von Schlitzen (130) in der oberen Fläche der vorderen Endwand (128) gebildet werden, die die Kontaktklingen (36) des elektrischen Verbinders aufnehmen, und wobei das Kunststoffgehäuse (122) mechanisch gestützt wird, während der verdickte Wandabschnitt (100) und vorstehende Drähte (16) abgeschert werden, um die Dimensionsstabilität des oberen Abschnitts der vorderen Endwand (128) und der Schlitze (130) darin zu erhalten.

14. Verfahren gemäß Anspruch 9, das weiterhin Drücken von Metallkontaktplatten in leitenden Eingriff mit Entsprechenden der Vielzahl von Drähten (16) umfasst.

15. Verfahren gemäß Anspruch 14, wobei Drücken von Metallkontaktplatten in leitenden Eingriff mit Entsprechenden der Vielzahl von Drähten (16), Drücken von Metallkontaktplatten durch eine Isolationsbeschichtung von Entsprechenden der Vielzahl von Drähten (16) und in leitenden Eingriff mit Entsprechenden der Vielzahl von Drähten (16) umfasst, während der verdickte Abschnitt (100) der vorderen Endwand (128) und die vorstehenden Enden der Drähte (16) abgeschert werden.

16. Verfahren gemäß Anspruch 15, weiterhin umfassend Crimpen des Verbindergehäuses (122), während Metallkontaktplatten in leitenden Eingriff mit Entsprechenden der Vielzahl von Drähten (16) gezwungen werden, und Abscheren des verdickten Abschnitts (100) der vorderen Endwand (128) und der vorstehenden Enden der Drähte (16).

Revendications

1. Connecteur électrique, comprenant :

un boîtier creux allongé (122) ayant une paroi d'extrémité avant continue (128) avec des zones de surface supérieure et inférieure, le connecteur électrique étant **caractérisé en ce qu'**il comprend une zone de surface la plus basse de la paroi d'extrémité avant (128) ayant une portion de paroi intégralement épaissie (100) qui est apte à être cisaillée pour rendre le connecteur opérationnel, et **en ce que**
la portion de paroi épaissie (100) a une pluralité d'ouvertures (144, 145) configurées de sorte que des fils (16) soient placés à travers la pluralité d'ouvertures (144, 145) à l'intérieur du boîtier pour faire saillie vers l'extérieur au-delà de la paroi d'extrémité avant (128).

2. Connecteur électrique selon la revendication 1, dans lequel la surface supérieure de la paroi d'extrémité avant (128) a une pluralité de fentes (130) formées à l'intérieur de celle-ci qui reçoivent des lames de contact (36) du connecteur électrique.

3. Connecteur électrique selon la revendication 1 ou 2, dans lequel les ouvertures (144, 145) incluent une rangée supérieure d'ouvertures (145) et une rangée inférieure d'ouvertures (144) et la portion de paroi épaissie (100) a une quantité mesurable de matériau plastique au-dessous de la rangée inférieure d'ouvertures (144).

4. Connecteur électrique selon la revendication 3, dans lequel une pluralité d'ouvertures (144, 145) sont formées dans la surface la plus basse épaissie de la paroi (128).

5. Connecteur électrique selon la revendication 4, dans lequel les ouvertures (144, 145) sont formées dans deux rangées horizontales, une rangée supérieure (145) et une rangée inférieure (144).

6. Connecteur électrique selon la revendication 5, dans lequel les ouvertures dans la rangée supérieure (145) ont un diamètre supérieur à celui des ouvertures dans la rangée inférieure (144).

7. Connecteur électrique selon la revendication 5, dans lequel les ouvertures dans les deux rangées (144, 145) sont dans une relation échelonnée.

8. Connecteur électrique selon la revendication 5, dans lequel les ouvertures des deux rangées (144, 145) sont partiellement fusionnées l'une avec l'autre.

9. Procédé de préparation d'un connecteur électrique, comprenant les étapes de :
la sélection d'un boîtier plastique creux allongé (122) ayant une extrémité arrière ouverte et une paroi d'extrémité avant continue (128), une portion inférieure de la surface avant de la paroi d'extrémité avant (128) étant épaissie intégralement, et la paroi d'extrémité avant (128) incluant la portion inférieure épaissie (100) comprenant un ensemble d'ouvertures (144, 145) à travers celle-ci, la portion supérieure de la paroi d'extrémité avant (128) ayant des fentes (130) recevant des lames de contact du connecteur électrique ; le procédé étant **caractérisé en ce qu'**il comprend :

l'insertion d'une pluralité de fils (16) dans l'extrémité arrière ouverte du boîtier (122) dans et à travers celles correspondantes de l'ensemble d'ouvertures (144, 145) dans la paroi d'extrémité avant (128) de sorte que la pluralité de fils (16) fassent saillie vers l'avant au-delà de la paroi d'extrémité avant (128) ; et
le cisaillement de la portion épaissie (100) de la paroi d'extrémité avant (128) et simultanément des extrémités saillantes des fils à niveau avec la surface de paroi d'extrémité avant (128) restante du boîtier (122).

10. Procédé selon la revendication 9, dans lequel deux rangées parallèles d'ouvertures (144, 145) sont formées dans la paroi d'extrémité avant (128), une rangée supérieure (145) et une rangée inférieure (144).

11. Procédé selon la revendication 10, dans lequel les ouvertures (144, 145) dans la rangée supérieure (145) sont plus grandes que les ouvertures dans la rangée inférieure (144).

12. Procédé selon la revendication 9 ou 10, dans lequel les fils (16) sont isolés électriquement.

13. Procédé selon l'une des revendications 9 à 12, dans lequel une pluralité de fentes (130) sont formées dans la surface supérieure de la paroi d'extrémité avant (128) recevant les lames de contact (36) du connecteur électrique, et dans lequel le boîtier plastique (122) est supporté mécaniquement pendant le cisaillement de la portion de paroi épaissie (100) et des fils saillants (16), de manière à préserver la stabilité dimensionnelle de la portion supérieure de la paroi d'extrémité avant (128) et des fentes (130) à l'intérieur de celle-ci.

14. Procédé selon la revendication 9, comprenant en outre l'étape consistant à forcer des plaques de contact métalliques à se mettre en prise de manière conductrice avec des fils respectifs de la pluralité de fils (16).

15. Procédé selon la revendication 14, dans lequel l'étape consistant à forcer des plaques de contact métalliques à se mettre en prise de manière conductrice avec des fils respectifs de la pluralité de fils (16) com-

prend l'étape consistant à forcer des plaques de contact métalliques à traverser un revêtement d'isolation de fils respectifs de la pluralité de fils (16) et à se mettre en prise de manière conductrice avec des fils respectifs de la pluralité de fils (16) pendant le cisaillement de la portion épaissie (100) de la paroi d'extrémité avant (128) et des extrémités saillantes des fils (16).

16. Procédé selon la revendication 15, comprenant en outre le sertissage du boîtier de connecteur (122) tout en forçant des plaques de contact métalliques à se mettre en prise de manière conductrice avec des fils respectifs de la pluralité de fils (16) pendant le cisaillement de la portion épaissie (100) de la paroi d'extrémité avant (128) et des extrémités saillantes des fils (16).

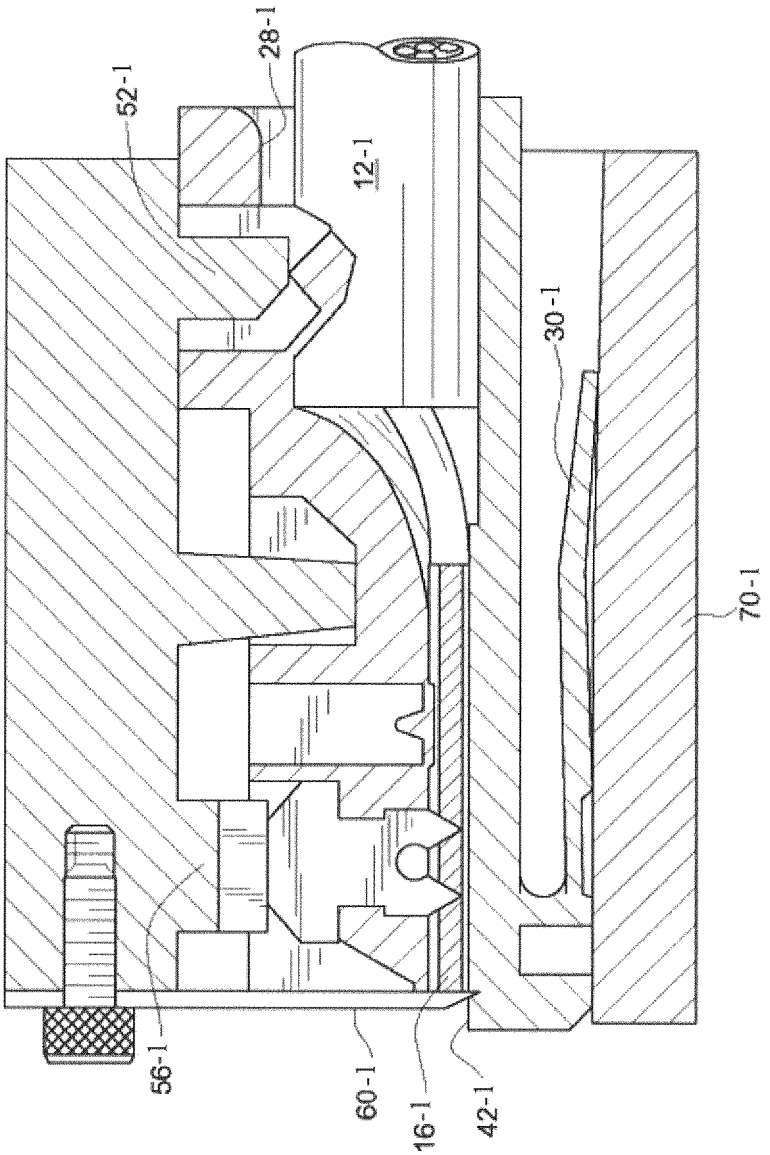


FIG. 1
Prior Art
(copy of Fig.8 of Patent 6,017,237)

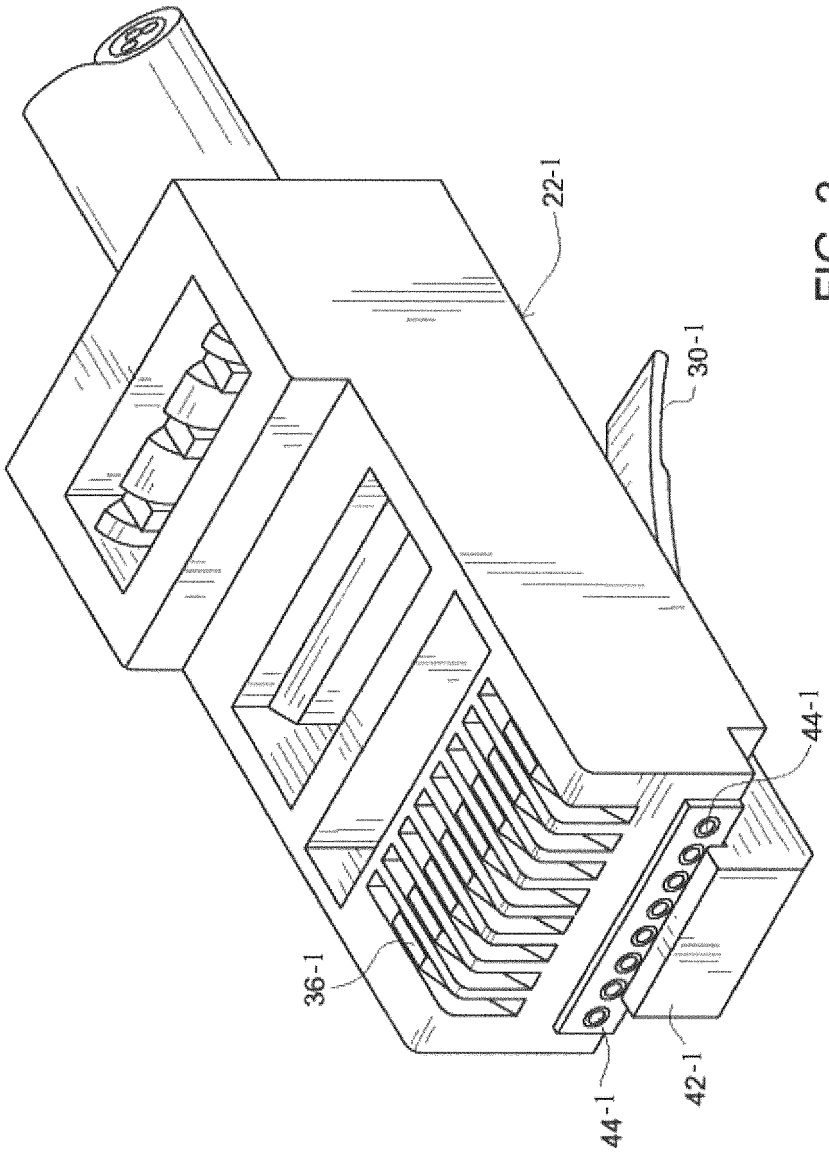


FIG. 2
Prior Art
(copy of Fig.9 of Patent 6,017,237)

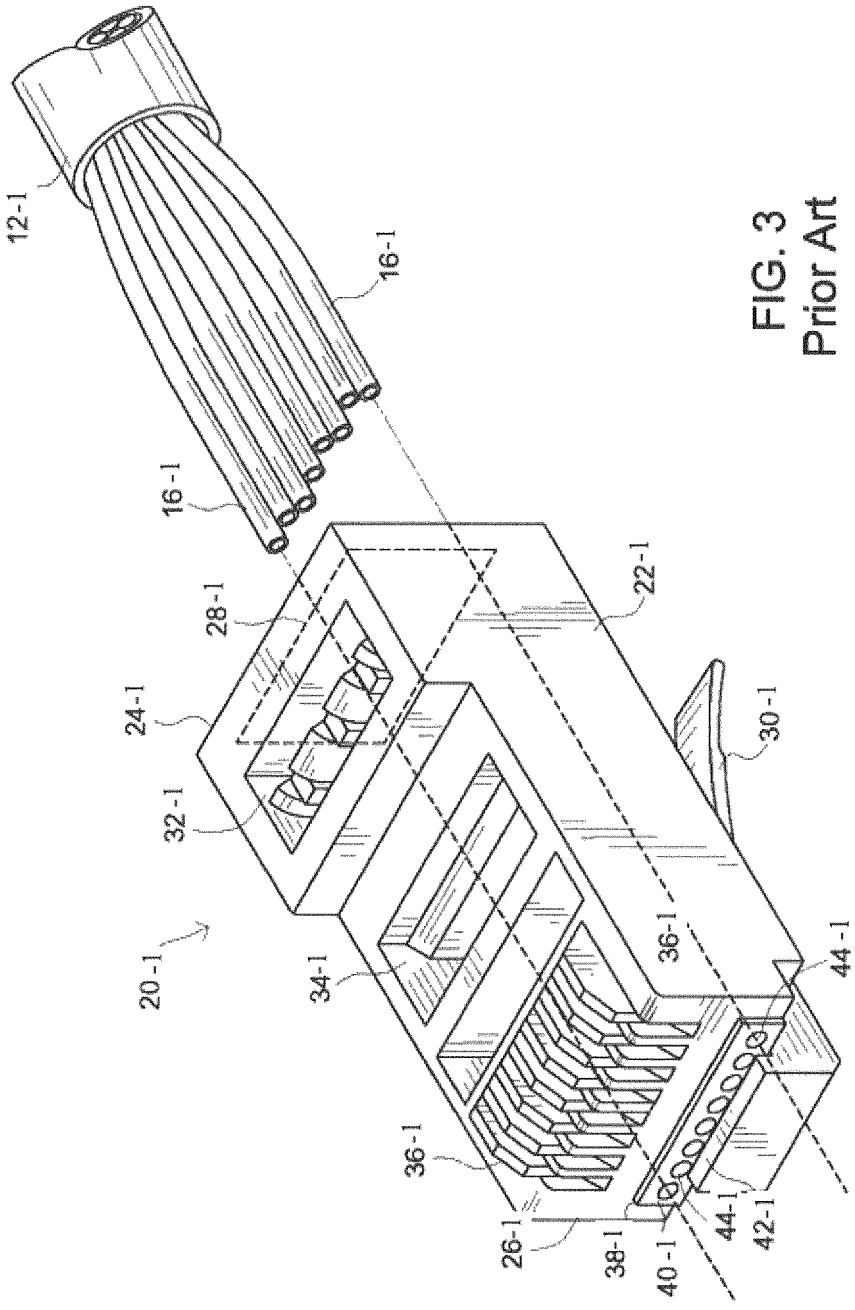


FIG. 3
Prior Art
(copy of Fig.5 of Patent 6,017,237)

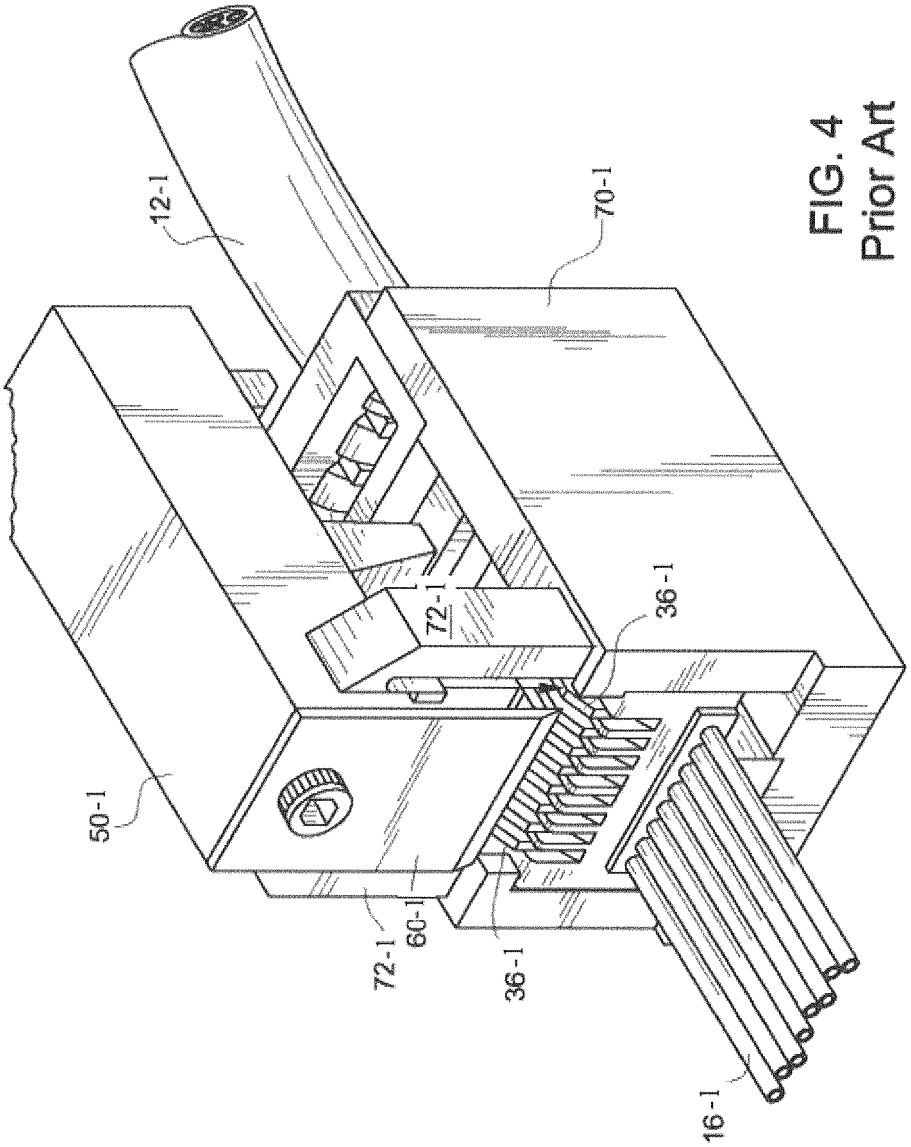


FIG. 4
Prior Art
(copy of Fig.6 of Patent 6,017,237)

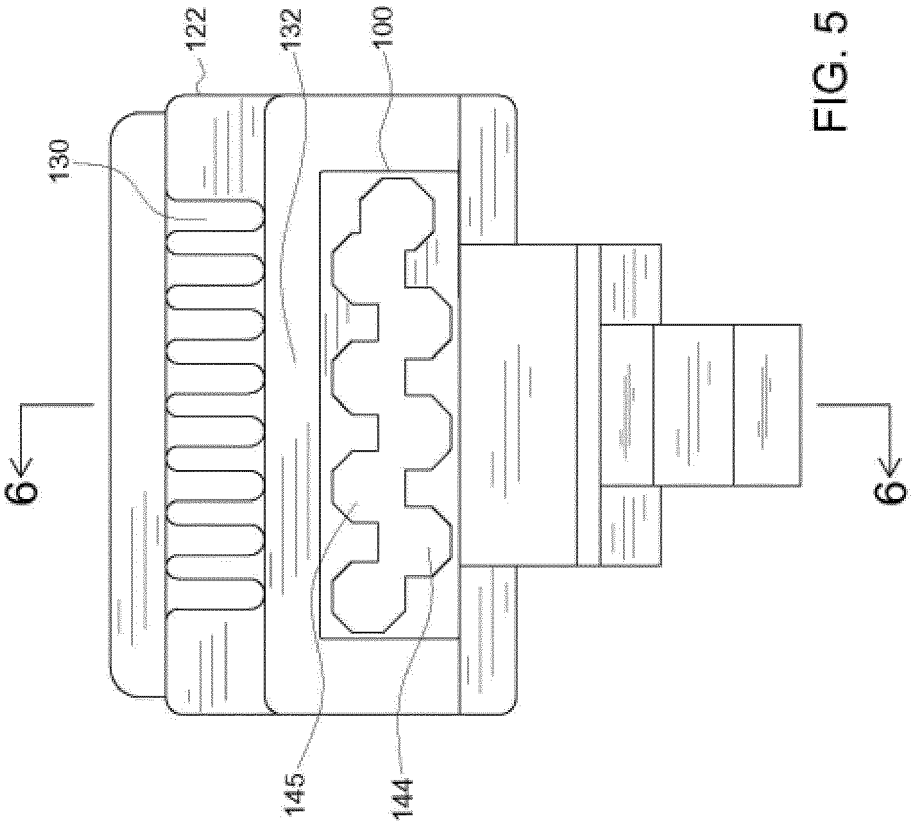


FIG. 5

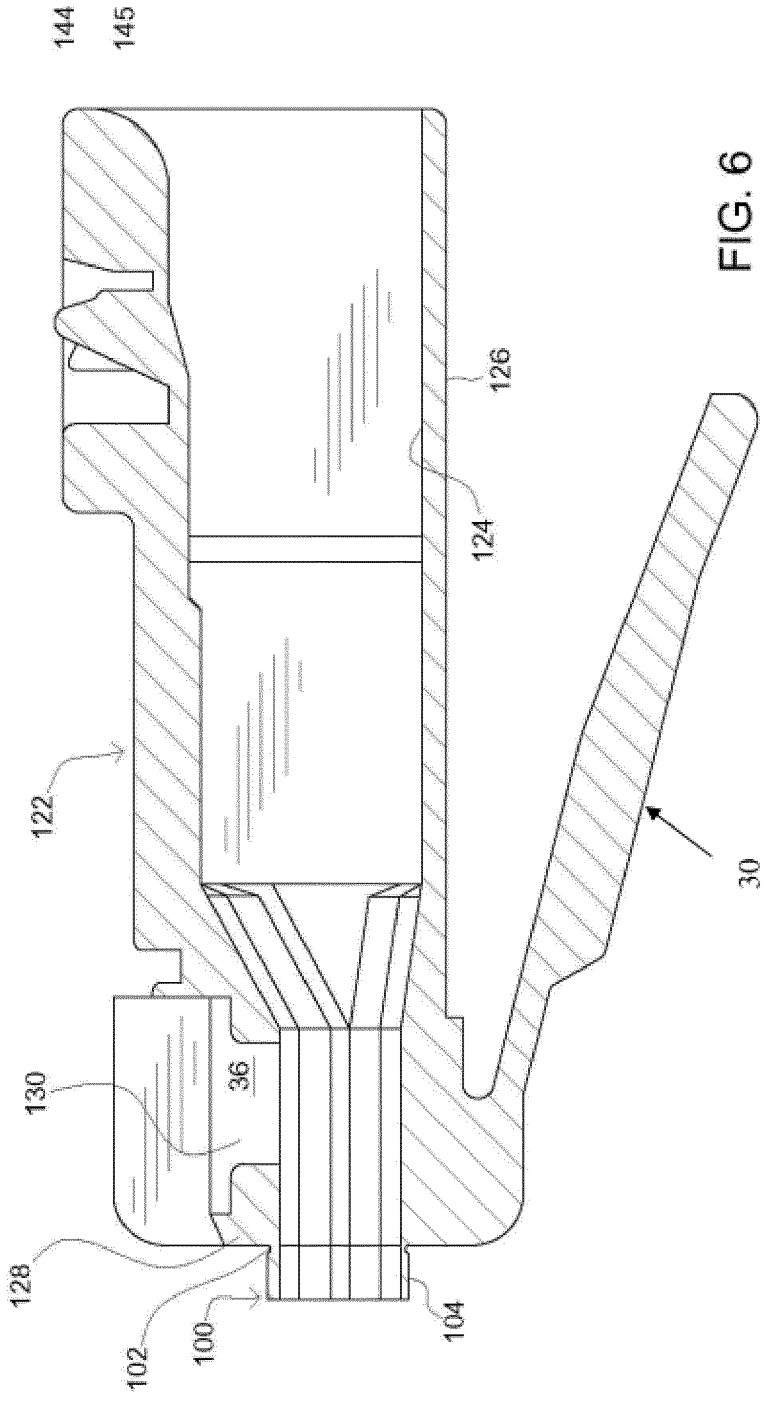


FIG. 6

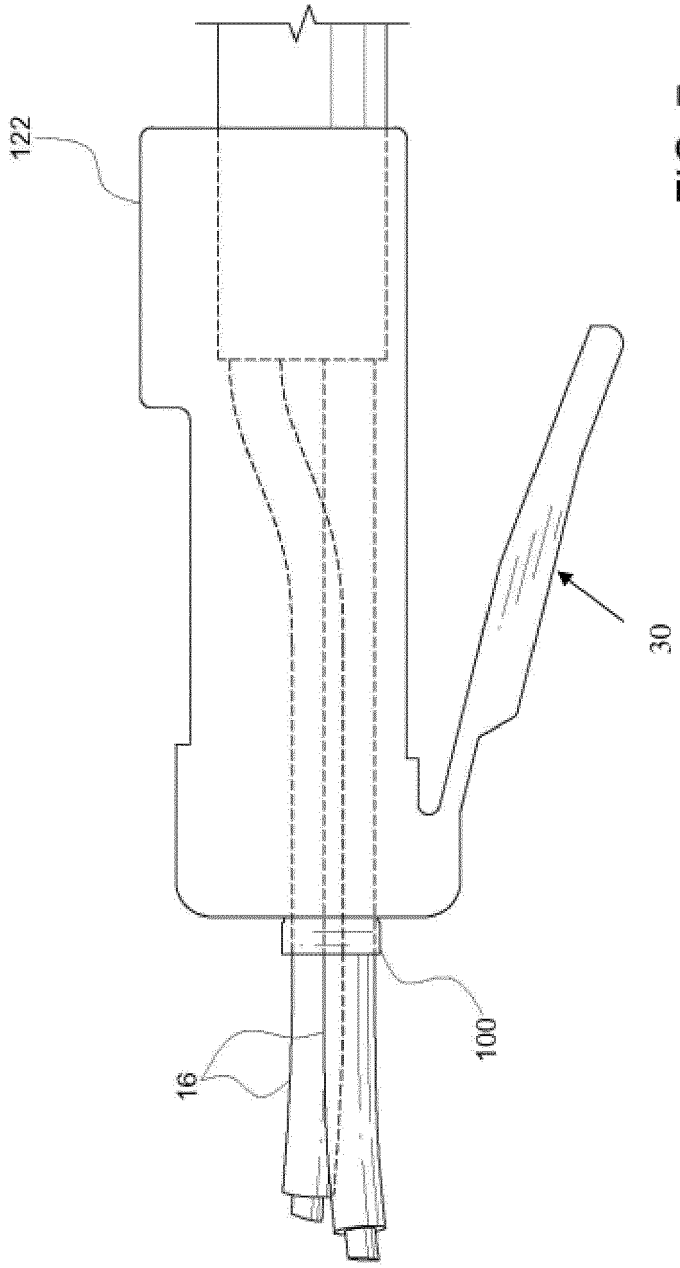


FIG. 7

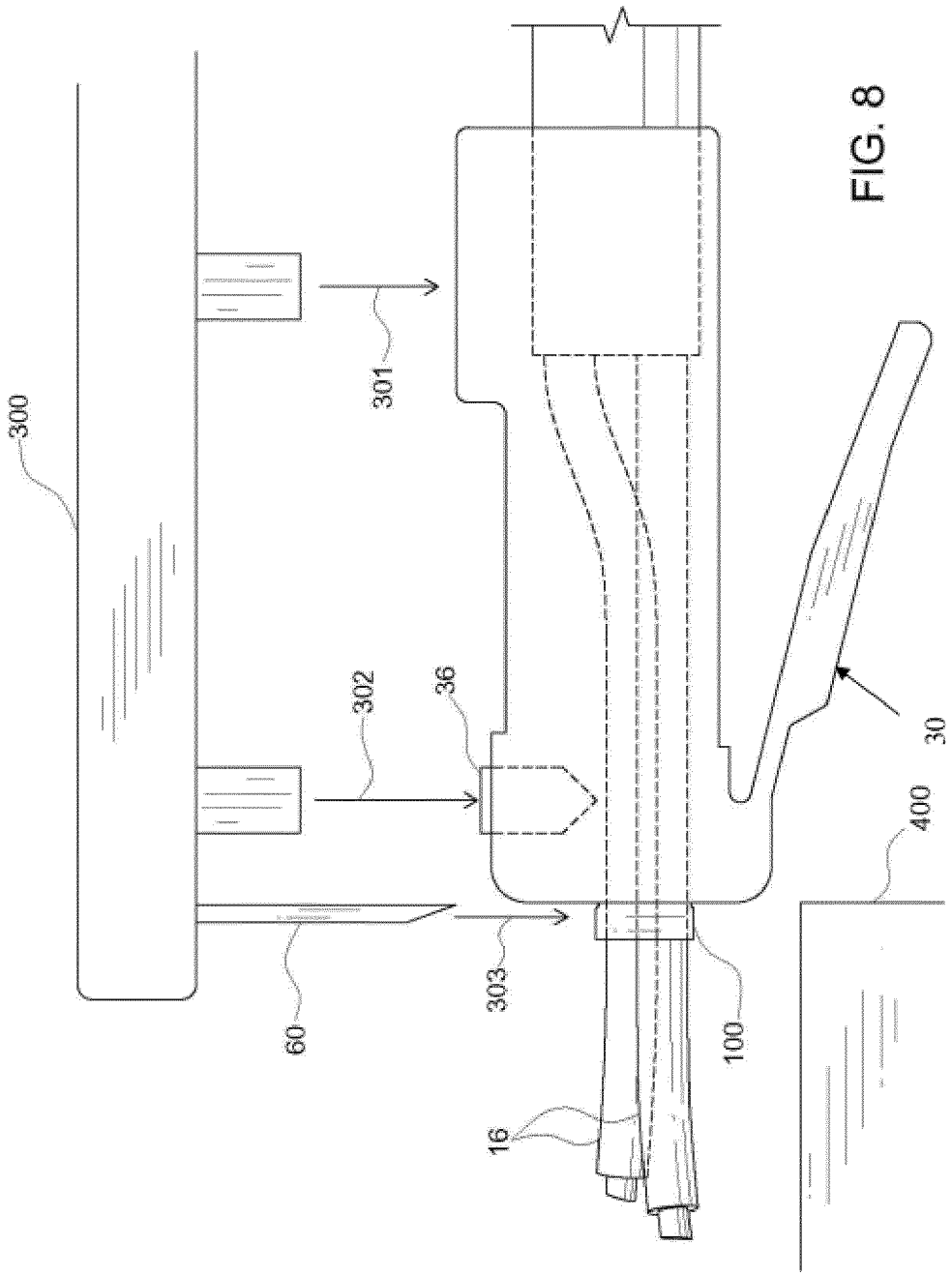


FIG. 8

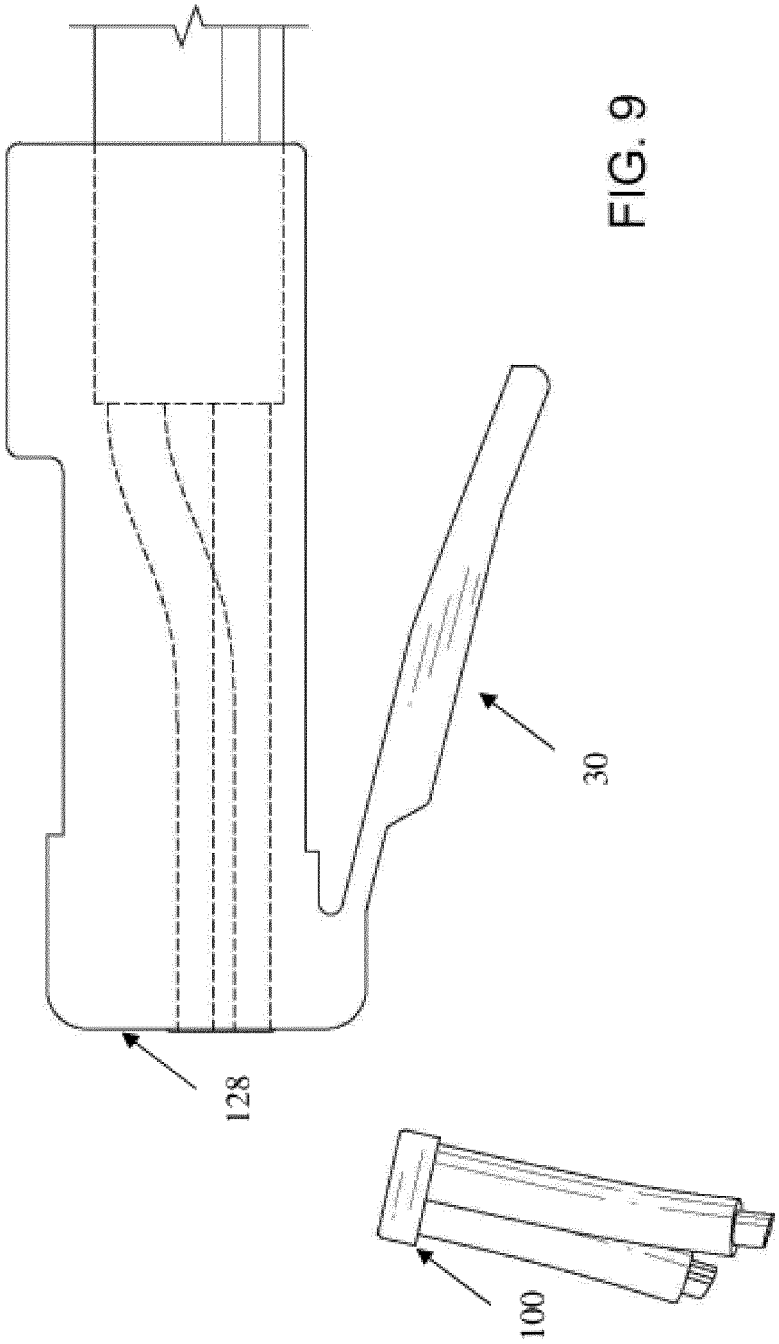
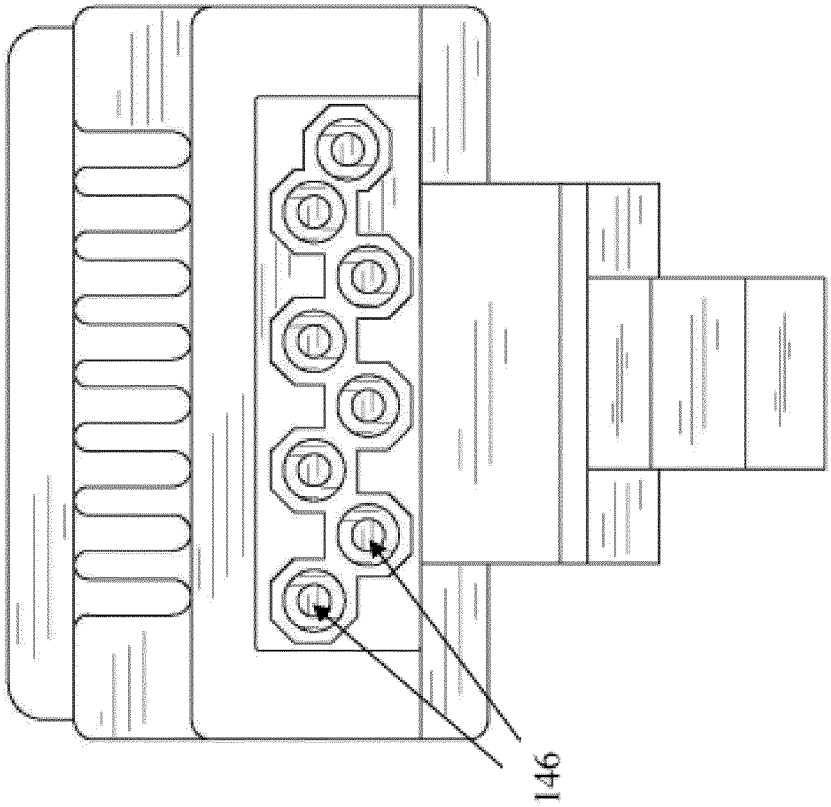


FIG. 9

FIG. 10



REFERENCES CITED IN THE DESCRIPTION

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