

(19)



(11)

EP 2 105 995 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

30.09.2009 Bulletin 2009/40

(51) Int Cl.:

H01R 9/26 (2006.01)

H01R 43/16 (2006.01)

H01R 12/04 (2006.01)

(21) Application number: **09155268.7**

(22) Date of filing: **16.03.2009**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL
PT RO SE SI SK TR**

Designated Extension States:

AL BA RS

(30) Priority: **27.03.2008 IT MI20080513**

(71) Applicant: **Cabur S.r.l.**

17041 Altare (SV) (IT)

(72) Inventor: **Cappa, Paolo**

17015, Celle Ligure SV (IT)

(74) Representative: **Mati, Silvia et al**

Barzanò & Zanardo Milano S.p.A.

Via Borgonuovo, 10

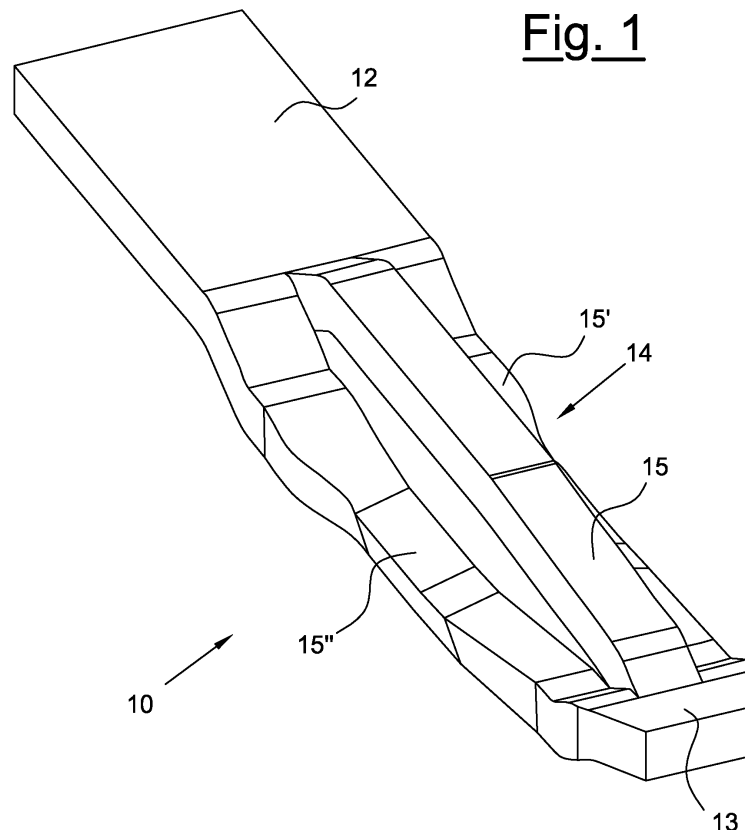
20121 Milano (IT)

(54) **Improved connector device, method and electrical connection group therefor**

(57) An improved connector device (10) for electrical connection of terminals (11, 11') for electrical panels obtained from a band of electrically conducting material, the connector device (10) comprising a first (12) and a second (13) end substantially arranged at the same level and a central portion (14) which connects the ends (12,

13), wherein the central portion (14) comprises an elastic three dimensional structure provided with at least three thin bars (15, 15', 15'') which start from the first end (12) and meet in the second end (13), the three bars (15, 15', 15'') developing longitudinally adjacent, separated and offset on at least two different levels with respect to the level of the first and second ends (12, 13).

Fig. 1



EP 2 105 995 A1

Description

[0001] The present invention refers to an improved connector device for electrical connection of electrical panel terminals, a method for obtaining such connector device, an electrical connection group provided with such improved connector device and an improved connector group comprising a plurality of improved connector devices.

[0002] In particular the abovementioned invention regards making removable electrical groups and connections suitable for transverse connections in a terminal board, typically for electrical panels for power distribution.

[0003] Generally, electrical panels for power distribution comprise a plurality of pairs of modular terminals arranged adjacent to each other and provided with connection units for the appliances served by the panel itself.

[0004] Each respective pair of terminals is generally made up of conductor bodies usually contained in insulating bodies, and narrow inlet and outlet spaces for the electrical connections.

[0005] The electrical connection of each pair of terminals is achieved by connecting two conductor bodies, generally a perforated plate accommodated in a first terminal and a rod element projecting from the second terminal which, during use, is inside the abovementioned hole to attain the passage of current between the related terminals.

[0006] Such connections must ensure a stable and efficient electrical contact, with shape constraints between holes and the relative rods which, cooperating with each other, must stably maintain a relative contact to ensure both the proper assembling position of the pair of terminals and an efficient electrical conduction.

[0007] In cases where there is a plurality of the previously mentioned pairs of terminals arranged adjacent to each other, common situation for electrical panels, it is possible that both the perforated plate and the relative rod elements are independent from each other but made in a single piece passing transversely through all the pairs of terminals ending up forming the so-called "parallel bridges".

[0008] According to the current state of the art such transverse connection elements are available according to various technical solutions.

[0009] However, such solutions are generally prepared for connections between parallel terminals arranged "a priori" at a determined distance from each other and not independent from the number of pitches separating the terminals to be connected.

[0010] Considering parallel connections of variable numbers and distances, the technical solutions available in the state of the art are quite complex, expensive and not free from drawbacks in any case.

[0011] An object of the present invention is that of providing a device capable of overcoming the abovementioned drawbacks of the prior art in an extremely simple, inexpensive and particularly functional manner.

[0012] Another object is that of obtaining an improved connector device for electrical connection between electrical terminals capable of guaranteeing a firm assembling position for the relative pair of terminals as well as an efficient electrical conduction between the terminals themselves.

[0013] Another object is that of obtaining an improved connector device for electrical connection between electrical terminals smaller in size and with a structure having a high elasticity.

[0014] Another object is that of obtaining an improved connector group, or a "parallel bridge", comprising a plurality of improved connector devices subject of the present invention capable of overcoming the drawbacks regarding connections of groups of parallel terminals of the prior art i.e. independent from the number of pitches of the electrical panel to be connected and allowing an easy, stable and efficient installation of the electrical panel itself.

[0015] Still, another object is that of providing a quick and efficient method for obtaining the connector device subject of the present invention.

[0016] Still, another object is that of obtaining an electrical connection group, or electrical panel, provided with at least one connector device subject of the present invention.

[0017] These objects according to the present invention are attained by providing an improved connector device for electrical connection between electrical terminals, a method for obtaining such connector device, an electrical connection group provided with such improved connector device and an improved connector group comprising a plurality of improved connector devices as outlined in claims 1, 5, 8 and 12.

[0018] Further characteristics of the invention are highlighted by the dependent claims.

[0019] Characteristics and advantages of an improved connector device for electrical connection between electrical terminals, a method for obtaining such connector device, an electrical connection group provided with such improved connector device and an improved connector group comprising a plurality of improved connector devices according to the present invention shall be clearer from the following exemplifying and non-limiting description referring to the attached schematic drawings wherein:

figure 1 shows a perspective view of an improved connector device according to the present invention; figure 2 shows a cross-sectional view of the improved connector device of figure 1;

figure 3 shows an exploded view of an electrical connection group according to the present invention provided with an improved connector device of figure 1; figure 4 shows the electrical connection group of figure 3 assembled;

figure 5 shows a cross-sectional view of an electrical panel made up of a plurality of electrical connection

groups of figure 4 assembled in parallel;
 figure 6 shows an enlarged detail of the electrical connection group of figure 4;
 figure 7 shows the enlarged detail of figure 6 partially cross-sectioned;
 figure 8 shows a step of the method for obtaining the improved connector device according to the present invention; figure 9 shows a subsequent step of the method for obtaining the improved connector device according to the present invention;
 figure 10 shows an enlarged detail of the improved connector device according to the present invention;
 figure 11 shows an enlarged detail of the electrical connection group of figure 7;
 figure 12 shows an improved connector group comprising a plurality of improved connector devices according to the present invention;
 figure 13 shows the improved connector group of figure 12 in a different step of use.

[0020] Referring to the figures, reference number 10 indicates an improved connector device for the electrical connection between electrical terminals, reference number 100 indicates an electrical connection group provided with such improved connector device 10 and reference number 102 indicates an electrical panel provided with an improved connector group 101 comprising a plurality of improved connector devices 10 in parallel.

[0021] The abovementioned improved connector device 10 of the present invention, in particular suitable to establish the conduction continuity between two different terminals 11, 11' of an electrical panel, is shown according to a preferred embodiment in figure 1 and it is obtained from a band 20 made of electrically conducting material, generally a high copper content alloy.

[0022] Such connector device 10 substantially develops in longitudinal direction and comprises a first 12 and a second 13 end which are substantially located at the same level.

[0023] Between the abovementioned ends 12, 13 the connector device 10 comprises a central portion 14 provided with a three dimensional and highly elastic structure.

[0024] Such high elasticity directly derives from the same geometry of the central portion 14 which is provided according to the invention with at least three thin bars 15, 15', 15" which start from the first end 12 and meet in the second end 13.

[0025] In particular the abovementioned three bars 15, 15', 15", during their relative longitudinal development, are separated from each other, i.e. they do not meet at any point, and they are adjacent but offset to occupy at least two different levels with respect to the abovementioned level occupied by the ends 12, 13.

[0026] As previously mentioned the geometry of the central portion 14 confers the connector device 10 a high elasticity which, advantageously, allows using highly conductive materials as well as reducing the dimension

of the connector device 10 itself without jeopardising the overall elasticity of the object of the present invention.

[0027] According to a preferred embodiment, the connector device 10 may be obtained from a high copper content metal section coated with tin on the two opposite faces.

[0028] As observable in figure 2 the three bars 15, 15', 15" of the connector device 10 may comprise a substantially square-shaped or parallelepiped section in which the external edges 35, as observable in figure 10 and 11, have a rounded shape and are protected by a tin coating, in such a manner to prevent the oxidation of the contact point and have a greater electrical transmission efficiency.

[0029] The method according to the present invention for the making of a connector device 10 as described previously solely comprises the steps of cutting and cold deformation of a band 20 of electrically conducting material.

[0030] In particular such cutting and cold deformation of the band 20 of electrically conducting material comprises the steps of:

a) actuating, as observable in figure 8, two first opposite knives 60, 60' to cut and deform the band 20 for lateral shaping and isolating from the rest of said band 20, the central portion 14 and the second end 13 of connector device 10;

b) actuating, as observable in figure 9, two second opposite knives 62, 62' to cut and deform from top to bottom two lateral portions of the central portion 14 isolated in the previous step to obtain two 15', 15" of the three bars 15, 15', 15", in which these two bars 15', 15" develop longitudinally in a level offset downwards with respect to the level of ends 12, 13 due to the two second opposite knives 62, 62';

c) actuating, as observable in figure 9, a third knife/punch 61 operating between the two second opposite knives 62, 62' to deform - from bottom to top - the remaining portion of the central portion 14 comprised between the two bars 15', 15" to obtain the third 15 of the three bars 15, 15', 15", in which such third bar 15 develops longitudinally in a level offset upwards with respect to the level of ends 12, 13 due to the third knife/punch 61.

[0031] In particular in cases where the band 20 comprises a tin coating, the abovementioned knives/punches 60, 60', 62, 62', 61 advantageously perform a plastic dragging of the protective tin layers on the turned in part of the cutting surface, as shown for example in figure 10.

[0032] The connector device 10, as described previously, is particularly advantageous for the electrical connection of said two terminals 11, 11' to obtain an electrical connection group 100 of the type shown in figures 3 and 4.

[0033] Such electrical connection group 100 according to the present invention comprises at least one first and one second terminal 11, 11' to be electrically connected

and at least one connector device 10, as described previously, which electrically connects the abovementioned two terminals 11, 11'.

[0034] In particular, as shown in figure 3, in such electrical connection groups 100 the first end 12 of the connector device 10 is constrained in a substantially non-accessible manner inside the first terminal 11 while the second end 13 is accessible and extended outwards from the first terminal 11 itself.

[0035] During use, i.e. when group 100 assembled as shown in figure 4, the three bars 15, 15', 15" are inserted and firmly accommodated in a hole 20 of the second terminal 11'.

[0036] In particular, as shown and highlighted in figures 6, 7 and 11, at least one of the external edges 35 of each bar 15, 15', 15" is in contact with the hole 20.

[0037] As observable in figures 3 and 4, according to an embodiment, the hole 20 is an end of an element 21 made of electrically conducting material arranged at least partially inside the second terminal 11'.

[0038] In order to ensure the contact of at least one edge 35 of each of the three bars 15, 15', 15" the hole 20 is preferably circular-shaped and the distance - when idle - between the opposite peripheral edges of the three bars 15, 15', 15" exceeds the value of the diameter of the hole 20 in the range of 0.1-1 mm.

[0039] According to another embodiment, the abovementioned "interference" range may also vary between 0.2-0.4 mm.

[0040] In other words, the three bars 15, 15', 15" which form the central portion 14 have the external edges 35 lying, when idle, at a mutual distance greater than the diameter of the hole 20 which is to receive the three bars 15, 15', 15" themselves.

[0041] When the latter are inserted into the hole 20, the bars 15, 15', 15" are brought together and the distance between their external edges 35 is reduced to coincide with the value of the diameter of the hole 20.

[0042] The bars 15, 15', 15" are thus elastically deformed and exert three reaction forces in direction opposite to the forced approaching of the bars themselves.

[0043] Furthermore, in particular, the constriction forces of the bars 15, 15', 15" are directed according to the contact diameter, identical and opposite to the reaction forces of the bars, thus ensuring contact.

[0044] By disassembling such constriction forces according to orthogonal coordinates, it is easy to observe that the moments generated between the orthogonal torques are identical and opposite.

[0045] Thus the play of the forces generated upon insertion of the bars 15, 15', 15" into the hole does not give rise to any torsional stress of the bars 15, 15', 15" themselves such torsional stress being capable of inducing disadvantageous deformations and/or rotations upon passage of current.

[0046] The circular shape of the hole 20 is preferred since it is capable of ensuring that the insertion of the three bars 15, 15', 15" occurs with a deformation that is

constant and independent from the orientation of the three bars 15, 15', 15" themselves with respect to the axis of the hole.

[0047] In cases where use of an electrical panel 102 is desired, as shown in figure 5 and comprising a plurality of electrical connection groups 100 as described previously, according to the present invention, provided for is an improved connector group 101, or "parallel bridge", comprising a plurality of connector devices 10 parallel to each other.

[0048] In particular in such last case this improved connector group 101, shown in figures 12 and 13 during different steps of use, comprises a common first end 12 from which a plurality of said central portions 14 ending in relative second ends 13 develop parallel to each other.

[0049] Advantageously such improved connector group 101 allows connecting a plurality of electrical connection groups 100 to obtain an electrical panel 102 independently from the number of pitches separating the terminals to be used of the electrical panel 102 itself.

[0050] As a matter of fact, at the common first end 12 provided for can be weakening grooves which facilitate the separation of some devices 10 to prepare the parallel bridges of the desired pitch as observable in the example of figure 13.

[0051] It is entirely easy to understand the operation of the device subject of the invention.

[0052] The connector device 10 as described previously comprises a first 12 and a second 13 end substantially arranged at the same level and a central portion 14 between such ends 12, 13 comprising a three dimensional and elastic structure provided with at least three thin bars 15, 15', 15" that start from the first end 12 and meet in the second end 13.

[0053] In particular these three bars 15, 15', 15" according to the present invention develop longitudinally separate and offset on at least two levels different from the level in which ends 12, 13 lie.

[0054] Advantageously such particular geometry of the central portion 14 confers to the improved connector device 10 for electrical connection between electrical terminals, the possibility of ensuring a firm assembling position in the relative pair of terminals where it is used as well as an efficient electrical conduction between the abovementioned terminals having at least three different contact points, and hence passage points, for the current.

[0055] Furthermore, such particular geometry of the central portion 14, confers the connector device 10 a high elasticity which, advantageously, allows using highly conductive materials as well as reducing the dimensions of the connector device 10 itself without jeopardising the overall elasticity of the object of the present invention.

[0056] As outlined, the connector device 10 of the present invention allows obtaining an improved connector group, or "parallel bridges", comprising a plurality of devices 10, independently from the number of pitches separating the various terminals in use in an electrical panel.

[0057] Advantageously, provided for at the common first end 12 can be weakening grooves which facilitate the separation of some devices 10 to prepare parallel bridges of the desired pitch.

[0058] It has thus been observed that an improved connector device for electrical connection between electrical terminals, a method for obtaining such connector device, an electrical connection group provided with such improved connector device and an improved connector group comprising a plurality of improved connector devices according to the present invention attain the objects outlined previously.

[0059] The improved connector device for electrical connection between electrical terminals, the method for obtaining such connector device, the electrical connection group provided with such improved connector device and the improved connector group comprising a plurality of improved connector devices of the present invention thus conceived are susceptible to numerous modifications and variants, all falling within the same inventive concept; furthermore, all details can be replaced by technically equivalent elements. In practice, the materials used, as well as dimensions thereof and the protective coating, may vary depending on the technical requirements.

Claims

1. Improved connector device (10) for electrical connection of terminals (11, 11') of electrical panels obtained from a band (20) made of electrically conducting material, said connector device (10) comprising a first (12) and a second (13) end, substantially arranged at the same level, and a central portion (14) which connects said ends (12, 13), **characterised in that** said central portion (14) comprises an elastic three dimensional structure provided with at least three thin bars (15, 15', 15'') which start from said first end (12) and meet in said second end (13), said three bars (15, 15', 15'') developing longitudinally adjacent, separated and offset on at least two different levels with respect to said level of said first and second ends (12, 13).
2. Connector device (10) according to claim 1, **characterised in that** said band is a copper metal section coated with tin on the two opposite faces.
3. Connector device (10) according to claim 1, **characterised in that** said three bars (15, 15', 15'') comprise a substantially square-shaped or parallelepiped section.
4. Connector device (10) according to claim 3, **characterised in that** the external edges (35) of said three bars (15, 15', 15'') have a rounded shape and are protected against oxidation through a tin coating.
5. Method for making a connector device (10) according to any one of the preceding claims, **characterised in that** it comprises the steps of cutting and cold deforming a band (20) made of electrically conducting material.
6. Method for making a connector device (10) according to claim 5, **characterised in that** said steps of cutting and cold deforming said section (20) comprise:
 - a) actuating two first opposite knives (60, 60') to cut and deform said section (20) for lateral shaping, and isolating from the rest of said band (20), at least said central portion (14) and said second end (13) of said connector device (10);
 - b) actuating two second opposite knives (62, 62') to cut and deform from top to bottom two lateral portions of said central portion (14) isolated to obtain two (15', 15'') of said three bars (15, 15', 15''), said two bars (15', 15'') developing longitudinally in a level offset downwards with respect to said level of said ends (12, 13);
 - c) actuating a third knife/punch (61) between said two second opposite knives (62, 62') to deform from bottom to top a portion of said central portion (14) comprised between said two bars (15', 15'') to obtain the third (15) of said three bars (15, 15', 15''), said third bar (15) developing longitudinally in a level offset upwards with respect to said level of said ends (12, 13).
7. Method for making a connector device (10) according to claim 6 **characterised in that** said band (20) comprises a tin coating and that said knives (60, 60', 62, 62') and said punch (61) perform a plastic dragging of the protective tin layer on a portion of the turned in part of the cutting surface.
8. Electrical connection group (100) comprising at least one first and one second terminal (11, 11') to be electrically connected and at least one connector device (10) for electrical connection of said two terminals (11, 11') according to any one of claims 1-4, wherein said first end (12) of said connector device (10) is constrained in a substantially non-accessible manner inside said first terminal (11), said second end (13) is accessible and extended outwards from said first terminal (11), said three bars (15, 15', 15'') are inserted and firmly accommodated in a hole (20) of said second terminal (11'), wherein the external edges of said three bars (15, 15', 15''), - when idle - have a slightly greater distance/overall dimension with respect to the dimensions of said hole (20) in such a manner that, during use, each of said three bars (15, 15', 15'') have at least one contact point with said hole (20).

9. Electrical connection group (100) according to claim 8 **characterised in that** said hole (20) is an end of an element (21) made of electrically conducting material arranged at least partially inside said second terminal (11'). 5
10. Electrical connection group (100) according to claim 9 **characterised in that** said hole (20) is circular-shaped and that the distance - when idle - between the external edges (35) of said three bars (15, 15', 15'') exceeds the value of the diameter of said hole (20) in the range of 0.1-1 mm. 10
11. Electrical connection group (100) according to claim 9 **characterised in that** said hole (20) is circular-shaped and that the distance - when idle - between the external edges (35) of said three bars (15, 15', 15'') exceeds the value of the diameter of said hole (20) in the range of 0.2-0.4 mm. 15
20
12. Improved connector group (101) comprising a plurality of connector devices (10) according to any one of claims 1-4, said group comprising a common first end (12) developing from which in a parallel manner is a plurality of said central portions (14) ending in relative second ends (13), said group (101) being for simultaneous connection of a plurality of electrical connection groups (100) according to any one of claims 8-11. 25
30

35

40

45

50

55

Fig. 1

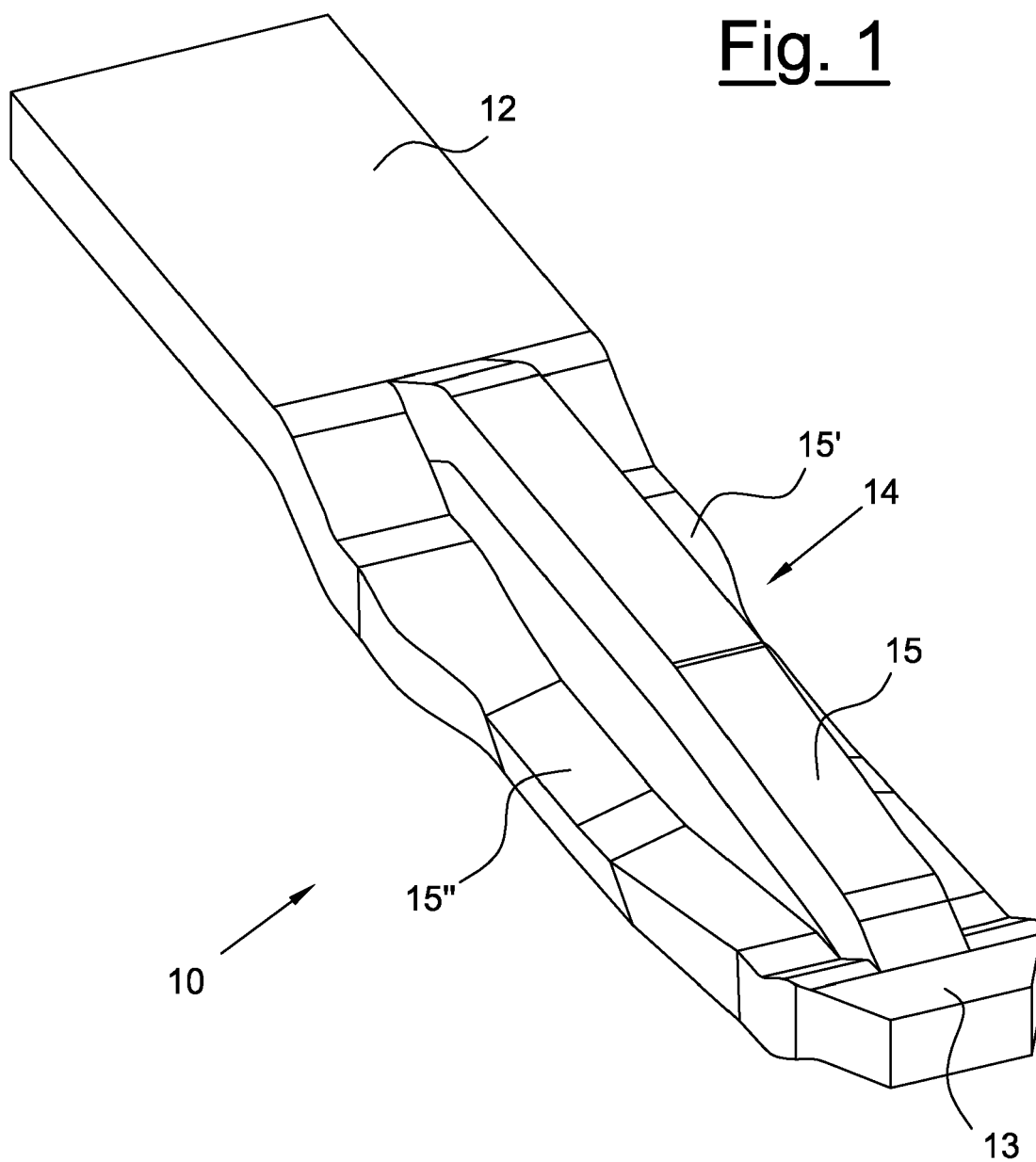


Fig. 2

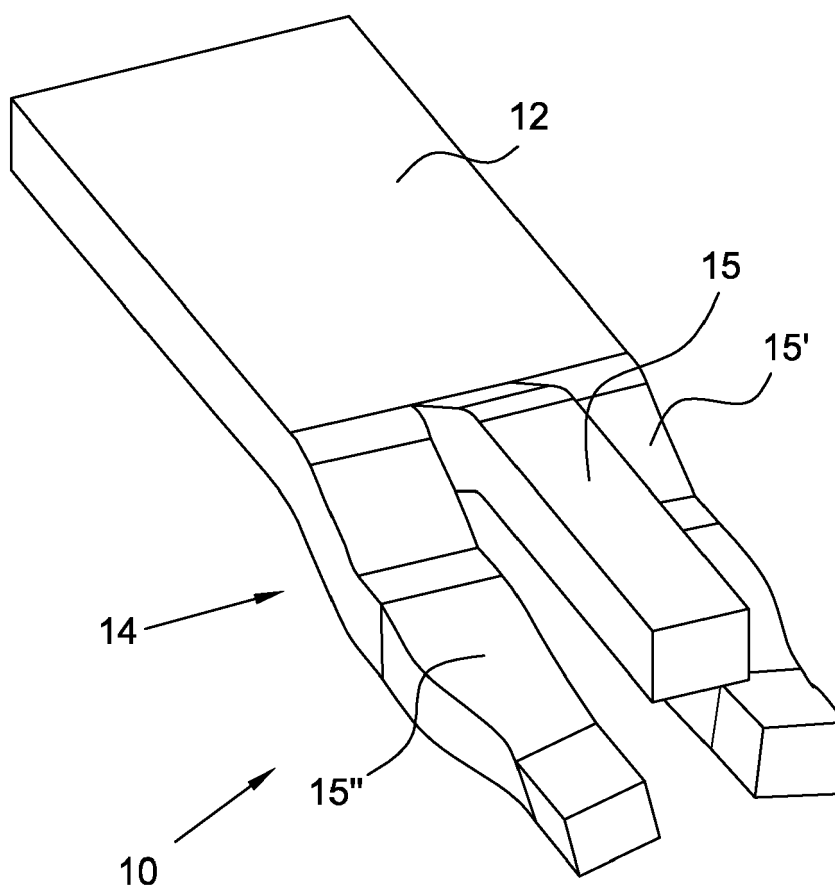


Fig. 3

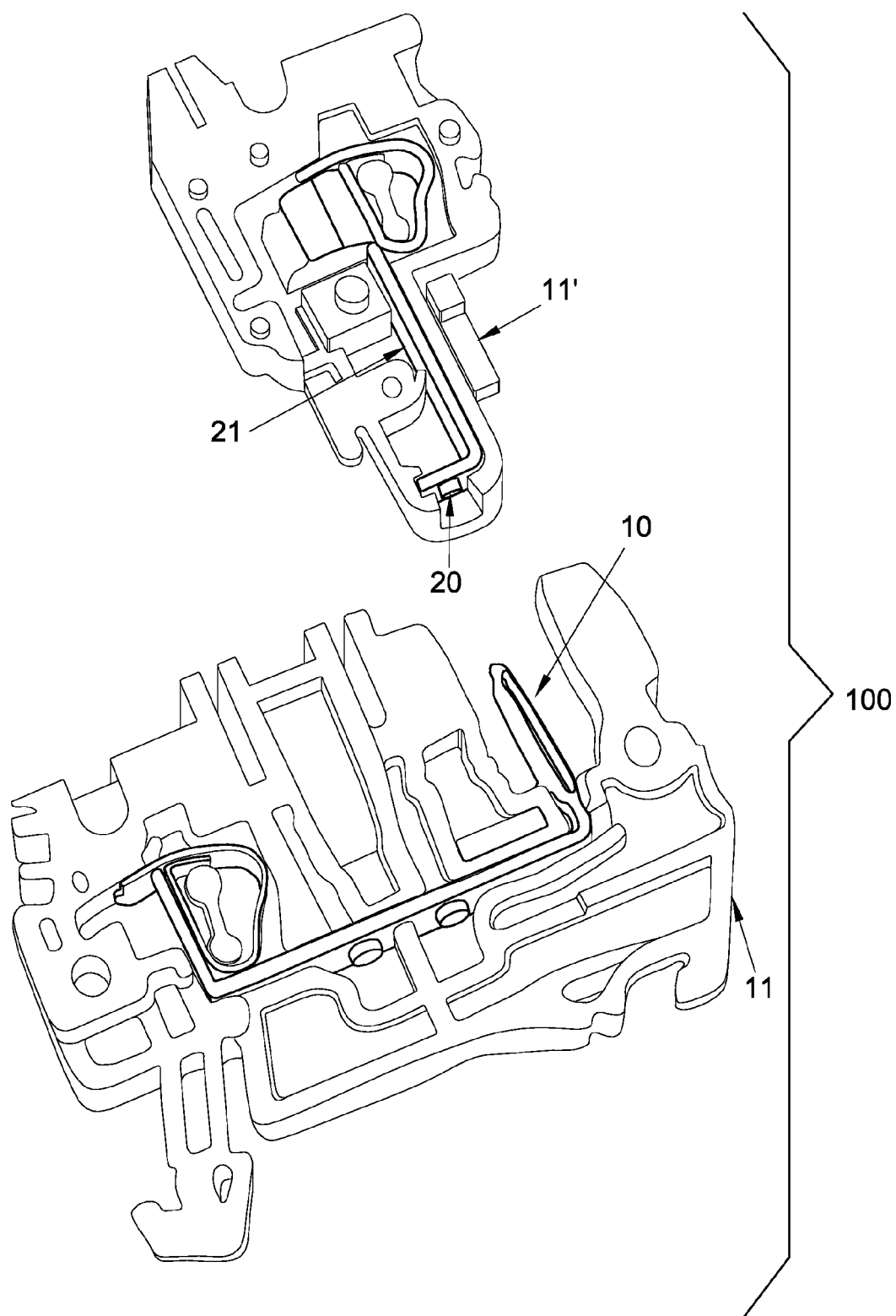


Fig. 4

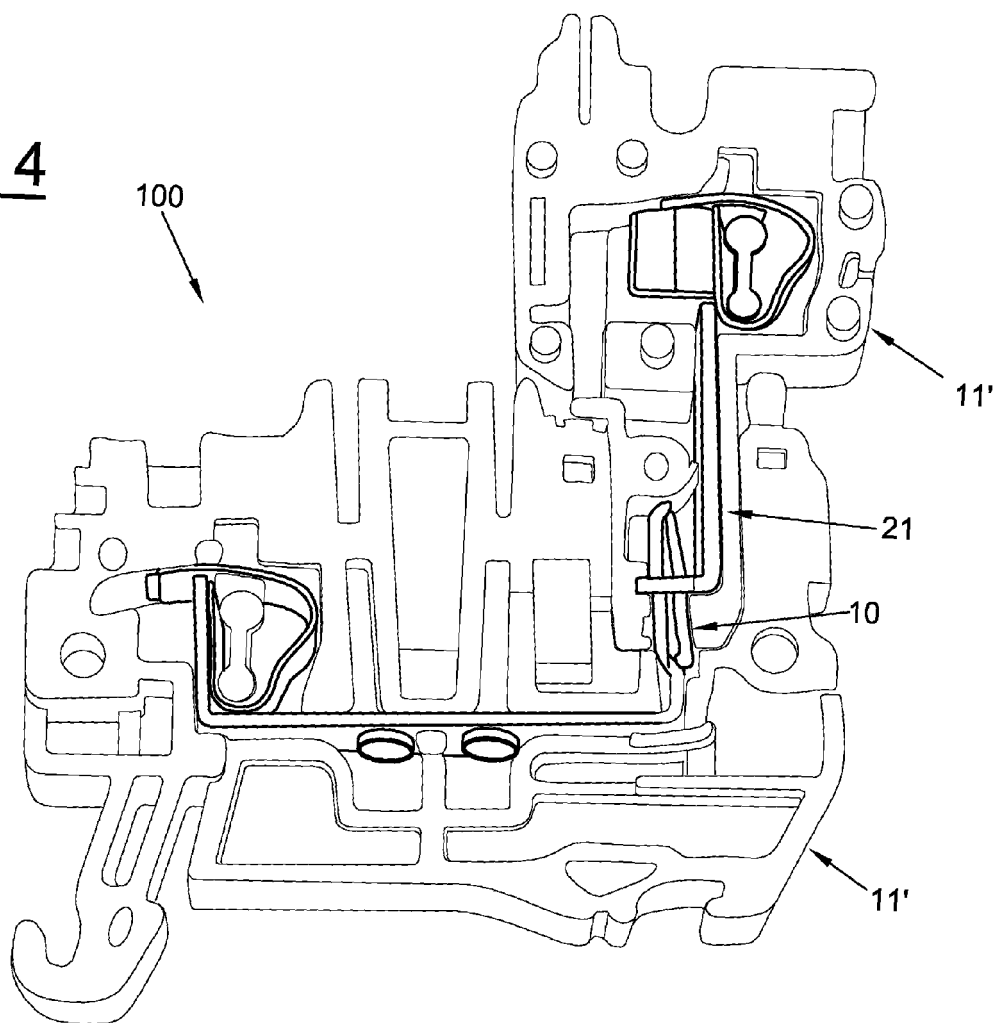
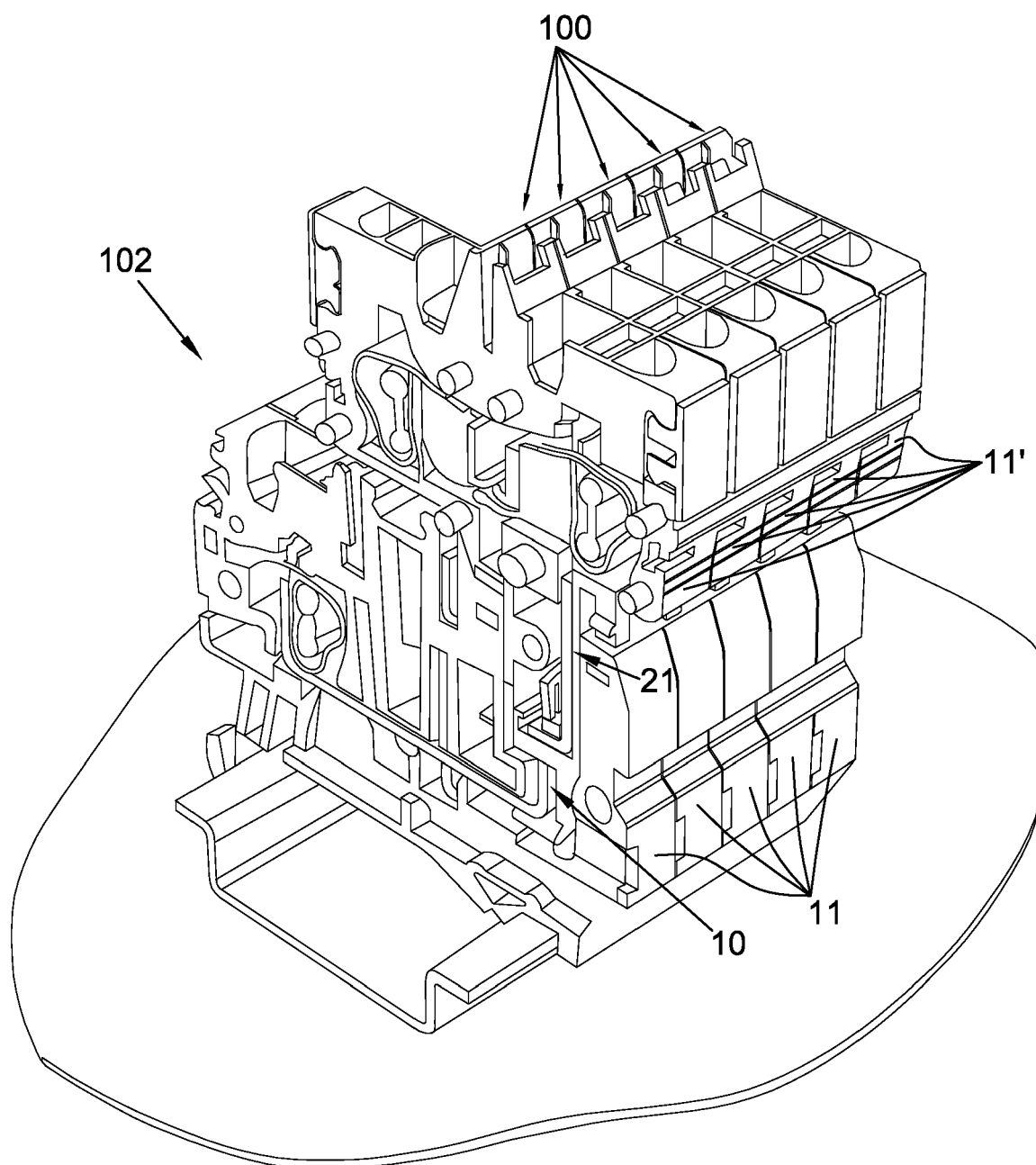


Fig. 5



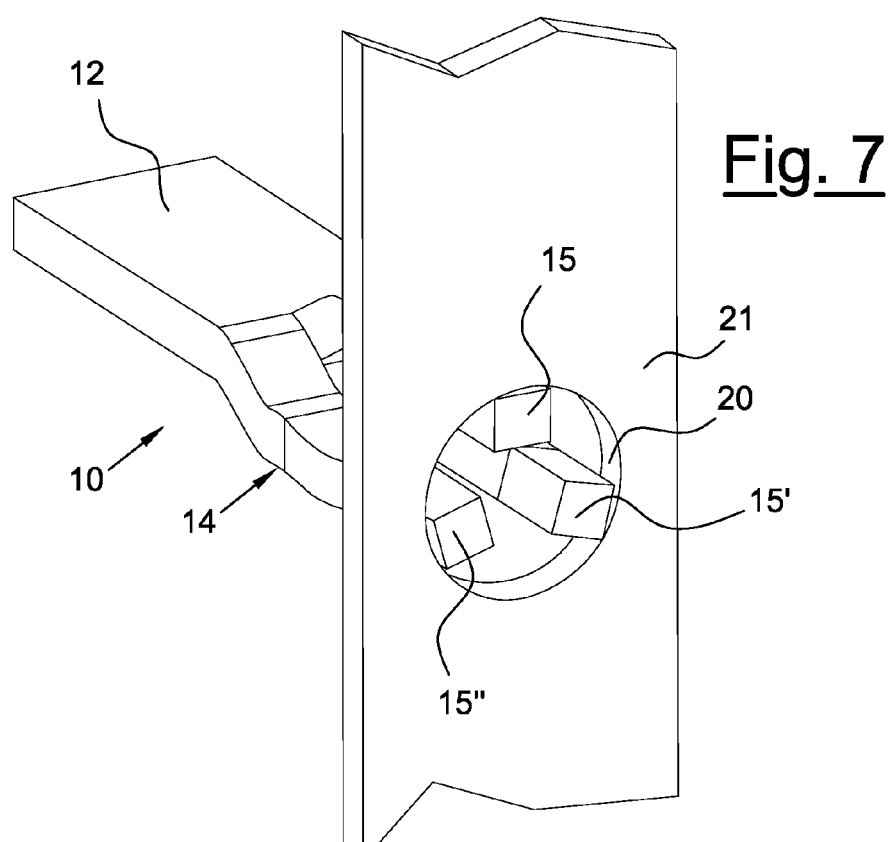
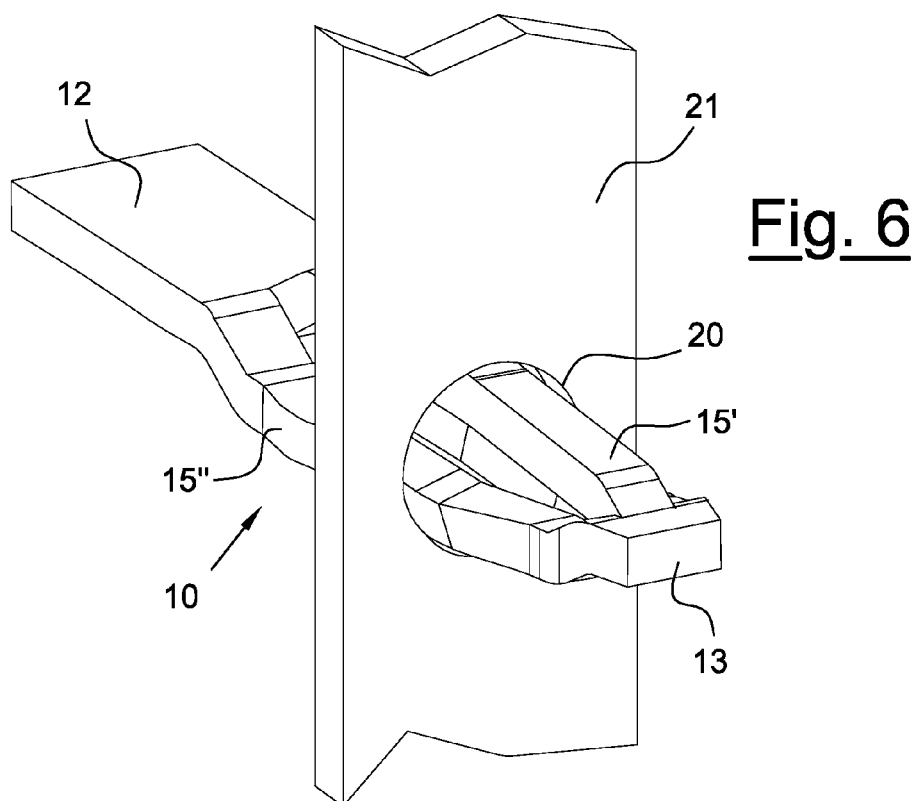


Fig. 8

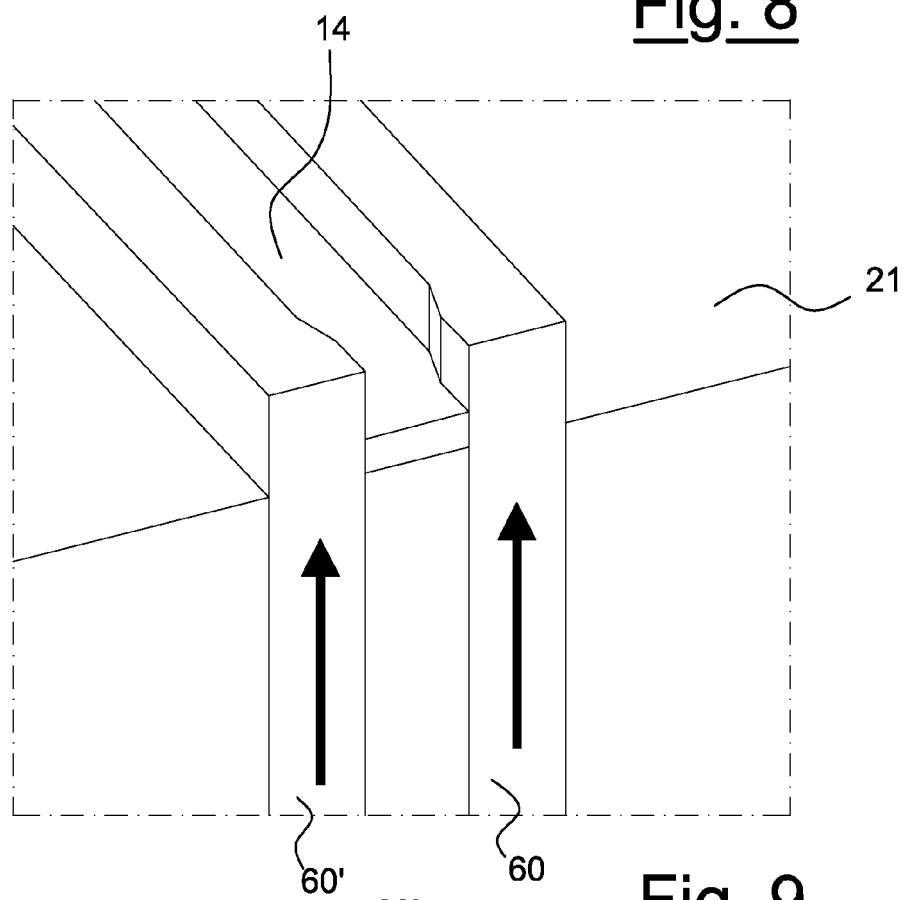
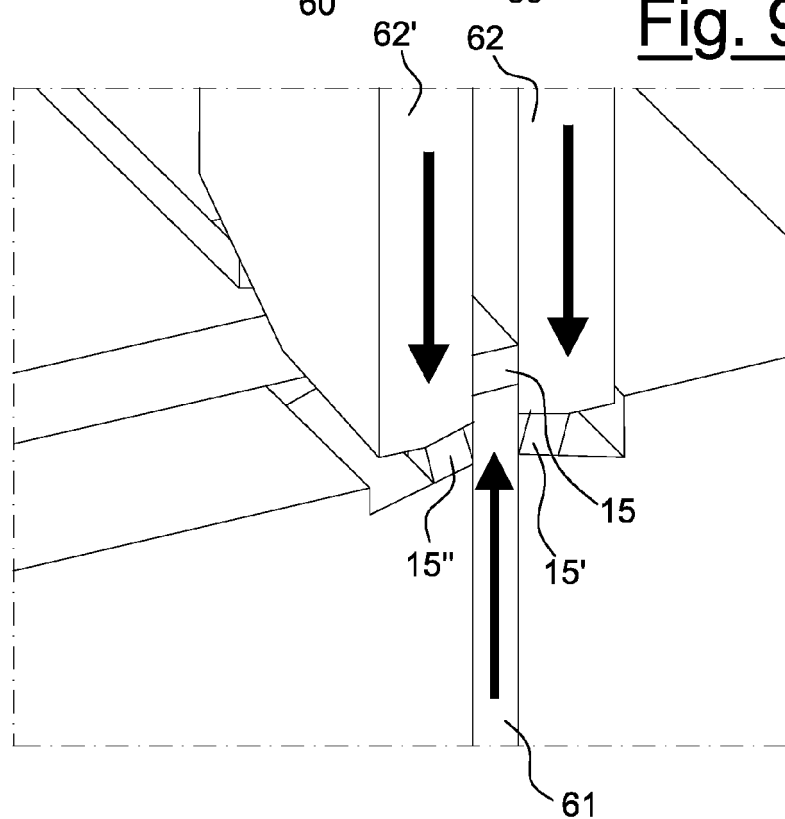
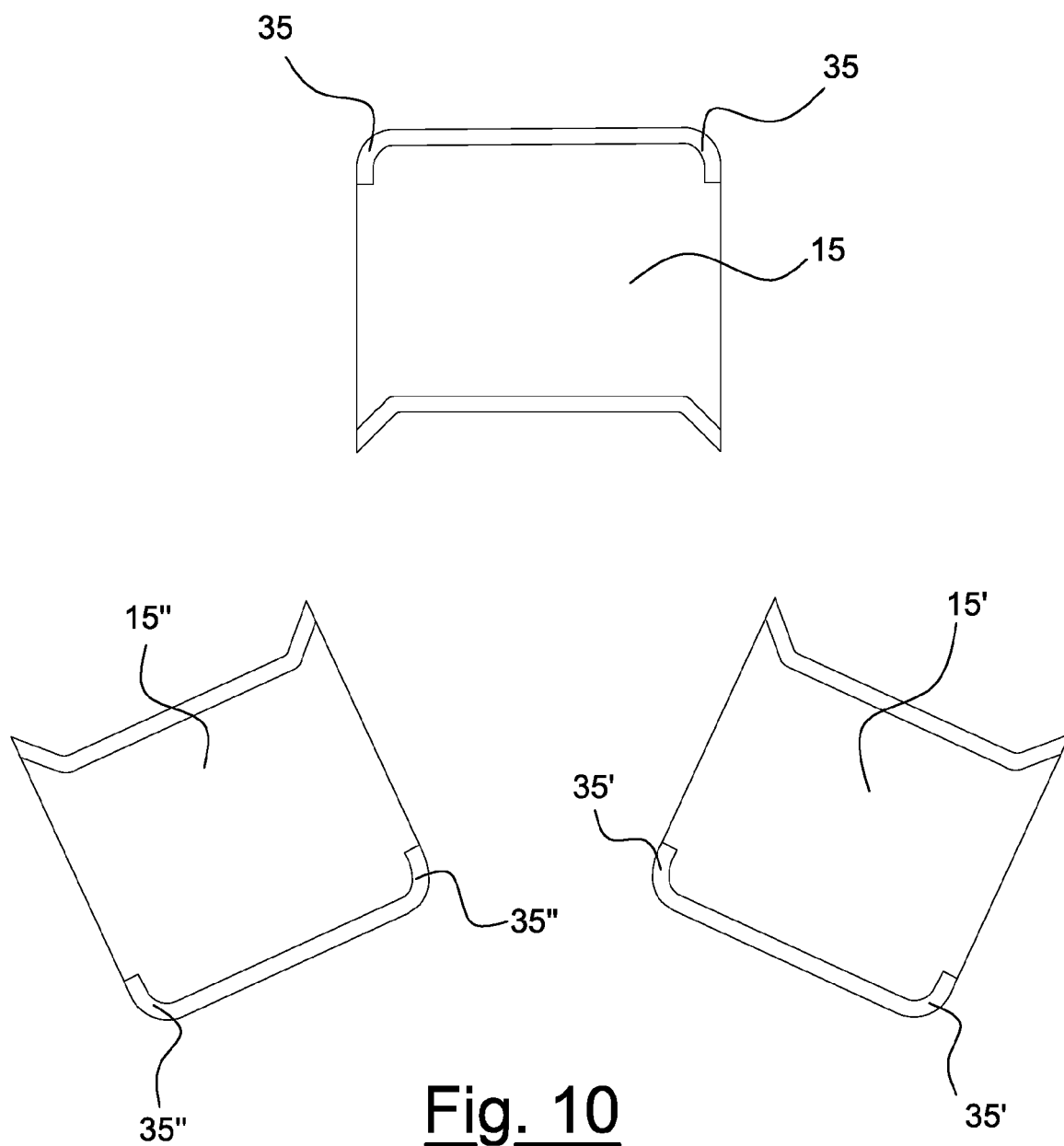


Fig. 9





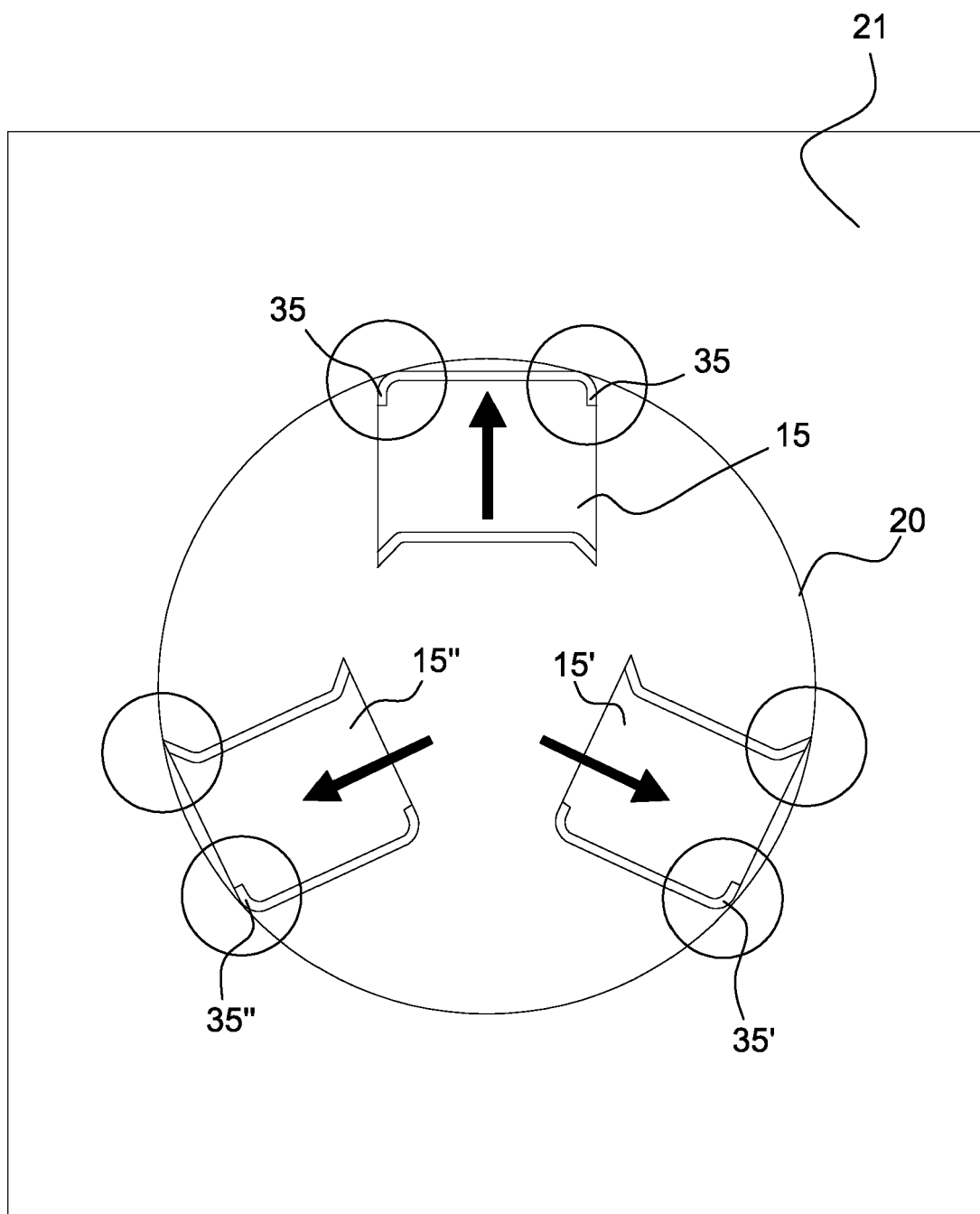


Fig. 11

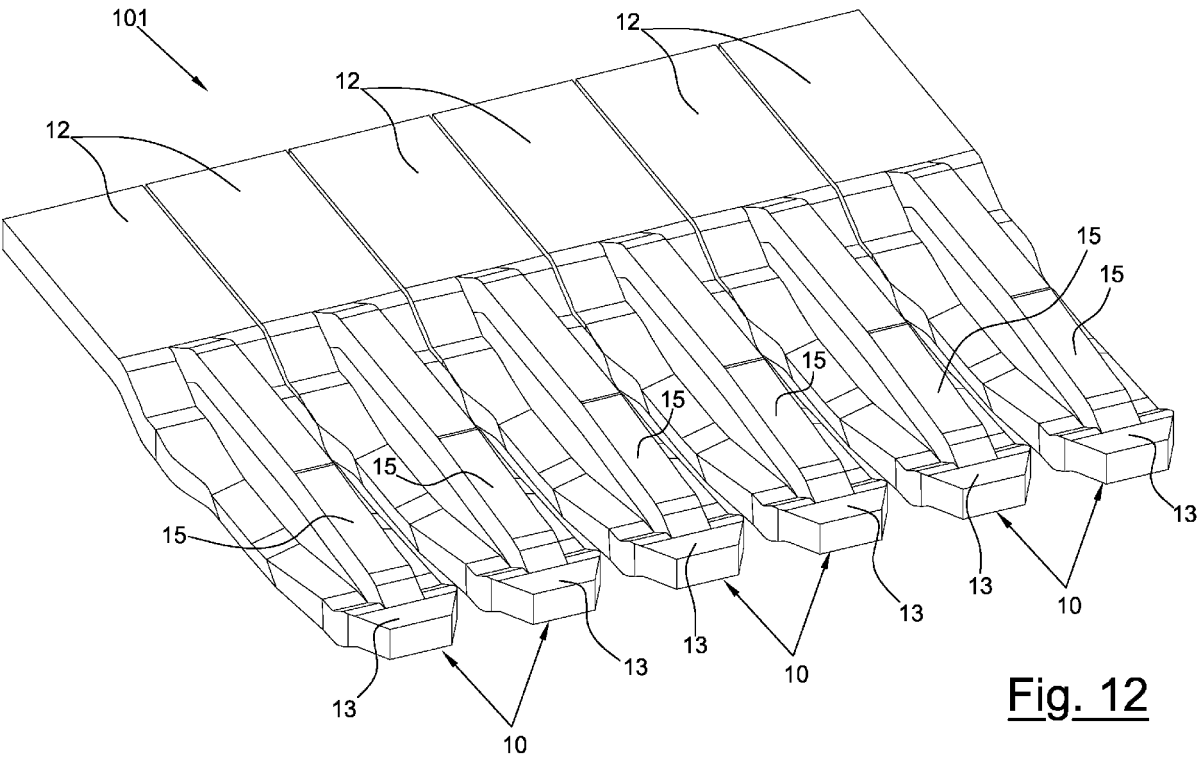
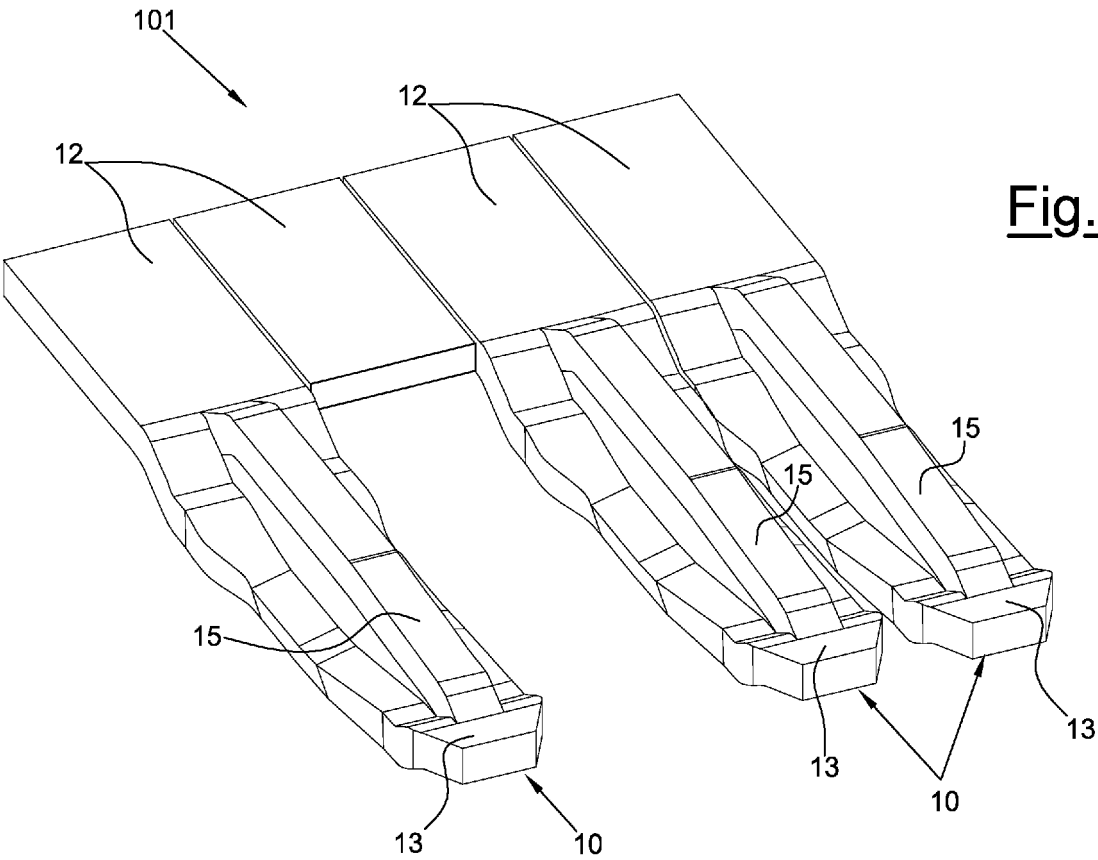


Fig. 12





EUROPEAN SEARCH REPORT

Application Number
EP 09 15 5268

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	US 2005/239345 A1 (FURUNO TOMOMI [JP] ET AL) 27 October 2005 (2005-10-27) * paragraphs [0033], [0042], [0044]; claims 1,2; figures 1,3 *	1,2	INV. H01R9/26 H01R43/16
X	US 4 906 209 A (TANABE TAKESHI [JP] ET AL) 6 March 1990 (1990-03-06) * column 2, lines 53-66; claim 1; figure 1 *	1-3,10,11	ADD. H01R12/04
X	EP 0 088 018 A (BENDIX CORP [US]) 7 September 1983 (1983-09-07) * claim 1 *	5	
A	US 2001/055697 A1 (SCHLEICHER KLAUS [DE] ET AL SCHLEICHER KLAUS [DE] ET AL) 27 December 2001 (2001-12-27) * paragraph [0005] *	2,4	
A	EP 0 784 355 A (ENTRELEC SA [FR]) 16 July 1997 (1997-07-16) * the whole document *	8,9	TECHNICAL FIELDS SEARCHED (IPC)
A	US 5 669 788 A (BROCKMAN DAVID J [US]) 23 September 1997 (1997-09-23) * claim 1; figures 4-6 *	12	H01R
A	US 5 944 538 A (SORIG LUDGER [DE]) 31 August 1999 (1999-08-31) * column 2, lines 42-44,56-60; claim 1; figure 1 *	4	
A	US 6 286 209 B1 (MITRA NIRANJAN K [NL] ET AL) 11 September 2001 (2001-09-11) * the whole document *	6,7	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 8 July 2009	Examiner VAUTRIN, Florent
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	

 8
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 15 5268

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

08-07-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005239345 A1	27-10-2005	CN 1700521 A	23-11-2005
		DE 102005018780 A1	17-11-2005
		JP 2005310626 A	04-11-2005
US 4906209 A	06-03-1990	NONE	
EP 0088018 A	07-09-1983	JP 58163192 A	27-09-1983
US 2001055697 A1	27-12-2001	AT 252774 T	15-11-2003
		CN 1325156 A	05-12-2001
		DE 10025106 A1	22-11-2001
		DK 1158618 T3	01-03-2004
		EP 1158618 A2	28-11-2001
		ES 2210063 T3	01-07-2004
		HK 1040837 A1	22-12-2006
		JP 2002025334 A	25-01-2002
		PT 1158618 E	31-03-2004
		TR 200301986 T4	21-01-2004
		TW 543249 B	21-07-2003
EP 0784355 A	16-07-1997	DE 69604376 D1	28-10-1999
		DE 69604376 T2	05-01-2000
		ES 2138310 T3	01-01-2000
		FR 2743448 A1	11-07-1997
		US 5848917 A	15-12-1998
US 5669788 A	23-09-1997	NONE	
US 5944538 A	31-08-1999	NONE	
US 6286209 B1	11-09-2001	NONE	