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### (54) Terminal for an electric connector, and electric connector featuring such a terminal

(57) A terminal (4, 15) for an electric connector (1, 1'), and which is housed inside a respective longitudinal cavity (3, 37) of the connector (1, 1') and has a connecting portion (12, 42) for connection to a respective electric cable, an interface portion (13, 43) interfacing with the cavity (3, 37) and adjacent to the connecting portion (12, 42), and a retaining portion (14, 44) located on the opposite side of the interface portion (13, 43) with respect to the connecting portion (12, 42), and in turn having a number of rigid tabs (24) which cooperate in snap-on manner with a number of flexible lances (23) associated with the cavity (3, 37), to lock the terminal (4, 15) inside the cavity (3, 37) and prevent withdrawal of the terminal; the retaining portion (14, 44) being of small transverse dimensions with respect to the transverse dimensions of the interface portion (13, 43), and being, together with the tabs (24), of a total overall transverse size no greater than the overall transverse size of the interface portion (13, 43).

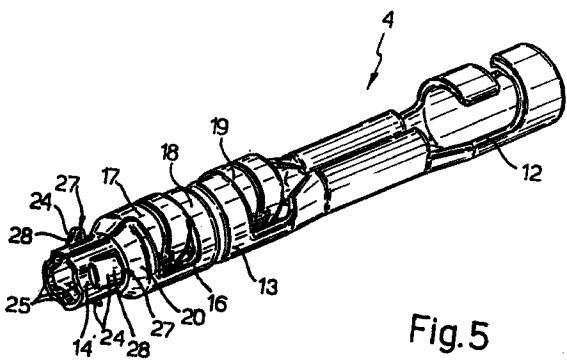
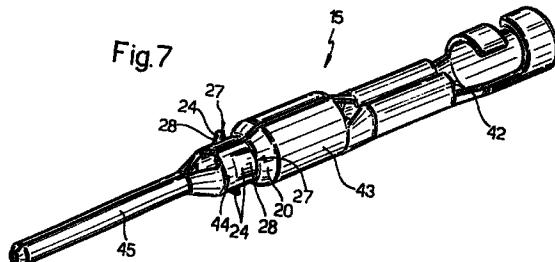


Fig.5

## Description

The present invention relates to a terminal for an electric connector, and to an electric connector featuring such a terminal.

Electric connectors are known, which comprise an insulating casing defining a number of cavities, each having a longitudinal axis; a number of electric terminals housed inside respective cavities; and first and second retaining means associated respectively with each terminal and the respective cavity, and which snap onto each other to lock the terminal inside the cavity and prevent it from being withdrawn.

More specifically, each terminal substantially comprises a connecting portion for connection to a respective electric cable; a portion interfacing with the respective cavity, located adjacent to the connecting portion, and which cooperates in sliding manner with the lateral wall of the cavity when assembling the terminal inside the casing; and contact means for contacting a complementary electric terminal.

Conveniently, the first retaining means comprise one or more rigid tabs projecting from the respective terminal; and the second retaining means comprise one or more elastically deformable lances projecting longitudinally inside, and from a lateral wall of, the respective cavity, and which snap onto the respective tabs. The tabs are normally located on the interface portion or, at any rate, adjacent to the connecting portion of the terminal.

The structure of terminals of the above type is therefore such that each cavity is inevitably fairly wide, by having to house both the respective terminal and tabs, and the respective flexible lances, each of which projects inside the cavity, and comprises a free end portion located a given distance from the lateral wall of the cavity to enable it to flex during insertion of the terminal. As a result, the distance between the axes of the various terminals and the size of the connector crosswise to the insertion direction of the complementary connector are considerable.

Moreover, the fact that the tabs of each terminal are normally located adjacent to the connecting portion results, during insertion, in prolonged contact between the terminal and respective lances, and possibly also in deformation of the terminal itself.

It is an object of the present invention to provide a terminal for an electric connector, designed to eliminate the aforementioned drawbacks typically associated with known terminals.

According to the present invention, there is provided a terminal for an electric connector, the terminal being housed inside a respective longitudinal cavity of an insulating casing of the connector, and comprising a connecting portion for connection to a respective electric cable; an interface portion interfacing with said cavity, located adjacent to said connecting portion, and cooperating in sliding manner with a lateral wall of the

cavity when assembling said terminal inside said casing; contact means for contacting a complementary terminal; and first retaining means, which cooperate in snap-on manner with second retaining means associated with said cavity to lock said terminal inside the cavity and prevent the terminal from being withdrawn; characterized in that said first retaining means are located on a retaining portion of said terminal located on the opposite side of said interface portion with respect to said connecting portion, and having a small cross section with respect to the transverse dimensions of the interface portion; said retaining portion and said first retaining means being of a total overall transverse size no greater than the overall transverse size of said interface portion.

Two preferred, non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a partial front view of an electric connector in accordance with the present invention; Figure 2 shows a partial front view of the Figure 1 electric connector in a different operating position; Figure 3 shows a smaller-scale section along line III-III in Figure 1; Figure 4 shows a smaller-scale section along line IV-IV in Figure 1; Figure 5 shows a smaller-scale view in perspective of an electric terminal in accordance with the present invention and for the Figure 1 connector; Figure 6 shows a partial front view of a further embodiment of an electric connector in accordance with the present invention; Figure 7 shows a smaller-scale view in perspective of an electric terminal in accordance with the present invention and for the Figure 6 connector; Figure 8 shows an axial section of a different version of the Figure 1 connector; Figure 9 shows an axial section of a different version of the Figure 6 connector.

Figures 1 to 4 show partial views of an electric connector indicated as a whole by 1.

Connector 1 substantially comprises an insulating casing 2 having a number of substantially cylindrical through cavities 3 (only one shown) having respective longitudinal axes A; and a number of female electric terminals 4 housed coaxially inside respective cavities 3 and retained unidirectionally inside cavities 3 by snap-on retaining means 5 described later on.

More specifically, casing 2 comprises a main box portion 6 in which cavities 3 for terminals 4 are formed; and each cavity 3 comes out through two openings 7, 8 formed respectively in a front wall 9 and a rear wall 10 of portion 6.

Casing 2 also comprises a number of parallel, substantially flat longitudinal walls 11 projecting from wall 9 of portion 6 and laterally defining openings 7.

With reference in particular to Figure 5, each terminal 4 comprises a connecting portion 12 for connection to a respective electric cable (not shown); an interface portion 13 interfacing with respective cavity 3, located adjacent to portion 12, and which cooperates in sliding manner with the lateral wall of cavity 3 when assembling terminal 4 inside casing 2; and a retaining portion 14, which is secured to casing 2 by retaining means 5, and is located on the opposite side of portion 13 with respect to portion 12.

As shown in Figures 3 and 4, each terminal 4 is inserted inside respective cavity 3 through respective opening 8 in an insertion direction parallel to axis A, so that portion 14 projects axially from cavity 3 through respective opening 7 and is enclosed laterally by a respective pair of walls 11.

More specifically, portion 13 is tubular of axis A, has a substantially circular cross section, and is engaged by a complementary male terminal 15 of the type shown in Figure 7. Portion 13 comprises, integrally, a substantially semitubular receptacle body 16 from which portion 12 extends rearwards; and three flexible contact blades 17, 18, 19 for contacting terminal 15, and which project integrally from body 16 in a direction crosswise to axis A, are axially offset with respect to one another, and are curved with their respective concavities facing inwards of body 16. More specifically, blades 17 and 19 project from a longitudinal lateral edge of body 16, and blade 18 is interposed axially between blades 17 and 19 and projects from an opposite longitudinal lateral edge of body 16.

With reference to Figures 1 to 4, retaining means 5 comprise, for each terminal 4, a pair of flexible lances 23 crosswise to walls 11 and projecting longitudinally outwards of respective cavity 3 from diametrically opposite portions of the lateral edge of respective opening 7; and three rigid tabs 24 projecting radially and integrally from portion 14 of terminal 4, and which cooperate in snap-on manner with lances 23 to lock terminal 4 inside cavity 3 and prevent it from being withdrawn through respective opening 8 in a direction opposite the insertion direction.

Tabs 24 of each terminal 4 are equally spaced about respective axis A, and are separated by angular distances smaller than the angular extension, or width, of each of respective lances 23, so as to ensure terminal 4 is retained inside respective cavity 3 regardless of the angular orientation of the terminal with respect to the cavity (Figures 1 and 2).

More specifically, each tab 24 is formed by blanking and bending the sheet metal from which portion 14 of terminal 4 is made, and comprises a side 27 crosswise to axis A and facing portion 12 of terminal 4, and an opposite side 28 inclined with respect to axis A.

Each lance 23 is elastically deformable in a direction crosswise to axis A and substantially parallel to walls 11, and comprises, on the surface facing respective terminal 4, an integral tooth 29 with a substantially

saw-tooth profile. Tooth 29 comprises an inclined side 30 facing respective opening 7; and an opposite side 31 crosswise to axis A and defining, in use, an axial stop for arresting sides 27 of tabs 24 of terminal 4 and so preventing terminal 4 from being withdrawn from cavity 3 through opening 8. The teeth 29 of each pair of lances 23 are also defined, towards each other, by respective curved concave edges 35 of axis A.

With reference in particular to Figures 3 to 5, portion 14 of each terminal 4 is substantially tubular of axis A, and is of smaller transverse dimensions than portion 13. More specifically, the total overall transverse size of portion 14 and tabs 24 is no greater than the overall transverse size of portion 13, so that the diameter of each cavity 3 depends solely on the transverse dimensions of portion 13 of terminal 4.

Portion 14 of each terminal 4 also provides for guiding complementary terminal 15, for which purpose, portion 14 comprises three impressions 25, which are convex inwards of portion 14 to cooperate with and center terminal 15 during insertion.

Each terminal 4 also comprises a substantially truncated-cone-shaped portion 20 connecting portions 13 and 14; and, as shown in Figure 4, in the working position of each terminal 4, sides 30 of teeth 29 of respective lances 23 are positioned along the outer surface of portion 20 to prevent further travel of terminal 4 inside cavity 3 in the insertion direction.

With reference to Figures 1 to 3, connector 1 also comprises axial stop means 32 for preventing each terminal 4 from being pushed out of respective cavity 3 through respective opening 7 in the insertion direction.

More specifically, stop means 32 comprise, for each terminal 4, a pair of appendixes 33 projecting integrally towards each other from respective walls 11 laterally defining cavity 3, and which define a front axial stop for portion 14 of terminal 4. Appendixes 33 extend from respective front end portions of walls 11, comprise respective concave edges 34 of axis A facing each other, and define a transverse opening of such a size as to permit insertion of complementary terminal 15 but prevent expulsion of portion 14 of terminal 4.

At the assembly stage, teeth 29 of each pair of lances 23 permit insertion of respective terminal 4, which slides along sides 30 to flex and slightly part lances 23 in a direction crosswise to axis A; and, once terminal 4 is inserted fully inside cavity 3 and just short of appendixes 33 (Figures 3 and 4), lances 23 snap back into the undeformed position, so that teeth 29 snap behind tabs 24 of terminal 4, and sides 31 of teeth 29 define a stop to prevent withdrawal of terminal 4.

Figures 1 and 2 show two extreme angular mating positions of terminal 4 and cavity 3. In the Figure 1 position, one of tabs 24 of terminal 4 is fully engaged by one of lances 23, and the other two tabs 24 are partially engaged by the other lance 23; in the Figure 2 position, two of tabs 24 of terminal 4 are partially engaged by respective lances 23, and the other tab 24 is detached

from lances 23.

As such, regardless of the angular orientation of each terminal 4 in relation to respective cavity 3, the particular geometry of retaining means 5 ensures at least two tabs 24 of terminal 4 are engaged at all times by respective lances 23.

Figure 6 shows a partial view of a different embodiment of an electric connector in accordance with the present invention and indicated as a whole by 1'. In the following description, connector 1' is described only insofar as it differs from connector 1, and using the same numbering system for any parts identical or corresponding to those already described.

Connector 1' mates longitudinally with connector 1 to define an electric connecting unit (not shown), and substantially comprises an insulating casing 36 complementary to casing 2 and having a number of through cavities 37 of axis A identical to cavities 3; and a number of male terminals 15 housed coaxially inside respective cavities 37 and retained unidirectionally inside cavities 37 by snap-on retaining means 38 identical to retaining means 5.

Like casing 2, casing 36 comprises a box portion 39 in which cavities 37 are formed; and a number of longitudinal walls 40 similar to walls 11 and projecting from a front wall 41 of portion 39.

With reference to Figure 7, each terminal 15 comprises a connecting portion 42, identical to portion 12 of terminal 4, for connection to a respective electric cable; an interface portion 43 interfacing with respective cavity 37, located adjacent to portion 42, and cooperating in sliding manner with a lateral wall of cavity 37 when assembling terminal 15 inside casing 36; a retaining portion 44 similar to portion 14 of terminal 4 (but without impressions 25) and located on the opposite side of portion 43 with respect to portion 42; and a cylindrical pin type contact portion 45 projecting frontwards from portion 44. Portions 43 and 44 of each terminal 15 are both cylindrical tubular portions of the same transverse dimensions as portions 13 and 14 of terminal 4.

Portions 44 and 45 of each terminal 15 project from respective cavity 37 through an opening 47 in wall 41. More specifically, portion 44 is enclosed laterally by a respective pair of walls 40, which, like connector 1 and for each terminal 15, comprise respective appendixes 46 similar to appendixes 33 and defining a transverse opening engaged by portion 45 of terminal 15 and of such a size as to prevent expulsion of portion 44.

Figures 8 and 9 show different versions of connectors 1, 1', indicated as a whole respectively by 1" and 1"".

In the following description, connectors 1" and 1"" are described only insofar as they differ from respective connectors 1, 1' and using the same numbering system for any parts identical or corresponding to those already described.

Connectors 1", 1"" differ from respective connectors 1, 1' as retaining means 5 comprise, for each terminal 4,

15, an annular ring 129 provided on a front side of respective cavity 3, 37 and cooperating with tabs 24 of terminal 4, 15.

More specifically, annular ring 129 comprises an axial stop surface 132, facing respective opening 8 and complementary to portion 20 of relative terminal 4, 15 for arresting and centering terminal 4, 15 and preventing total expulsion of the terminal 4, 15 from the cavity 3, 37 in the insertion direction; and an opposite surface 131 crosswise to axis A and defining, in use, a retaining surface for tabs 24 of terminal 4, 15 in a direction contrary to insertion direction.

Finally, in Figure 8, reference 200 corresponds to a partial view of a front grid used to guide the pin type contact portion 45 of terminals 15 during mating connector 1" and connector 1' or 1"".

The advantages of terminals 4, 15 and respective connectors 1, 1', 1", 1"" according to the present invention will be clear from the foregoing description.

In particular, as tabs 24 of each terminal 4, 15 are located on a small-diameter portion (14, 44) of the terminal, and do not project transversely with respect to the rest of terminal 4, 15 (interface portion 13, 43), the diameter of cavity 3, 37 and, consequently, the distances between the axes of the various terminals 4, 15 and the transverse dimensions of connectors 1, 1', 1", 1"" are relatively small.

The location of lances 23 outside respective cavity 3, 37 provides for further reducing the diameter of cavity 3, 37 by eliminating the additional space otherwise required for housing lances 23.

As tabs 24 are located substantially at the front of terminal 4, 15, terminal 4, 15 only contacts lances 23 towards the end of insertion, thus minimizing possible deformation of terminal 4, 15 as it is inserted inside respective casing 2, 36.

Finally, as retaining means 5, 38 of connectors 1, 1', 1", 1"" are identical, and retaining portions 14, 44 of terminals 4, 15 are of the same transverse size, cavities 3, 37 may be formed using the same mold, thus reducing cost.

Clearly, changes may be made to terminals 4, 15 and respective connectors 1, 1', 1", 1"" as described and illustrated herein without, however, departing from the scope of the present invention.

In particular, retaining means 5, 38 may comprise only one flexible lance 23 and at least two tabs 24; and lances 23 may be rigid, and tabs 24 elastically deformable.

Furthermore, retaining means 5 of connectors 1", 1"" may comprise, for each terminal 4, 15, only one or more annular ring sectors instead of annular ring 129.

## Claims

1. A terminal (4, 15) to be housed inside a respective longitudinal cavity (3, 37) of an insulating casing (2, 36) of an electrical connector (1, 1', 1", 1""), and

comprising a connecting portion (12, 42) for connection to a respective electric cable; an interface portion (13, 43) located adjacent to said connecting portion (12, 42), contact means (17, 18, 19; 45) for contacting a complementary terminal (15, 4); and first retaining means (24), which cooperate in snap-on manner with second retaining means (23, 129) associated with said cavity (3, 37) to lock said terminal (4, 15) inside the cavity (3, 37) and prevent the terminal from being withdrawn; characterized in that said first retaining means (24) are located on a retaining portion (14, 44) of said terminal (4, 15) located on the opposite side of said interface portion (13, 43) with respect to said connecting portion (12, 42), and having a small cross section with respect to the transverse dimensions of the interface portion (13, 43); said retaining portion (14, 44) and said first retaining means (24) being of a total overall transverse size no greater than the overall transverse size of said interface portion (13, 43).

2. A terminal as claimed in Claim 1, characterized in that said retaining portion (14, 44) is substantially tubular; and in that said first retaining means comprise at least one tab (24) projecting radially from said retaining portion (14, 44) and which snaps onto said second retaining means (23, 129).

3. A terminal as claimed in Claim 2, characterized by comprising a number of said tabs (24).

4. A terminal as claimed in any one of the foregoing Claims, characterized in that said contact means comprise a cylindrical pin type contact portion (45) projecting longitudinally from said retaining portion (44) on the opposite side to said connecting portion (42).

5. A terminal as claimed in any one of Claims 1 to 3, characterized in that said interface portion (13) is substantially tubular, and comprises a receptacle body (16) having a longitudinal axis (A), and which is engaged by said complementary terminal (15) and in turn comprises at least one flexible contact blade (17, 18, 19) extending crosswise to said longitudinal axis (A) from a lateral edge of said receptacle body (16).

6. An electric connector (1, 1', 1", 1'') comprising:

- an insulating casing (2, 36) in turn comprising at least one cavity (3, 37) having a longitudinal axis (A);
- at least one electric terminal (4, 15) housed inside said cavity (3, 37) and in turn comprising a connecting portion (12, 42) for connection to a respective electric cable; an interface portion (13, 43) located adjacent to said connecting portion (12, 42), contact means (17, 18, 19; 45) for contacting a complementary terminal (15, 4); and first retaining means (24), which cooperate in snap-on manner with second retaining means (23, 129) associated with said cavity (3, 37) to lock said terminal (4, 15) inside the cavity (3, 37) and prevent the terminal from being withdrawn; characterized in that said first retaining means (24) are located on a retaining portion (14, 44) of said terminal (4, 15) located on the opposite side of said interface portion (13, 43) with respect to said connecting portion (12, 42), and having a small cross section with respect to the transverse dimensions of the interface portion (13, 43); said retaining portion (14, 44) and said first retaining means (24) being of a total overall transverse size no greater than the overall transverse size of said interface portion (13, 43), said interface portion (13, 43) interfacing with said cavity (3, 37).

7. A connector as claimed in Claim 6, characterized in that said retaining portion (14, 44) of said terminal (4, 15) is substantially tubular; said first retaining means comprising at least one tab (24) projecting radially from said retaining portion (14, 44) of said terminal (4, 15); and said second retaining means comprising at least one elastically deformable lance (23) projecting longitudinally outwards of said cavity (3, 37) from a front part of said casing (2, 36), and which snaps onto said tab (24) to prevent withdrawal of said terminal (4, 15) from said cavity (3, 37) in a direction opposite an axial insertion direction of the terminal (4, 15) inside said casing (2, 36).

8. A connector as claimed in Claim 7, characterized in that said first retaining means comprise a number of angularly equally spaced said tabs (24); and in that said second retaining means comprise a number of said lances (23) equally spaced about said longitudinal axis (A).

9. A connector as claimed in Claim 8, characterized in that said tabs (24) are separated by angular distances smaller than the angular extension of each said lance (23) with respect to said longitudinal axis (A), so as to ensure said terminal (4, 15) is locked inside said cavity (3, 37) regardless of the angular orientation of the terminal with respect to the cavity.

10. A connector as claimed in Claim 8 or 9, characterized in that each said tab (24) comprises a first side (27) crosswise to said longitudinal axis (A) and facing said connecting portion (12, 42) of said terminal (4, 15), and an opposite second side (28) inclined with respect to said longitudinal axis (A); each said

lance (23) comprising, on a respective surface facing said terminal (4, 15), a tooth (29) having a substantially saw-tooth profile and in turn comprising an inclined first side (30) facing said opening (7, 47), and an opposite second side (31) crosswise to said longitudinal axis (A) and defining, in use, an axial stop for said first sides (27) of said tabs (24), so as to prevent withdrawal of said terminal (4, 15) from said cavity (3, 37) in a direction opposite said insertion direction inside the cavity (3, 37). 10

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11. A connector as claimed in any one of the foregoing Claims from 7 to 10, characterized in that said casting (2, 36) comprises stop means (32, 33; 46) defining a front axial stop for arresting said retaining portion (14, 44) of said terminal (4, 15) and preventing total expulsion of said terminal (4, 15) from said cavity (3, 37) in said insertion direction. 15

12. A connector according to Claim 6, characterized in that said second retaining means consists in at least one annular ring sector (129) provided on a front side of said cavity (3, 37), said annular ring sector (129) defining an axial stop surface (132), complementary to a portion (20) connecting said interface portion (13, 43) to said retaining portion (14, 44) of the terminal (4, 15), for arresting and centering said terminal (4, 15) and preventing total expulsion of the terminal (4, 15) from the cavity (3, 37) in the insertion direction, and said annular ring sector (129) defining a retaining surface (131) for said at least one tab (24) in a direction contrary to said insertion direction. 20

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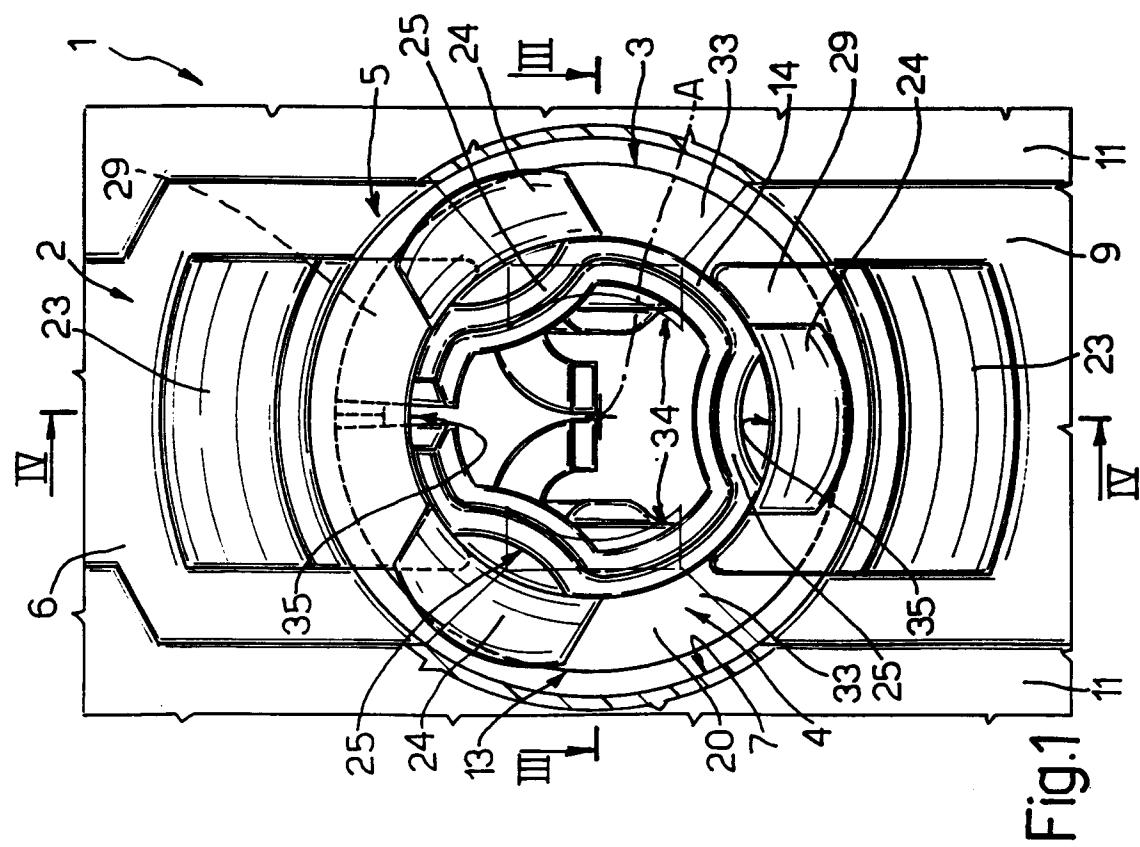
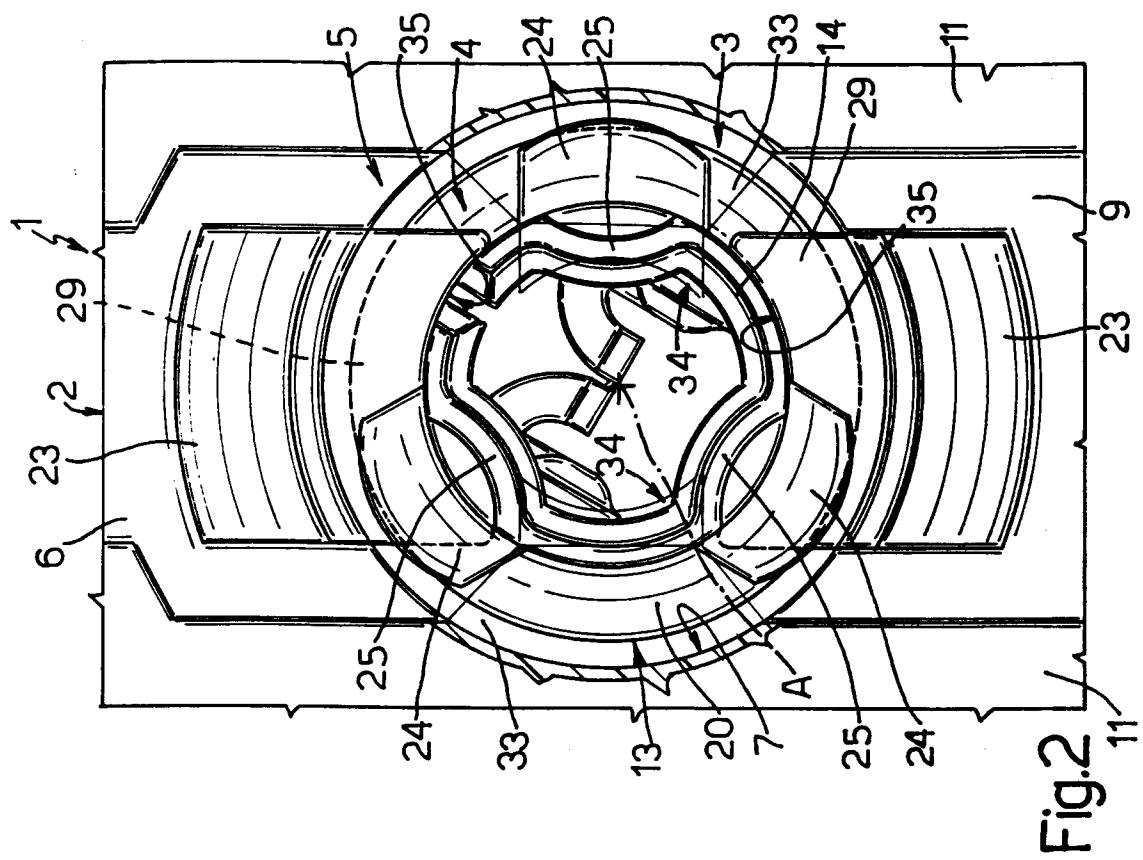
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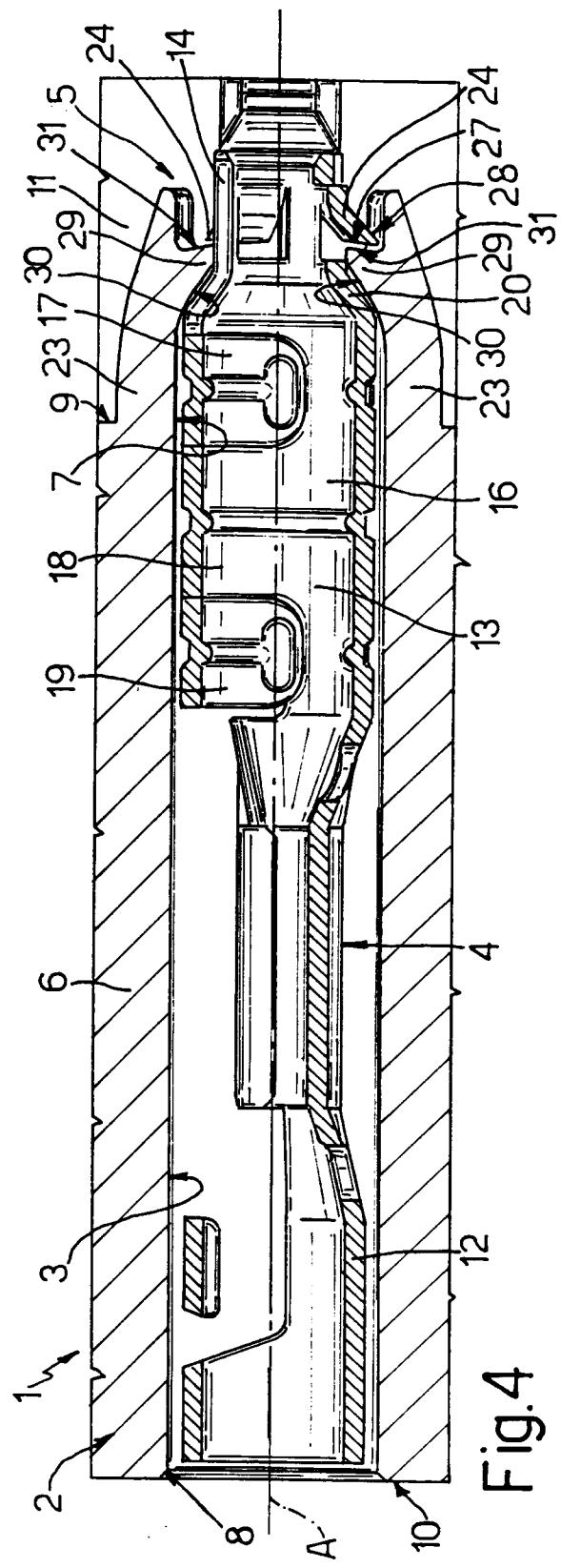


Fig. 4

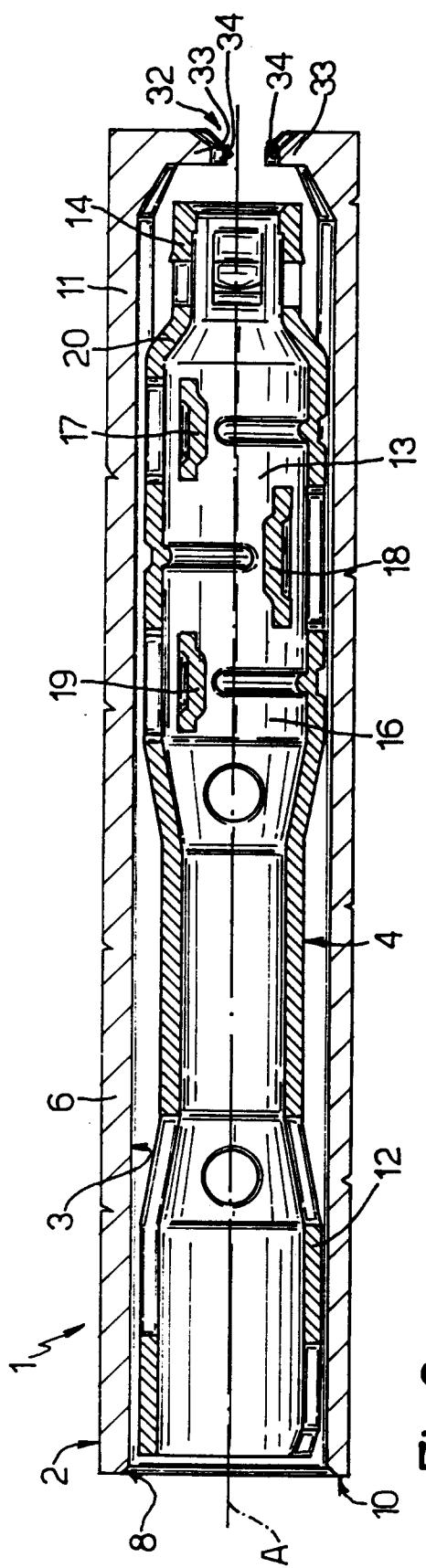
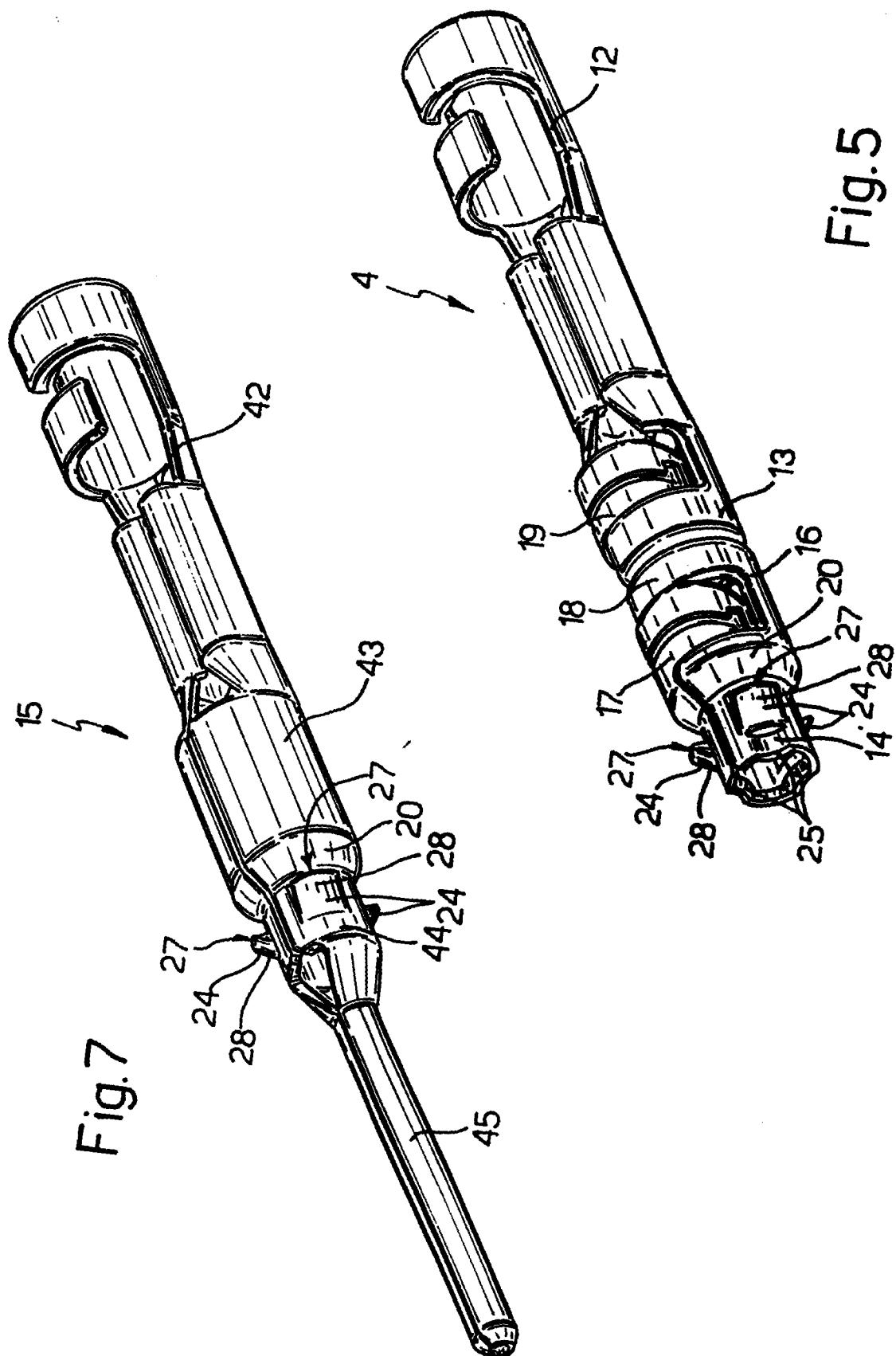


Fig. 3



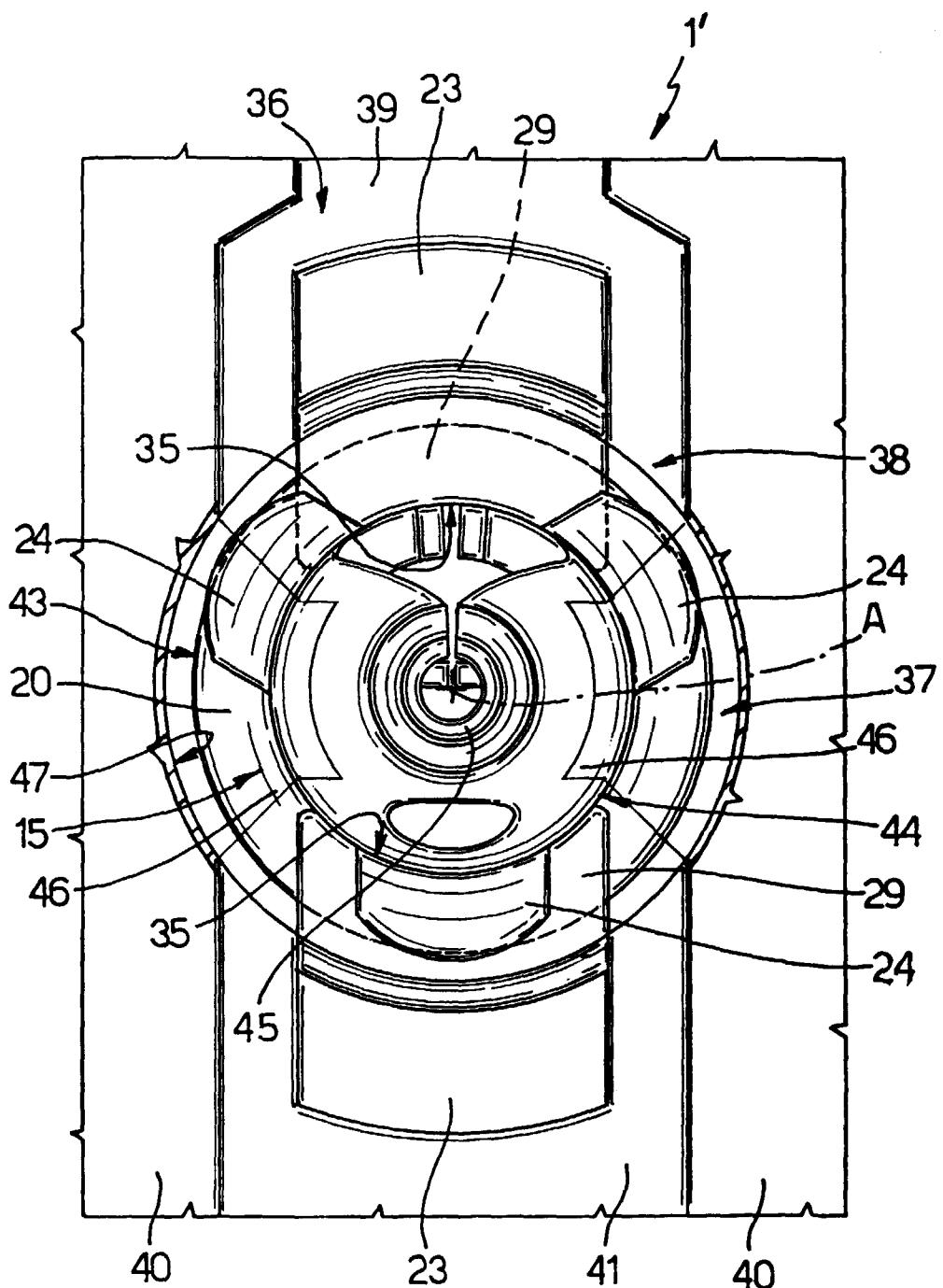
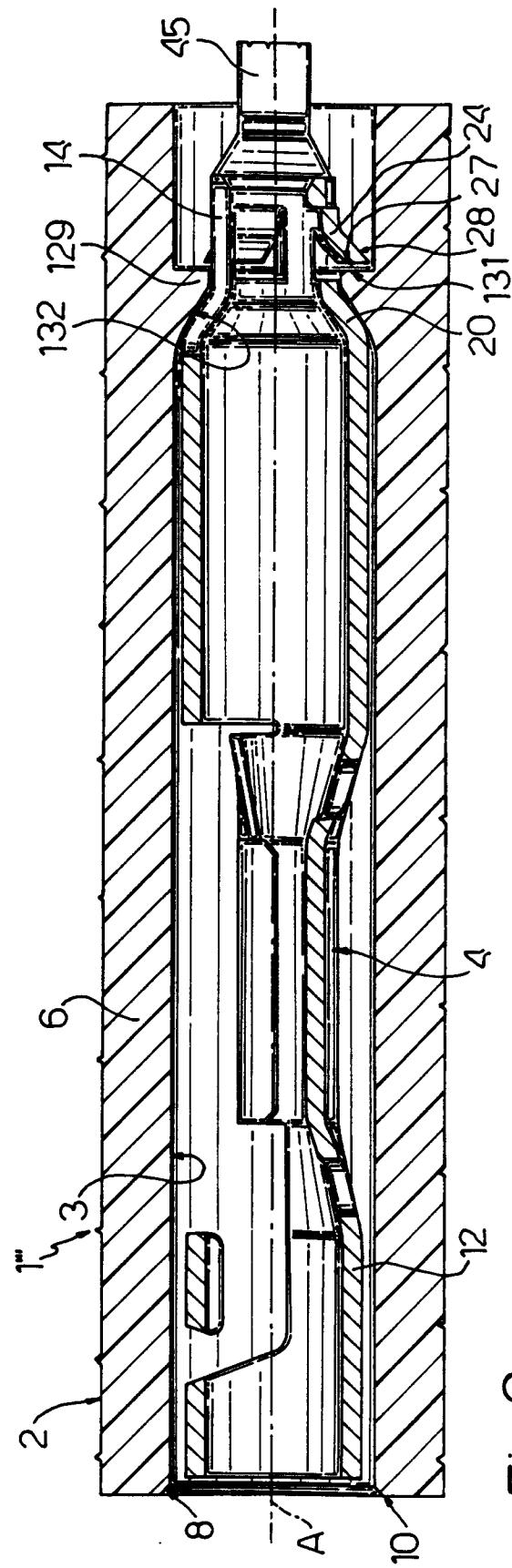
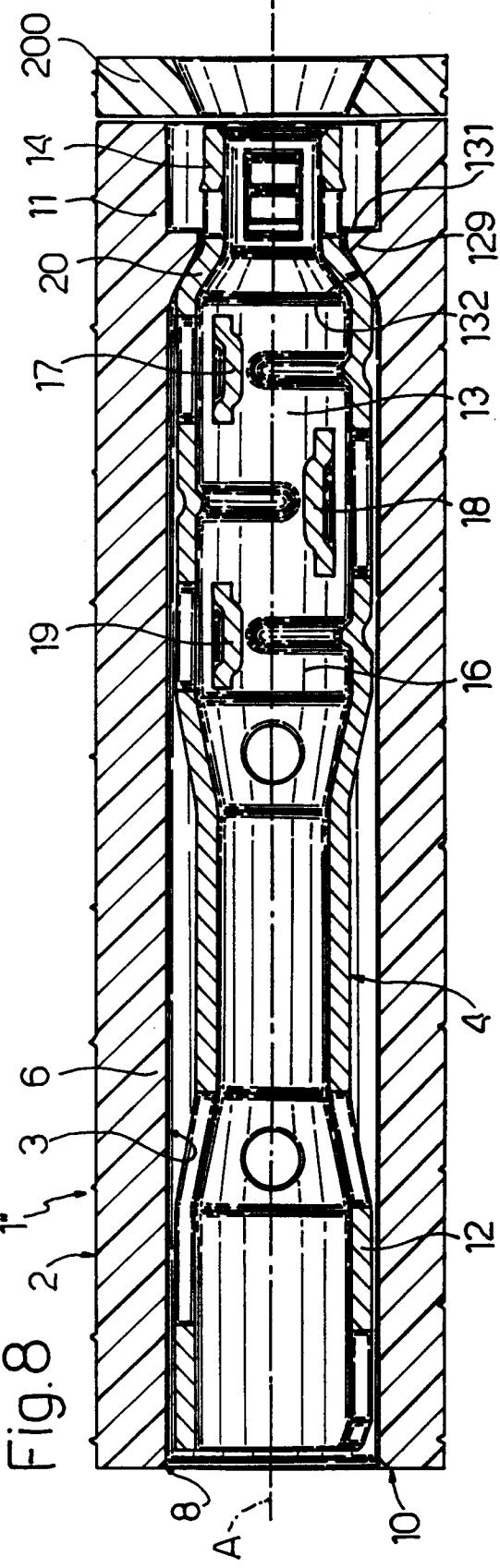


Fig. 6



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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 489 223 A (FAJE RICHARD A ET AL) 6 February 1996	1,6,12	H01R13/432
Y		2-4,7	
A	* column 3, line 22 - column 4, line 38 * * figures 1-10 *	5,10	
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X	US 4 990 104 A (SCHIEFERLY STEPHEN B) 5 February 1991	1,6	
Y		7	
A	* column 3, line 17 - line 36 * * figures 1,2 *	8,9	
	---		
Y	FR 2 149 241 A (GROTE & HARTMANN) 23 March 1973	2-4	
A	* page 2, line 29 - page 3, line 29 * * figures 1-5 *	1,5,6,8	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			H01R
<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search		Examiner
BERLIN	23 April 1998		Stirn, J-P
CATEGORY OF CITED DOCUMENTS		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	
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			