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(71) Applicant: **DELPHI INTERNATIONAL OPERATIONS LUXEMBOURG S.À.R.L.** [LU/LU]; Avenue de Luxembourg, L-4940 Bascharage (LU).

(72) Inventors: **TRISTANI, Laurent**; c/o Delphi Connection Systems Holding France, 18, Parc Ariane III, 3/5, rue Alfred Kastler, 78280 Guyancourt (FR). **YAHYA, Ould**; c/o Delphi Connection Systems Holding France, 18, Parc Ariane III, 3/5, rue Alfred Kastler, 78280 Guyancourt (FR).

(74) Agent: **ROBERT, Vincent**; Delphi France SAS - IP Department, Bât. Le Raspail - ZAC Paris Nord 2, 22, avenue des Nations, CS 65059 Villepinte, F-95972 Roissy CDG CEDEX (FR).

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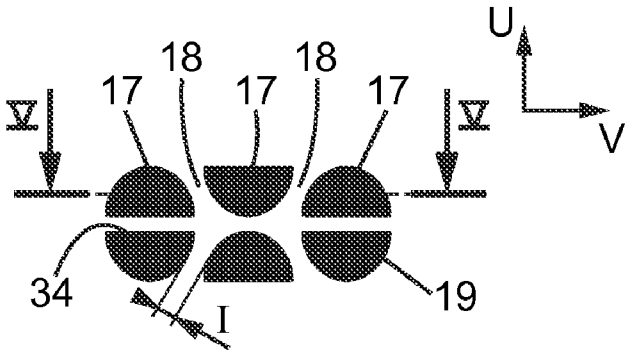


FIG. 4a

(57) Abstract: The present invention relates to an arrangement of an electrical wire (30) and an electrical terminal sheet (4), the electrical wire (30) defining a wire longitudinal direction (U) and comprises a plurality of strands (33), each strand (33) defining a strand longitudinal direction, and having a diameter (D) measured transverse to the strand longitudinal direction and the electrical terminal sheet (4) comprising at least a rear section (36) for assembly with the electrical wire (30), the rear section (36) comprising a wire crimping section (11) having at least an inner face (11a). Longitudinal and lateral dimensions of the wire crimping section (11) are measured along the sheet longitudinal direction and a sheet lateral direction, respectively. A plurality of recesses (17) are provided in the wire crimping section (11) at the inner face (11a), each recess (17) having a maximal transversal dimension. A ratio of the diameter (D) to the maximal transversal dimension is between 0.25 and 1.

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Arrangement of an electrical wire and an electrical terminal sheet and method of manufacturing thereof.

The present invention relates to arrangements of an electrical wire and an electrical terminal sheet and to methods of manufacturing electrical connections.

In particular, the present invention is related to electrical connections comprising an electrical wire and an electrical terminal.

A conventional method for assembling an electrical wire with an electrical terminal is crimping a crimp section of the electrical terminal onto the electrical wire. While this method has been very reliable for copper connections, a layer of insulating oxide will easily form at the surface of the electrical wire, which will make the assembly of the wire to the terminal more difficult. Indeed, this assembly must both correctly transfer electricity between the electrical wire and the electrical terminal, and mechanically withstand any efforts applied to the connection. These abilities must also last with time in varying external conditions.

Therefore, a need arises to provide a reliable assembly between a terminal and an electrical wire.

To this aim, it is provided a arrangement of an electrical wire and an electrical terminal sheet.

The electrical wire defines a wire longitudinal direction and comprises a plurality of strands each defining a strand longitudinal direction. Each strand has a diameter measured transverse to the strand longitudinal direction.

The electrical terminal sheet is deformable to form the electrical terminal. It comprises a front section for electrical connection with a complementary contact. It also comprises a rear section for assembly with the electrical wire.

Preferably, the front and rear section are provided along a sheet longitudinal direction. The wire longitudinal direction and the sheet longitudinal direction are parallel.

The rear section comprises a wire crimping section. This wire crimping section has an inner face and at least an outer face.

The wire crimping section is thin. A thickness of the wire crimping section is lower than longitudinal and transversal dimensions of the wire crimping section. The longitudinal and transversal dimensions of the wire crimping section are measured along the sheet longitudinal direction and a sheet transversal direction, respectively, the sheet transversal direction being transverse to the sheet longitudinal direction.

A plurality of recesses is provided in the wire crimping section at the inner face. Each recess has a maximal transversal dimension measured along the sheet transversal dimension. A ratio of the diameter to the maximal transversal dimension is between 0.25 and 1.

Although some recesses have already been provided in the terminal crimping section in order to improve the assembly of the terminal and the wire, only the localized interaction between the wire and the terminal is studied, whereby the edge of the recess is provided locally to break the oxide layer at the surface of the wire.

Unexpectedly, it was recently discovered that substantial improvement in performance could be gained by designing the recesses according to the size of the strands along to the above ratio.

The interaction of the recess with the wire plays a role also on the macroscopic scale. Thus, selection of the above dimensional ratio was discovered to substantially improve the reliability of this assembly.

This invention appears to apply not only to copper wires, but also to aluminium wires, where the oxide layer may form even more easily at the surface of the wire.

Aluminium wires refer either to wires of pure aluminium (including a controlled number of impurities) or aluminium alloys (Mg or Fe aluminium alloys).

In some embodiments, one might also use one or more of the features as defined in the claims.

Of course, different features, alternatives and/or embodiments of the present invention can be combined with each other in various arrangement to the extent that they are not incompatible or mutually exclusive of others.

The present invention will be better understood and other features and advantages will become apparent upon reading the following detailed description including embodiments for illustrative purposes with reference to the figures, presented as non-limitative examples, which can be used to complete the understanding of the present invention and the description and, where appropriate, contribute to its definition, in which:

- Figure 1 is a schematic top view of an apparatus

for the manufacture of electrical terminals,

- Figure 2 is a schematic partial top view of an electrical terminal sheet strip,
- Figure 3 is a perspective partial view of a arrangement of an electrical wire and the electrical terminal,
- Figure 4a is a detailed top view of a part of a crimping section of a terminal sheet, according to a first embodiment of the present invention,
- Figure 4b is a view similar to Figure 4a for a second embodiment of the present invention,
- Figure 5 is a partial section view along line V-V of Figure 4a,
- Figures 6a and 6b are schematic views, taken along line VI-VI of Figure 3, respectively, before and after applying the crimping step,
- Figure 7 is partial schematic top view of the second embodiment of the present invention, and
- Figures 8a and 8b are cross-sectional photographs of, respectively, an embodiment of the present invention and a comparative embodiment.

It should be noted that, on Figures, structural and/or functional elements which are common to different embodiments may have the same reference sign. Thus, unless otherwise stated, these elements have structural, dimensional and material properties which are identical.

Figure 1 schematically shows, from the top, an apparatus to form strips of electrical contacts. A band of material 2, advantageously a band of metal 2, is provided from a feeding station 3 and passes through a forming station 1 to be processed.

At the output to the forming station 3, the band of material 2 can be wound of a not shown uptake station,

according to a reel-to-reel process. The band of material 2 may comprise, on each side, holes 5 which are used to drive the band of material 2 through the forming station 1. Other mechanical features than holes 5 can be provided.

The forming station 3 can be divided in a plurality of individual stations 6a to 6e which are each used to shape a part of the band of material 2, so that the output of the forming station 1 will comprise electrical terminals 8. All the outgoing electrical terminals 8 are linked to a common band 9.

Each individual station 6a to 6e comprises one or more tools 13 useful to shape the electrical terminal 8 from the band of material 2. Shaping can either consist of cutting away material from the band of material 2, or folding or drawing a part of the future terminal out of plane.

Cutting, folding and drawing operations can take place whenever suitable. Thus, the electrical terminal 8, which is output from the forming station 1, comprises portions which are placed outside of a X-Y plane in which the band of material 2 extends.

Although Figure 1 shows the electrical terminals 8 shaped and ready to be separated from the common band 9 and to be assembled to an electrical wire, Figure 2 shows an intermediate product, where electrical terminal sheets 4 are attached to the common band 9. The electrical terminal sheet 4 corresponds to the pattern of the electrical terminal 8 before any folding step. Thus, the electrical terminal sheet 4 extends flat in the X-Y plane and only has to be folded in order to form the electrical terminal 8.

As seen on Figure 2, starting from the common band 9, the electrical terminal sheet 4 exhibits an optional sheath crimping section 10, a wire crimping section 11 and a contact section 12, which is partly shown on Figure 2. The sheath crimping section 10 and the wire crimping section 11 form together a rear section 36 of the electrical terminal sheet 4.

After performing the folding steps and also after separation from the common band 9, the electrical terminal 8 can also be seen on Figure 3 with a rear sheath crimping section 20, an intermediate wire crimping section 21, and the contact section 22.

The wire crimping section 21 comprises two transversal wings 24 and 25. A central portion 26 is provided between the two transversal wings 24 and 25. Hence, the wire crimping section 21 is somehow barrel shaped.

Referring back to Figure 2, in the electrical terminal sheet 4, a central portion 16 is provided between two transversal portions 14 and 15. Forming the transversal portions 14 and 15 and the transversal 16 will provide the central portion 24 and 25 and the central portion 26, respectively, of the wire crimping section 21.

As can also be seen on Figure 3, an electrical wire 30 is provided. The electrical wire 30 is provided as an electrically conducting core 31, which is embedded into an insulating sheath 32. The electrical wire 30 extends along a wire longitudinal direction U.

The electrical core 31 comprises a plurality of strands 33, which each extend along a strand direction, which is generally speaking parallel to the wire longitudinal direction U. The number and arrangement of strands 33 may

vary. Generally speaking, the diameter of the strand 33, as referred in the application can refer to the diameter of the strand 33 in contact with the wire crimping section 21.

For the assembly of the electrical terminal 8 and the electrical wire 30, the electrical wire 30 and the electrical terminal 8 are arranged so that the wire longitudinal direction U is globally parallel to a terminal longitudinal direction U'.

Directions V and V' designate respective transversal directions. W and W' designate respective vertical directions. The longitudinal direction U, the transversal direction V and the vertical direction W are perpendicular the one another. The same applies for the longitudinal direction U', the transversal direction V' and the vertical direction W'.

A front part of the electrical wire 30 is placed in the wire crimping section 21 of the electrical terminal 8. A front end of this insulating sheath 32 is provided in the sheath crimping section 20 of the electrical terminal 8.

As can be seen on Figure 6a, in the present example, the strands 33, which are provided external in the wire crimping section 21, have a transverse diameter D. It is noted that other strands, in particular internal strands, may be provided with a different diameter. In the present example, the strands 33 are for example made from copper or aluminium.

As can be seen at Figure 5, the wire crimping section 11 of the electrical terminal sheet 4 is shaped from a thin plate having a maximal thickness t.

A plurality of recesses 17 and protrusions 18 are formed on an inner face 11a of the wire crimping section 11, i.e. the face of the wire crimping section 21 which faces the strands 33 of the electrical wire 30. An outer face 11b is defined as being an opposed face of the inner face 11a.

Figure 4a shows a partial view of the crimping section 11 of the electrical terminal sheet 4. Hence, the inner face 11a is provided with a repetitive pattern of recesses 17. The recesses 17 can be provided in lines and columns, for example, for example oriented respectively along the longitudinal direction U and the transversal direction V.

As can be seen on Figure 4a and 5, each recess 17 is defined by a peripheral line 19, at the inner face 11a which is designed along a geometrical pattern.

Each recess 17 also comprises a bottom face 23, which extends sensibly parallel to the inner faces 11a and the outer face 11b of the wire crimping section 11.

Transversal walls 27 extend from the bottom face 23 to the inner face 11a of the wire crimping section 11.

As can be seen on Figure 5, each recess 17 has a depth d.

According to Figure 4a and 4b, two embodiments of the present invention, the geometry and arrangements of the recesses 17 is sufficiently simple and repetitive to ensure interaction with the strands 33, but also sufficiently varying to ensure a broad dispersion of the types of interactions between an individual strand 33, and an individual recess 17.

Hence, as shown on Figure 4a, all recesses 17 may have the same peripheral line 19, but may be arranged along varying

orientations.

For example, some recesses 17 may be symmetrical with respect to some other ones, for example with respect to the longitudinal direction U and the transversal direction V.

This may also guaranty a higher concentration of recesses 17.

Each peripheral line 19 may comprise at most one line 34 extending perpendicular to the wire longitudinal direction U. Hence, the other line(s) of each peripheral line 19 may not extend along the transverse direction.

In this context, "perpendicular" means that the angle between the line 34 and the longitudinal direction U of the electrical wire 30 is between 75° and 105°. This provides a good anchoring of the strand 33 in the electrical terminal 8.

Such as in the present example, each peripheral line 19 is partially symmetric. In the present example, the peripheral line 19 comprises a single axis of symmetry which is along the electrical terminal 8 axis.

The peripheral line 19 may also comprise few straight lines. In the present example, it comprises a single straight line, and a rounded line.

Therefore, it ensures a large variety of orientations of the interaction line between the strands 33 and the recess 17.

As can be seen on Figure 4a, in the present example, each recess 17 is provided from the peripheral line 19 of a

half circle. Other portions of circle are possible patterns.

Other shapes than the shape of Figure 4a can be used in order to provide a suitable crimping section according to the present invention.

As shown on Figure 4b, recesses 17 having a trapeze-shaped peripheral line 19 can be provided.

In the present example, the axis of the strand 33 can form an angle β, between 5° and 25° with respect to the peripheral lines 19.

For smallest recesses 17, this would prevent the recesses 17 folding on themselves, if the angle between the strand 33 and transversal faces of the recess 17 is significant.

Each recess 17 thus shows at least three non-parallel lines, in the embodiment of Figure 4a, the straight line 34 and two tangent lines to the arcuate line. This geometry ensures a high dispersion of stress generation in the strand 33.

This is especially of interest when the material of the strand 33 and of the electrical terminal 8 have different mechanical relaxation properties, i.e., in particular, when combining an aluminium strand with a terminal of another material, in particular a copper containing terminal.

Figure 7 schematically shows the interaction between the strand 33 and the recess 17 upon crimping.

In the present example, the strand 33 is provided with its longitudinal axis parallel to the longitudinal axis of the

wire crimping section 21.

As shown, the strand 33 may be supported between two spaced apart points 35 of the recess 17, over a dimension D1, and can be supported on two intersection points 35' of the electrical wire 30 with the peripheral pattern 19, each intersection points 35' being provided on the base and transversal sides of the recess 17.

Hence, the distance between the two intersection points 35' is D2. D2 is lower than D1. The recess 17 is provided sufficiently deep, so that substantial material of the strands 33 can enter the recess.

This complex geometry of this interaction between the recess 17 and the strands 33 will generate multi-axial stress inside the strand 33.

Further, this simple description does not take into account the interaction of the strand 33 with the neighbour recesses 17, nor with the other neighbour strands 33.

Hence, many components of the stress tensor for the material of the wire 33 inside the recess 17 will have significant amplitude. Compressive and shear stresses are generated along many principal directions.

Further, this is generated, regardless of the actual respective locations of the strand 33 and the recess 17, i.e. the specific respective locations of Figure 7 need not, and indeed cannot, be reproduced to obtain this phenomena.

With this complexly deformed strand 33, it is ensured that continuous contact between the strand 33 and the

electrical terminal 8 will be kept, even in case of high relaxation of the strand 33.

This is because, even in case of relaxation along some of the principal directions of stress, it is believed that there will be less relaxation along other principal directions.

Simulation and tests have shown that a successful balance of the strength and durability of the assembly of the electrical wire 30 to the electrical wire 30 could be achieved, when the dimensions of the strands 33 and the recesses 17 were related on the macroscopic scale.

This was deemed particularly true when a ratio of the diameter D of the strand 33 to the maximal transversal dimension of the recess 17 was about 0.5. Suitable results were achieved for this ratio between 0.25 and 1.

Indeed, if this ratio is greater than 1, the recess would risk closing on themselves upon crimping, without interaction with the strand 33. If the ratio is lower than 0.25, the macroscopic scale effect will be lost.

These results were further improved, in particular for aluminium strands, when the ratio of the depth d of the recesses 17 to the thickness t of the electrical terminal sheet 4 was rather high, namely between 0.25 and 0.6, in particular between 0.3 and 0.6.

This ratio ensures a high deformation of the strands 33, while still ensuring a good manufacturability. There is no tearing of the electrical terminal sheet 4 during the formation of the recesses 17. Further, it was observed that, when the ratio of the transverse dimension of the recess 17 to its depth was over 4, the risk of the recess

17 closing on itself without acting on the strand 33 was minimized.

In order to break the oxide layer provided at the surface of the aluminium strands, it is provided with rather sharp edges of the recesses 17. Hence, to fulfil this function, the angle a between the lateral wall 27 and the normal to the inner surface 11a is between 0° and 15°.

One may strive to provide a high concentration of recesses 17 while still maintaining a good manufacturability. In order to achieve this, an inter distance I between two neighbour recesses 17 will be between half and twice the diameter D of the strand 33. A typical example for the inter distance I will for example be chosen between 0.2 mm and 0.3 mm, for the diameter D of the strand 33 between 0.25 mm and 0.5 mm.

Another relevant parameter for the assembly of the electrical wire 30 to the electrical terminal 8 is the crimp compression rate. The compression rate will be defined below in relation with Figures 6a and 6b.

Figure 6a shows a cross section of the assembly of the electrical terminal 8 and the electrical wire 30 made of aluminium before applying the crimping step. The cross section is taken along any suitable location of the wire crimping section 21 along the axis Y, for example in the middle.

As shown on Figure 6a, the surface area of the cross section of the electrical wire 30 can be measured before applying the crimping step.

Figure 6b now shows schematically the same cross section after applying the crimping step.

This crimping step also led to a deformation of some strands 33. The cross sectional area of the electrical wire 30 can be measured at the same section immediately after crimping step.

The compression rate is defined as the ratio between the difference between the initial section area and the final section area, compared to the initial section area. According to the present embodiment, compression rates of between 35% and 60% have been applied to provide an efficient cooperation between the electrical wire 30 and the electrical terminal 8.

It will be noted that the sheath crimping section 20 of the terminal can also be deformed to be assembled to the sheath 32 of the electrical wire 30 to provide additional retention.

The contact section 22 of the electrical terminal 8 can be any suitable contact section, such as a male or a female contact section, straight or angled, for example by 90°. The electrical terminal 8 will for example be provided from a copper alloy material, which has a very different mechanical behaviour than aluminium.

Thus, a suitable network of recesses 17 will be provided in the electrical terminal sheet 4, then in the electrical terminal 8, by folding the electrical terminal sheet 4 using the forming station 1 of the manufacturing apparatus.

The electrical terminal 8 thus formed can be assembled to suitable electrical wires 30, such as for example aluminium electrical wires 30.

Due to the complex shape of the recesses 17 and their network, this electrical terminal 8 is assumed to be able to cooperate with a broad variety of electrical wires 30, while still providing the requested properties.

The high heterogeneity of stress distribution encountered by the material of the strand 33 inside the recess 17 raises the ability for the electrical terminal 8 to withstand relaxation of the strand 33 after crimping.

The shape of the recesses 17 is selected to prevent any risk of closing of the recess 17 on itself upon crimping.

This feature can be seen for one embodiment of the present invention shown on Figure 8a, where the strands 33 enter the recesses 17. However, according to a comparative embodiment not falling within the scope of the invention, as shown on Figure 8b, the recesses 17 close on themselves without interacting on the electrical wires 30, which is not suitable.

Obviously, the present invention is not limited to embodiments which are here above described and provided only as examples. It also includes different modifications, and alternatives that may be considered by the person skill in the art as part of the present invention, including all arrangements of different embodiments here above described, taken alone or in arrangement.

CLAIMS

1. Arrangement of an electrical wire (30) and an electrical terminal sheet (4),
wherein the electrical wire (30) defines a wire longitudinal direction (U) and comprises a plurality of strands (33), each strand (33) defining a strand longitudinal direction, and having a diameter (D) measured transverse to the strand longitudinal direction,
wherein the electrical terminal sheet (4) comprises at least a rear section (36) for assembly with the electrical wire (30), the rear section (36) comprising a wire crimping section (11) having at least an inner face (11a),
wherein longitudinal and lateral dimensions of the wire crimping section (11) are measured along the sheet longitudinal direction and a sheet lateral direction, respectively,
wherein a plurality of recesses (17) are provided in the wire crimping section (11) at the inner face (11a), each recess (17) having a maximal transversal dimension,
wherein a ratio of the diameter (D) to the maximal transversal dimension is between 0.25 and 1.

2. Arrangement according to claim 1,
wherein the electrical terminal sheet (4) has a thickness (t), and each recess (17) has a depth (d)
wherein the ratio of the depth (d) to the thickness (t) is between 0.25 and 0.6, in particular between 0.3 and 0.6.

3. Arrangement according to claim 1 or 2,
wherein each recess (17) comprises a bottom surface (23), and a side surface (27) extending between the bottom surface (23) and the inner face (11a) of the wire crimping section (11), and
wherein an angle measured between the inner face (11a) and the side surface (27) is comprised between 75° and 90°.

4. Arrangement according to any of claims 1 to 3, wherein each recess (17) defines a peripheral line (19) at the inner face (11a), and
wherein each peripheral line (19) has one or more of the following features:
- at least one straight line (34) extending along a line direction,
wherein an angle between the line direction and the sheet longitudinal direction is comprised between 75° and 105°,
- at least three non-parallel lines,
- at least partial asymmetry.

5. Arrangement according to any of claims 1 to 4, wherein each recess (17) defines a peripheral line (19) at the inner face (11a), and
wherein each peripheral line (19) has one or more of the following features:
- at most one straight line (34),
- at most one straight line parallel to the sheet longitudinal direction,
- a shape of a portion of a circle.

6. Arrangement according to any of claims 1 to 4, wherein each recess (17) defines a peripheral line (19) at the inner face, and
wherein each peripheral line (19) has a trapeze shape, which is optionally angled with respect to the strand longitudinal direction.

7. Arrangement according to any of claims 1 to 6, wherein the recesses (17) are arranged along lines and columns.

8. Arrangement according to claim 7,

wherein at least two recesses (17) are symmetric to one another.

9. Arrangement according to claim 8,
wherein said at least two recesses (17) are symmetric to one another with respect to one of the sheet longitudinal and lateral dimensions.

10. Arrangement according to any of claims 7 to 9,
wherein a ratio between a distance (I) between two neighbour recesses (17) and an average strand diameter is between 0.5 and 2.

11. Arrangement according to any of claims 1 to 10,
wherein the electrical terminal sheet (4) includes copper.

12. A method of manufacturing an electrical connection, comprising:
- providing an electrical wire (30),
wherein the electrical wire (30) defines a wire longitudinal direction, and comprises a plurality of strands each defining a strand longitudinal direction, and having a diameter measured transverse to the strand longitudinal direction
- providing an electrical terminal sheet (4),
wherein the electrical terminal sheet comprises a rear section for assembly with the electrical wire (30), the rear section comprising a wire crimping section (11) having at least an inner face,
wherein longitudinal and lateral dimensions of the wire crimping section (11) are measured along the sheet longitudinal direction and a sheet lateral direction, respectively,
wherein a plurality of recesses (17) are provided in the wire crimping section (11) at the inner face, each recess

(17) has a maximum dimension measured along the sheet lateral dimension,
wherein a ratio of the diameter to the maximum dimension is between 0.25 and 1,

- assembling the electrical wire (30) to the electrical terminal sheet,

wherein assembling comprises both deforming the electrical terminal sheet into an electrical terminal, and assembling the rear section of the electrical terminal sheet to the electrical wire (30) by crimping.

13. A method according to claim 12 wherein:

- deforming comprises folding the rear section about the sheet longitudinal direction into a receiving section (21) shaped as a channel for receiving the electrical wire (30), and
- assembling comprises placing the electrical wire (30) in the receiving section in contact with the inner face.

14. A method according to any of claims 12 or 13,
wherein crimping comprises applying a compression rate of between 35% and 60%,
wherein the compression rate is defined as a ratio between a difference between an initial and a final section area to the initial section area,
wherein section area designates a section area of matter of the aluminium wire measured in a section plane transverse to the wire longitudinal direction, and
wherein initial and final respectively designate the section area measured before and after applying crimping.

15. Arrangement of an electrical wire (30) and an electrical terminal obtained from providing a arrangement according to any of claims 1 to 11, and folding the rear section about the sheet longitudinal direction into a

receiving section shaped as a channel for receiving the electrical wire (30).

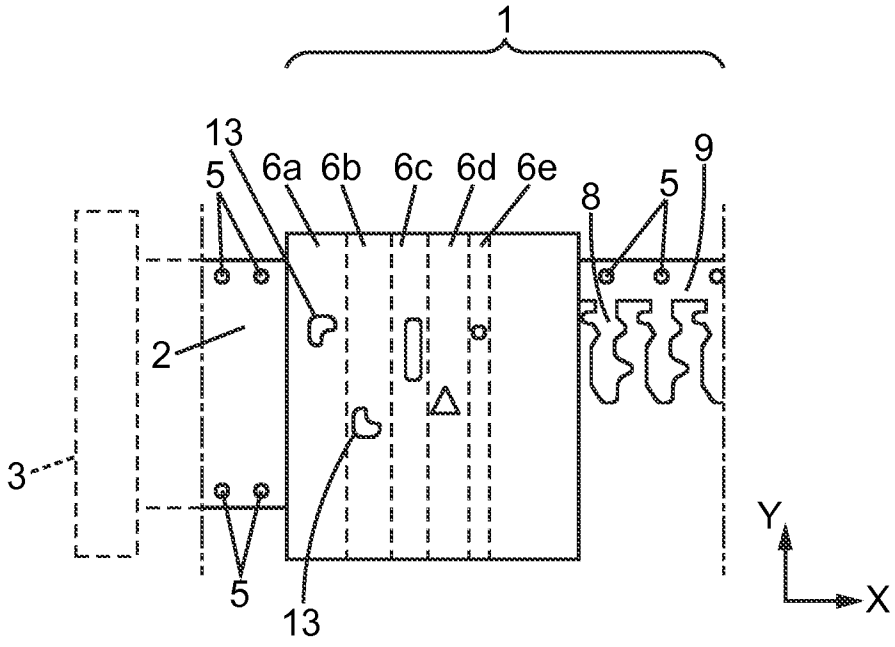


FIG. 1

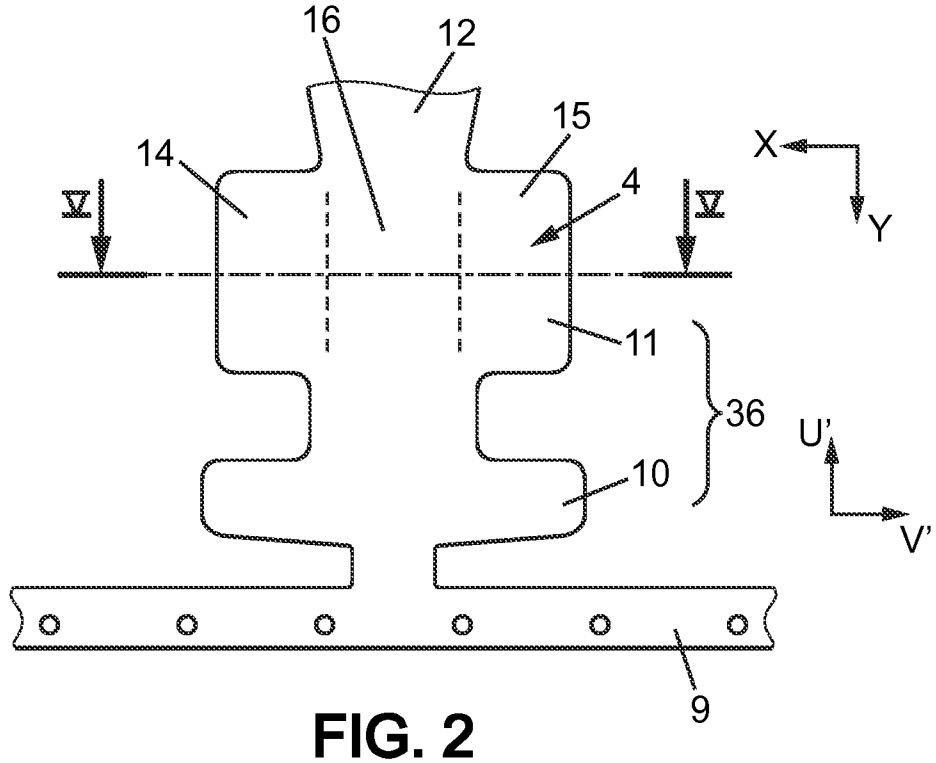


FIG. 2

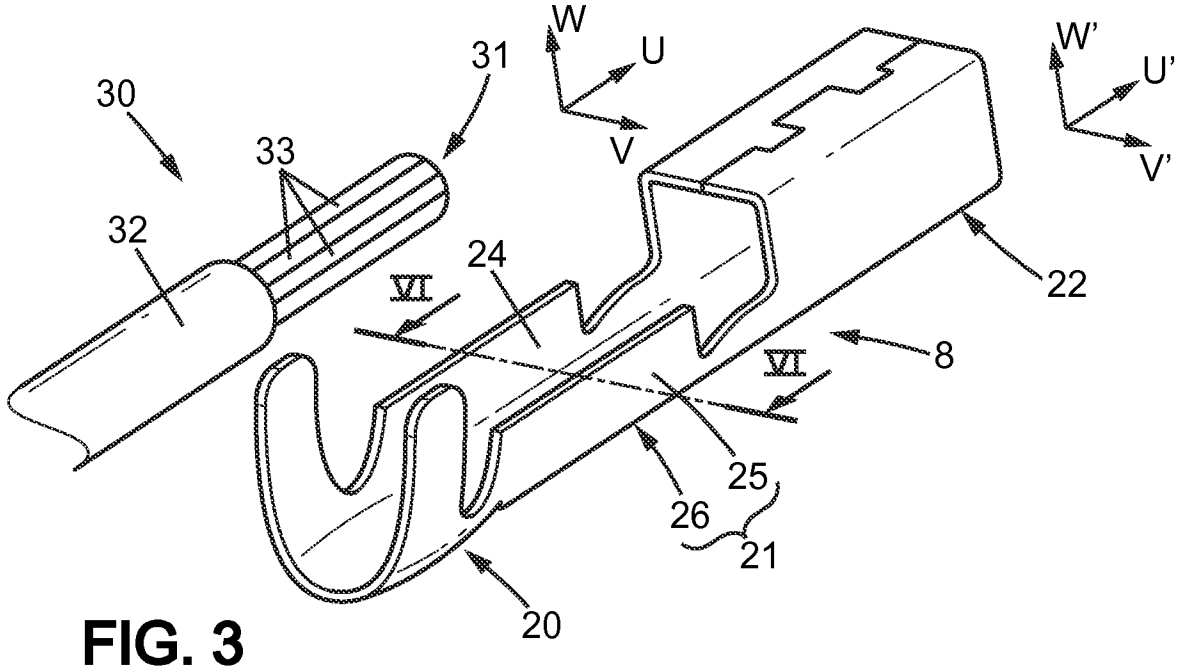


FIG. 3

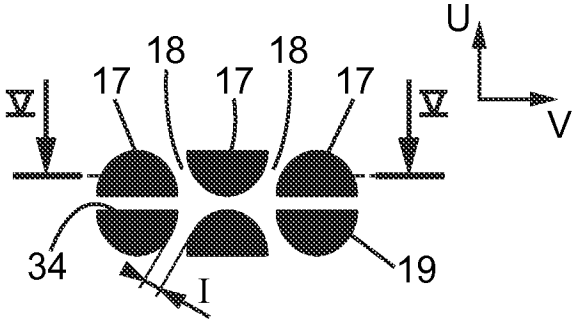


FIG. 4a

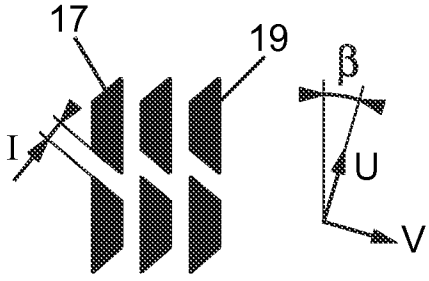


FIG. 4b

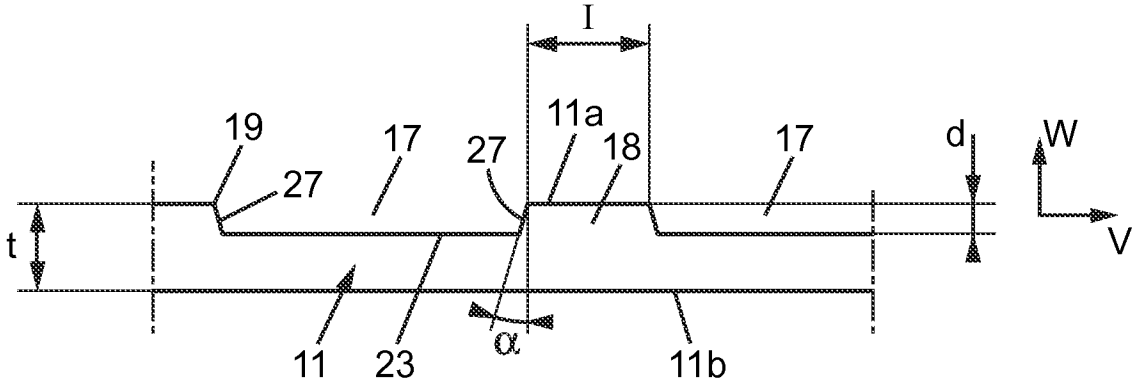


FIG. 5

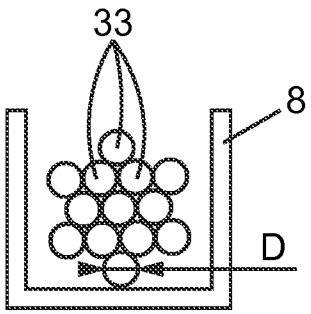


FIG. 6a

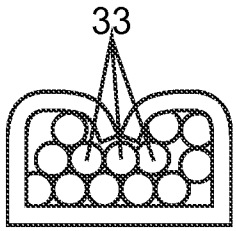


FIG. 6b

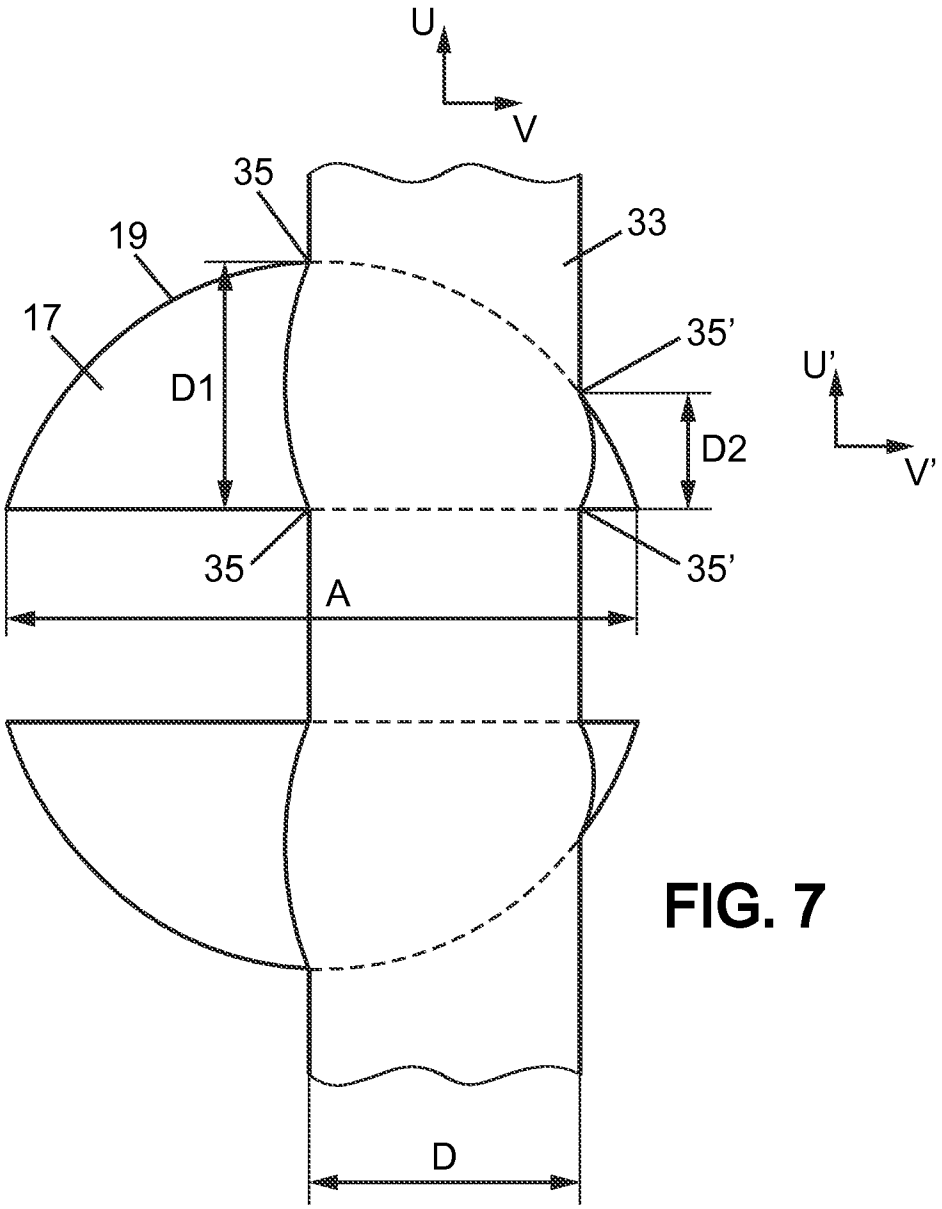


FIG. 7

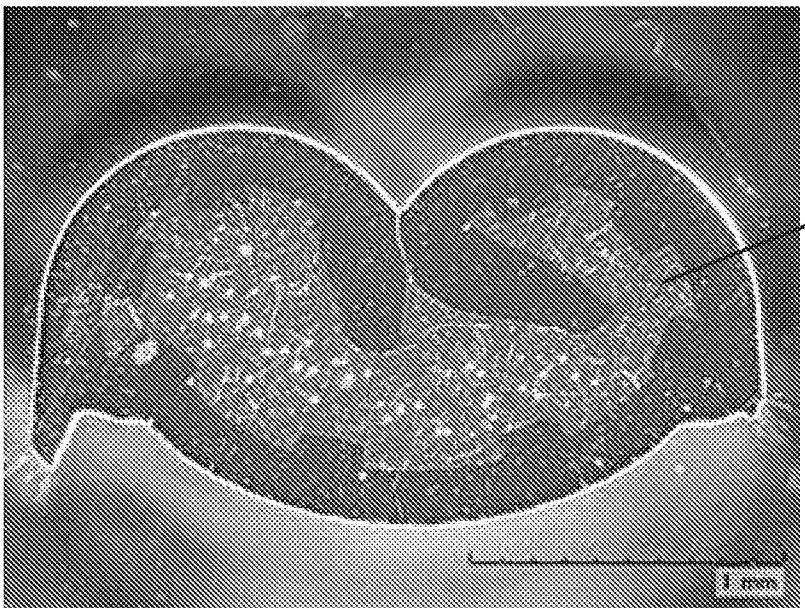


FIG. 8a

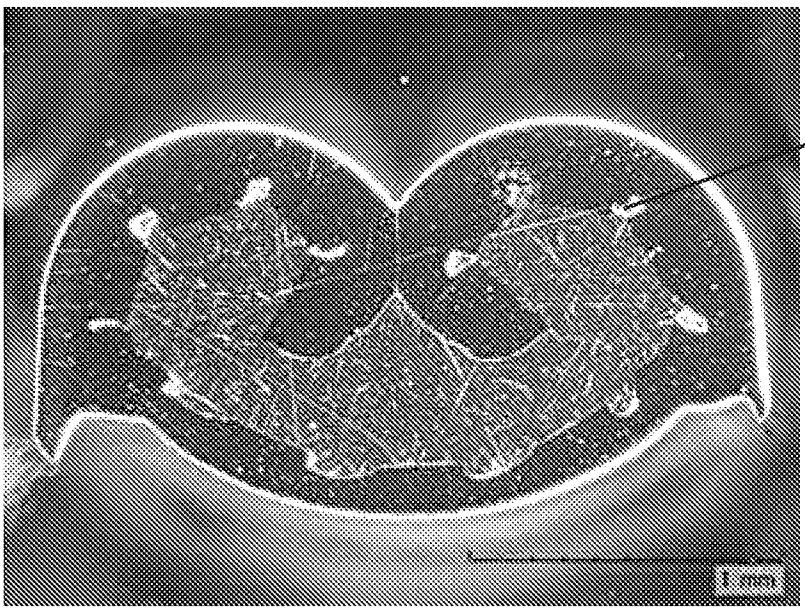


FIG. 8b

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2012/003099

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R4/18 H01R43/048
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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2012/018050 A1 (YAZAKI CORP [JP]; ONUMA MASANORI [JP]; TAKEMURA KOSUKE [JP]) 9 February 2012 (2012-02-09)	1,12
Y	paragraph [0007] - paragraph [0008]; figures 3,9	2,3,5,7

Y	US 2010/297894 A1 (OOTSUKA TAKUJI [JP] ET AL) 25 November 2010 (2010-11-25) abstract; figure 3	2,3

Y	EP 2 309 599 A1 (SUMITOMO WIRING SYSTEMS [JP]) 13 April 2011 (2011-04-13) figures 3a,3b	5,7

X	WO 2012/017736 A1 (YAZAKI CORP [JP]; ONUMA MASANORI [JP]; TAKEMURA KOSUKE [JP]) 9 February 2012 (2012-02-09) figure 9	1

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 August 2013	21/08/2013

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Corrales, Daniel

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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		WO 2012017736 A1	09-02-2012