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(54) Title: ELECTRICAL CONTACT TERMINAL COMPRISING A CRIMPING SECTION

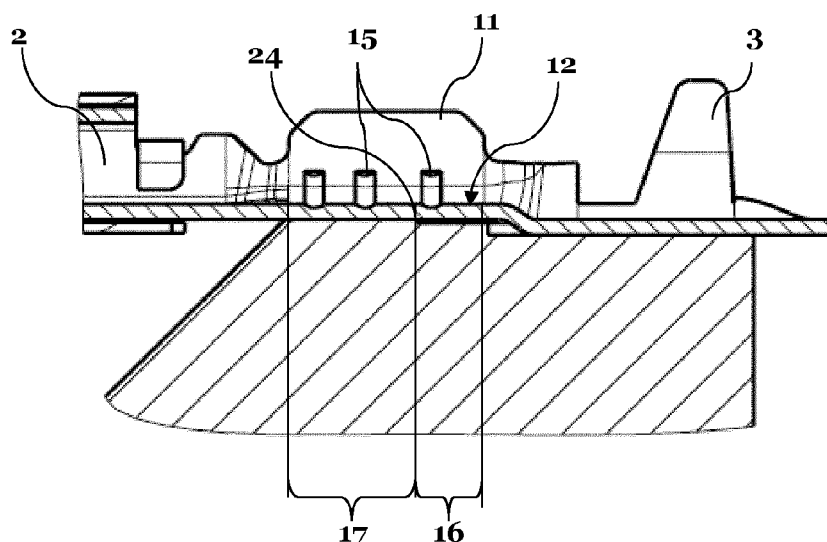


Fig. 4

(57) Abstract: The present invention relates to an electrical contact terminal comprising a conductor and a crimping section which comprises a basis (12) and two crimping wings (11). The crimping wings (11) are bent around the conductor, to provide a mechanical and electrical connection. The basis (12) of the crimping section comprises at least one step, so that the crimping section comprises a first crimping portion (16) and a second crimping portion (17) with different heights.



Electrical contact terminal comprising a crimping section

The present invention relates to an electrical contact terminal comprising a conductor and a crimping section, which crimping section comprises a basis and two crimping wings, which are bent around the conductor to provide a mechanical and electrical connection.

Electrical contact terminals facilitate an electrical contacting of conductors, cables or single wires by means of a simple plug-connection with the electric component which is to be connected. Thereby, numerous different designs for such contact terminals are known, whereby contact terminals, which are connected with a conductor by means of a crimping connection, are particular common in the field of automotive applications. Such contact terminals are also denoted as crimping terminals. The contact terminals, which are usually made from stamped and bent sheet metal, comprise, on the one end, two wings projecting from a straight base, which are also denoted as crimping wings. The electrical conductor is arranged inside of the so formed U-shaped reception of basis and crimping wings and the crimping wings are then bent via a suitable tool around the inserted conductor to provide a mechanical and electrical connection. In mass production, this is usually done by means of suitable forming tools, whereby the basis of the crimping section is arranged onto a flat anvil and a correspondingly formed press block bends the crimping wings around the conductor. In crimping condition, the basis of the crimping section thus stays essentially level. Although the basic principle of such crimping connections is well-known, there exists room for improvement.

It should be noted that, in the terminology of the present application, the expression "conductor" denotes the electrical conducting part, as for example the wires or single wires, which are usually surrounded by a cable sheathing made from insulating plastic. The crimping section, as well as the crimping wings, which from part of the present application, are thus those parts of the contact terminal, which provide a contact to the electrical conducting part. Usually, the contact terminals comprise additional crimping wings, which are

bent around the cable sheathing to provide for additional strain relief of the connection.

For example, the document WO 2009/115860 A1 of the same applicant
5 discloses the use of a crimping tool, wherein the anvil, onto which the basis of the crimping section is arranged, has an essentially flat shape, whereas the corresponding press block consists of three pieces. Due to these three pieces, the two crimping wings can be bent in different amounts during the crimping of a contact terminal around a conductor. Thereby, in the crimping
10 section, different crimping portions are provided having different heights, respectively different crimping tightness. In this respect, three crimping portions are provided, wherein either the middle portion, or both outer crimping portions, should provide a stronger crimping force than the remaining portions. Thereby, an undesired relaxation of the crimping wings
15 due to the elasticity of the material can be avoided.

From the document US 7,306,495 B2, a similar method is known, wherein the crimping section comprises, on each side of the basis, two crimping wings, thus four crimping wings in total (i.e. two crimping wing pairs as shown
20 on figures 14 to 22 of the US 7,306,495 B2). Both crimping wing pairs of this US document are arranged in longitudinal direction of the conductor, behind each other, and provide, upon crimping, two crimping portions with different crimping height, i.e. with different crimping force acting on the conductor. The double pair of crimping wings serves to provide a good mechanical and
25 electrical connection in the case of electrical conductors made from aluminium, since the tighter crimping destroys the unavoidable oxidation layer of the aluminium conductor and the wider crimping provides a good mechanical connection. The tighter crimping destroys, at least partially, the aluminium wires from which the conductor is made and thereby weakens the
30 mechanical connection between the contact terminal and the conductor. In the document US 7,306,495 B2, further several crimping serrations are provided over the length of the crimping section, which are arranged, essentially in plains, perpendicular to the longitudinal direction of the

conductor. These crimping serrations likewise lead to a partial breaking of the aluminium wires and, thus, improve the electrical connection. However, such crimping serrations usually impair the mechanical connection between the contact terminal and the conductor, due to the partial breaking of the wires.

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Although the known contact terminals function satisfactory, they have the disadvantage that specially shaped crimping wings are necessary, thus it is not possible to use standard contact terminals. This is in particular disadvantageous in mass production.

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Starting from the known prior art, the present invention is faced with the problem to provide an electrical contact terminal which eliminates, respectively reduces, the above mentioned disadvantage of the prior art. It is, in particular, the object to provide a contact terminal, which provides an improved mechanical and electrical connection to the conductor and which, nevertheless, allows the use of standard contact terminals as starting material.

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These and other objects, which the skilled person will find upon reading the following description, are solved with an electrical contact terminal according to claim 1.

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The electrical contact terminal according to the present invention comprises at least one conductor and a crimping section. As it was explained above, the term "conductor" denotes herein the electrical conducting part, which can, for example, be a common cable, which comprises one or more electrically conducting wires (conductor) and an insulating cable sheathing. The crimping section comprises a basis, from which two opposed crimping wings project. The conductor is arranged inside the space between the two crimping wings, so that the crimping wings are bent around the conductor, to provide mechanical and electrical connection between the contact terminal and the conductor. The particular advantage of the contact terminal according to the present invention is that the basis of the crimping section comprises at least

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one step, so that the crimping section comprises a first and a second crimping portion having different heights. The step in the crimping section can, for example, be achieved, upon production, with an anvil having a corresponding step, such that, during crimping, the crimping wings are uniformly bent around the conductor, whereas the basis, however, is provided with the step. Preferably, due to the step in the basis, the second crimping portion is provided with a lower height than the first crimping portion and is arranged in an insertion direction of the contact terminal before the first crimping portion. The lower crimping height leads to a tighter crimping and, thus, to an improved electrical connection by, simultaneously, weakening the mechanical connection, since the lower crimping height leads to a certain damaging of the conductor. This is, in particular, advantageous and desired when conductors on aluminium basis have to be crimped, since the damaging due to the lower crimping height leads to a breaking of the oxide layer of the surface of the conductor, which, in turn, leads to an improved electrical connection between the contact terminal and the conductor. The first crimping portion leads to an improved mechanical connection, since due to the larger height, respectively the wider crimping, the conductor is not stressed as much as with the tighter crimping.

To improve the electrical connection, it is further advantageous that the crimping section comprises at least two crimping serrations (crimping ribs), which are arranged, essentially in planes perpendicular to the conductor. The step in the crimping section is preferably arranged between the two crimping serrations. Generally preferred, the distance between the step and the closest crimping serration, in an longitudinal direction of the contact terminal, respectively the conductor, is at least 0.3 mm, preferably at least 0.5 mm, more preferably at least 0.75 mm and most preferred at least 1 mm. In this way, a mechanical weakening of the contact terminal, respectively a weakening of the mechanical connection between the contact terminal and the conductor, can substantially be avoided, by, at the same time, improving the electrical conductivity.

Preferably, the first crimping portion does not comprise any crimping serrations. In a further preferred embodiment, in the first crimping portion instead, a three-dimensional corrugation is provided. Such a corrugation can, for example, be provided by means of a knurling wheel and serves, in general, to improve the mechanical connection between the conductor and the contact terminal.

Generally preferred, the crimping section is provided only with a single step. It was found, that a single step offers the best combination of a mechanical and electrical connection, while, at the same time, the least weakening of the contact terminal. In practice, the length of the contact terminals is often only a few millimeters and the crimping section is, accordingly, only 2 to 5 mm long. It was found that the use of several steps, in such a small section of the contact terminal, leads, in mass production, very often to problems, since it is difficult to achieve the desired tolerances to produce homogenous parts in large number.

In contrast to the prior art, it is further preferred, with the present invention, that the edges or sides of the crimping wings opposite to the base are not provided with any steps, as it is the case in the prior art discussed above. In other words, the upper edges of the crimping wings should, in crimping condition, be essentially parallel to the longitudinal direction of the conductor, and should not be provided with any steps. A step is only provided on the basis, which is arranged opposite to the upper edges of the crimping wings. It is, further generally, preferred that both crimping wings are symmetrical to each other.

The present invention achieves the same advantages as the prior art with a substantially simplified structure and allows in addition – if this is desired – the use of standard contact terminals as starting material. The invention, in particular, offers the possibility to suitably crimp conductors, which tend, due to their material, to the formation of oxide surfaces, as in particular aluminium conductors, respectively conductors on aluminium basis. Due to this step in

the basis of the crimping section, it is possible to provide, in the same crimping section, two crimping portions with different crimping height, respectively crimping strength, without the necessity for any specially formed crimping wings. Due to a suitable choice of the anvil, onto which the basis of the crimping section is arranged, different crimping heights can be produced for both crimping portions, which can, in addition, easily be adjusted to the respective form and shape of the conductor to be crimped. With the present invention, it is sufficient to exchange the anvil, if, for example, different conductors based on different materials or diameters have to be crimped, which require different crimping heights for the first and second crimping portion. Such anvils for crimping are cost-effective to obtain and can be kept in stock in large amounts without any problems and can be exchanged when different conductors have to be crimped. In the prior art, where the use of specially designed crimping wings was necessary, this was relatively complex, since, for each conductor, an especially formed crimping section had to be stamped, which in practice required the stocking and the exchange of a large number of different stamping tools, since such stamp processes are usually done in several steps by several tools.

In the following, a detailed description of the figures is given, wherein:

- Figure 1 shows a schematic illustration of an electrical contact terminal before crimping onto a conductor,
- Figure 2 is a schematic illustration of a crimping tool for the production of an electrical contact terminal in accordance with the invention,
- Figure 3 is a schematic, cut-view of an electrical contact terminal, as it is arranged on the tool according to figure 2,
- Figure 4 is a cut-side view of the illustration of figure 3, and
- Figure 5 shows a stepped basis of the crimping section according to the invention.

In figure 1, an electrical contact terminal 1 is shown, as it is commonly used in the prior art. The contact terminal 1 comprises a front contact end 2, which is shaped to receive a correspondingly formed contact pin therein. The shape

of the contact end 2 is not relevant for the present invention and could also be provided differently. At the opposite end, two wings 3, 3' are arranged to encompass the cable sheath 31 of a cable 32. Between the wings 3, 3' and the contact end 2, a crimping section 10 is provided, which comprises a basis 12, from the sides of which two parallel, opposite and symmetrical crimping wings 11, 11' project. The cross section of the crimping section 10, in the starting position shown in figure 1, is essentially U-shaped cross section. The cable 32 is arranged such onto the electrical contact terminal 1, such that an electrically conducting conductor 30 of the cable 32 is between both crimping wings 11, 11' and the cable sheathing 31 is arranged between both wings 3, 3'. Upon crimping of the crimping wings 11, 11', the crimping wings 11, 11' are bent around conductor 30, to provide a mechanical and electrical connection. Preferably, at the same time, the wings 3, 3' are also bent around the cable sheathing 31, to provide an additional strain relief. However, wings 3, 3' are only optional and not part of the present invention.

In figure 2, a tool for the production of an electrical contact terminal 1 in accordance with the invention is shown. The right hand illustration in figure 2 is an enlarged view of Y area. As the skilled person will recognize, the shown tool is an anvil 20 for the production of a crimping connection. In the crimping process, the electrical contact terminal 1 of, for example, figure 1 is arranged on the anvil 20 such that the crimping section 10 rests on both crimping faces or press faces 22 and 23 and the end section, with both wings 3, 3', rests on the larger face 21. Between the two crimping faces 22 and 23, a step 24 is provided, and the curvature, i.e. the radius of the surface of crimping face 23 is smaller than the radius of the surface of crimping face 22. In this way, the crimping connection in a second crimping portion 17, which is provided by crimping face 23, will be tighter than the crimping connection in a first crimping portion 16, which is provided by crimping face 22. In crimped condition, this means that the crimping face 23 leads to a tighter contacting of the crimping wings 11, 11' around the conductor 30, whereby a particular good electrical connection is provided, as it was explained above. The first crimping portion 16 is provided by means of crimping face 22, and here the

crimping wings 11, 11' are bent around the conductor 30 less tightly, so that a particular good mechanical connection is created.

5 In figure 3, a schematic cut view of an electrical contact terminal according to the present invention is shown, as it is arranged onto the crimping faces of tool 20. As one can see, the crimping section 10 rests on the two crimping faces 22 and 23, and the end section with wings 3, 3' for the cable sheath 31 rests on the larger face 21. The step 24 is arranged approximately in the rear third of crimping section 10, as seen from an insertion direction (i.e. from the left in figure 4). In the embodiment shown in figure 3, the basis 12 of the crimping section 10 comprises three crimping serrations 15, which serve to improve the electrical connection.

15 Figure 4 shows the same embodiment as figure 3, however, in a side cut view and seen from the opposite side. In figure 4, one can see that the step 24 of the crimping tool is arranged between two crimping serrations 15. The first crimping portion 16 is formed by the crimping face 22 and the second crimping portion 17 is formed by crimping face 23. The crimping face 23 creates a lower crimping height than the crimping face 22, such that the crimping connection in the second crimping portion 17 is tighter and thus stronger, as in the first crimping portion 16. Preferably, the crimping connection in the second crimping portion 17 is such that it leads to a certain damaging of conductor 30 to, in particular, create a good electrical connection, in the case of oxidized surfaces of the conductor 30. The crimping connection in the first crimping portion 16 has a higher height as the height of the second crimping portion 17, so that, here, a particular good mechanical connection is created, since the conductor 30 remains substantially undamaged in this portion. As one can likewise take from figure 4, the upper edges of the crimping wings 11, 11' are essentially parallel to the longitudinal direction of the crimped conductor. The skilled person will recognize that this will also be the case in crimped condition, when one uses a common press tool for crimping, i.e. a press tool without any steps.

In figure 5, the basis 12 of crimping section 10 is shown from below. One can recognize the step 14, which is created due to the crimping tool, respectively the step 24 of the crimping tool 20, and the thus resulting the first and second crimping portions 16 and 17.

Claims

1. Electrical contact terminal (1) comprising a conductor (30) and a crimping section (10), which crimping section (10) comprises a basis (12) and two crimping wings (11, 11'),
5 wherein the crimping wings (11, 11') are bent around the conductor (30), to provide a mechanical and electrical connection,
characterized in that the basis (12) of the crimping section (10) comprises at least one step (14), so that the crimping section (10)
10 comprises a first crimping portion (16) and a second crimping portion (17) with different heights.
2. Electrical contact terminal according to claim 1, **characterized in that** the second crimping portion (17) has a lower height than the first crimping portion (16) and is arranged, in an insertion direction of the
15 contact terminal (1), before the first crimping portion (16).
3. Electrical contact terminal according to any one of the preceding claims, **characterized in that** the crimping section (10) comprises at least two crimping serrations (15), which are arranged essentially in planes
20 perpendicular to conductor (30).
4. Electrical contact terminal according to the preceding claim, **characterized in that** the step (14) is arranged between the crimping
25 serrations (15).
5. Electrical contact terminal according to one of claims 3 or 4, **characterized in that** the distance between the step (14) and the closest crimping serration (15), in a longitudinal direction of the contact
30 terminal (1), is at least 0,3 mm, preferably at least 0,5 mm, more preferred at least 0,75 mm and most preferred at least 1 mm.

6. Electrical contact terminal according to any one of the preceding claims,
characterized in that the first crimping portion (16) does not comprise
any crimping serrations (15).
- 5 7. Electrical contact terminal according to any of the preceding claims,
characterized in that, in the first crimping portion (16), a three-
dimensional corrugation is provided.
- 10 8. Electrical contact terminal according to any of the preceding claims,
characterized in that the crimping section (10) comprises only a single
step (14).
- 15 9. Electrical contact terminal according to any one of the preceding claims,
characterized in that the height of the first crimping portion (16),
respectively the second crimping portion (17), is essentially constant
along its length.
- 20 10. Electrical contact terminal according to any one of the preceding claims,
characterized in that the side of the crimping wings (11, 11') opposite
to the basis (12) does not comprise any step.
- 25 11. Electrical contact terminal according to any one of the preceding claims,
characterized in that the upper edge of the crimping wings (11, 11')
are essentially parallel to the longitudinal direction of the conductor (30).

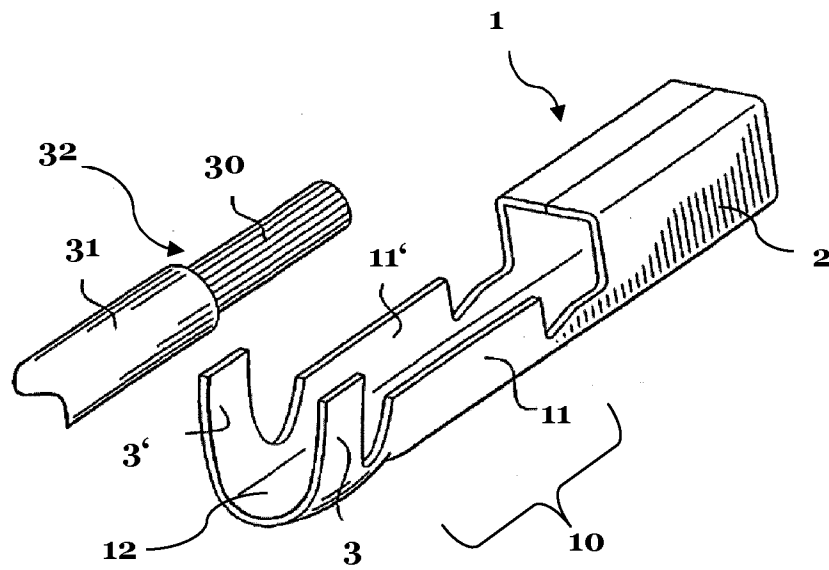


Fig. 1

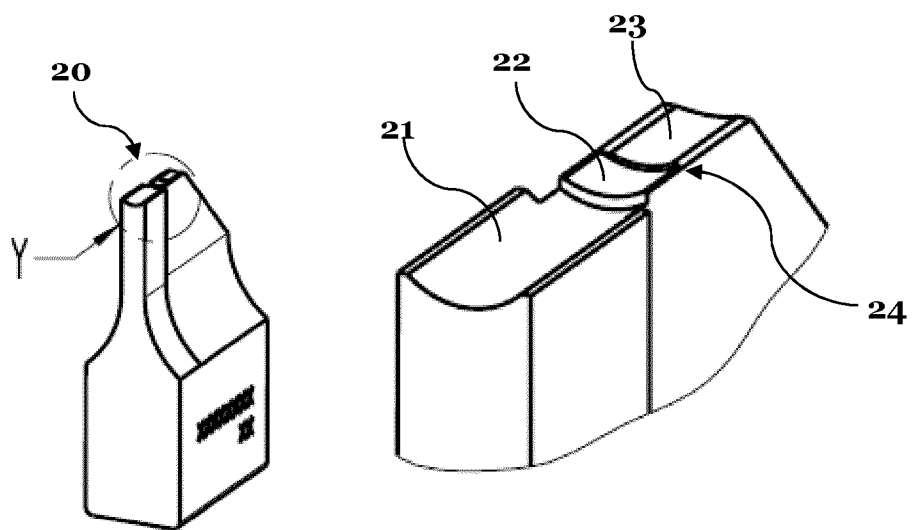


Fig. 2

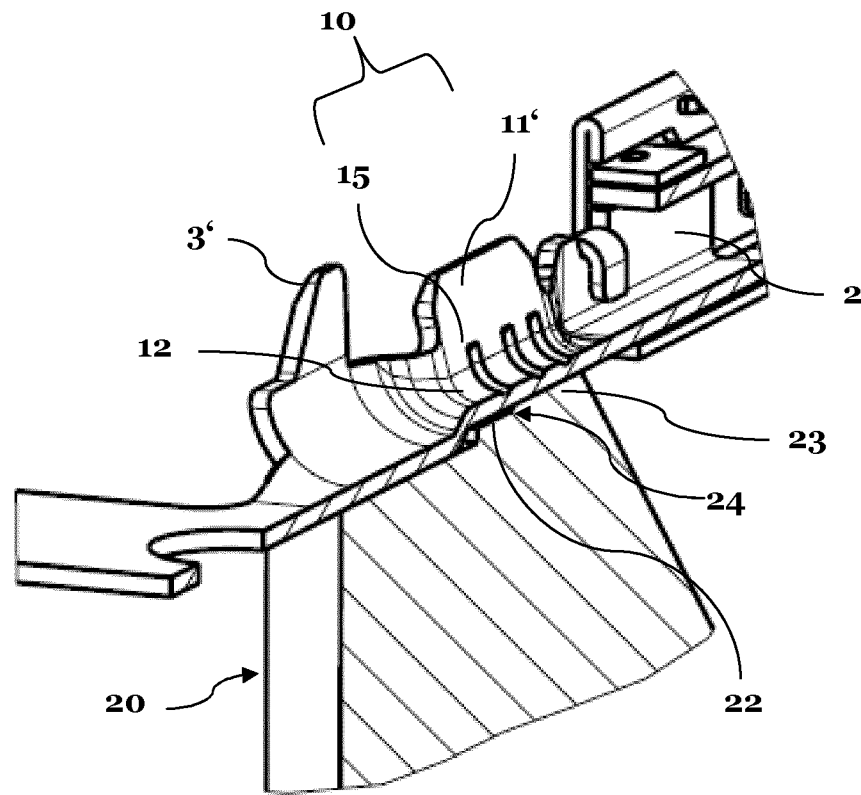


Fig. 3

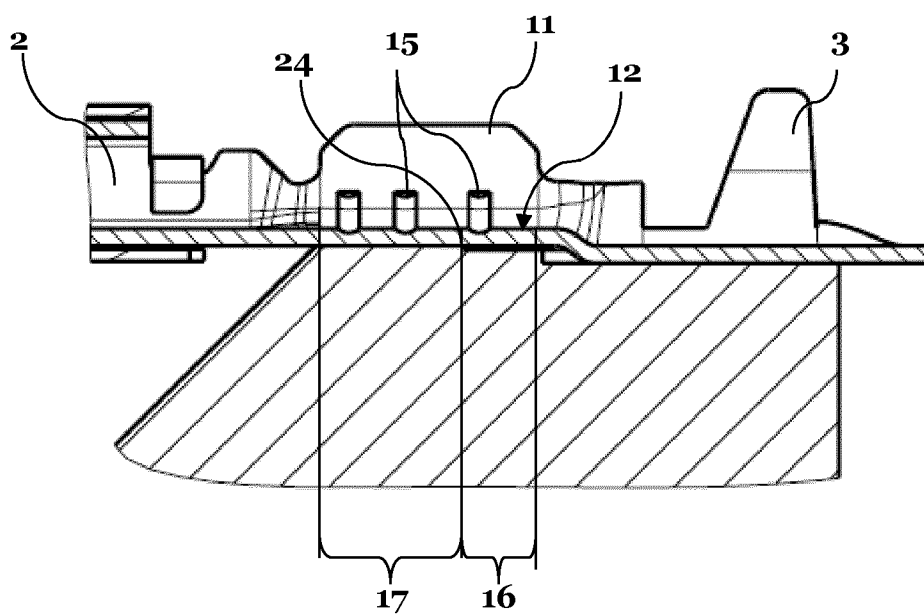
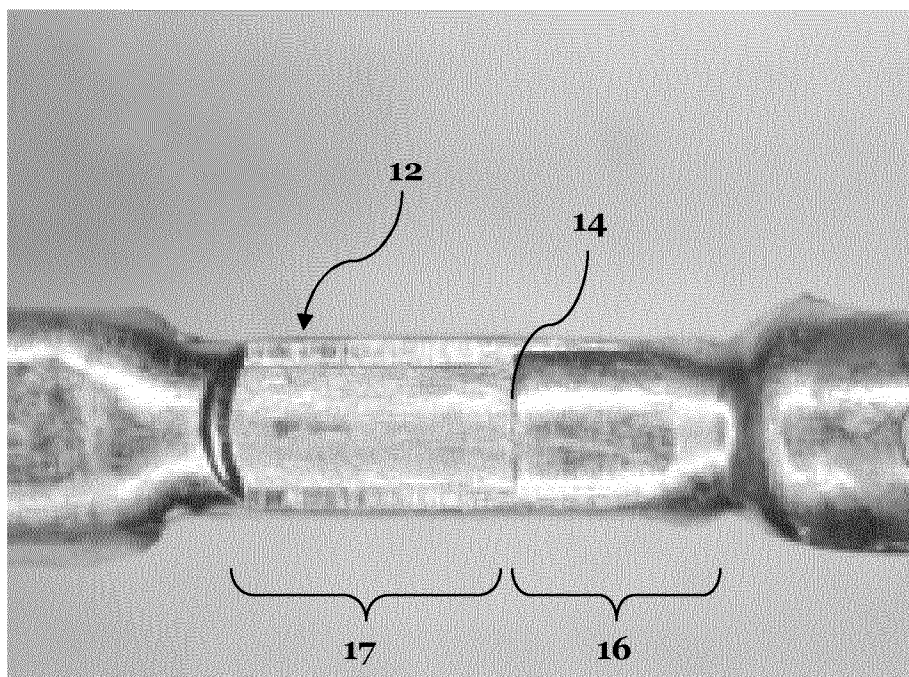


Fig. 4

**Fig. 5**

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/050332

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R4/18
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2009 037908 A (SUMITOMO WIRING SYSTEMS) 19 February 2009 (2009-02-19)	1,2,6, 8-11
Y	abstract figures 3-10 , 17	3-5,7
X	JP 60 047386 A (NIPPON TANSI CO) 14 March 1985 (1985-03-14)	1,2,6, 8-11
Y	figure 8	3-5,7
X	US 2010/087103 A1 (DECKER DONALD F [US] ET AL) 8 April 2010 (2010-04-08)	1,2,6, 8-11
Y	claims 1, 4, 5, 10 paragraph [0015] - paragraph [0017] figures 1-5	3-5,7
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☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

Date of the actual completion of the international search

26 March 2013

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Stichauer, Libor

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2013/050332

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 2009/115860 A1 (FRAMATOME CONNECTORS INT [FR]; JOSSIFIDIS ILIAS [DE]; BAUER ANDREAS [D] 24 September 2009 (2009-09-24) cited in the application	3-5,7
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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