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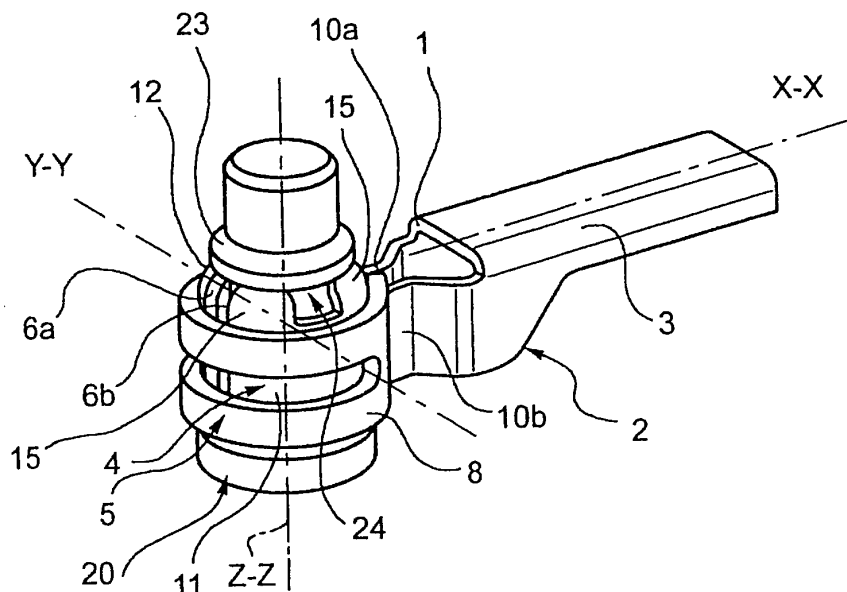
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(54) **Female electric terminal**

(57) A female electric terminal (1) comprises a conducting body (2) having a conducting part (4) able to be engaged, in a predefined direction of engagement (Z-Z), with a male electric terminal (20) and means (5) for clamping this conducting part (4) on the male terminal (20). The conducting part (4) comprises at least two portions which can be moved towards each other in a direction (Y-Y) transverse to the direction of engagement (Z-

Z), and the clamping means (5) are able to act on the portions movable towards each other so that their movement towards each other causes clamping of the conducting part (4) on the male terminal (20). The clamping means (5) comprise a retaining element (8) associated on the outside of the conducting part (4) so as to exert on the conducting part (4) a bracing action able to keep the conducting part (4) in contact with the male terminal (20).

Fig. 8



Description

[0001] The present invention relates to a female electric terminal in accordance with the preamble of Claim 1.

[0002] In particular, the female terminal according to the present invention may be used for the ground connection on the bodywork of motor vehicles.

[0003] Female terminals for engagement with male terminals are known. An example of the known art envisages a female terminal with an eyelet able to be mounted on a threaded pin having the function of a male terminal. Tightening of the female eyelet on the male terminal is achieved by means of a threaded metric nut which is screwed onto the threaded pin so as to keep the female eyelet in contact with the pin and establish electric continuity between the female terminal and the male terminal.

[0004] This solution, however, although being constructionally simple, requires a screwing operation in order to tighten the threaded nut on the threaded pin. Moreover, this solution may prove to be unsatisfactory when there are mechanical stresses on the female terminal, such as, for example, vibrations or rotation of the female terminal about the threaded pin, in particular if the nut has not been correctly screwed onto the pin. Therefore, in order to obtain correct screwing of the nut, it is required to use dynamometric tools with a consequent increase in the cost of assembly of these eyelet terminals.

[0005] Furthermore, it must be pointed out that the mechanical stresses to which the eyelet terminal may be subject may result in a reduction in the degree of tightness of the threaded nut and even separation of the female eyelet terminal from the male terminal.

[0006] In order to overcome these drawbacks, a female terminal able to be engaged with a threadless male terminal has been proposed.

[0007] An example of such a female terminal is described in the patent US-4,657,335. According to the above-mentioned prior art, the female terminal comprises a cylindrical sleeve inside which a cylindrical element formed by a plurality of uniformly spaced, longitudinal, parallel strips is inserted. This cylindrical element is fixed to the sleeve at one end and rotated through a predetermined angle at the opposite end so as to form, inside the cylindrical sleeve, a cage structure intended to receive a male terminal.

[0008] This solution, although overcoming the drawbacks encountered in the female terminals where the male/female connection was achieved by screwing a nut onto a threaded pin, has disadvantages in terms of the structural complexity of the female terminal thus obtained and is unsuitable for low-cost applications.

[0009] Consequently, there exists a particularly pressing need for a female terminal which can be engaged with a threadless male terminal and is constructionally simple and low-cost, but at the same time reliable as regards the degree of tightness of the female terminal on the male terminal.

[0010] The object of the present invention is to provide a female terminal having structural and functional characteristics such as to satisfy the above-mentioned requirements and overcome at the same time the drawbacks mentioned with reference to the prior art.

[0011] This object is achieved by a female terminal in accordance with Claim 1.

[0012] Further characteristic features and advantages of the female terminal according to the present invention will emerge from the description given below of a preferred example of embodiment thereof, provided by way of a nonlimiting illustration, with reference to the accompanying figures, in which:

- Figure 1 shows a perspective view of a female terminal in accordance with the present invention;
- Figure 2 shows a different perspective view of the female terminal according to Figure 1;
- Figure 3 shows a side plan view of the female terminal according to Figure 1;
- Figure 4 shows a top plan view of the female terminal according to Figure 1;
- Figures 5 and 6 show different plan views of the female terminal according to Figure 1;
- Figure 7 shows a cross-sectional plan view of the terminal according to Figure 1 along the cross-sectional line VII-VII shown in Figure 4;
- Figure 8 shows a perspective view of the female terminal according to Figure 1 in the operative configuration engaged with a male terminal; and
- Figure 9 shows an exploded perspective view of the female terminal according to Figure 1 engaged with the male terminal as shown in Figure 8.

[0013] With reference to the accompanying figures, 1 denotes overall a female electric terminal in accordance with the present invention.

[0014] The female electric terminal 1 comprises a conducting body 2 having a first conducting part 3 intended to be connected, in a manner known per se, by means of a conductor element, for example an electric cable, to an electrical installation (both not shown in figures) and a second conducting part 4 able to be engaged, in a predefined direction of engagement Z-Z, with a male electric terminal 20 extending mainly in the direction of engagement Z-Z.

[0015] The conducting body 2 of the female terminal 1 may be obtained, for example, by means of shearing and folding operations from a sheet of conductive material, preferably a tinned copper alloy.

[0016] Engagement of the female terminal 1 with the

male terminal 20 is able to establish electrical continuity between an electric cable connected to the first conducting part 3 of the female terminal 1 and the male electric terminal 20.

[0017] The female terminal 1 according to the invention may be used for grounding electric and/or electronic devices. In this case, the male terminal 20 is a ground terminal fixed to a structure acting as ground (not shown in the figures), while the ground connection of the devices to be grounded is connected, in a manner known per se, to the female terminal 1 by means of an electric cable. In this way, an grounded connection of the electronic devices connected to the female terminal 1 via the electric cable is achieved.

[0018] The structure acting as ground may be, for example, the bodywork of a motor vehicle, in particular a motor car.

[0019] The female terminal 1 must satisfy predefined requirements as regards electrical conductivity and is therefore made of conductive metallic material, for example pre-tinned copper of the type Cu ETP h4.

[0020] The male terminal 20 is made, for example, of a galvanized steel alloy. In particular, owing to the use of a steel alloy, the operation of welding the male terminal 22 to the structure acting as ground in the case of welding onto the bodywork of a motor car may be performed more easily and safely.

[0021] Alternatively, the male terminal 20 may be a battery terminal or any male terminal which requires connection to a female terminal.

[0022] The female terminal 1 also comprises means, denoted overall by 5, for clamping the second conducting part 4 of the conducting body 2 on the male terminal 20. These means are indispensable on account of the slackening which, with time, would affect the second conducting part 4 of the female terminal 1 when the female terminal 1 is engaged with the male terminal 20. This slackening is due mainly to the mechanical stresses which the female terminal 1 undergoes when engaged with the male terminal 20, for example following repeated rotation of the female terminal 1 about the male terminal 20 or owing to mechanical vibrations or stress-relief of the metallic material from which the female terminal 1 is made. As stated, the female terminal 1 is made of conductive metallic material, for example copper, and therefore these stresses would diminish the mechanical and therefore electrical contact between the second conducting part 4 and the male terminal 20.

[0023] Therefore, the clamping means 5 must be able to keep the second conducting part 4 of the female terminal 1 clamped on the male terminal 20.

[0024] For this purpose, the second conducting part 4 comprises at least two portions which can be moved towards each other in a direction, indicated by Y-Y in the figures, transverse to the direction of engagement Z-Z of the female terminal 1 with the male terminal 20. In the example, the direction Y-Y is perpendicular to the direction of engagement Z-Z.

[0025] The clamping means 5 are able to act on the portions of the second conducting part 4 movable towards each other so that the movement towards each other of the portions of the second conducting part 4 movable towards each other causes clamping of the second conducting part 4 on the male terminal 20.

[0026] In particular, the clamping means 5 comprise a retaining element 8 associated on the outside of the second conducting part 4 so as to exert on the second conducting part 4 a bracing action able to keep the second conducting part 4 itself in contact with the male terminal 20.

[0027] This configuration ensures that there is a contact pressure of the second conducting part 4 with the male terminal 20 sufficient to ensure clamping of the said second conducting part 4 on the male terminal 20 even when mechanical stresses are present on the female terminal.

[0028] In accordance with an advantageous embodiment of the invention and as shown in the example in the accompanying figures, the first conducting part 3 and the second conducting part 4 are connected by means of two connecting portions 10a,10b which can be moved towards each other in the direction Y-Y. Advantageously, the clamping means 5 act on the two connecting portions 10a,10b so as to cause the movement towards each other of the portions of the second conducting part 4 movable towards each other.

[0029] Advantageously, the retaining element 8 is a spring able to embrace the second conducting part 4 with a predefined clamping torque. In this way, the second conducting portion 4 is kept constantly in contact with the male terminal 20. In particular, the retaining element 8 is a spring clamp or clip shaped as an open ring having two portions 9a,9b which can be moved towards each other in the direction Y-Y so that the movement towards each other of these two portions 9a,9b of the open ring 8 causes a corresponding movement towards each other of the portions of the second conducting part 4 movable towards each other so as to keep the second conducting part 4 clamped on the male terminal 20.

[0030] In the example, the clip 8 has two facing surfaces 16 and 17 able to act on the two connecting portions movable towards each other 10a 10b, respectively, so as to keep the second conducting part 4 clamped on the male terminal 20.

[0031] The retaining element 8 may be made, for example, of metallic material or other material having properties such that it exerts a bracing action sufficient to keep the second conducting part 4 in contact with the male terminal 20.

[0032] The metallic material of the retaining element 8 is, for example, stainless steel of the type AISI 301.

[0033] In the example, the portions which can be moved towards each other comprise four portions indicated by 6a,6b,7a,7b and provided in the second conducting part 4 able to be engaged with or embrace a portion of the male terminal 20.

[0034] In accordance with a preferred embodiment, the first conducting part 3 extends in a main longitudinal direction X-X, transverse to the direction of engagement Z-Z, and the second conducting part 4 comprises two oppositely arranged half-shells 11,12 which in the example have a cylindrical shape. The two half-shells 11, 12 project from the first conducting part 3 in the longitudinal direction X-X, by means of the respective connecting portions 10a,10b, and extend in the direction of engagement Z-Z so as to embrace between them a portion of the male terminal 20.

[0035] Advantageously, the inner walls 11a,12a of the two half-shells 11,12 intended to be placed in contact with the outer wall 21 of the male terminal 20 comprise a plurality of projections, denoted overall by 13, able to define contact elements projecting from the inner walls 11a,12a of the half-shells 11,12.

[0036] These contact elements 13 are able to ensure more secure and uniform contact between the inner contact walls of the second conducting part 4 of the female terminal 1 and the outer wall 21 of the male terminal 20.

[0037] For grounding applications, the cylindrical shape of the two half-shells 11,12 is particularly suitable since it provides a greater useful surface for the flow of current towards the bodywork of a motor vehicle. However, it must be pointed out that half-shells also with different shapes may be used.

[0038] Advantageously, the second conducting part 4 has at least one stop element 15 able to bear against an axial abutment element 23 projecting from the male terminal 20 transversely with respect to the direction of engagement Z-Z, so as to prevent axial displacement of the female electric terminal 1 along the direction of engagement Z-Z in the opposite direction to the direction of insertion, when the female terminal 1 is inserted over the male terminal 20.

[0039] In the example, the male terminal 20 comprises a cylindrical body 22 extending axially in the direction of engagement Z-Z. Alternatively, the male terminal 20 may be of the blade type or have another shape suitable for performing the function of a male terminal.

[0040] In order to improve further the clamping effect of the female terminal 1 on the male terminal 20 and prevent undesirable movements of the female terminal 1 in the direction of engagement Z-Z corresponding to the axis of the male terminal 20, the stop element comprises, advantageously, a plurality of lugs 15 provided on each half-shell 11,12 and folded so as to be directed towards the opposite half-shell 11,12. In particular, the lugs 15 are intended to engage with a bearing surface 24 defined by the axial abutment element 23 projecting transversely and radially from the male terminal 20.

[0041] The second conducting part 4 of the female terminal 1 may be formed so that it can be mounted with interference onto the male terminal 20 against the action of the clamping means 5, or against the action of the metallic clip 8 which acts so as to move towards each other the portions 6a,6b,7a,7b of the second conducting

part 4. In this way gripping of the female terminal 1 on the male terminal 20 is further improved.

[0042] As can be appreciated from the above description, the female terminal according to the present invention is able to satisfy the requirements and overcome the drawbacks mentioned in the introductory part of the present description with reference to the prior art.

[0043] In particular, the female terminal according to the invention proposes a solution which simplifies the constructional design of the male/female connection, eliminating the use of tools for tightening a threaded nut on the threaded male element.

[0044] Obviously, a person skilled in the art, in order to meet contingent and specific requirements, may make numerous modifications and variations to the female terminal according to the invention described above, all of which, however, are contained within the scope of protection of the invention as defined by the following claims.

Claims

1. Female electric terminal (1) comprising:

- a conducting body (2) having a first conducting part (3) intended to be connected to a conductor element and a second conducting part (4) able to be engaged, in a predefined direction of engagement (Z-Z), with a male electric terminal (20), so as to establish electrical continuity between said conductor element and said male electric terminal (20), said male electric terminal (20) extending mainly in said direction of engagement (Z-Z), and
- means (5) for clamping said second conducting part (4) of said conducting body (2) on said male terminal (20),

characterized in that:

- said second conducting part (4) comprises at least two portions movable towards each other along a direction (Y-Y) transverse to said direction of engagement (Z-Z), and
- said clamping means (5) are able to act on said at least two portions movable towards each other of said second conducting part (4), the movement towards each other of said at least two portions movable towards each other causing clamping of said second conducting part (4) on said male terminal (20), said clamping means (5) comprising a retaining element (8) associated on the outside of said second conducting part (4) so as to exert on said second conducting part (4) a bracing action able to keep said second conducting part (4) in contact with said male terminal (20).

2. Female electric terminal (1) according to Claim 1, in which said retaining element (8) is a spring able to embrace said second conducting part (4).
3. Female electric terminal (1) according to Claim 2, in which said retaining element (8) is a clip shaped as an open ring, said open ring having two portions (9a, 9b) which can be moved towards each other in said direction (Y-Y), the movement towards each other of said two portions (9a,9b) of the open ring (8) able to be moved towards each other causing a corresponding movement towards each other of said at least two portions of the second conducting part (4) able to be moved towards each other, so as to keep said second conducting part (4) clamped on said male terminal (20).
4. Female electric terminal (1) according to Claim 2 or 3, in which said retaining element (8) is made of metallic material.
5. Female electric terminal (1) according to any one of Claims 1 to 4, in which said first conducting part (3) and said second conducting part (4) are connected by means of two connecting portions (10a,10b) movable towards each other in said direction (Y-Y), said clamping means (5) acting on said two connecting portions (10a,10b) so as to cause the movement towards each other of said portions movable towards each other (6a,6b,7a,7b) of said second conducting part (4).
6. Female electric terminal (1) according to any one of Claims 1 to 5, in which said first conducting part (3) extends in a main longitudinal direction (X-X) transverse to said direction of engagement (Z-Z), said second conducting part (4) comprising two oppositely arranged half-shells (11,12) projecting from said first conducting part (3) along said longitudinal direction (X-X), said two half-shells (11,12) extending in said direction of engagement (Z-Z) so as to embrace between them a portion of said male terminal (20).
7. Female electric terminal (1) according to Claim 6, in which the inner walls (11a,12a) of said two half-shells (11,12), intended to be placed in contact with the outer wall (21) of said male terminal (20), comprise a plurality of projections (13) able to define contact elements projecting from said inner walls (11a,12a).
8. Female electric terminal (1) according to any one of Claims 1 to 7, in which said second conducting part (4) has at least one stop element (15) able to bear against an axial abutment element (23) projecting from said male terminal (20) transversely with respect to said direction of engagement (Z-Z), so as to prevent axial movements of said female electric terminal (1) along said direction of engagement (Z-Z) in the opposite direction to the direction of insertion, when the female terminal (1) is inserted over the male terminal (20).
9. Female electric terminal (1) according to Claim 8 when dependent upon Claim 6, in which said at least one stop element comprises a plurality of lugs (15) provided on each half-shell (11,12) and folded so as to be directed towards the opposite half-shell (11,12), said lugs (15) being intended to engage with a bearing surface (24) defined by the axial abutment element (23) projecting radially from said male terminal (20).
10. Male electric terminal (20) able to be engaged with a female electric terminal (1) according to any one of Claims 1 to 9, in which said male terminal (20) is a ground terminal fixed to a structure acting as ground.
11. Male electric terminal (20) according to Claim 10, in which said structure acting as ground is a portion of the bodywork of a motor vehicle.
12. Male electric terminal (20) according to any one of Claims 1 to 11, in which said male terminal (20) is a battery terminal.

Fig. 1

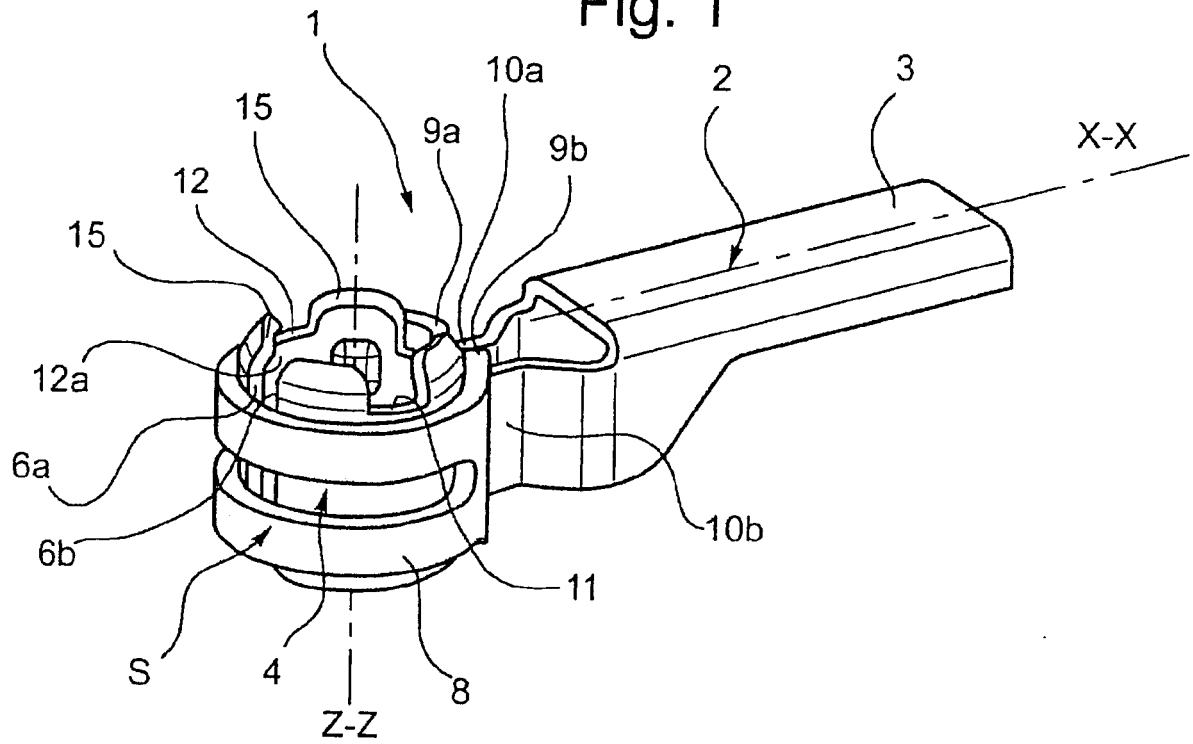


Fig. 2

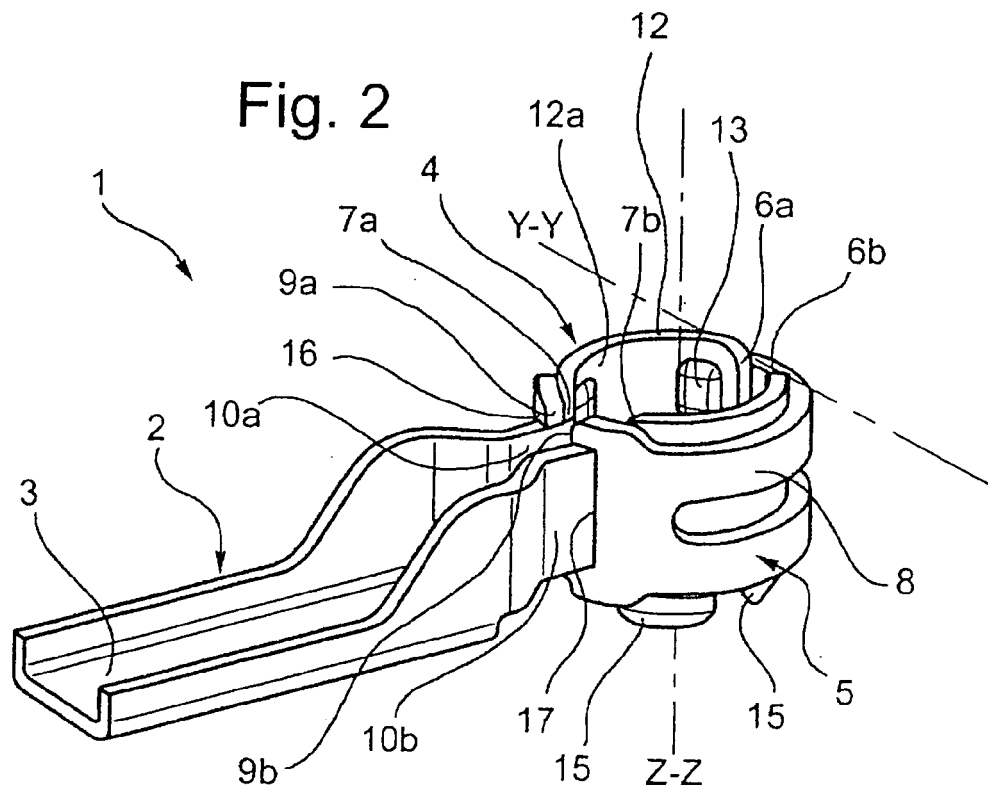


Fig. 3

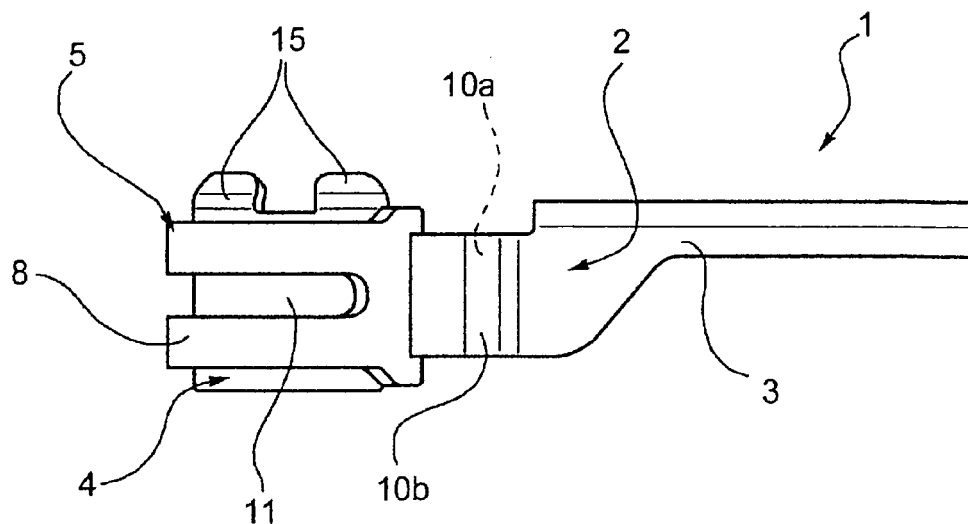


Fig. 4

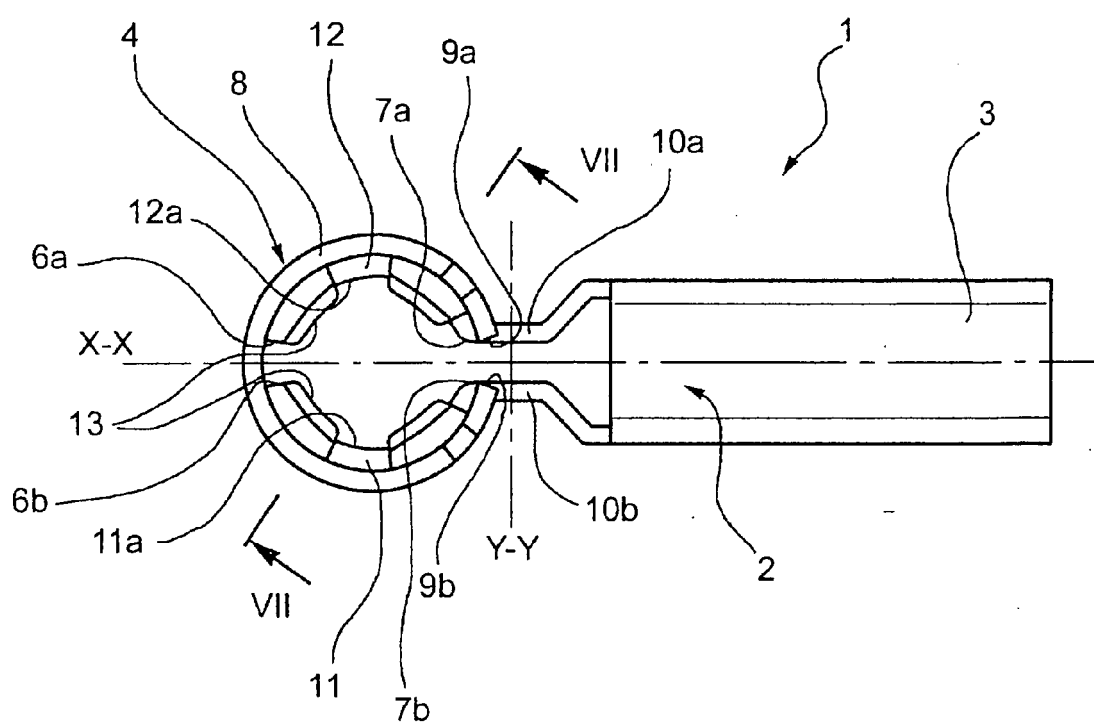


Fig. 5

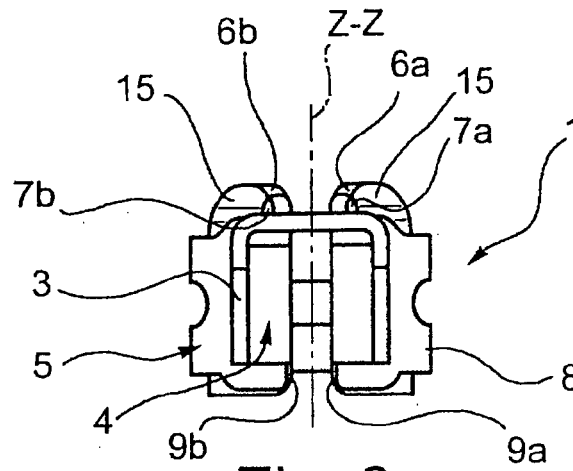


Fig. 6

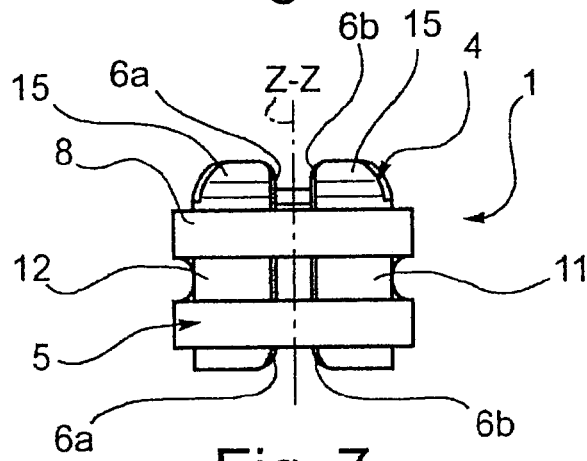


Fig. 7

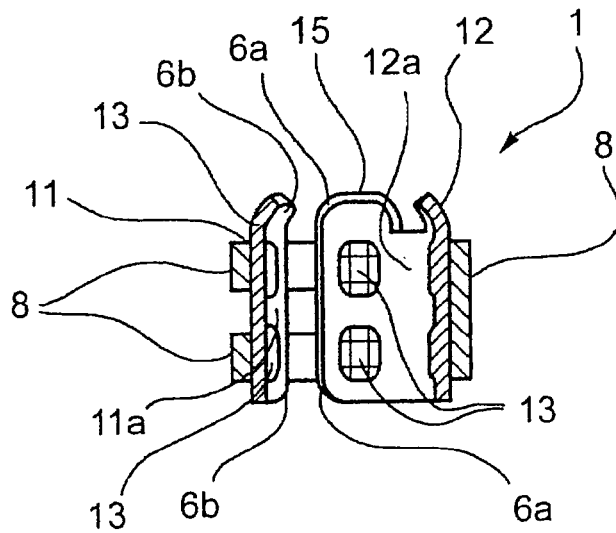


Fig. 8

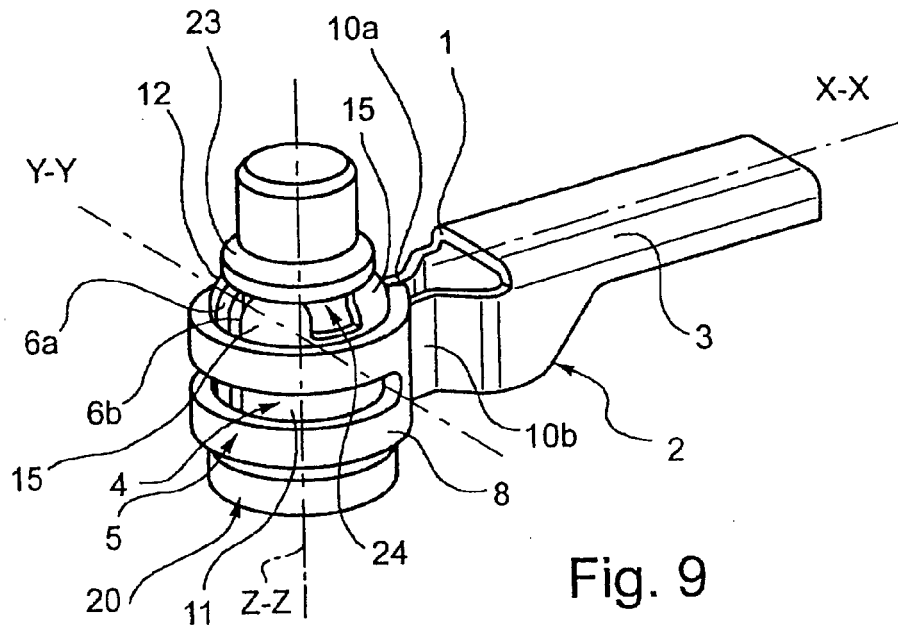
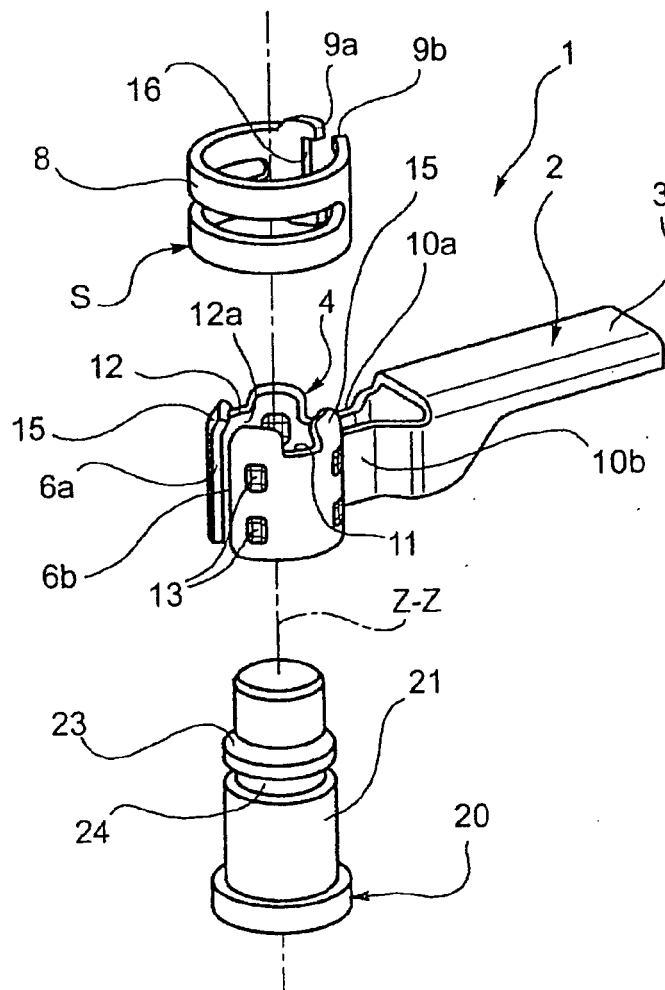


Fig. 9





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 06 01 0945

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 413 748 A (JOHN BRISTOW TUCKER) 26 July 1934 (1934-07-26)	1-4,6	INV. H01R13/18
Y	* page 1, line 60 - line 96; figures 1-5 * -----	7,11,12	
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			TECHNICAL FIELDS SEARCHED (IPC)
			H01R
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 20 September 2006	Examiner WHITTINGTON, J
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 01 0945

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20-09-2006

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GB 413748	A	26-07-1934	NONE	

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REFERENCES CITED IN THE DESCRIPTION

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