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(54) **Metal sheet preform and female electrical terminal**

(57) The invention relates to an electrically conductive metal sheet preform (20), for shaping a female electrical terminal (10) having at least one internal contact element (11), which makes use of material from the central region of the metal sheet (20) for shaping at least one of the at least one internal contact element (11), and a female electrical terminal (10) shaped from the same metal sheet preform (20).

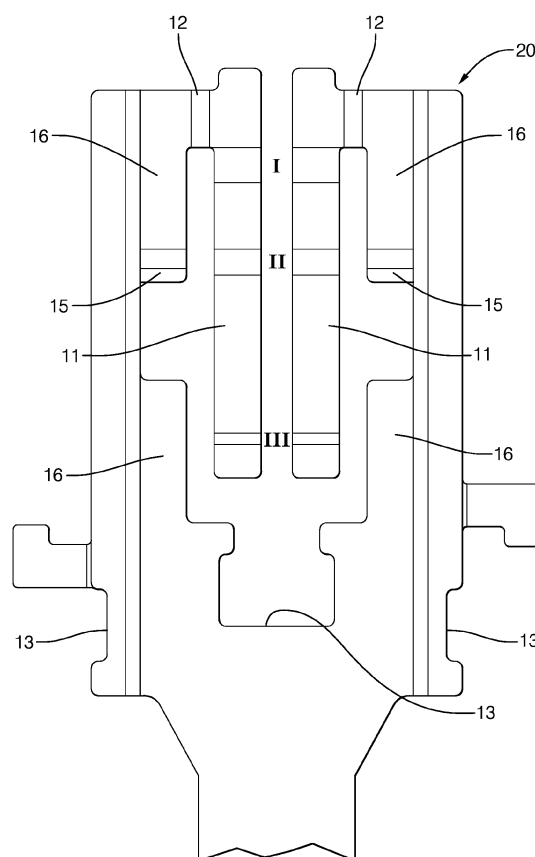


FIG. 3

Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a female electrical terminal, intended for connection with a male blade-type terminal, made from an electrically conductive metal sheet preform that uses material from its central region to define its contact elements. The present invention also refers to such respective a preformed metal sheet.

BACKGROUND OF THE INVENTION

[0002] Female electrical terminals made from a conductive metal sheet by cutting and bending the same are known in the art. Such terminals are characterized by having a portion that allows the connection with electrical cables and a portion that allows the connection with a male terminal, usually of the blade type.

[0003] The portion that allows the connection with a male terminal comprises a bottom, sidewalls, and internally, contact elements that provide the electrical connection with the blade of the male terminal to be connected. Those contact elements are shaped such that upon insertion of the blade they apply the necessary pressure to warrant the required efficiency in electrical transmission between the male terminal and the female terminal.

[0004] In known configurations of such terminals, they have one or two contact elements in the form of internal tabs that are intended to provide the electrical connection with the blade of the male terminal. Those contact elements are made from a metal sheet by means of front bending (where the bend is realized at the foremost region of the sheet) or by way of side bending (where the bend is realized at the lateral region of the metal sheet).

[0005] In Figure 1a there is shown a terminal 5 whose contact elements are shaped by front bending, whereby it is warranted that the fixed end 3 of the contact element 1 be located at the region of insertion of the blade of the male terminal and that the overhung ends 4 be located inside the terminal 5. The arrow indicates the direction of insertion of the male terminal blade. Figure 1b shows a lateral section view of another terminal of that type, however with only one internal contact element. In this manner, in both Figures 1a and 1b, the contact element 1 guides the insertion of the blade, thereby minimizing the stress required for establishment of the connection. This form of operation, however, entails waste of material at the time of cutting the sheet 6 that will provide the terminal 5, since a large amount of material will be discarded, as may be noted in Figure 1, wherein is depicted a schematic diagram of a metal sheet 6. The cross-hatched area represents the material that is not used after the terminal is cut off.

[0006] In the side bend shaping, as exemplified in Figures 2a and 2b, the fixed end 3 of the contact element 1 is located at the rear region while the overhung end 4 is located near the front region. That characteristic entails

the risk that the blade of the male terminal might damage the female terminal 8 at the time of connection if the former is inserted at certain inclination angles. In order to prevent this type of damage there is used a protective barrier 2 at the entry of terminal 8. In Figure 2b there is shown a sectional view of a terminal 8 of this type where it may be clearly seen that without the protective barrier 2 the blade of the male terminal would not be guided towards correct insertion into the female terminal 8. The cited barrier 2, however, entails the use of further material for manufacture thereof and increased waste of material. As may be noted in Figure 2, wherein is depicted a sheet 7 that will provide the terminal 8, all the crosshatched area is discarded after the metal sheet 7 is cut, and therefore, if the use of protective barriers 2 was not necessary, a lesser amount of material would be used to make the terminal 8.

[0007] Thus, there is a need in the art of a female electrical terminal that is made from a sheet of metal and that might entail less waste of sheet material.

[0008] The subject matter discussed in the background section should not be assumed to be prior art merely as a result of its mention in the background section. Similarly, a problem mentioned in the background section or associated with the subject matter of the background section should not be assumed to have been previously recognized in the prior art. The subject matter in the background section merely represents different approaches, which in and of themselves may also be inventions.

BRIEF SUMMARY OF THE INVENTION

[0009] In light of the problems set out above herein, the object of the present invention consists in the provision of an electrical terminal made from a metal sheet preform allowing to optimize the utilization of the latter's material, and providing the respective preform wherefrom the terminal is made.

[0010] In order to achieve the above objects, the present invention provides a metal sheet preform for making a female terminal that comprises at least one contact element, using material from the central region of the sheet to make at least one of the at least one contact element.

[0011] In an embodiment of the present invention, electrically conductive metal sheet preform for shaping a female electrical terminal which has at least one internal contact element is provided. The metal sheet preform has at least one internal contact element that is shaped from material from a central region of a metal sheet.

[0012] In another embodiment of the present invention, a female electrical terminal is provided. The female electrical terminal is shaped from the metal sheet preform.

[0013] Further features and advantages of the invention will appear more clearly on a reading of the following detailed description of the preferred embodiment of the invention, which is given by way of non-limiting example only and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

[0014] The present invention will now be described, by way of example with reference to the accompanying drawings, in which:

[0015] Figure 1 shows a metal sheet used to make a female terminal comprising contact elements shaped by means of frontal bending as known in the art;

[0016] Figure 1a shows a female terminal comprising contact elements shaped by means of frontal bending as known in the art;

[0017] Figure 1b shows a cross sectional view of a female terminal comprising contact elements shaped by means of frontal bending as known in the art;

[0018] Figure 2 shows a metal sheet used to make a female terminal comprising contact elements shaped by means of lateral bending as known in the art;

[0019] Figure 2a shows a female terminal comprising contact elements shaped by means of lateral bending as known in the art;

[0020] Figure 2b shows a cross sectional view of a female terminal comprising contact elements shaped by means of lateral bending as known in the art;

[0021] Figure 3 shows the preferred embodiment of the metal sheet preform according to one embodiment;

[0022] Figure 4 shows the preferred embodiment of the metal sheet preform according to the present invention with the contact elements positioned after bending;

[0023] Figure 5 shows a perspective view of a preferred embodiment of the female terminal according to the present invention after shaping thereof;

[0024] Figure 6 shows a side view of the preferred embodiment of the female terminal shaped from the metal sheet preform according to the present invention;

[0025] Figure 7 shows a side view of the preferred embodiment of the female terminal shaped from the metal sheet preform according to the present invention, with a blade inserted therein;

[0026] Figure 8 shows the female terminal of Figure 5 sheathed in a sleeve;

[0027] Figure 9 shows the female terminal of Figure 8 with the portion thereof that provides the connection with an electrical cable;

[0028] Figure 10 shows an alternative embodiment of the metal sheet preform according to the present invention;

[0029] Figure 11a shows a perspective view of an alternative embodiment of the female terminal according to the present invention, made from the metal sheet preform of Figure 10, upon shaping thereof; and

[0030] Figure 11b shows a perspective view of an alternative embodiment of the female terminal according to the present invention, made from the metal sheet preform of Figure 10, upon shaping thereof.

DETAILED DESCRIPTION OF THE INVENTION

[0031] The description that follows will be based on a preferred embodiment of the invention. As will be evident to any technician skilled in the art, however, the invention is not limited to such particular embodiment.

[0032] Figure 3 shows the preferred embodiment of a metal sheet preform 20 of an electrically conductive material, wherefrom is made the female terminal 10 shown in Figure 5, where it is possible to note that the contact elements 11 are shaped from material from the central region of the metal sheet 20, reducing the waste of material, since no extra material is used from the lateral or frontal regions of the sheet. That advantage becomes even clearer on comparing the preforms of Figures 1 and 2 with that of Figure 3.

[0033] Figure 4 shows the same metal sheet preform 20 of electrically conductive material as shown in Figure 3 with only the contact elements 11 bent in operating (use) position. In that figure it can be noted that all the material of the central region of the metal sheet preform is used to shape the contact elements 11. This fact causes the female terminal 10, upon being completely shaped, to have no sidewalls in one of the transversal directions. That fact may also be observed in Figure 5, where it is noted that the female terminal 10 does not have sidewalls in the width direction A of the blade to be inserted. In optional embodiments in which it is desired to have sidewalls, it is possible to maintain a portion of material from the central region of the sheet in order to warrant the existence of sidewalls in the terminal after its conformation.

[0034] Still in Figures 3 and 4, it may be noted that the fixed end 12 of the contact element 11 is optionally located in the region of insertion of the blade of the male terminal to be connected. This can also be observed in Figure 5, where the arrow indicates the sense of insertion of the blade of the male terminal.

[0035] In that image there is noted the presence of two contact elements 11, positioned in front of one another, with their fixed ends 12 located at the region of insertion of the blade 17 of the male terminal, therefore leaving it clear that the contact elements guide the blade 17, eliminating the risk of damage at that time and facilitating the insertion of the blade 17. That same characteristic may be observed in Figure 6, which shows a side view of the same embodiment of the female terminal 10 of Figure 5. It will be worth pointing out that alternatively the fixed end 12 of the contact element 11 may be located inside the terminal. However, in such embodiment, there will be required an element to guide the insertion of the blade of the male terminal in order to avoid the occurrence of damage to the contact element.

[0036] Additionally, it is noted that each contact element 11 preferably has an element 15 for protection against fatigue and/or inelastic deformation. Such element can be shaped from the same metal sheet 20 wherefrom the female terminal 10 is made, and is posi-

tioned in alignment with the point of contact II of the contact element. Optionally, this protective element 15 may be positioned at any point along the sidewalls 16. However, it is preferred that the said element be positioned near the fixed end 12 of the contact element 11, without interfering with the amplitude of deflection thereof.

[0037] On observing Figure 6 it is noted that each contact element 11 preferably has three inflexions (numbered from I to III) that cause the same to act as a spring, applying pressure on the blade 17 of the male terminal to be connected, in order to warrant the required quality to the electrical connection. Inflexions I and III are located near the ends and act as springs, and inflexion II constitutes the point where contact is realized with the blade 17 of the male terminal. At the time of insertion of the blade 17, the same applies pressure on the contact element, displacing the latter towards the sidewall until a point where the moving end where inflexion III is located contacts the sidewall, whereupon this inflexion also starts to act as a spring, increasing the pressure against the blade 17 and improving the electrical connection therebetween. In Figure 7 there is shown a female terminal according to this preferred embodiment with a blade 17 inserted therein, where there can be clearly observed what is described above. Optionally, the contact element 11 may be provided with only two inflections, and thereby only the first spring will apply pressure on the blade 17, which may be sufficient in some applications.

[0038] In Figure 10 there is illustrated an alternative embodiment of the metal sheet preform 50 where it can be noted that the first contact element 11a is shaped from material from the central region of the sheet, and the second contact element 11b is shaped from the lateral region. In that embodiment, the metal sheet preform also affords an economy of material, since it uses material from the central region of the sheet to shape one of the contact elements.

[0039] Figures 11a and 11b show perspective views of a terminal shaped from the metal sheet preform of Figure 10, where there can be noted the absence of sidewalls in one of the directions, also in that embodiment. Additionally, it will be worth pointing out that all the characteristics found in the previously described terminal may be found in the terminal shaped from that alternative embodiment of the metal sheet preform 50 described herein.

[0040] In situations requiring enhanced stability in the connection between the male and female terminals, the existence of sidewalls may be necessary to avoid displacement in the width direction A of the blade of the male terminal. In those cases there may be used a protective sleeve 30 around the female terminal 10, as illustrated in Figure 8. That sleeve 30 has an exclusively mechanical function, and therefore it may be made from a material with high mechanical performance, such that its thickness may be reduced in the absence of minimum electrical conductivity requirements.

[0041] Still in Figure 8, it is possible to note that the female terminal 10 optionally has two openings 13 at the

rear part thereof. Those openings 13 are meant to retain the sleeve 30 (when the same is used) by means of fastening retainers 32, present on the sleeve 30, that are bent towards the inside of the female terminal 10 and fit into the openings 13.

[0042] In Figure 8 it is also possible to observe the optional presence of a guide element 33 to guide the insertion of the blade 17 towards each contact element 11. That guide element 33 is additionally intended for protection against direct impact on the terminal at the time of insertion of the blade 17. It is additionally noted that beside the guide elements 33 there exist two optional positioning elements 34 that assist in securing the sleeve 30 to the female terminal 10. The utilization of those positioning elements 34 together with the fastening retainers 32 causes the assembly to be static.

[0043] It will be worth pointing out that all elements of the female terminal having been described in the present specification may be shaped from the same metal sheet preform 20 and are indicated by their respective reference numerals in Figures 3 and 4.

[0044] Finally, it is important to point out that any female terminal having the characteristics described herein will further have, at the rear portion thereof, means for connection 40 to electrical cables. Optionally, that element is comprised of a conductor clamp 41 and an insulator clamp 42, as depicted in Figure 9. However, the type of clamp that is actually used can be that which is most appropriate for the use for which the terminal is intended.

[0045] While this invention has been described in terms of the preferred embodiments thereof, it is not intended to be so limited, but rather only to the extent set forth in the claims that follow. Moreover, the use of the terms first, second, etc. does not denote any order of importance, but rather the terms first, second, etc. are used to distinguish one element from another. Furthermore, the use of the terms a, an, etc. do not denote a limitation of quantity, but rather denote the presence of at least one of the referenced items.

Claims

1. An electrically conductive metal sheet preform (20) for shaping a female electrical terminal (10) which has at least one internal contact element (11), **characterized in that** the at least one internal contact element (11) is shaped from material from a central region of a metal sheet.
2. The metal sheet preform (20) according to claim 1, **characterized in that** a fixed end (12) of the at least one internal contact element (11) is located at a front region of the metal sheet preform (20).
3. The metal sheet preform (20) according to claim 1 or 2, **characterized in that** the at least one internal

contact element (11) has three previously established inflections (I, II, III).

4. The metal sheet preform (20) according to claims 1 to 3, **characterized in that** the metal of the metal sheet preform (20) is copper. 5
5. A female electrical terminal (10), **characterized by** being shaped from the metal sheet preform (20) as defined in any one of claims 1 to 4. 10
6. The female electrical terminal (10) according to claim 5, **characterized by** having only sidewalls (16) parallel to the at least one internal contact element (11). 15
7. The female electrical terminal (10) according to claim 5 or 6, **characterized by** comprising a protective element (15) on a sidewall (16) for preventing the occurrence of inelastic deformations of the at least one internal contact element (11). 20
8. The female electrical terminal (10) according to any one of claims 5 to 7, **characterized by** having at least one opening (13) at a rear part thereof. 25
9. The female electrical terminal (10) according to one of claims 5 to 8, **characterized by** having all elements thereof shaped from a single metal sheet.
10. The female electrical terminal (10) according to any one of claims 6 to 9, **characterized by** being sheathed in a sleeve (30). 30

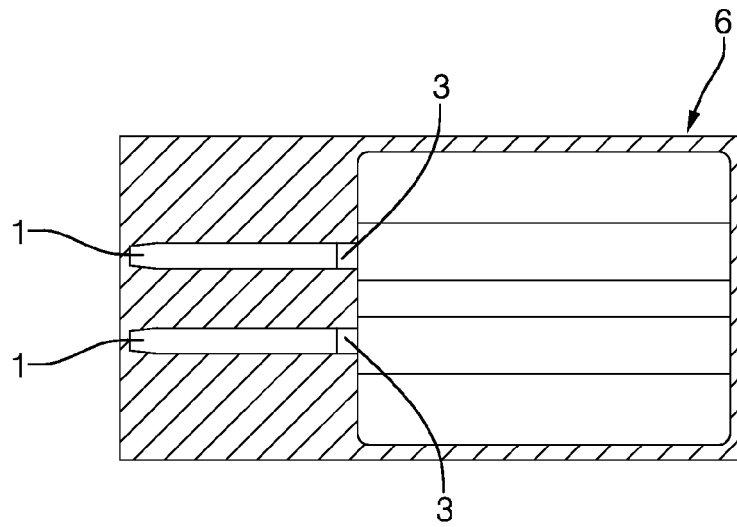
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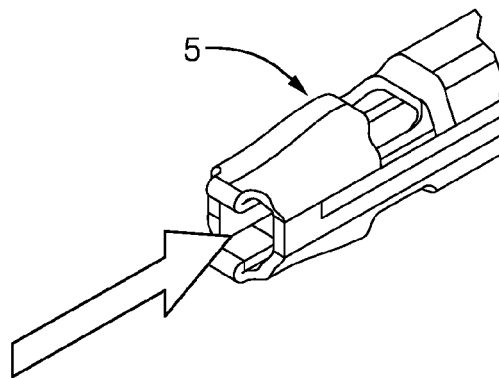
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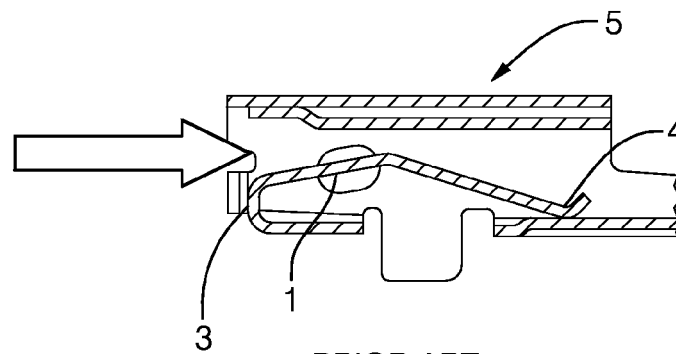
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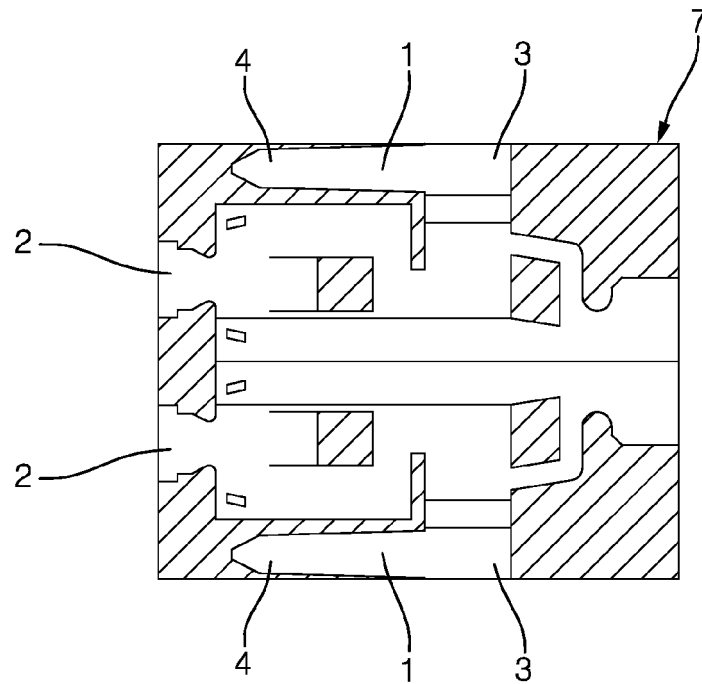
PRIOR ART
FIG. 1



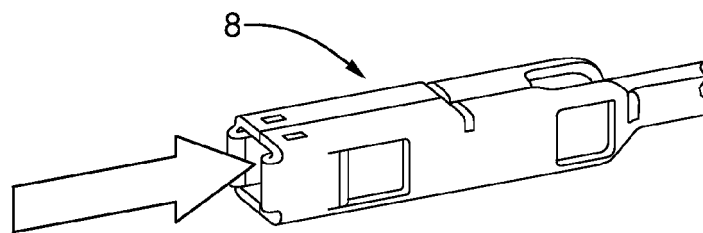
PRIOR ART
FIG. 1A



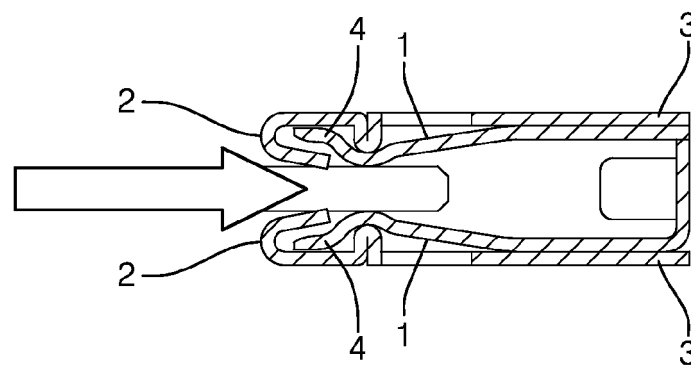
PRIOR ART
FIG. 1B



PRIOR ART
FIG. 2



PRIOR ART
FIG. 2A



PRIOR ART
FIG. 2B

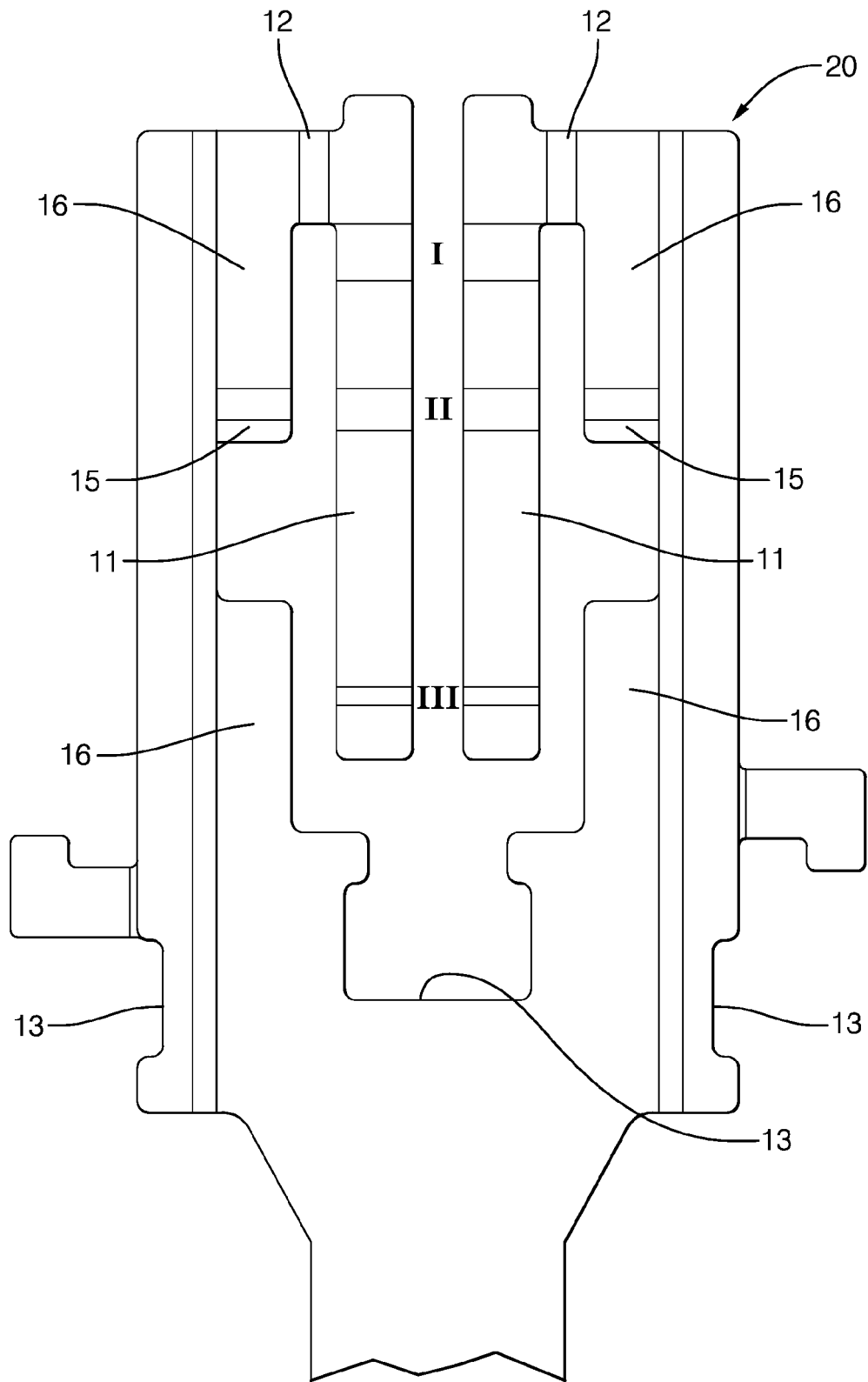


FIG. 3

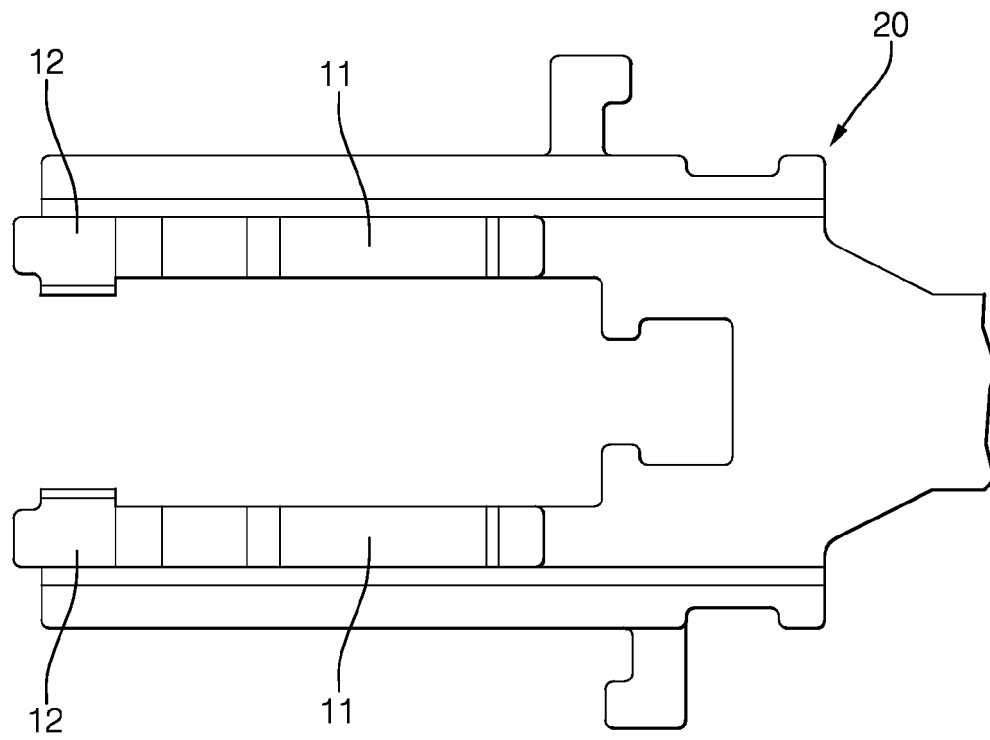


FIG. 4

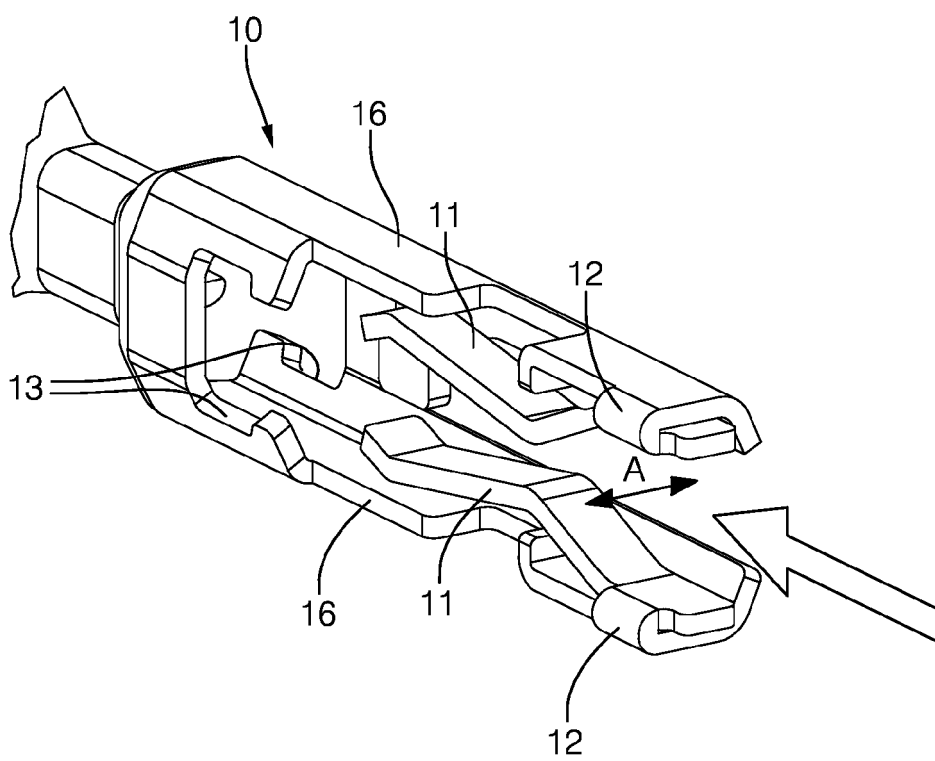


FIG. 5

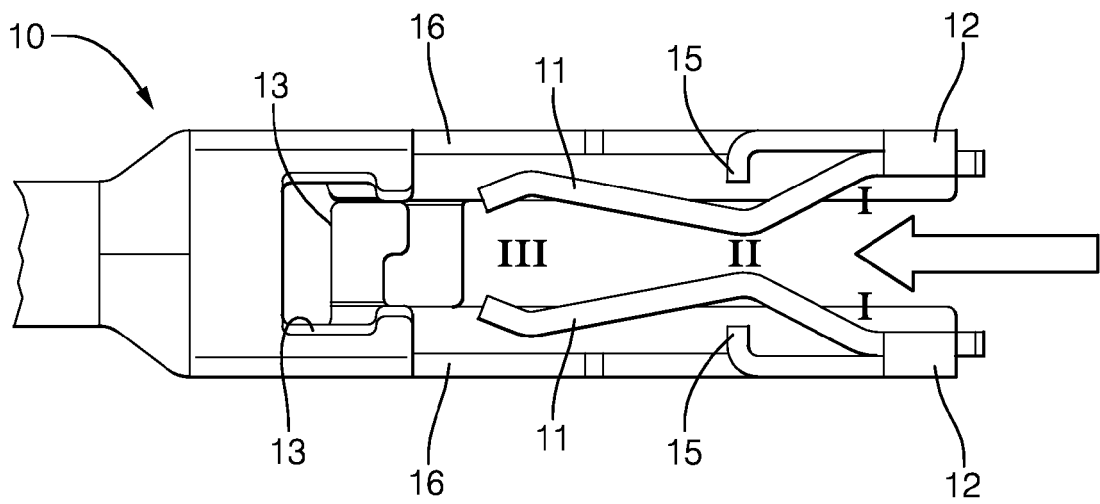


FIG. 6

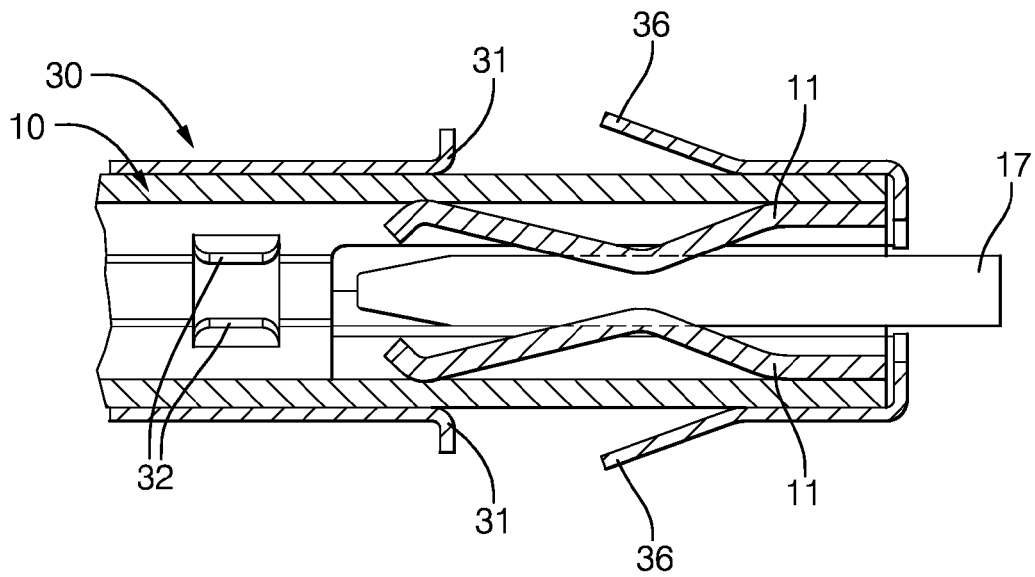
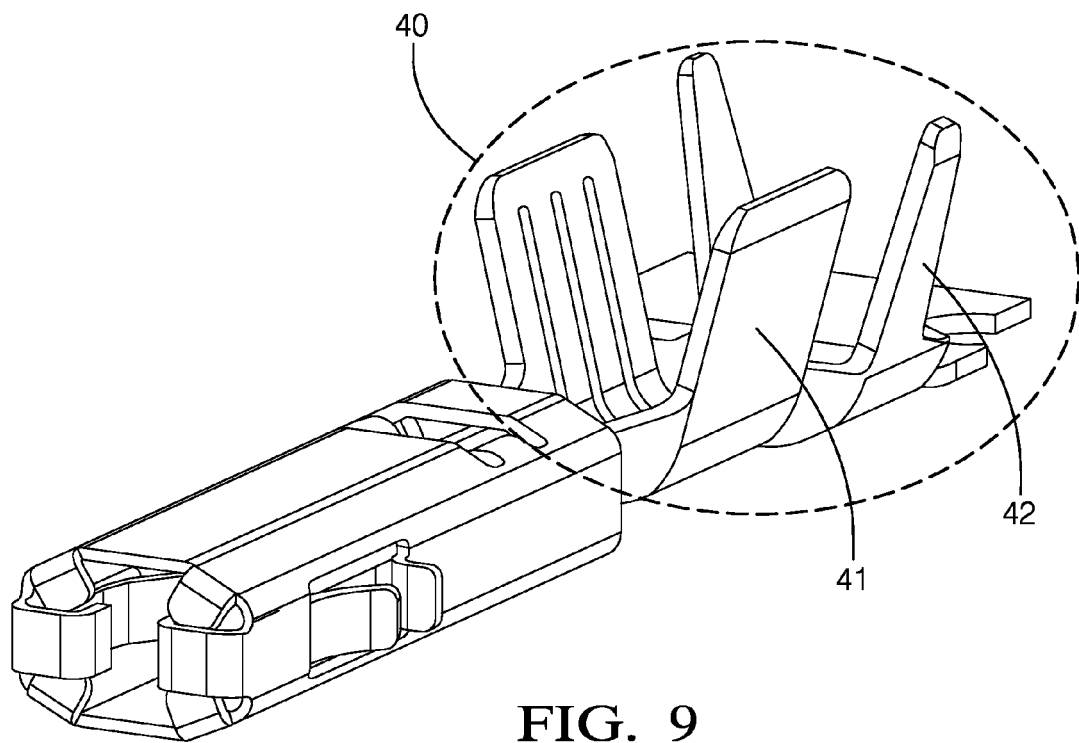
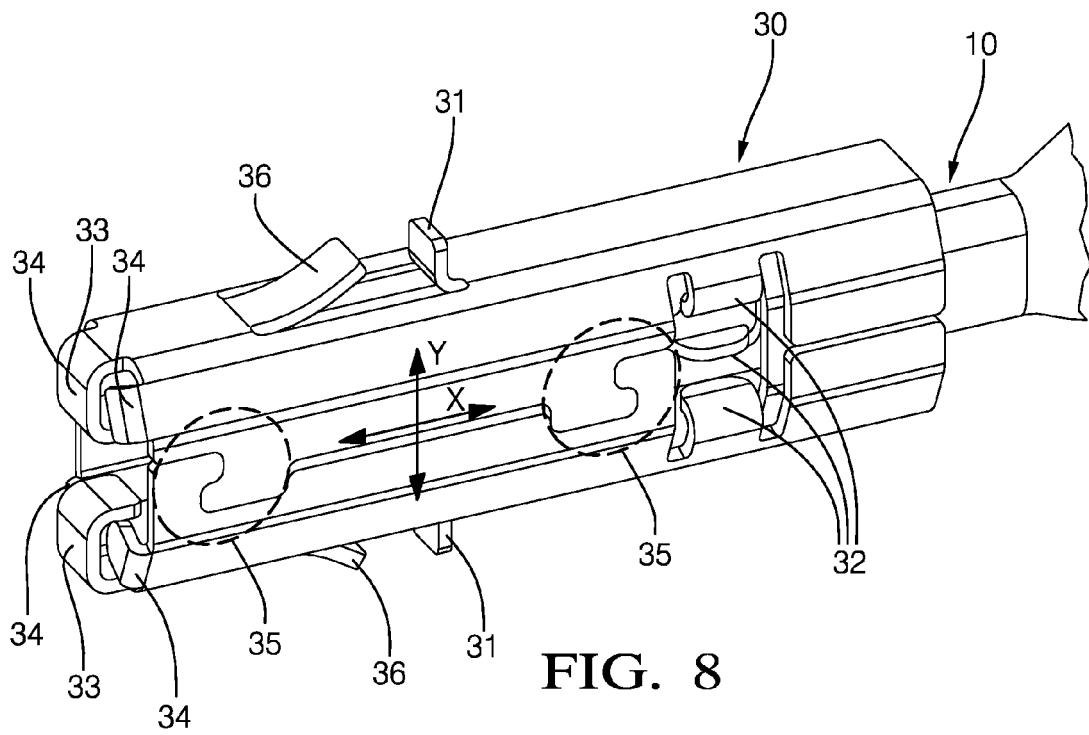


FIG. 7



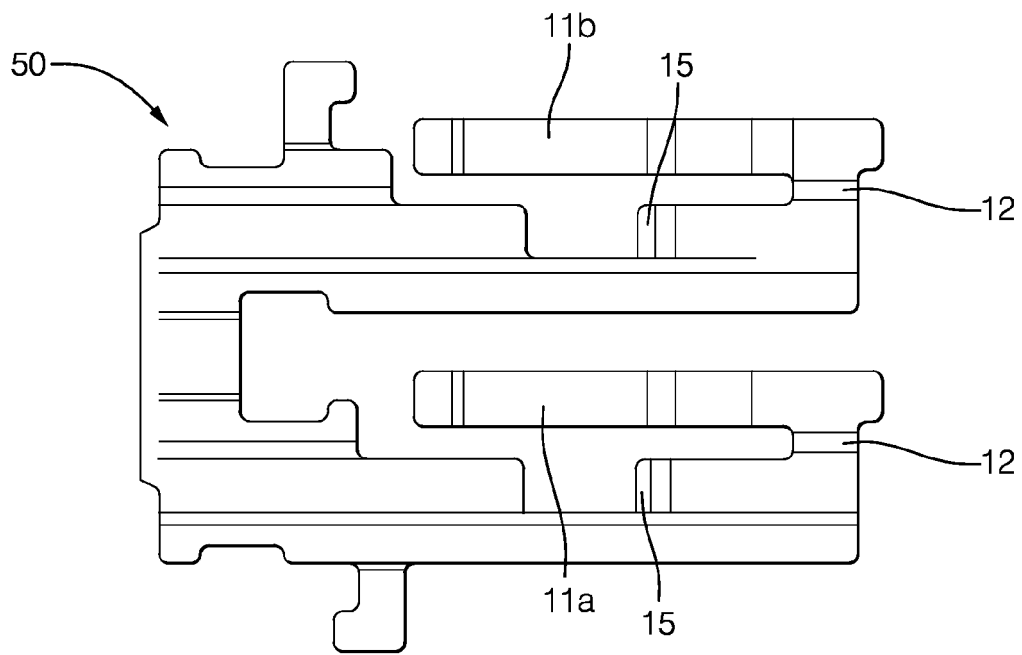


FIG. 10

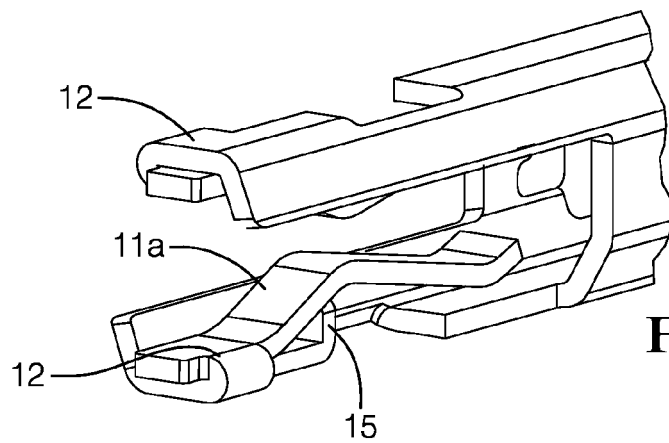


FIG. 11A

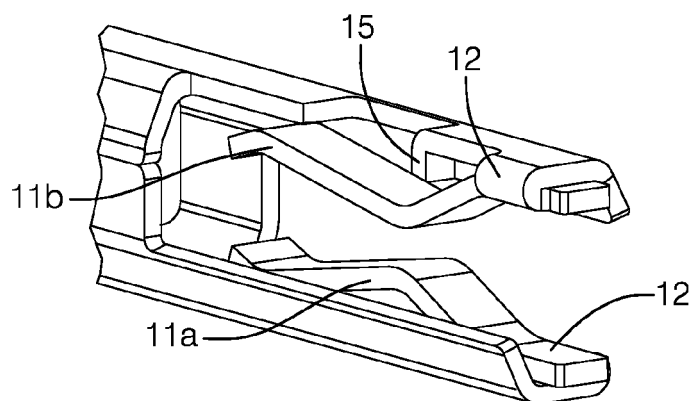


FIG. 11B



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Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 27 January 2014	Examiner Oliveira Braga K., A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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Place of search The Hague		Date of completion of the search 27 January 2014	Examiner Oliveira Braga K., A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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