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(11) **EP 1 003 244 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
13.04.2005 Bulletin 2005/15

(51) Int Cl.7: **H01R 9/05**, H01R 4/18,
H01R 13/646, H01R 43/05

(21) Application number: **99123130.9**

(22) Date of filing: **19.11.1999**

(54) **A shielded connector and a method for connecting a shielded connector with a shielded cable**

Abgeschirmter Verbinder und Verfahren für die Verbindung von einem abgeschirmten Verbinder mit
einem abgeschirmten Kabel

Connecteur blindé et procédé pour connecter un connecteur blindé avec un câble blindé

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: **19.11.1998 JP 32968598**
27.11.1998 JP 33772398
01.12.1998 JP 34193398

(43) Date of publication of application:
24.05.2000 Bulletin 2000/21

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(56) References cited:
EP-A- 0 475 387 **EP-A- 0 510 264**
US-A- 2 789 279 **US-A- 4 744 769**

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Description

[0001] The present invention relates to a shielded connector and to a method for connecting a shielded connector with a shielded cable, in particular a crimping method.

[0002] In recent years, there has been a tendency for making a variety of electric equipments smaller. There is a demand to make shielded connectors smaller in order to make parts of the electric equipments smaller. A shielded connector for connecting a shielded cable comprised of an inner conductor for transmitting a high-frequency signal and an outer conductor for shielding the inner conductor needs to separately connect the inner and outer conductors. A known shielded connector of this type is disclosed in Japanese Unexamined Utility Model Publication No. 5-27983. This terminal 1 is provided with three crimping portions: an inner conductor crimping portion 1a, an outer conductor crimping portion 1b and a sheath crimping portion 1c as shown in FIG. 7.

[0003] A shielded cable 2 and the shielded connector 1 are connected as follows. An inner conductor 2a is exposed by stripping a sheath 2c, the outer conductor 2b and an insulating element 2d at an end of the shielded cable, and the inner conductor crimping portion 1a is fastened to the exposed inner conductor 2a. Subsequently, only the sheath 2c is stripped at this end of the shielded cable 2 to expose the outer conductor 2b, and the outer conductor crimping portion 1b is fastened to this exposed portion 2e of the outer conductor 2b. Finally, the sheath crimping portion 1c is fastened to the sheath 2c at the end of the shielded cable 2 located behind the exposed portion 2e.

[0004] Generally, crimping portions which are fastened taking advantage of the plastic deformation of metal members inevitably undergo a slight restoration after crimping. As a result, the fastened crimping portions may be slightly loosened. If the exposed portion 2e of the shielded cable 2 is fastened as in the prior art, the crimping portion is left loosened if being restored after crimping since the outer conductor 2b surrounds the hard insulating element 2d at the exposed portion 2e. Therefore, a fastening force is insufficient.

[0005] With the construction of the known outer conductor crimping portion 1b, crimping is performed with no clearance left between the ends of the outer conductor crimping portion 1b as shown in FIG. 8(a) when the exposed portion 2e of the shielded cable 2 having a corresponding small diameter is connected, whereas the ends of the outer conductor crimping portion 1b are spaced apart after crimping if a cable having a large diameter is fastened as shown in FIG. 8(b). Accordingly, the outer conductor 2b comes loose through the clearance, thereby loosening the fastening by the outer conductor crimping portion 1b. Therefore, it is essential to additionally hold the cable by the sheath crimping portion 1c.

[0006] The above known terminal 1 is obliged to have

a long length since it has the inner conductor crimping portion 1a, the outer conductor crimping portion 1b and the sheath crimping portion 1c for the connection with the shielded cable 2. The longer length of the shielded connector 1 disadvantageously leads to a longer length of a connector housing (not shown) for accommodating it.

[0007] It may be considered to delete the sheath crimping portion 1c and to directly apply the crimping construction (see FIG. 9) of the prior art sheath crimping portion 1c to the exposed portion 2e. In such a case, the sheath crimping portion 1c of the prior art crimping construction forms a clearance as shown in FIG. 10. As a result, no sufficient electrical connection is obtained and the fastening force becomes insufficient due to the aforementioned restoration of the crimping portion. This necessitates provision of the outer conductor crimping portion 1b and the sheath crimping portion 1c, which disadvantageously make the entire length of the shielded connector longer.

[0008] Further, document EP 0 510 264 A discloses a shielded connector comprising an inner terminal, an outer terminal and a dielectric plug. This shielded connector comprises three crimping sections, namely a first crimping section of the inner terminal for crimping the insulating element of the coaxial cable, a second crimping section of the inner terminal for crimping onto the inner conductor and a third crimping section of the outer terminal for crimping onto the outer conductor. Thus, this shielded connector needs at least three crimping sections being arranged in series.

[0009] The object of the invention is to provide a new shielded connector which may be downsized, has an improved operability and a facilitated assembly and a respective method for connecting a shielded connector with a shielded cable.

[0010] This object may be achieved by a shielded connector having the features as defined in claim 1 and a respective method having the features as defined in claim 4.

[0011] Further developments of the invention are defined in the dependent claims.

[0012] According to the invention, there is provided a shielded connector according to claim 1.

[0013] Accordingly, since the crimping portion is fastened to the outer conductor folded back over the sheath of the shielded cable, it can be fastened while squeezing the sheath taking advantage of the elasticity of the sheath. Even if the crimping portion is restored after crimping, the elastic deformation of the sheath is not completely cancelled since the crimping portion squeezing holds the sheath. Therefore, the sheath and the outer conductor folded back over it can be closely held by the crimping portion.

[0014] Since the crimping portion provides sufficient fastening force and electrical connection, it can serve both as the sheath crimping portion and as the outer conductor crimping portion of the prior art shielded con-

nector. As a result, the entire length of the shielded connector can be shortened.

[0015] Accordingly, since the pair of crimping pieces surround the outer surface of the outer conducted folded back over the sheath, electrical connection can be more securely established over the entire circumference and the fastening force can be further increased.

[0016] Further, the shielded connector can deal with shielded cables of various outer diameters by adjusting the overlapping length of the ends of the crimping pieces.

[0017] Preferably, the at least two crimping pieces extend from a bottom surface of the crimping portion while being spaced apart wider from each other toward the leading ends thereof. Accordingly, the shielded cable can be more easily inserted, since a risk of interaction with the crimping portion is reduced. Furthermore, a risk of widthwise displacement of the folded portion during the connection can be reduced.

[0018] Further preferably, the leading ends of the crimping pieces are slanted.

[0019] According to the invention, there is further provided a method according to claim 5.

[0020] Preferably, the crimping portion is allowed in the crimping step to slightly restore so that the elastic deformation of the sheath corresponding to or in proximity of the folded portion is correspondingly allowed to elastically restore, wherein the elastic deformation of the sheath is not completely cancelled so that a sufficient fastening force can be obtained.

[0021] These and other objects, features and advantages of the present invention will become more apparent upon a reading of the following detailed description and accompanying drawings in which:

FIG. 1 is an exploded side view showing parts constructing a shielded connector according to one embodiment of the invention,

FIG. 2 is a perspective view of an outer terminal,

FIG. 3 is a perspective view showing the shielded connector before a folded portion is fastened,

FIG. 4 is a perspective view showing a state after the shielded connector is fastened,

FIG. 5 is a vertical section of the shielded connector in its fastened state,

FIG. 6 is a section of an outer crimping portion and a folded portion after crimping,

FIG. 7 is a perspective view of a prior art shielded connector,

FIG. 8 is an enlarged view of a prior art outer conductor crimping portion,

FIG. 9 is a section of a prior art sheath crimping portion, and

FIG. 10 is a section of the prior art sheath crimping portion fastened to an exposed portion of an outer conductor.

[0022] Hereinafter, one embodiment of the invention

is described with reference to the accompanying drawings.

[0023] A shielded connector 10 according to this embodiment has such an integral construction that an inner terminal 20 is accommodated in an outer terminal 40 via a dielectric element 30, and a shielded cable 50 is connected therewith. In the description below, a side (right side in FIG. 1) of the connector 10 to be connected with an unillustrated mating connector is referred to as a front side and an opening direction (an upward direction in FIG. 1) of an outer crimping portion 45 before being assembled is referred to as an upward direction.

[0024] The shielded cable 50 is constructed such that an insulating element 53 is provided between an inner conductor 51 formed e.g. by bundling a plurality of strands and an outer conductor 52 made e.g. of a braided wire and/or a metal sheath and the outer surface of the outer conductor 52 is surrounded by a sheath 54 made of, e.g. vinyl (see FIG. 1). The inner conductor 51 is connected or connectable with the inner terminal 20, whereas the outer conductor 52 is connected or connectable with the outer terminal 40.

[0025] The inner terminal 20 preferably is a female terminal as shown in FIG. 1 and is electrically conductive. A front part of the inner terminal 20 is a tab portion 21 engageable with an unillustrated female terminal and a tapered surface is formed at the leading end thereof. At a rear part of the inner terminal 20 is provided a biting or engaging projection 23 for securing the inner terminal 20 by biting into or engaging the upper wall of an accommodating hole 31 when being inserted into the dielectric element 30 to be described later. Behind the biting projection 23 is provided an inner crimping portion 24 to be fastened to the inner conductor 51.

[0026] The dielectric element 30 is made of an insulating material such as resin, and is electrically insulated from the inner and outer terminals 20, 40. Inside the dielectric element 30 is defined the accommodating hole 31 for fixing the inner terminal 20 accommodated therein. In order to be fixed in the outer terminal 40, the upper wall of the dielectric element 30 is formed with a locking recess 32 and the bottom wall thereof is formed with a contact portion 33 (see FIG. 1).

[0027] The outer terminal 40 is formed e.g. by bending an electrically conductive plate, and a front part thereof is an accommodating portion 41 in the form of a rectangular tube. In order to lock the aforementioned dielectric element 30 in a specified position in the accommodating portion 41, a substantially elastically deformable locking portion 42 and a contact piece 49 are provided on the upper and bottom walls of the accommodating portion 41, respectively. Contact pieces 43 for substantially elastically contacting an unillustrated shielded connector and locking it are provided on the left and right side walls. Behind the accommodating portion 41, stabilizers 44 projecting outward along the transverse direction of the accommodating portion 41 are provided to position the shielded connector 10 while it is inserted into an un-

illustrated connector housing and to substantially stably fix the shielded connector 10 in the connector housing after insertion. Behind the stabilizers 44 is provided an outer crimping portion 45 to be fastened to a folded portion 55 of the outer conductor 52 of the shielded cable 50, wherein the outer crimping portion 45 is providable at least partly in correspondence or overlapping with the folded portion 55. Preferably, the outer crimping portion 45 is substantially fully provided in a position corresponding to the folded portion 55.

[0028] The outer crimping portion 45 is provided with a pair of preferably substantially strip-shaped crimping pieces 46, 47 extending from a bottom portion 48 as shown in FIG. 2. The crimping pieces 46, 47 are spaced gradually wider and slanted surfaces are formed at the leading ends thereof. The crimping pieces 46, 47 preferably have a length sufficient to substantially surround shielded cables of various diameters.

[0029] How the shielded connector 10 is assembled is described. First, the sheath 54 is stripped at one end of the shielded cable 50 to partly expose the outer conductor 52, which is then substantially folded back at least partly over the sheath 54, thereby forming a folded portion 55 (see FIG. 1). Subsequently, the insulating element 53 of the shielded cable 50 is stripped to partly expose the inner conductor 51, to which the inner crimping portion 24 of the inner terminal 20 is then fastened or fastenable.

[0030] Next, the dielectric element 30 is at least partially inserted into the accommodating portion 41 of the outer terminal 40 from front. Then, the contact portion 33 substantially comes into contact with the contact piece 49 and the locking portion 42 substantially slips into the locking recess 32, thereby substantially locking the dielectric element 30 in a specified position in the accommodating portion 41. When the inner terminal 20 connected with the inner conductor 51 is then inserted into the accommodating hole 31 of the dielectric element 30, the biting projection 23 bites or engages into the upper wall of the accommodating hole 31 to stably fix the inner terminal 20 (see FIG. 5).

[0031] Then, the folded portion 55 is placed on the bottom portion 48 of the outer terminal. At this time, since the crimping pieces 46, 47 are preferably most narrowly spaced at their bases near the bottom portion 48 as shown in FIG. 3, the folded portion 55 will not be displaced in widthwise direction since being held between the bases of the crimping pieces 46, 47.

[0032] Thereafter, the shielded connector 10 in the state of FIG. 3 is placed in an unillustrated crimper or folding device. The crimping pieces 46, 47 are brought into substantially close contact with the outer surface of the folded portion 55. At this time, crimping is performed such that the end of the crimping piece 47 is placed on that of the crimping piece 46 (see FIG. 6). Since the leading ends of the crimping portions 46 are formed into slanted surfaces, the ends of the crimping pieces 46, 47 to be preferably placed one over the other can be easily

held in close contact.

[0033] Here, the sheath 54 is compressively deformed in radial directions during crimping. On the other hand, the crimping pieces 46, 47 preferably are slightly restored upon completion of crimping as described above. In this state, the outer crimping portion 45 squeezes the folded portion 55. The elastic deformation of the sheath 54 surrounded by the outer crimping portion 45 is preferably substantially cancelled as the crimping pieces 46, 47 are restored. However, since the elastic deformation is not completely cancelled, the outer conductor 52 over the sheath 54 is held in close contact with the crimping pieces 46, 47 by an elastic force of the sheath 54 as shown in FIG. 6. Accordingly, a sufficient electrical connection is established between the folded portion 55 and the crimping pieces 46, 47 and a sufficient fastening force can be obtained.

[0034] Thus, according to the shielded connector 10 of this embodiment, it is not necessary to separately provide the sheath crimping portion as in the prior art since the outer crimping portion 45 provides sufficient electrical connection and fastening force. The shielded connector 10 can be made smaller by shortening its entire length.

[0035] The shielded connector 10 can preferably deal with shielded cables 50 of different outer diameters by adjusting the overlapping length of the crimping pieces 46, 47. Shielded cables 50 of different specifications can also be dealt with by the shielded connector 10 of this embodiment.

[0036] Since fastening which is realized by the outer conductor crimping portion and the sheath crimping portion in the prior art is realized by the single outer crimping portion 45, operation efficiency can be considerably improved.

< Other Embodiments >

[0037] The present invention is not limited to the foregoing embodiments. For example, embodiments as described below are also embraced by the technical scope of the present invention as defined in the claims. Besides the following embodiments, a variety of changes can be made without departing from the scope of the present invention as defined in the claims.

(1) Although the crimping piece 46 is fastened inside the crimping piece 47 in the foregoing embodiment, this arrangement may be reversed.

(2) Although the invention is applied to the male shielded connector in the foregoing embodiment, it may be applied to a female shielded connector.

(3) Although the invention is applied to the connection of the shielded connectors in the foregoing embodiment, it may be applied to a shielded connector to be directly connected with a circuit board or the like.

LIST OF REFERENCE NUMERALS

[0038]

10	Shielded connector
20	Inner Terminal
30	Dielectric Element
40	Outer Terminal
45	Outer Crimping Portion (Crimping Portion)
46	Crimping Portion
47	Crimping Portion
50	Shielded Cable
51	Inner Conductor
52	Outer Conductor
53	Insulating Element
54	Sheath
55	Folded Portion

Claims

1. A shielded connector connectable with a shielded cable (50) in which cable an insulating element (53) is provided between inner and outer conductors (51, 52) and the outer surface is covered by a sheath (54), the connector comprising:

an inner terminal (20) connectable with the inner conductor (51),
 an outer terminal (40) which is adapted to at least partly accommodate the inner terminal (20) with a dielectric element (30) provided therebetween and is connectable with the outer conductor (52),

wherein the outer terminal (40) comprises a crimping portion (45) to be fastened to the outer conductor (52) folded back over the sheath (54) of the shielded cable (50), thereby being fastened to both the outer conductor (52) itself and to the sheath (54),

characterized in that the crimping portion (45) comprises at least one pair of crimping pieces (46, 47), which are so crimped as to substantially surround the outer conductor (52) folded back over the sheath (54) and to place the end of a first crimping piece (47) over that of a second crimping piece (46).

2. A shielded connector according to claim 2, wherein the at least two crimping pieces (46, 47) extend from a bottom surface (48) of the crimping portion (45) while being spaced apart wider from each other toward the leading ends thereof.

3. A shielded connector according to claim 2 or 3, wherein leading ends of the crimping pieces (46, 47) are slanted.

4. A method for connecting a shielded connector (10) having an inner terminal (20), an outer terminal (40) and a dielectric element (30) provided therebetween, with a shielded cable (50), in which an insulating element (53) is provided between inner and outer conductors (51, 52) and the outer surface is covered by a sheath (54), comprising the following steps:

stripping the sheath (54) to partly expose the outer conductor (52);
 folding back a portion of the outer conductor (52) at least partly onto the sheath (54) to form a folded portion (55);
 crimping the shielded connector (10) to the shielded cable (50) by bringing a crimping portion (45) of the outer terminal (40) substantially into close contact with the folded portion (55),

characterized in that in the crimping step two or more crimping pieces (46, 47) of the crimping portion (45) are so crimped as to at least partly wind on or around the outer conductor (52) with the end of a first crimping piece (47) substantially placed (FIG. 4; FIG. 6) on that of a second crimping piece (46).

5. A method according to claim 5 or 6, wherein the crimping portion (45) is allowed in the crimping step to slightly restore so that the elastic deformation of the sheath (54) corresponding to or in proximity of the folded portion (55) is correspondingly allowed to elastically restore, wherein the elastic deformation of the sheath (54) is not completely cancelled so that a sufficient fastening force can be obtained.

Patentansprüche

1. Abgeschirmter Verbinder, welcher mit einem abgeschirmten Kabel (50) verbindbar ist, in welchem Kabel ein isolierendes Element (53) zwischen inneren und äußeren Leitern (51, 52) vorgesehen ist und die äußere Oberfläche durch eine Ummantelung bzw. Umhüllung (54) abgedichtet ist, wobei der Verbinder umfaßt:

einen inneren Anschluß (20), welcher mit dem inneren Leiter (51) verbindbar ist,
 einen äußeren Anschluß (40), welcher adaptiert ist, um wenigstens teilweise den inneren Anschluß (20) aufzunehmen, wobei ein dielektrisches Element (30) dazwischen vorgesehen ist und mit dem äußeren Leiter (52) verbindbar ist,

wobei der äußere Anschluß (40) einen crimpenden bzw. Crimpabschnitt (45) umfaßt, welcher an dem

äußeren Leiter (52) festzulegen ist, welcher über die Ummantelung (54) des abgeschirmten Kabels (50) rückgefaltet ist, wodurch er sowohl an dem äußeren Leiter (52) selbst als auch an der Ummantelung (54) festgelegt ist,

dadurch gekennzeichnet, daß

der crimpende Abschnitt (45) wenigstens ein Paar von crimpenden bzw. Crimpstücken (46, 47) umfaßt, welche so gecrimpt sind, um im wesentlichen den äußeren Leiter (52) zu umgeben, welcher über die Ummantelung (54) rückgefaltet ist, und das Ende eines ersten crimpenden Stücks (47) über demjenigen eines zweiten crimpenden Stücks (46) anzuordnen.

2. Abgeschirmter Verbinder nach Anspruch 2, wobei sich die wenigstens zwei crimpenden Stücke (46, 47) von einer Bodenoberfläche (48) des crimpenden Abschnitts (45) erstrecken, während sie weiter voneinander zu den vorderen Enden davon beabstandet sind.

3. Abgeschirmter Verbinder nach Anspruch 2 oder 3, wobei vordere Enden der crimpenden Stücke (46, 47) geneigt bzw. abgeschrägt sind.

4. Verfahren zum Verbinden eines abgeschirmten Verbinders (10), welcher einen inneren Anschluß (20), einen äußeren Anschluß (40) und ein dielektrisches Element (30) dazwischen vorgesehen aufweist, mit einem abgeschirmten Kabel (50), in welchem ein isolierendes Element (53) zwischen inneren und äußeren Leitern (51, 52) vorgesehen wird und die äußere Oberfläche durch eine Umhüllung bzw. Ummantelung (54) abgedeckt wird, umfassend die folgenden Schritte:

Abziehen der Ummantelung (54), um teilweise den äußeren Leiter (52) freizulegen;

Rückfalten eines Abschnitts des äußeren Leiters (52) wenigstens teilweise auf die Ummantelung (54), um einen gefalteten Abschnitt (55) auszubilden;

Crimpen des abgeschirmten Verbinders (10) auf das abgeschirmte Kabel (50), indem ein crimpender Abschnitt (45) des äußeren Anschlusses (40) im wesentlichen in unmittelbarem Kontakt mit dem gefalteten Abschnitt (55) gebracht wird,

dadurch gekennzeichnet, daß

in dem Crimpschritt zwei oder mehr crimpende bzw. Crimpstücke (46, 47) des crimpenden Abschnitts (45) so gecrimpt werden, um sich wenigstens teilweise um oder über den äußeren Leiter (52) zu winden, wobei das Ende eines ersten crimpenden Stücks (47) im wesentlichen auf demjenigen eines zweiten crimpenden Stücks (46) angeordnet wird

(Fig. 4; Fig. 6).

5. Verfahren nach Anspruch 5 oder 6, wobei dem crimpenden Abschnitt (45) in dem crimpenden Schritt erlaubt wird, sich geringfügig rückzustellen, so daß die elastische Deformation der Ummantelung (54) entsprechend dem oder in Nachbarschaft des gefalteten Abschnitts (55) entsprechend erlaubt wird, sich elastisch rückzustellen, wobei die elastische Deformation der Ummantelung (54) nicht vollständig aufgehoben wird, so daß eine ausreichende festlegende bzw. Befestigungskraft erhalten werden kann.

Revendications

1. Connecteur blindé connectable à un câble blindé (50), dans lequel câble un élément isolant (53) est prévu entre des conducteurs intérieur et extérieur (51, 52) et la surface extérieure est couverte par une gaine (54), le connecteur comprenant :

une borne intérieure (20) connectable au conducteur intérieur (51),

une borne extérieure (40) qui est prévue pour recevoir au moins en partie la borne intérieure (20), un élément diélectrique (30) étant prévu entre ces bornes, et elle est connectable au conducteur extérieur (52),

dans lequel la borne extérieure (40) comprend une partie de sertissage (45) à fixer au conducteur extérieur (52) rabattu sur la gaine (54) du câble blindé (50), de façon à être fixée à la fois au conducteur extérieur (52) lui-même et à la gaine (54),

caractérisé en ce que :

la partie de sertissage (45) comprend au moins deux pièces de sertissage (46, 47) qui sont serties de façon à entourer substantiellement le conducteur extérieur (52) rabattu sur la gaine (54) et à placer l'extrémité d'une première pièce de sertissage (47) sur celle d'une deuxième pièce de sertissage (46).

2. Connecteur blindé selon la revendication 2, dans lequel les dites au moins deux pièces de sertissage (46, 57) s'étendent à partir d'une surface inférieure (48) de la partie de sertissage (45) tout en s'écartant l'une de l'autre vers leurs extrémités de tête.

3. Connecteur blindé selon la revendication 2 ou 3, dans lequel les extrémités de tête des pièces de sertissage (46, 47) sont biseautées.

4. Procédé pour connecter un connecteur blindé (10)

ayant une borne intérieure (20), une borne extérieure (40) et un élément diélectrique (30) prévu entre ces bornes, avec un câble blindé (50) dans lequel un élément isolant (53) est prévu entre des conducteurs intérieur et extérieur (51, 52) et la surface extérieure est couverte par une gaine (54), comprenant les étapes suivantes :

enlèvement de la gaine (54) de manière à découvrir en partie le conducteur extérieur (52) ;
 rabattement d'une partie du conducteur extérieur (52) au moins en partie sur la gaine (54) de manière à former une partie rabattue (55) ;
 sertissage du connecteur blindé (10) sur le câble blindé (50) par amenée d'une partie de sertissage (45) de la borne extérieure (40) sensiblement en contact étroit avec la partie rabattue (55),

caractérisé en ce que :

dans l'étape de sertissage, deux pièces de sertissage (46, 47), ou plus, de la partie de sertissage (45) sont serties de façon à s'enrouler au moins en partie sur ou autour du conducteur extérieur (52), l'extrémité d'une première pièce de sertissage (47) étant substantiellement placée (figure 4 ; figure 6) sur celle d'une deuxième pièce de sertissage (46).

5. Procédé selon la revendication 4, dans lequel la partie de sertissage (45) peut être légèrement restaurée vers son état initial, à l'étape de sertissage, de sorte que la déformation élastique de la gaine (54) en correspondance ou à proximité de la partie rabattue (55) peut subir une restauration élastique correspondante, dans lequel la déformation élastique de la gaine (54) n'est pas complètement annulée, de sorte qu'on peut obtenir une force de fixation suffisante.

FIG. 1

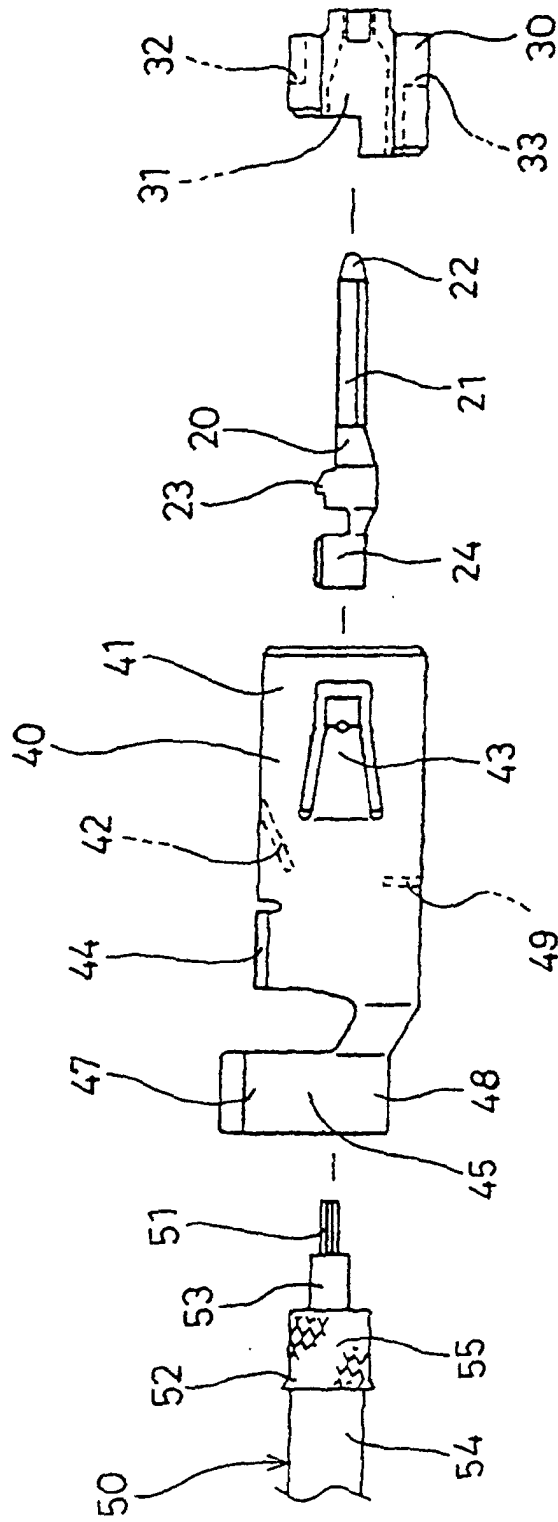


FIG. 2

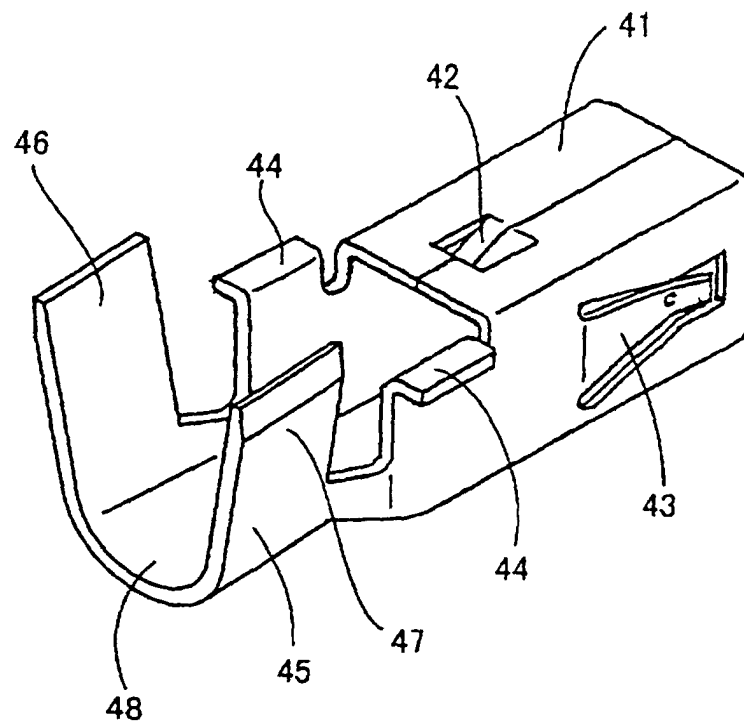


FIG. 3

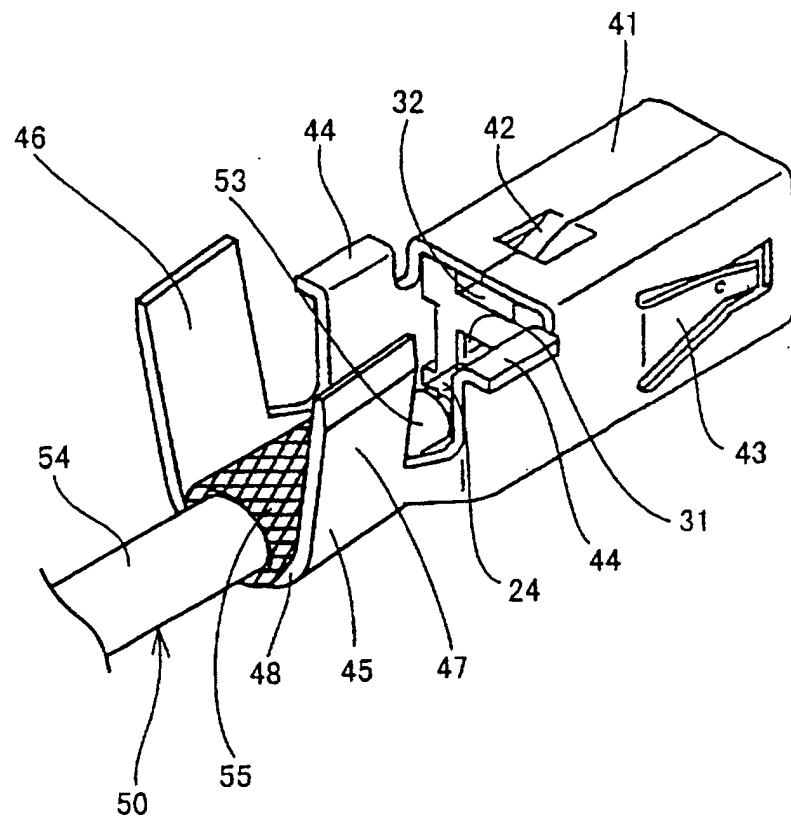


FIG. 4

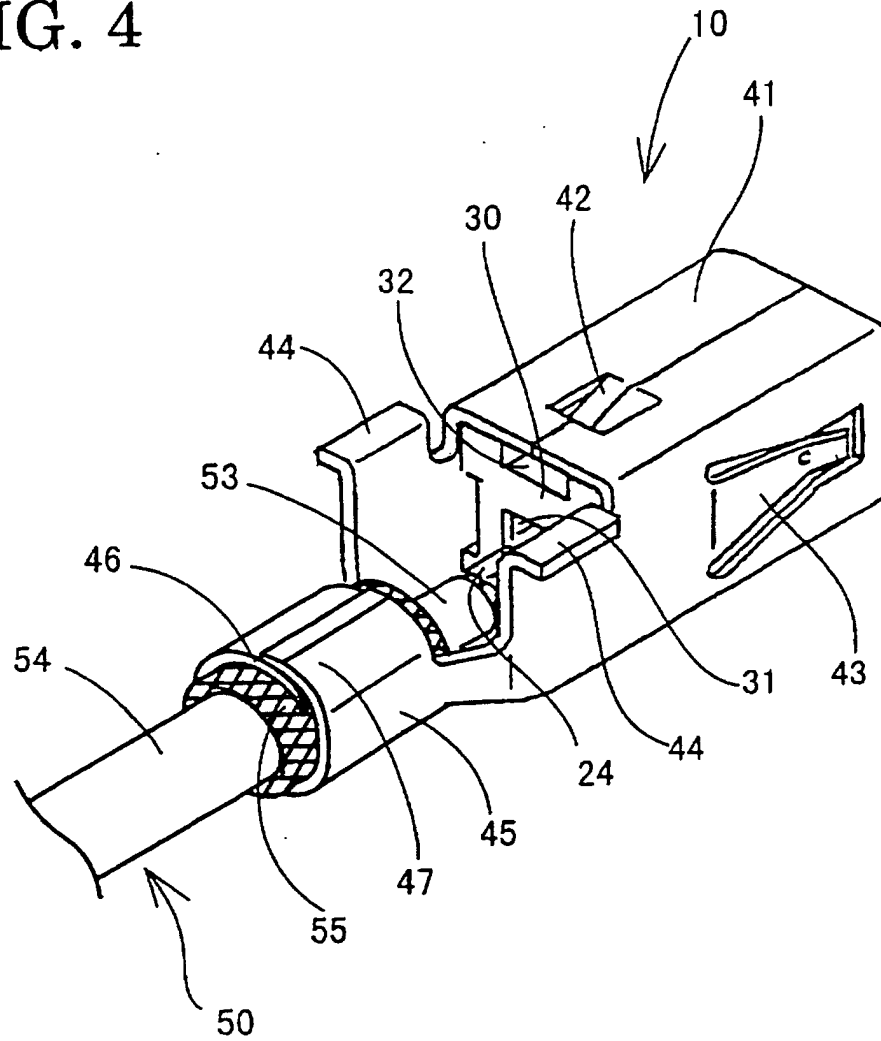


FIG. 5

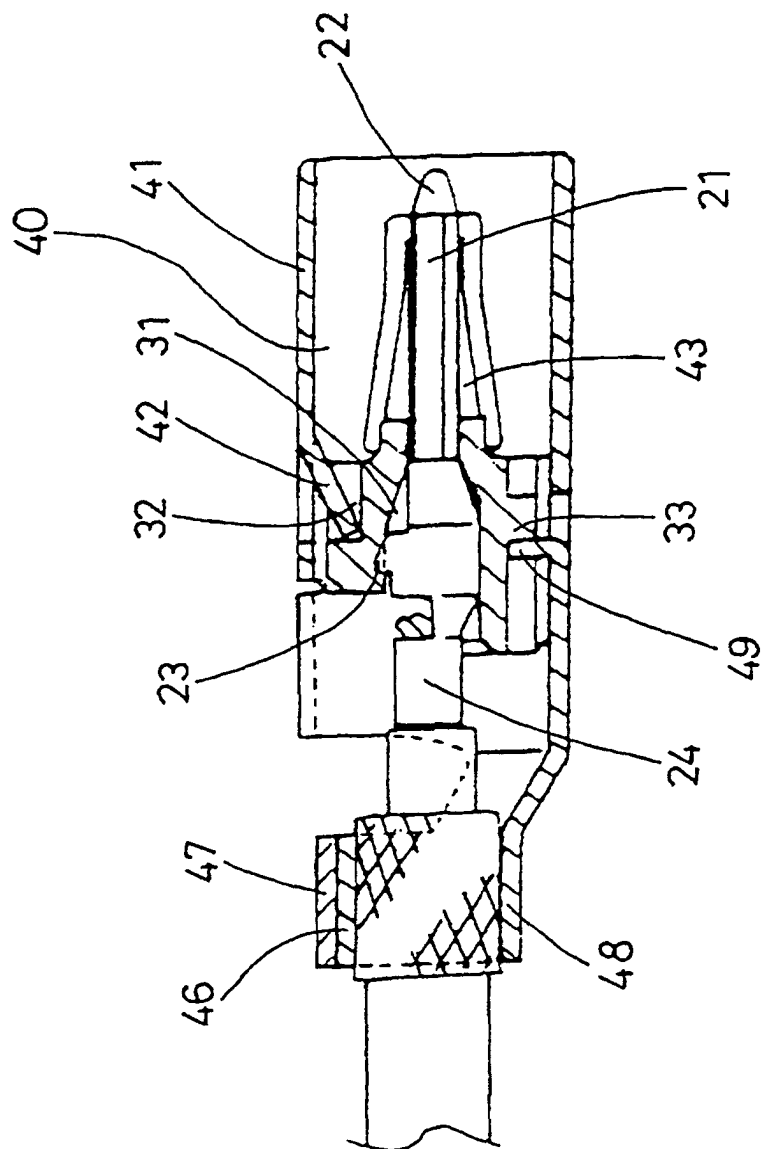


FIG. 6

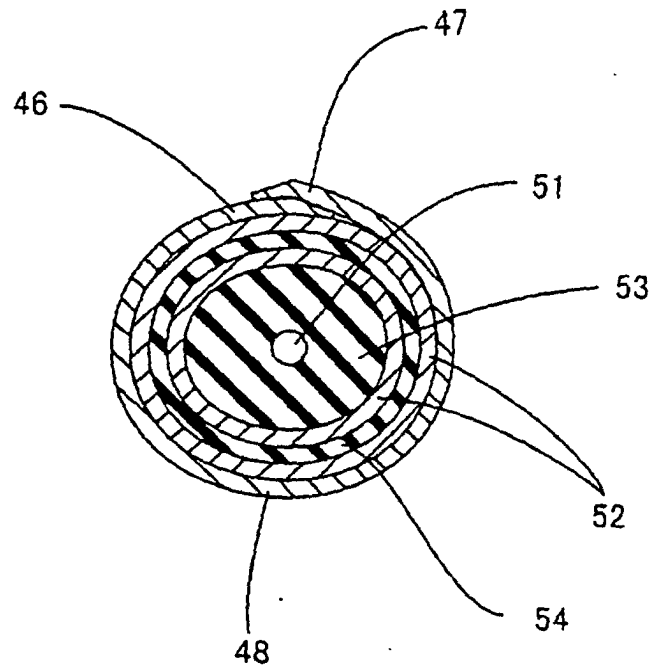


FIG. 7
PRIOR ART

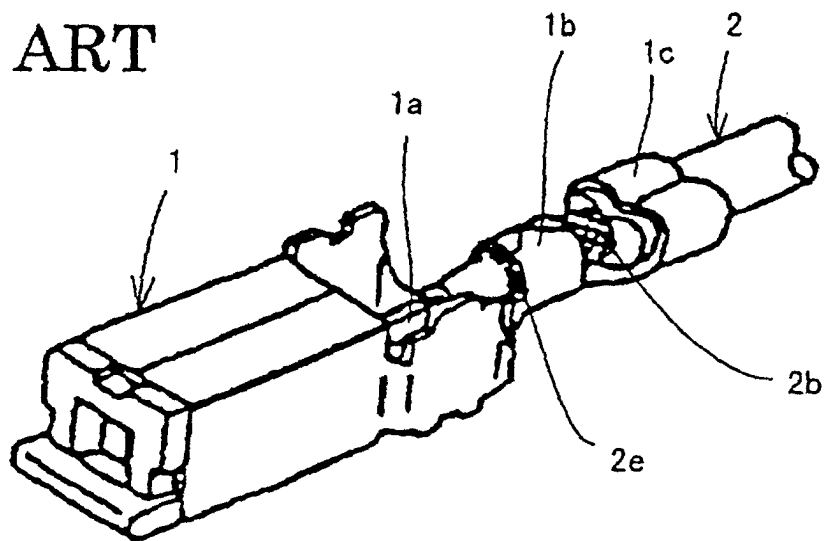


FIG. 8
PRIOR ART

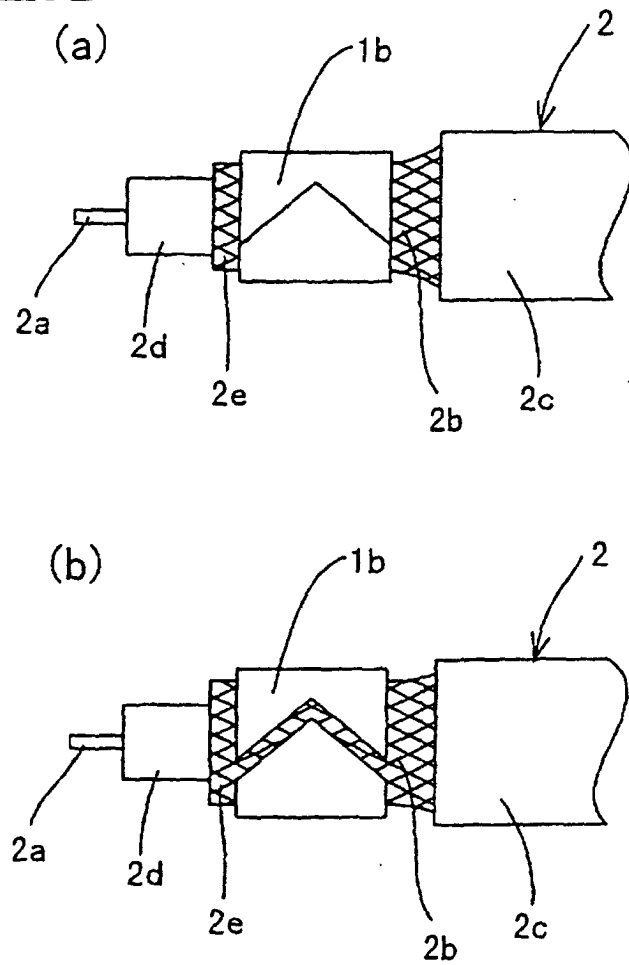


FIG. 9
PRIOR ART

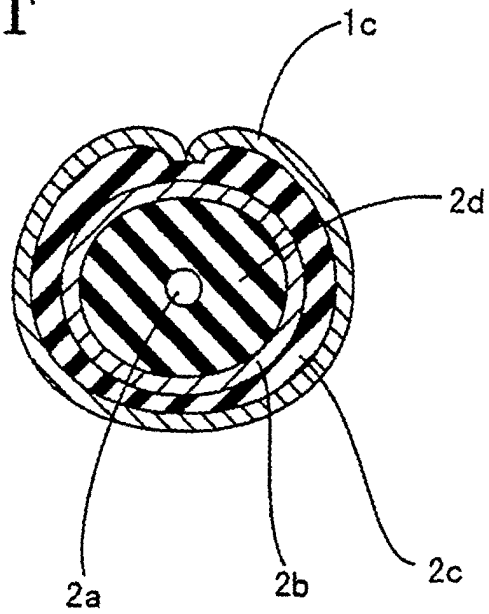


FIG. 10
PRIOR ART

