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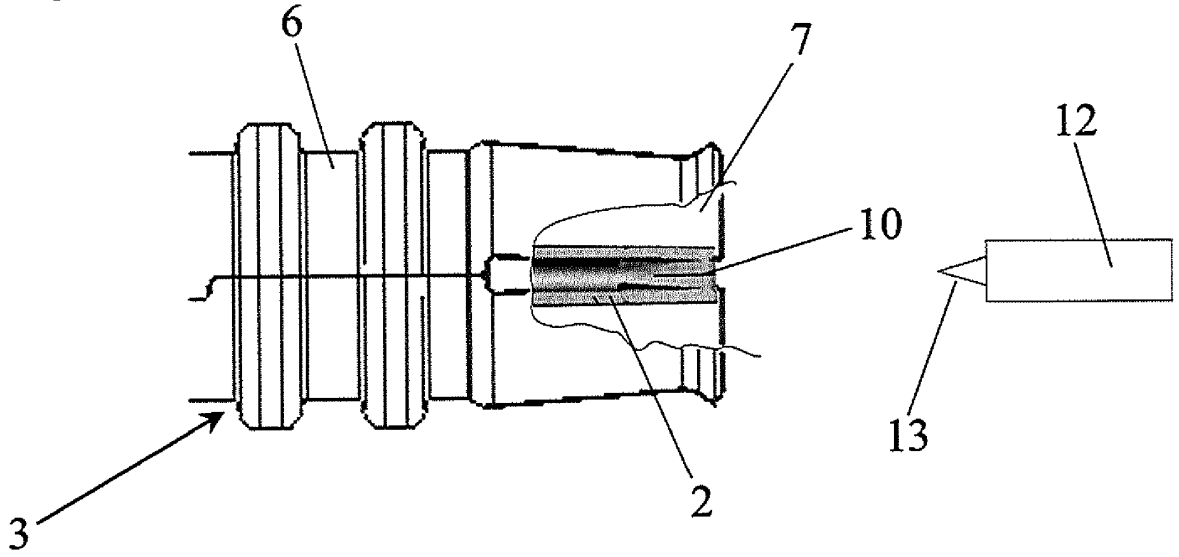
(54) Process and device for the automatic production of coaxial cables

(57) A process and the relative device for the production of coaxial cables comprising a conductor (2) housed in the hole (7) of a corresponding terminal (3) stapled onto the body of said coaxial cable (1), wherein the guided alignment is effected, of said conductor (2) with the above-mentioned hole (7) of the terminal (3).

With respect to the known art described above, the process and device of the invention allow the assembly of the terminal onto the conductor, to be automated, ensuring the perfect centering between these components and considerably increasing the yield of the production process.

Fig.2



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Description

[0001] The present invention relates to a process for the automatic production of coaxial cables. The invention is also extended to the device used in the implementation of this process.

[0002] The field of the invention relates to systems used for assembling formation components of coaxial cables. In particular, the coaxial cables to which the invention relates are a conductor (inner) contained inside an insulating sheath. A terminal (outer) having a substantially cylindrical form is stapled onto the end of the conductor which protrudes from the insulator, in which the above-mentioned conductor is housed. In order to assemble the terminal to the conductor, these components must therefore be centered with respect to each other in order to keep them in a coaxial position during the insertion of the conductor in the terminal.

[0003] These operations are traditionally effected manually, with drawbacks linked to the use of manpower and possible operating errors. The times required by manpower are also so lengthy as to significantly jeopardize the yield and also the quality of the production process.

[0004] An objective of the invention is therefore to automate the assembly of coaxial cables, ensuring a perfect coaxiality between its components and improving the process yield.

[0005] This and other objectives are achieved with the process and device of claims 1 and 5 respectively. Preferred embodiments of the invention are specified in the remaining claims.

[0006] With respect to the known art described above, the process and device of the invention allow the assembly of the terminal onto the conductor to be automated, ensuring a perfect centering between these components and considerably increasing the yield of the production process.

[0007] These and other objectives are achieved with the process and device illustrated for illustrative and non-limiting purposes in the figures of the enclosed drawings.

[0008] In these:

- figure 1 illustrates a partial sectional view of a coaxial cable according to the invention:
- figure 2 illustrates the enlarged detail of the part of the terminal of the coaxial cable of figure 1;
- figure 3 illustrates a variant of the cable of figure 2;
- figure 4 illustrates a partial sectional view of the components of the coaxial cable of the previous figures, in the insertion phase of the conductor in the terminal;
- figure 5 is an exploded view of the coaxial cable of figure 4;
- figures 6 to 11 schematically illustrate the various phases of the process of the invention;
- figure 12 illustrates a partial cross-section of the device of the invention;
- figure 13 illustrates the device of figure 12 in the section A-A in the initial phase of the process;
- figure 14 illustrates the device of figure 12 in the section B-B in the same phase as figure 13;
- figure 15 illustrates the device of figure 13 with the terminal inserted in the needle;
- figure 16 illustrates the device of figure 14 with the terminal inserted in the needle;
- figures 17 and 18, illustrate the detail of the funnel opening of the previous figures, in the open and closed positions respectively.

[0009] The coaxial cable to which the invention refers is indicated as a whole with 1 in figure 1. The coaxial cable 1 is composed of a conductor or inner 2, housed inside a terminal or outer 3. The cable 1 also comprises an external insulating coating 4 which, in correspondence with the protruding or free portion of the conductor 2, has a sleeve 5. In particular, the terminal 3 has a portion 6 having a substantially cylindrical shape, with a hole 7 inside which the conductor 2 is housed. Flaps 8 are also envisaged, whose function is to staple the terminal 3 onto the cable 1 at the height of both its sleeve 5 and also the insulator 4. The terminals 3 to be stapled are initially supported by a respective strip 9.

[0010] In the version illustrated in figure 2, the conductor 2 has, at its free end, a hole 10 to be engaged with the pointed end 13 of the guide needle 12.

[0011] In the variant of figure 3, the same end of the conductor 2, has, on the other hand, a pointed conformation 11, suitable for being engaged inside a cavity 28 situated on the end of the guide needle 12.

[0012] As illustrated in figures 6 to 11, the process of the invention initially comprises the alignment between the conductor 2, the cylindrical portion 6 of the terminal 3 and said guide and centering needle 12. In particular, this needle 12 has a tip 13 positioned coaxially with respect to both the hole 7 of the terminal 3, and the hole 10 present on the free end of the conductor 2 (figures 2 and 6).

[0013] Starting from this initial configuration, the process of the invention envisages the blockage of the terminal 3 by means of a presser 14 which acts on its portion 6, and subsequently the detachment of the strip 9 (figure 7). At this point, the terminal 3 is translated onto the body of the needle 12 (arrow F1 of figure 8), by inserting the needle 12 inside the hole 7 of the terminal 3, until it causes the point 13 of the needle 12 to exit from the terminal 3. In the subsequent phase, the cable 1 is moved forward in the direction of the needle 12 (arrow F2 of figure 9), until its tip 13 is engaged in the hole 10 of the terminal 2. In this phase, a correct relative centering is obtained between the conductor 2 and the hole 7 of the terminal 3 (figure 9). Once the centering state described above has been reached, the terminal 3 is moved forward towards the conductor 2 (arrow F3 of figure 10), until the same conductor 2 has been inserted inside the hole 7 of the terminal 3. The needle 12 is then moved away from the conductor 2 (arrow F4 of figure 11) and the flaps 8

are stapled onto the cable 1.

[0014] The device illustrated in figures 12 and 13 has a conveyor 15 which transfers the terminals 3 towards a station equipped with a blade 16 for cutting the strip 9, with the terminal 3 held in position by means of a presser 14 which cooperates with a respective support 29 (figure 14). On the side of the flaps 8, the cable 1 with the conductor 2 and, on the side of the cylindrical portion 6 of the terminal 3, the tip 13 of the needle 12, are present in an aligned position with the terminal 3, from which the strip 9 has been sheared by means of the cutting station 16. A movement cylinder 17 of the needle 12 is also envisaged, the needle being guided in its run by means of bushes 18, 19.

[0015] As illustrated in figures 15 and 16, the terminal 3 is moved from its initial position towards the needle 12 (arrow F1), by means of a corresponding movement cylinder 20. The device of figure 15 also comprises a funnel opening 21 which, when operating, is moved by a cylinder 22 in the direction of the arrow F5, until it comes into alignment with the needle 12. The above-mentioned position of the funnel 21 allows the conductor 2 of the cable 1 to be centered on the tip 13 of the needle 12. For this purpose, and as better illustrated in figures 17 and 18, the funnel 21 comprises two jaws 24 activated by a cylinder 23 and which, when operating, are clasped on the tip 13 of the needle 12, thus holding it in a centered position on the conductor 2. The cable 1 is therefore also inserted in the funnel 21, until the tip 13 of the needle 12 is engaged in the hole 10 of the conductor 2. A sensor 25 reveals the above-mentioned position between the needle 12 and conductor 2, subsequently allowing the cable 1 to be blocked in position by means of grippers 26 (figures 9 and 16).

[0016] The terminal 3 is brought from this position onto the conductor 2 by means of the above-mentioned cylinder 20, where the knife group 27 effects the stapling of the flaps 8 of the terminal 3 on the body of the cable 1 (figure 16). When the terminal has thus been stapled, the gripper 26 is opened to release the cable 1 and the presser 14 is opened to release the terminal 3. The conveyor 15 then commands the advancing of the new terminal 3 towards the cutting station 16, to initiate the subsequent cycle.

[0017] In order to guarantee the continuity of the assembly operation of the coaxial cable, the device of the invention obviously comprises means for activating the blade of the cutting station 16 and the funnel 21 with movements contrary to those described above and necessary for freeing the respective movement positions of the terminals.

[0018] Furthermore, although the production process described so far envisages moving the terminal 3 with respect to the needle 12 held in a fixed position, contrary movements, i.e. with the needle 12 movable and the terminal 3 held in a fixed position with respect to the latter, are obviously also possible.

Claims

1. A process for the production of coaxial cables comprising a conductor (2) housed in the hole (7) of a corresponding terminal (3) stapled onto the body of said coaxial cable (1), **characterized in that** it comprises the guided alignment of said conductor (2) with the above-mentioned hole (7) of the terminal (3).

2. The process according to claim 1, **characterized in that** it comprises the engagement of the terminal (3) on the cable (1) by means of a needle (12) which holds said conductor (2) in a guided alignment position with the same terminal (3).

3. The process according to claim 2, **characterized in that** said alignment is effected by guiding the conductor (2) inside the above-mentioned hole (7) of the terminal (3), by means of said needle (12) having a shaped end (13, 28) suitable for being engaged with the corresponding shaped end (10, 11) of the same conductor (2).

4. The process according to claim 3, **characterized in that** it comprises the definitive stapling of the terminal (3) onto said cable (1) and the removal of the needle (12) from the conductor (2).

5. A device for producing coaxial cables with the process according to one or more of the previous claims, **characterized in that** it comprises a gripper (26) for holding said cable (1) in an aligned position with the hole (7) of the terminal (3), a presser (14) cooperating with a respective support (29) being provided for holding said terminal (3) in a fixed position, bushes (18, 19) being further envisaged for guiding said needle (12) into an aligned position with said hole (7) of the terminal (3).

6. The device according to claim 5, **characterized in that** it comprises a cylinder (20) for moving said terminal (3) according to the axis of the needle (12) and a cylinder (17) for moving the same needle (12) according to the axis of the hole (7) of said terminal (3).

7. The device according to claim 6, **characterized in that** it comprises a funnel (21) equipped with movable jaws (24) moved by a cylinder (23), a cylinder (22) also being envisaged for moving said funnel (21) between an operating position, in which it is clamped onto the end (13, 18) of the needle (12), and a rest position, in which it is moved away from said operating position.

8. The device according to claim 7, **characterized in that** it also comprises a sensor (25) for revealing the state of the aligned position of the needle (12) with the conductor (2).

9. The device according to claim 8, **characterized in that** it comprises a conveyor (15) of said terminal (3), a cutting station (16) of the strip (9) of the same terminal (3) and a knife group (27) for stapling said terminal onto the cable (1).

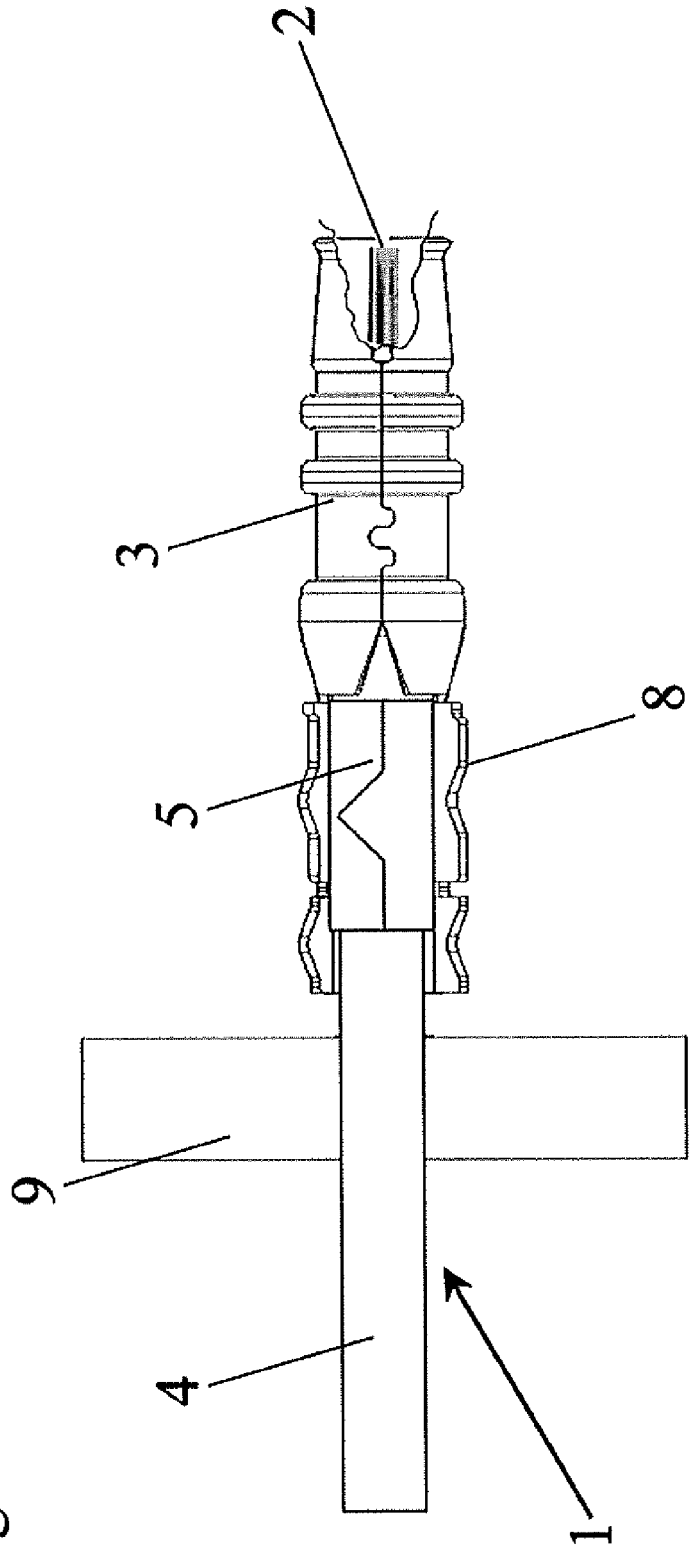


Fig.1

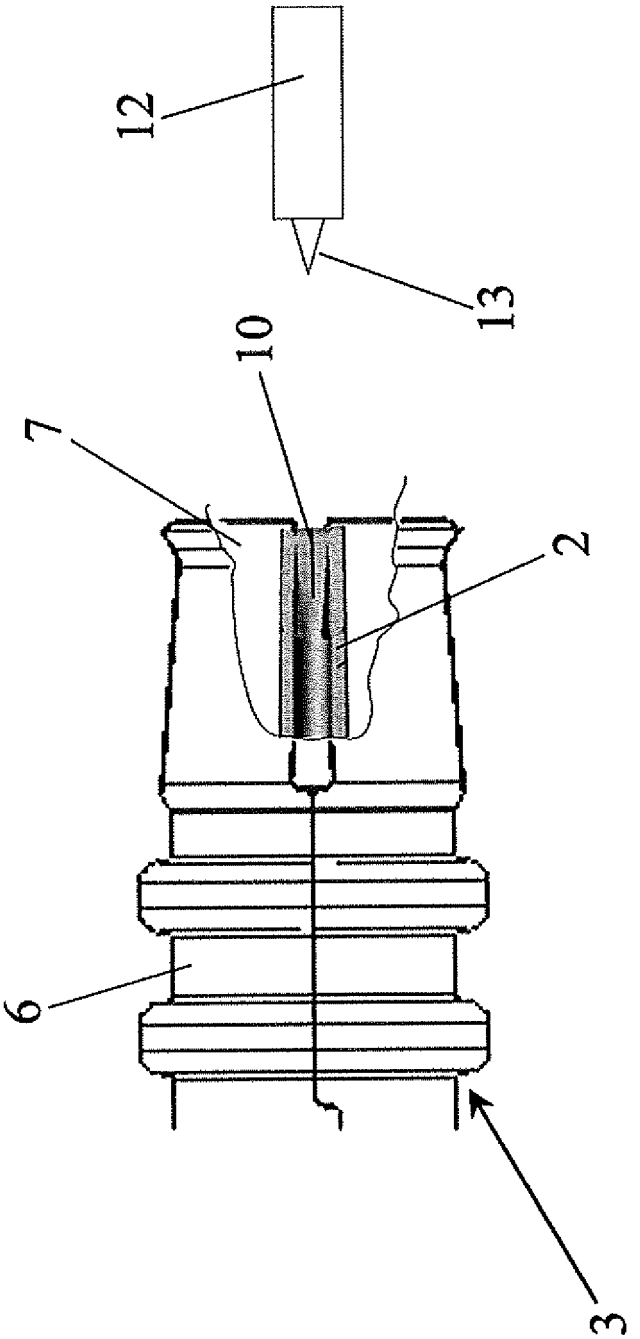


Fig.2

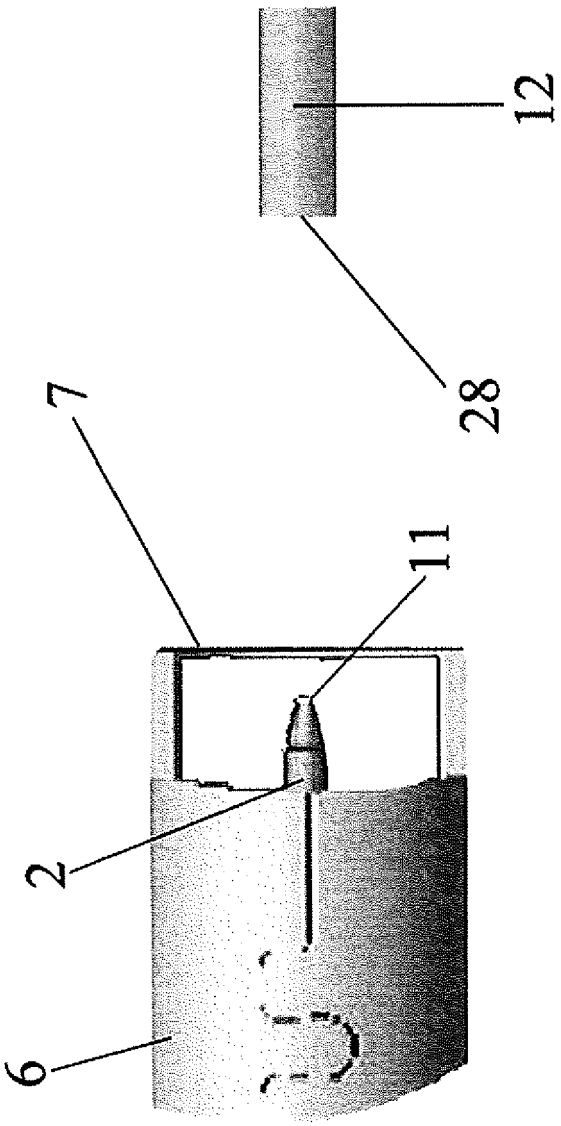


Fig.3

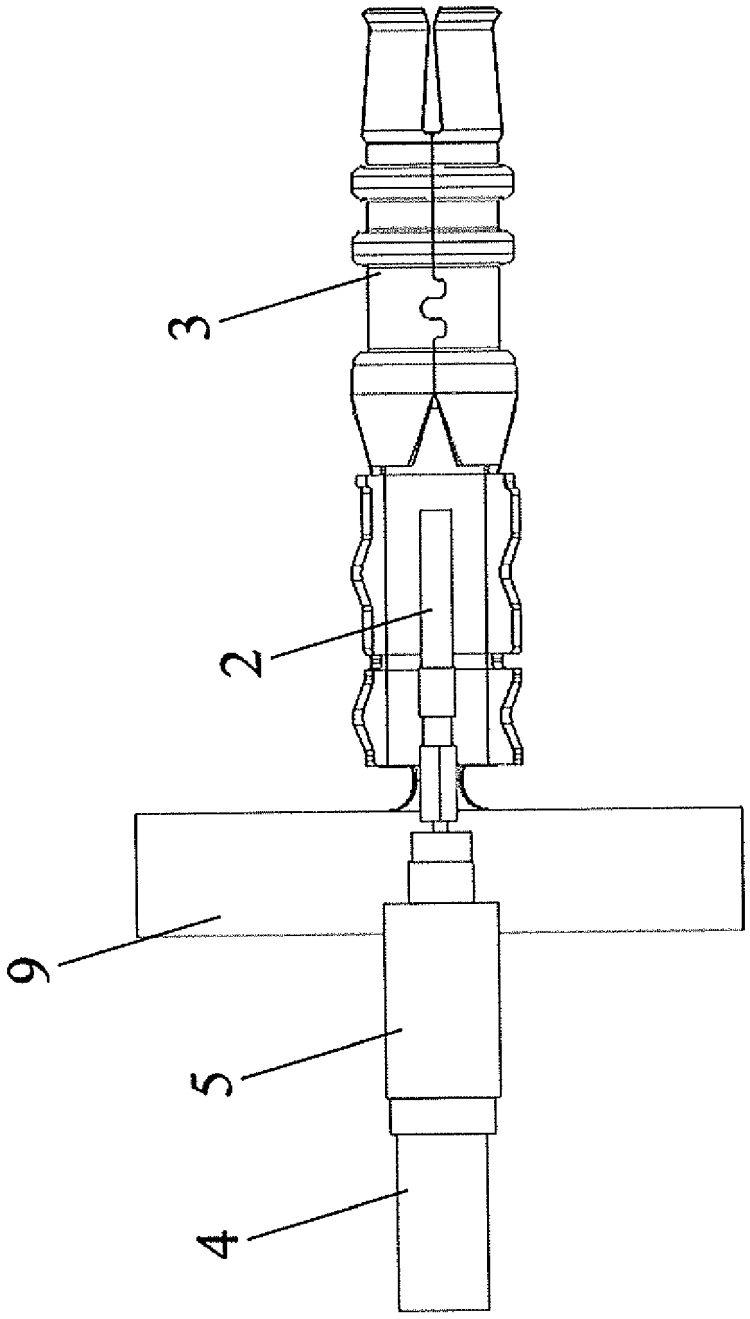


Fig.4

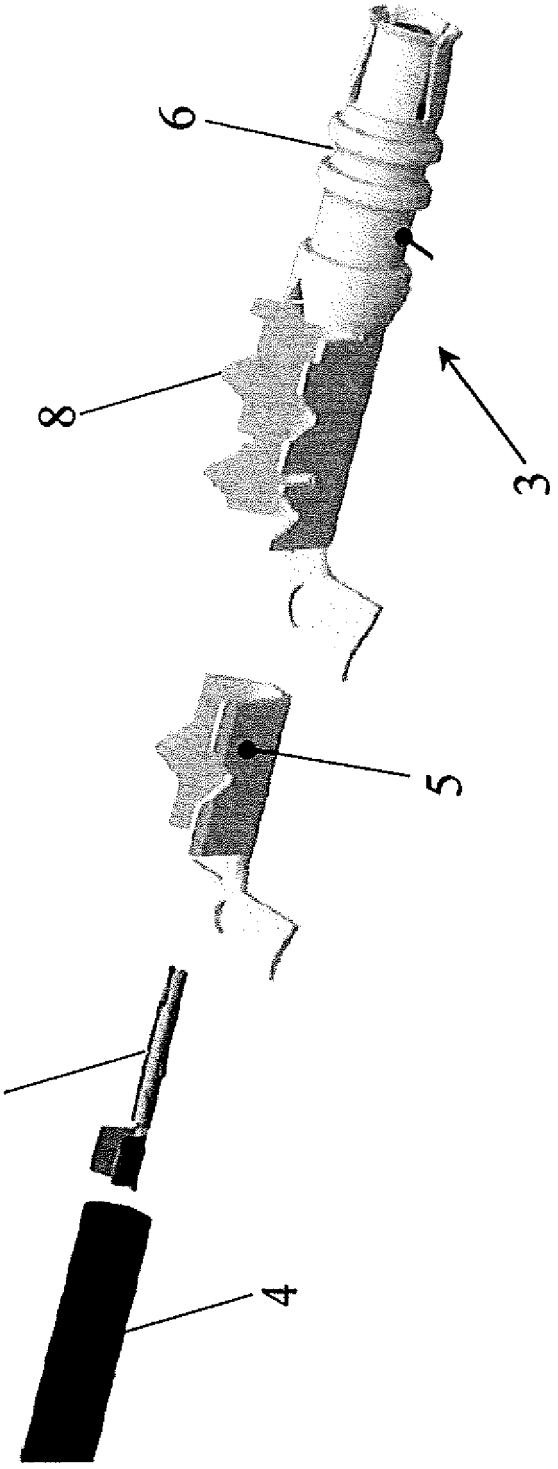


Fig.5

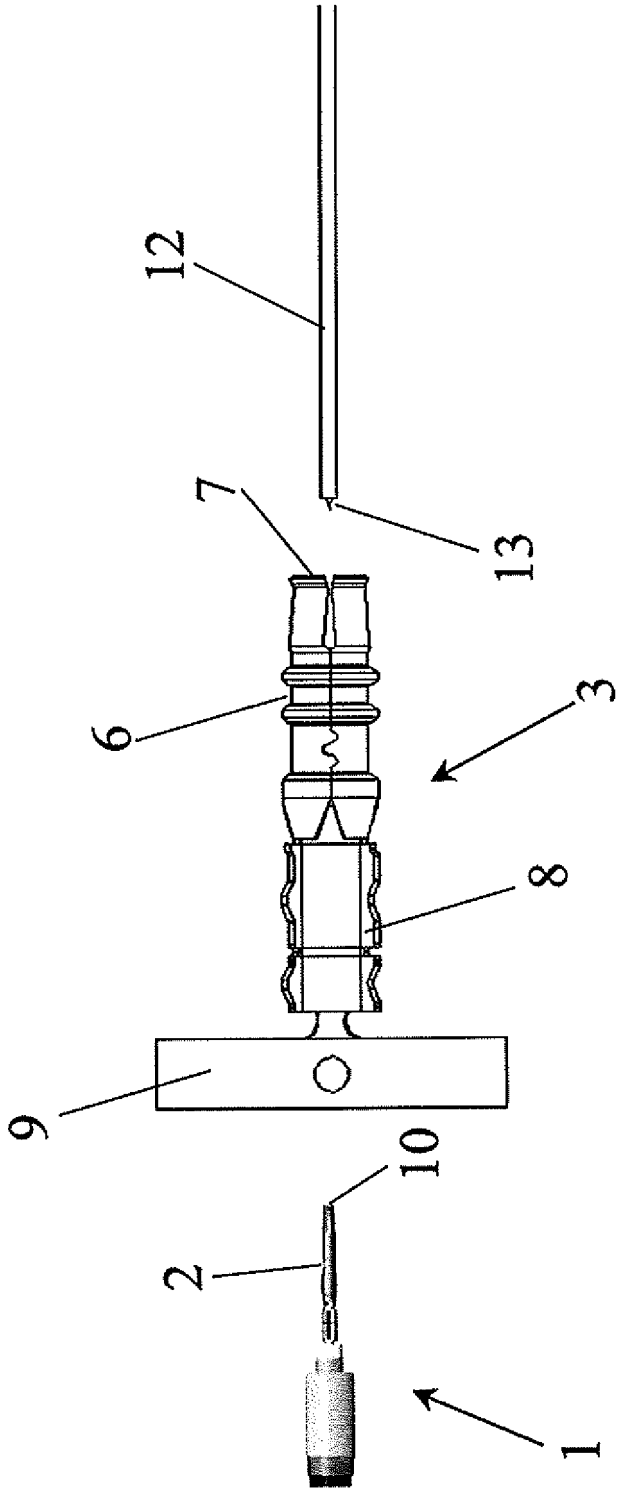


Fig.6

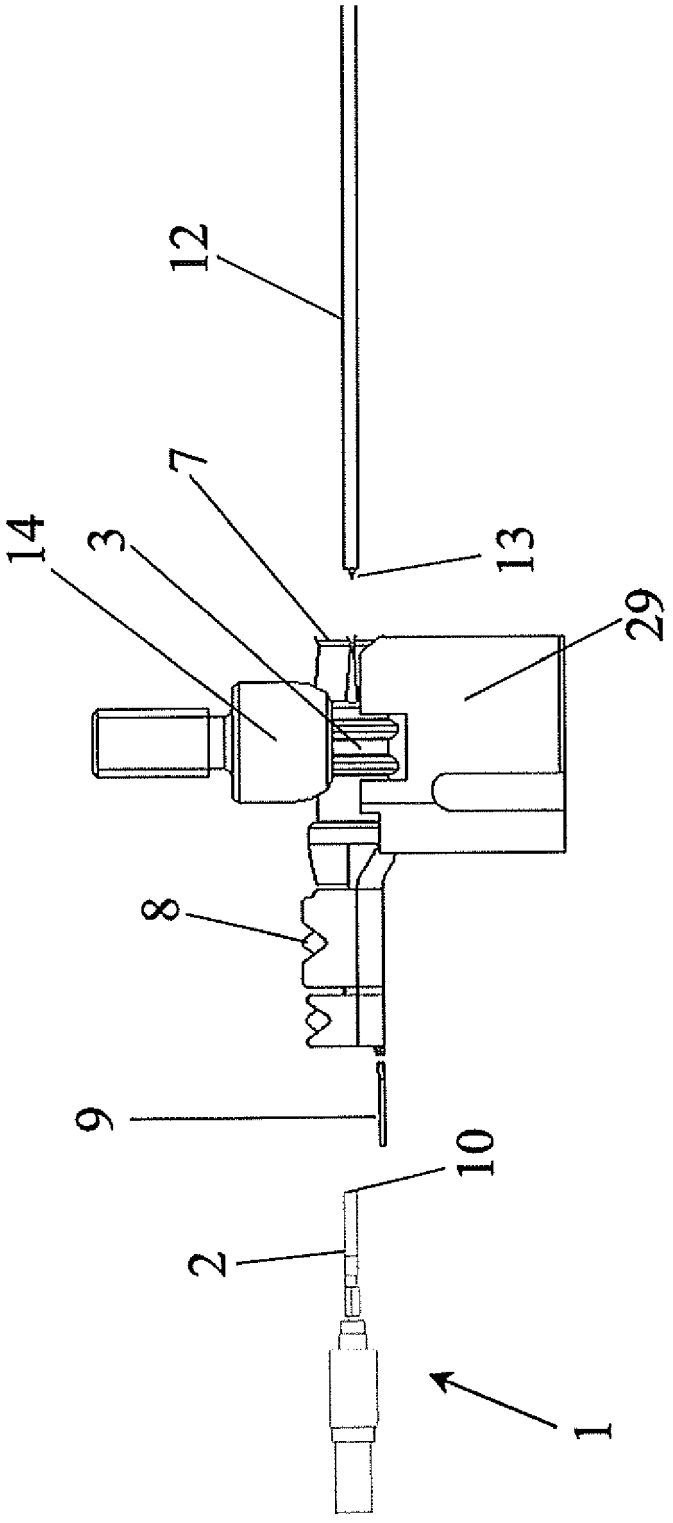
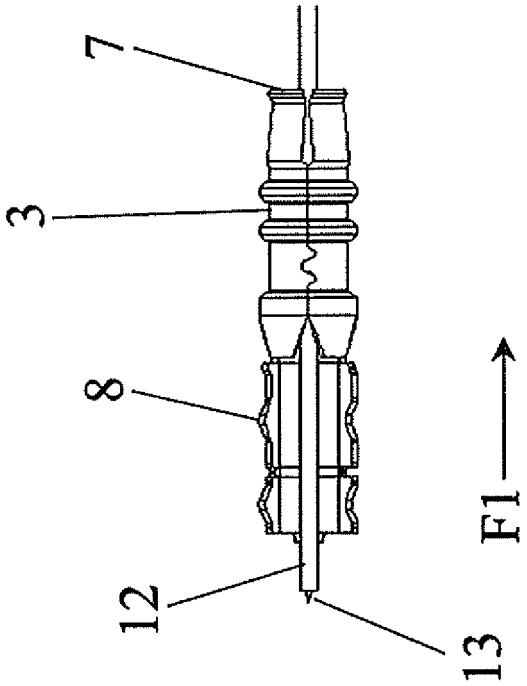
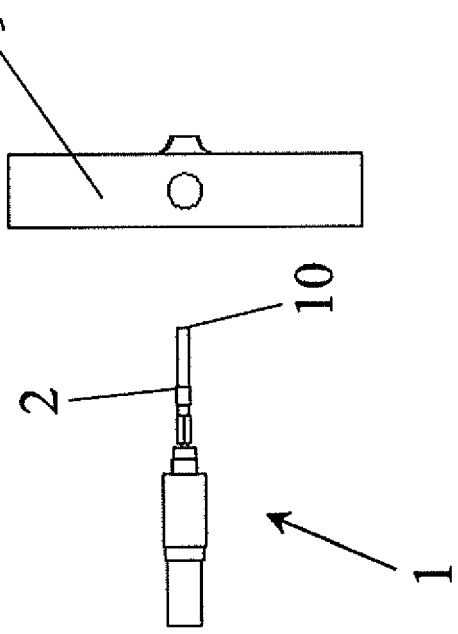


Fig.7





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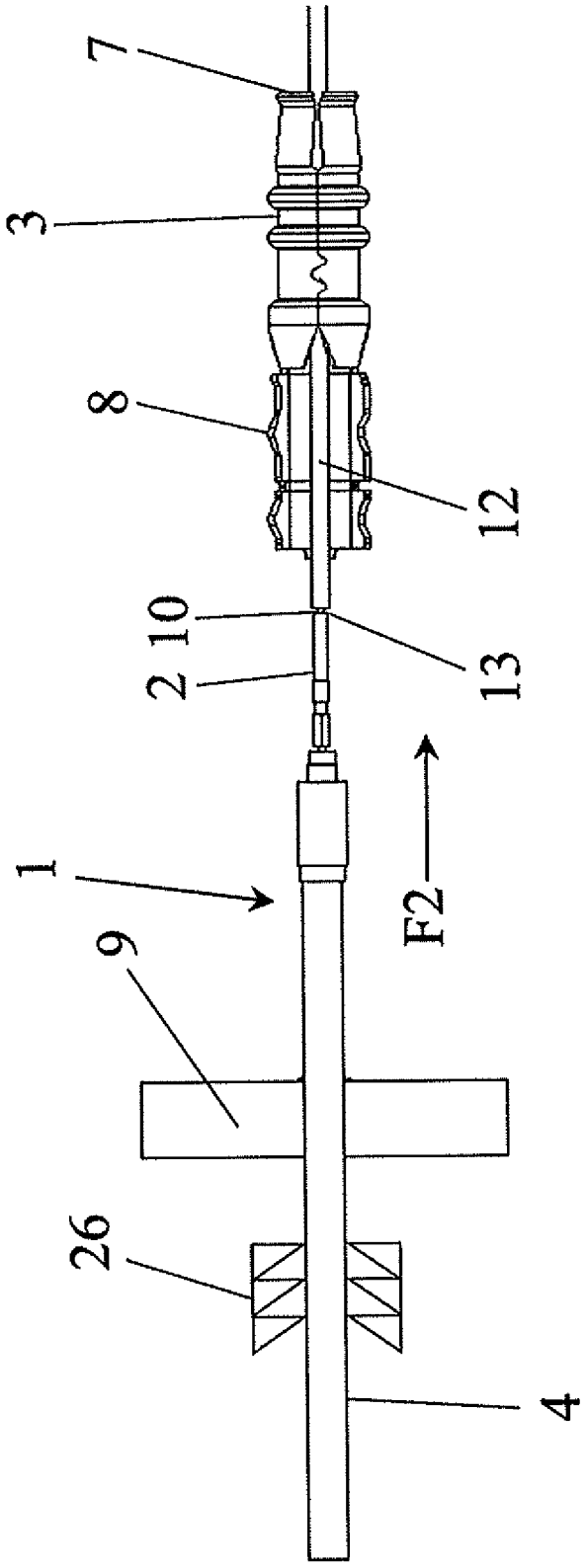


Fig.9

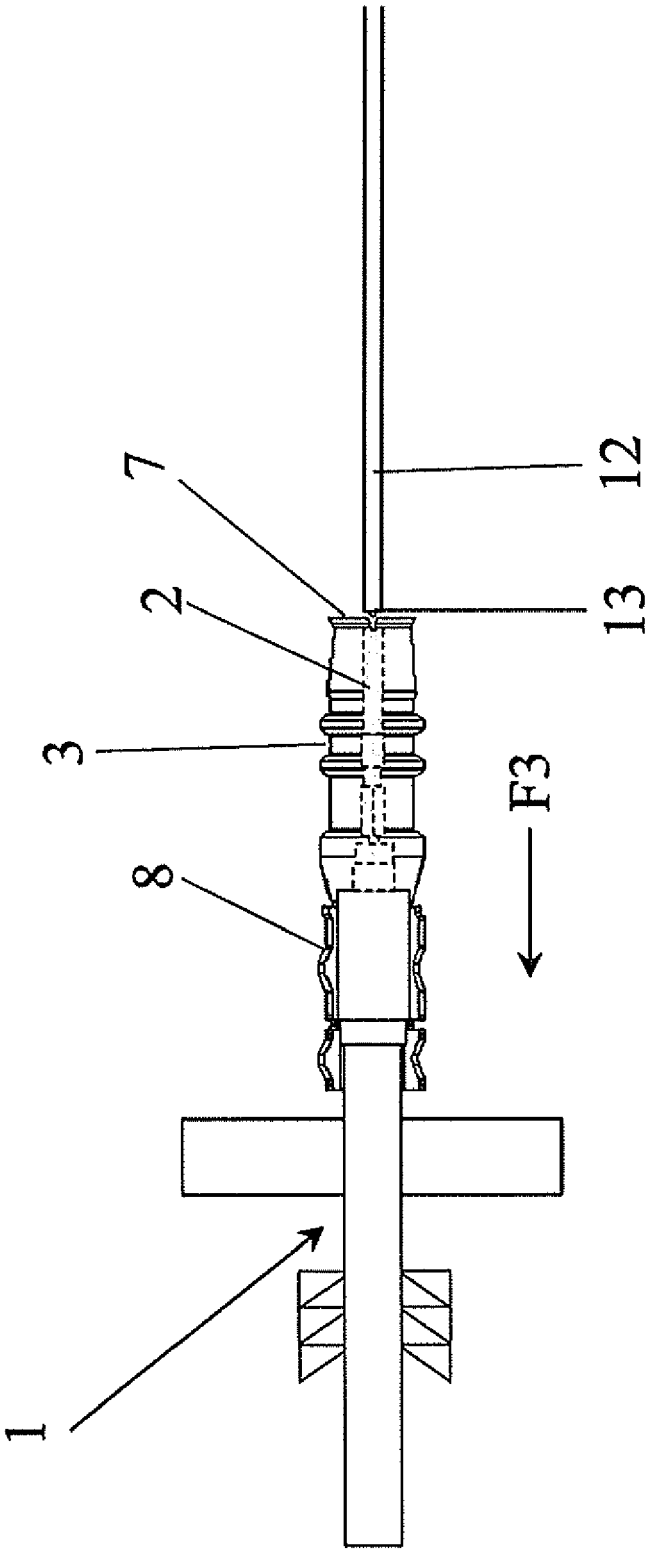


Fig.10

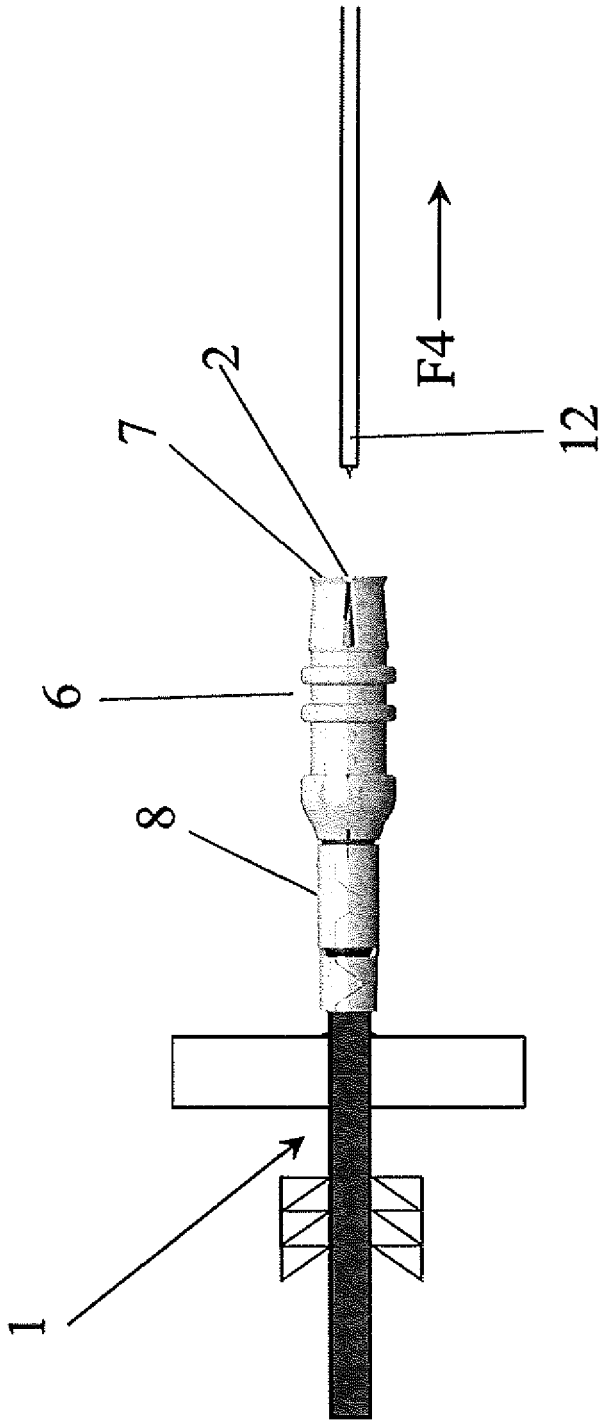


Fig.11

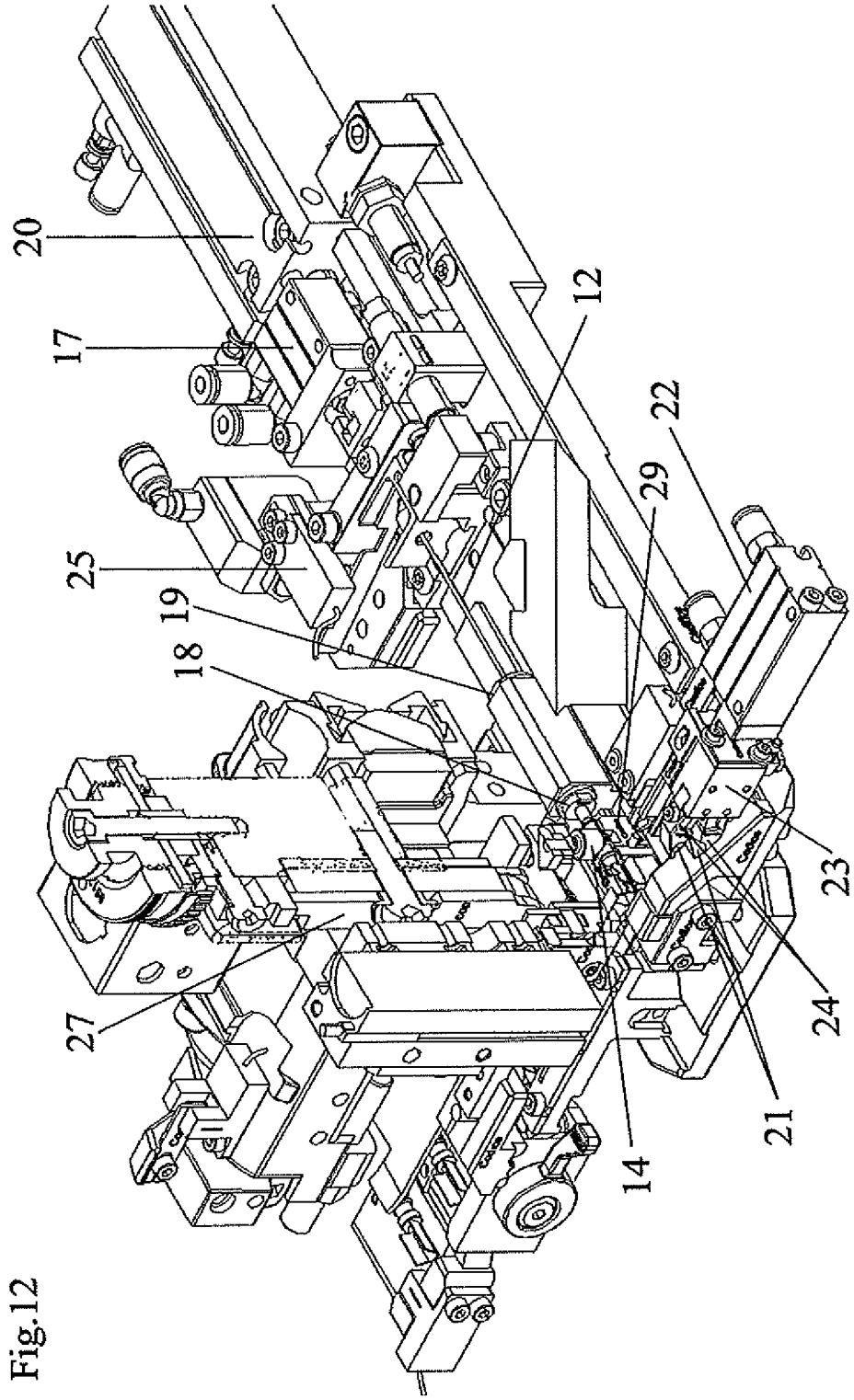


Fig.12

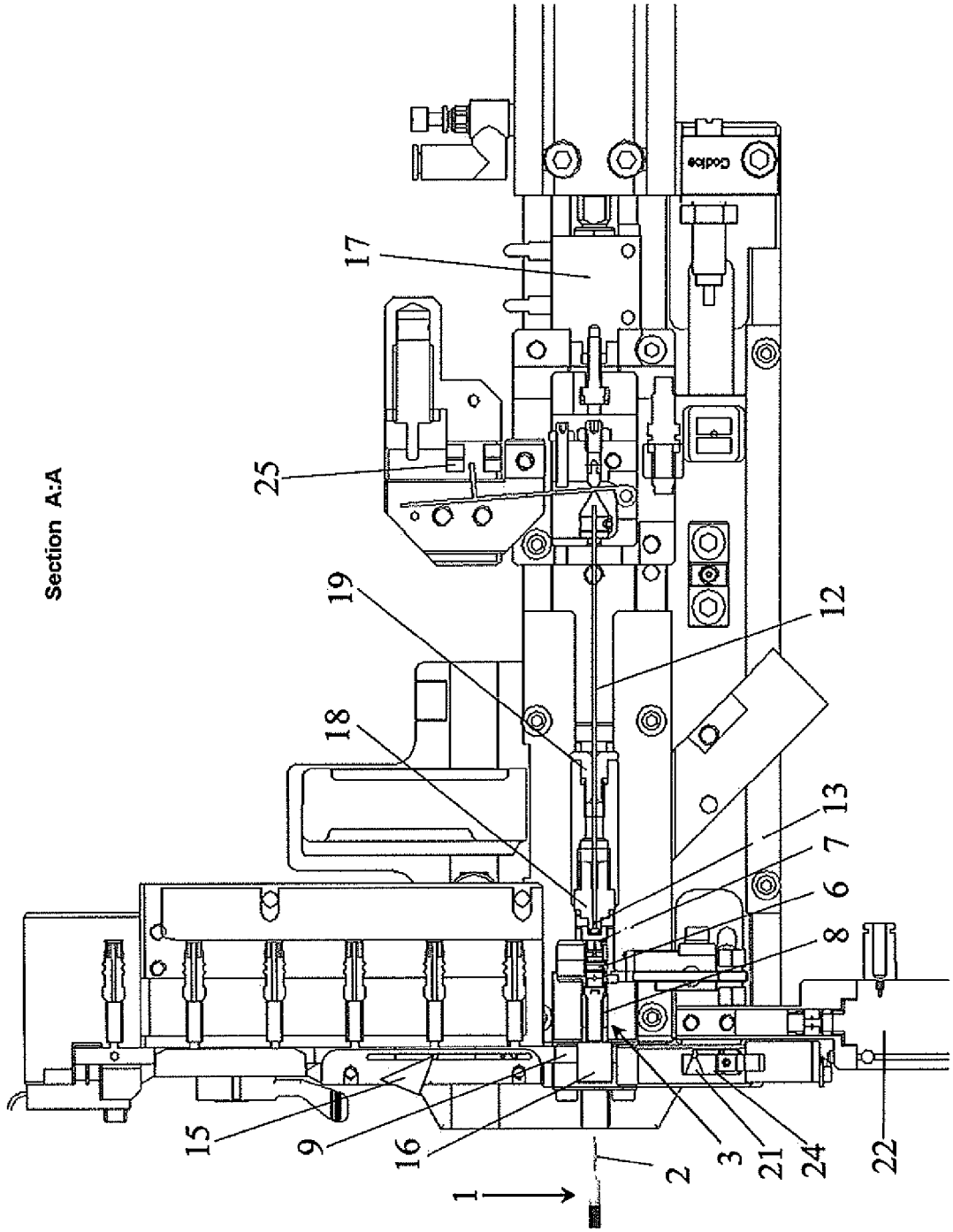


Fig.13

Fig.14

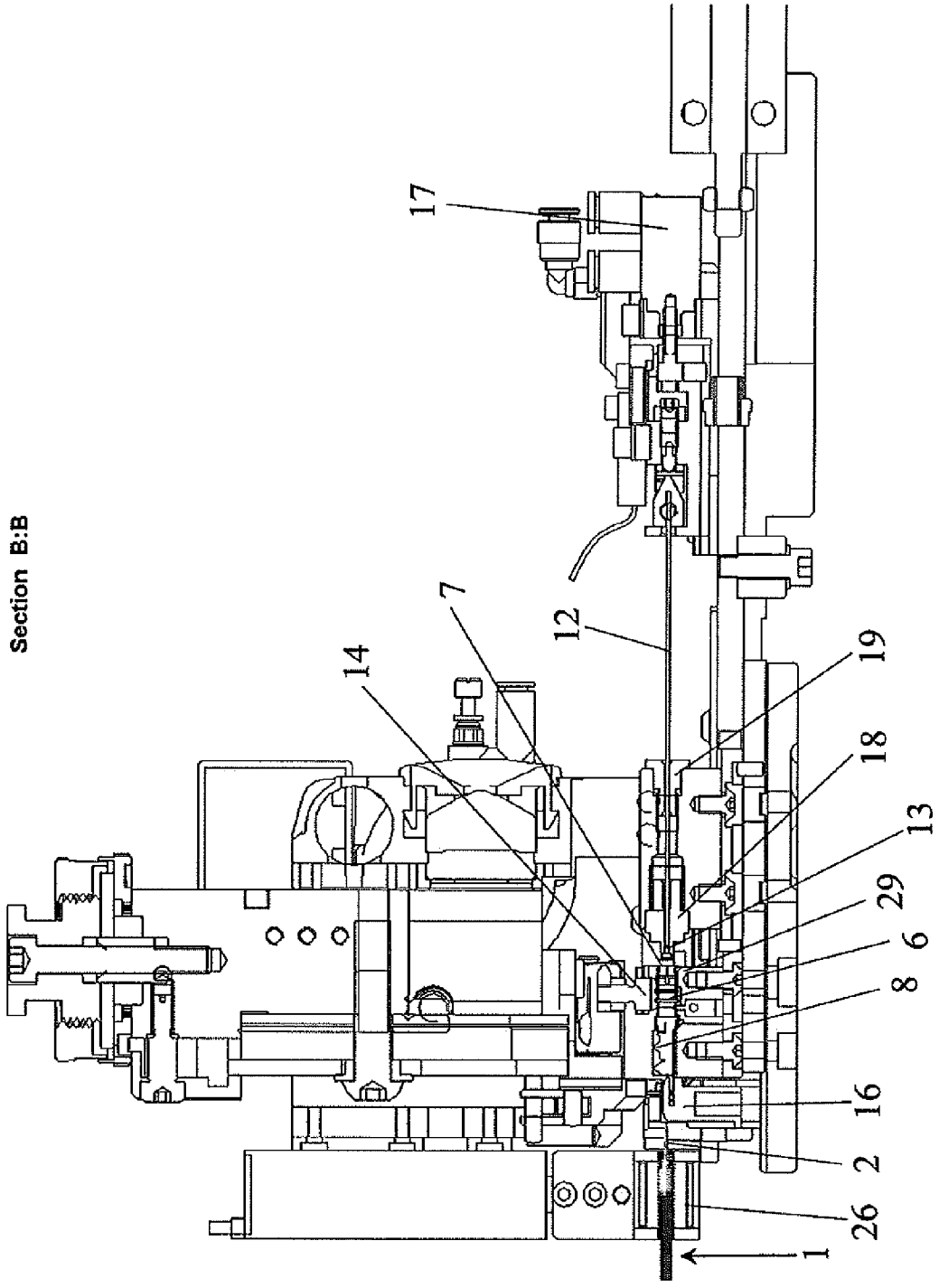


Fig.15

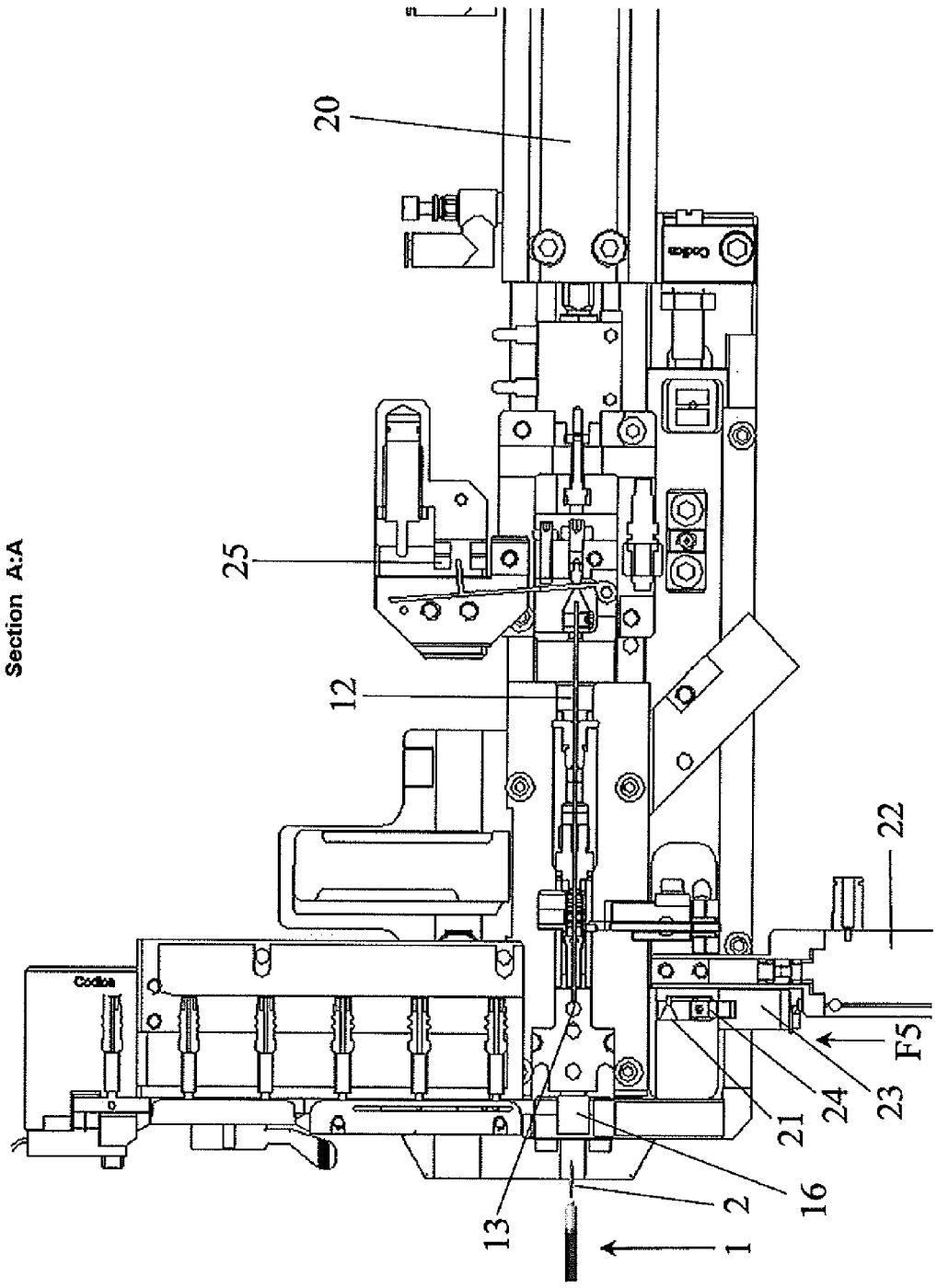
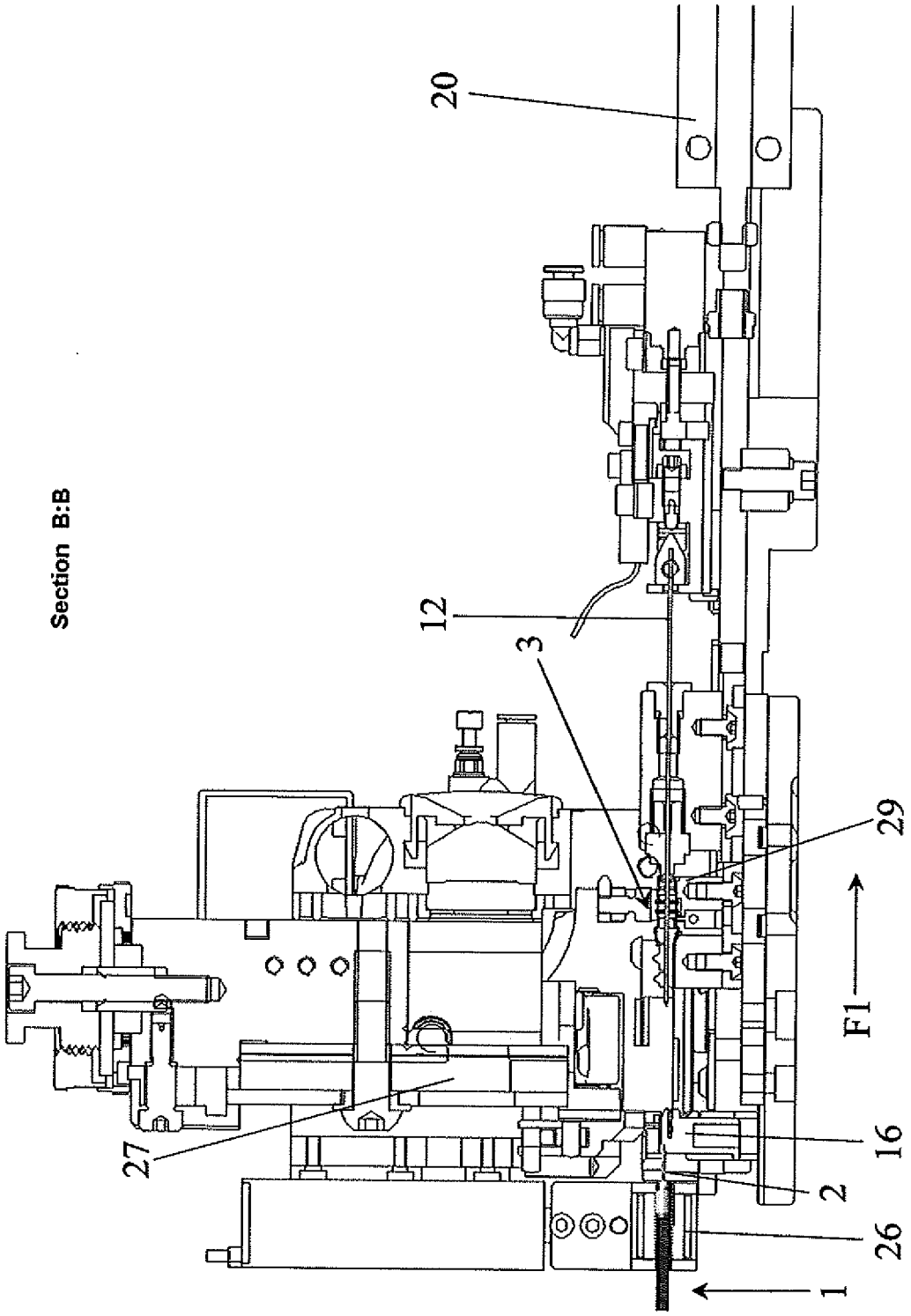


Fig.16



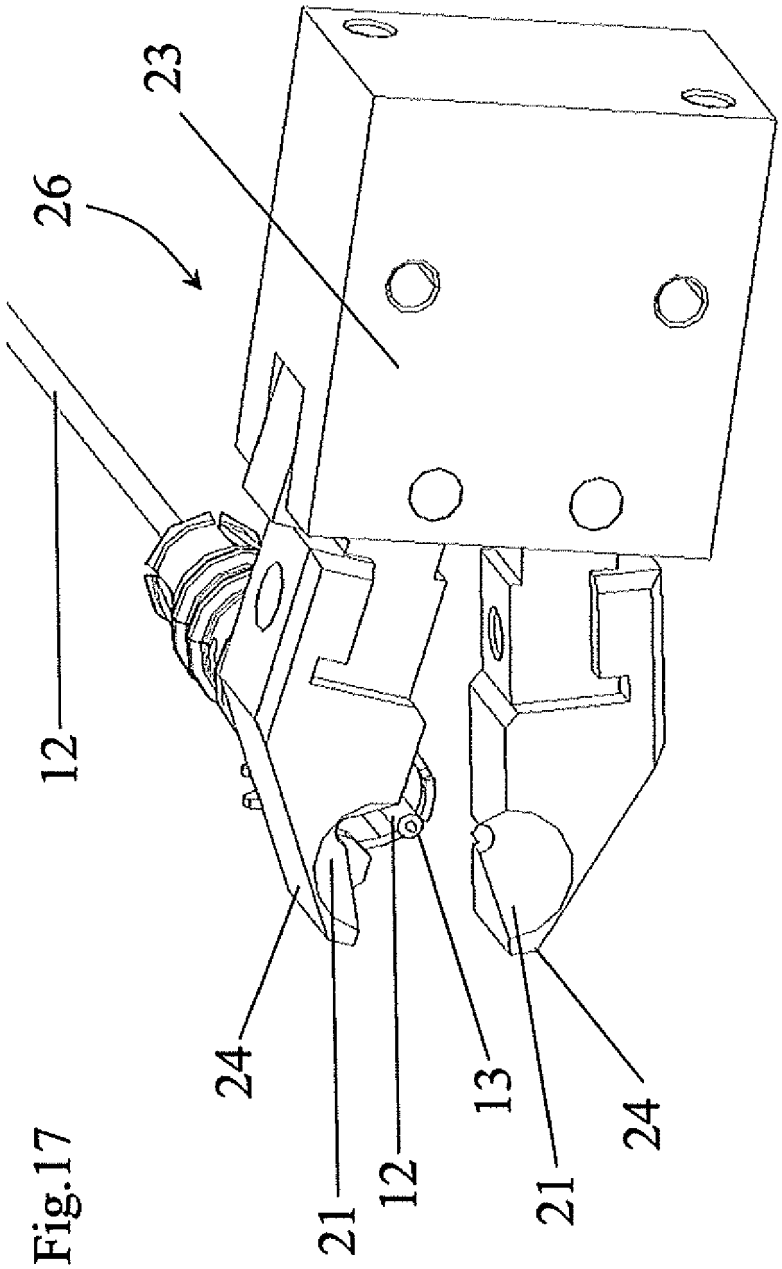


Fig.17

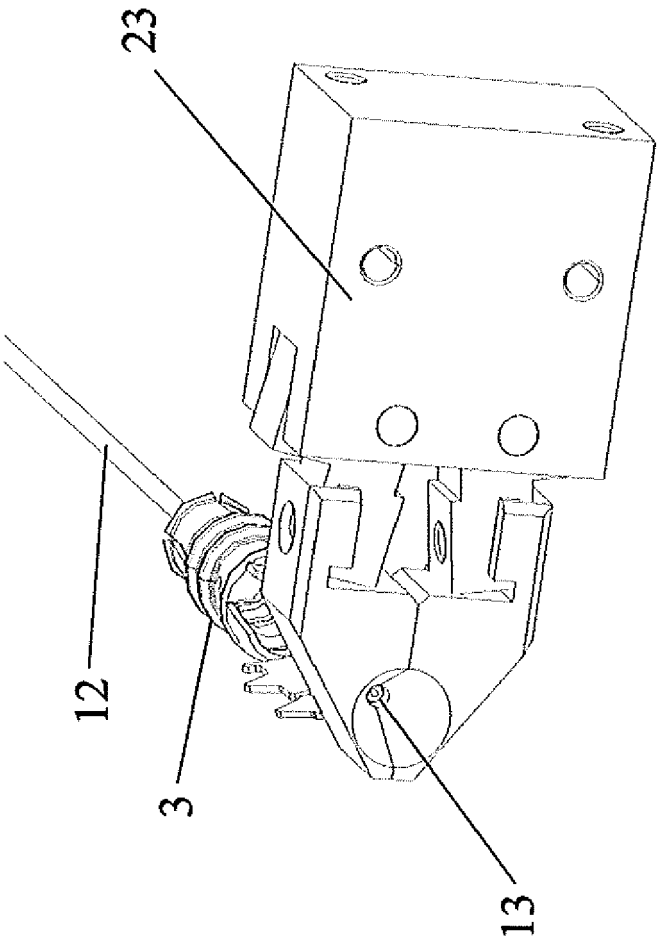


Fig.18

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EUROPEAN SEARCH REPORT

Application Number
EP 14 17 0473

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 4 553 806 A (FORNEY JR EDGAR W [US] ET AL) 19 November 1985 (1985-11-19)	1-4	INV. H01R43/28 H01R43/048 H01R9/05
A	* the whole document *	5-9	
A	US 5 402 566 A (LONG ALDEN O [US]) 4 April 1995 (1995-04-04) * the whole document *	1-9	

TECHNICAL FIELDS SEARCHED (IPC)
H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 October 2014	Pugliese, Sandro

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02-10-2014

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