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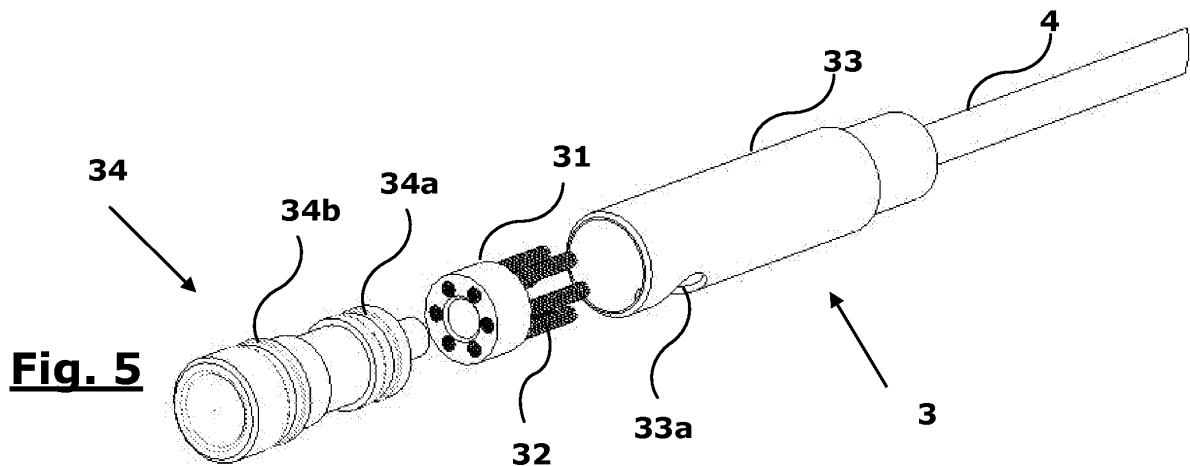
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(54) **Launch nozzle with weft retaining means for a pneumatic weaving loom**

(57) A launch nozzle for a weft thread in a pneumatic weaving loom is disclosed, of the type comprising at least one lance (4), which extends from a respective base body

(3), provided with a through-hole in which it is possible to establish a compressed air flow, ciliated means (31, 32) being inserted in the base body (3) provided with a central gap for said compressed air.



Description

FIELD OF THE INVENTION

[0001] The present invention refers to an improved launch nozzle for a pneumatic weaving loom.

STATE OF THE PRIOR ART

[0002] As known, weaving in a weaving loom requires that a series of crosswise wefts is inserted into a set of parallel warp yarns, opening said yarns scissor-wise, according to different and preset patterns, by means of the weaving machine. Upon each insertion, the weft is then beaten against the fabric being formed, by means of a reed device, and the cycle is repeated at very high speeds, up to 1.200-1.500 strikes per minute.

[0003] Weft insertion into the warp shed occurs according to various technologies. In pneumatic weaving looms, the weft is inserted using an air jet which blows the weft, through a suitable launch nozzle, at the entrance of the warp shed; along the warp shed additional relay nozzles are located with air jets which make the weft thread flies towards the shed exit, on the opposite side of the loom.

[0004] Fig. 1 shows schematically the devices intended for weft insertion in a weaving loom. As can be clearly seen, the weft thread comes out of a thread spool, runs on a drum pre-meter, enters a pre-nozzle and then a main nozzle. From said main nozzle, through a suitable control of the compressed air flow, the weft thread is inserted into the warp shed until it comes out from the opposite side. Once it is completely inserted, the weft thread is cut in correspondence of the entry side, so as to sever it from the spool and leave it inserted in the fabric: a new thread end is thus formed, which can be inserted again during the following cycle.

[0005] This configuration is suited to a single weft thread and is repeated for the number of weft threads (different by colour, type, count, and so on) made simultaneously available on the same loom. In order to meet the functional requirements of the weaving loom, however, the need exists to arrange the launch point of all weft threads (i.e. of all the nozzles) around a very small area. Therefore, on a practical level, at least the final launch device normally consists of a rather complex assembly which incorporates a plurality of lances with which the individual weft threads are associated. Such a multiple, prior-art nozzle, able to handle up to four weft threads, is illustrated in figs. 2 and 3, in an assembled condition and in an exploded condition, respectively.

[0006] In substance, a main block body 1 has a series of seats 1a with converging axes. Inside such seats there are inserted, on the entry side - i.e. on the upstream side with respect to the flow direction - a corresponding plurality of needles 2, i.e. devices configured to suitably channel the air flow together with the weft thread. On the exit side, within the seats 1a of the block body there are

engaged base bodies 3 of rectilinear lances 4, which converge towards a head clamp 5 which keeps them with the open ends closely adjacent. Each lance 4 is substantially shaped as a hollow cannula, with a base body 3 having an enlarged diameter suitable for coupling with the seats of block body 1.

[0007] A problem affecting this type of configuration is that of keeping the weft thread correctly inserted in the nozzles, i.e. of avoiding that the thread can come out upstream of the needle. As a matter of fact, during insertion, the weft thread is kept taut and correctly inserted only by the dynamic air pressure; therefore, when it is cut at the end of the insertion, the elastic return of the fibre material may cause the free end to come up along the lance and come out behind the needle. The exit of the thread from the nozzle forces to stop the loom to be able to re-enter the thread, with inevitable productivity reduction, costs and possible fabric flaws.

[0008] This drawback is perceived in particular with elastic-type yarns.

[0009] In order to solve such problem, two different approaches have traditionally been used.

[0010] One provides to supply the nozzle block body with a series of (electric or, usually, pneumatic) actuators which are operative between the body of the lance and the needles with a gripping system apt to mechanically clamp the weft thread.

[0011] An exemplifying embodiment of this system of the prior art is shown precisely in figs. 2 and 3. As can be seen, on main block body 1 crosswise seats 10 are provided with which gripping devices 11 are engaged, said devices being variously controlled, for example by means of a pneumatic circuit.

[0012] This mode is quite effective, because it allows to securely retain the weft thread and avoid the exit thereof on the upstream side of the nozzle. However, as can be imagined, it is very expensive, because it provides the use of reliable actuators operating at a high frequency (as a matter of fact, the gripping system must release the weft thread during the launch and block it after cutting with a frequency equal to the number of insertions per minute, up to 25 Hz), as well as a drive chain synchronised with the main drive of the loom. This system also requires considerable maintenance.

[0013] A second approach provides to use a continuous air jet within the lances (both during operation and with a stationary loom). The dynamic air pressure, in addition to allowing the weft launch when it is released from the weft feeders, prevents it from being able to rise backwards when it is cut.

[0014] However, this mode causes other drawbacks. As a matter of fact, in addition to the cost linked to the high consumption of compressed air, the continuous air flow negatively affects many types of fabric fibres. As an example, the yarns most sensitive to air stress are the so-called "core-spun" elastic yarns with one cotton yarn plus one elastomere yarn, or low-twist "ring-spun" yarns (twist K lower than 4) or again flamed "ring-spun" yarns.

As a matter of fact, the air flow flowing on these yarns, when they are retained by the weft feeder, causes an untwisting effect, i.e. the loosening of the spinning twist which keeps them cohesive, with an adverse fraying effect.

[0015] EP 2014808 discloses a tubular element to be provided within an air-jet channel. The trailing edge of the tubular element is provided with a plurality of notches defining a plurality of corresponding projections. This solution, however, relying on rigid tapered projections does not give satisfactory results, since the weft yarn is prone to be kept entangled in the notches even when a regular flow is established again; furthermore, the sharp edges of the notches may result in yarn damage. Finally, when a conical hole is used, to obtain a better operation of projections, high pressure losses and substantial wear on yarns is produced.

[0016] The object of the present invention is hence to solve the above-mentioned problems, suggesting an innovative retaining system of the weft thread inside launch nozzles.

[0017] Such object is achieved through a device as described in its essential features in the attached claims.

[0018] In particular, according to a main aspect of the invention a launch nozzle is provided for a weft thread in a pneumatic weaving loom, of the type comprising at least one lance, which projects from a respective base body, provided with a through-hole in which it is possible to establish a flow of compressed air, wherein said base body has ciliated means inside, provided with a central gap for compressed air.

[0019] According to a further aspect of the invention, the ciliated means are shaped as a tubular support wherefrom tufts of bristles project.

[0020] According to a further aspect of the invention, ciliated means for a nozzle of a pneumatic weaving loom are provided, consisting of a tubular portion from the trailing edge of which a plurality of flexible needle means project, along the longitudinal tubular axis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Further features and advantages of the device according to the invention will in any case be more evident from the following detailed description of a preferred embodiment of the same, given by way of example and illustrated in the accompanying drawings, wherein:

fig. 1, as anticipated, is a diagrammatic view of the operation of a nozzle for the weft thread in a weaving loom;

fig. 2 is a perspective view of a prior-art, exemplifying multiple nozzle, of which

fig. 3 is an exploded view;

fig. 4 is an elevation side exploded view of a lance according to the invention; and

fig. 5 is a perspective, partly exploded view, of the base body of the lance according to the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

[0022] The nozzle device according to the invention provides a configuration fully similar to the prior-art one, thereby hence remaining fully interchangeable in prior-art systems and weaving looms. On the block body no actuator is provided: therefore any additional control between the main drive of the loom and the nozzles can be fully avoided.

[0023] Moreover, according to the invention, inside the base body 3 of lances 4 a tubular support body 31 is provided, wherefrom flexible tufts or groups of bristles 32 depart. As can be clearly seen in fig. 5, bristles 32 are distributed circumferentially on the circular trailing edge downstream of support body 31 and extend substantially along the longitudinal axis of the nozzle hole provided in body 3, i.e. along the longitudinal axis of lance 4.

[0024] Tubular support 31 is preferably shaped as a ring of plastic material, with which bristles 32 are engaged, but it can also have other shapes. However, it is important that it comprises a central through-hole sufficiently wide not to obstruct the airflow path.

[0025] Bristles 32 can be engaged with annular/tubular support 31 by means known per se, for example small metal anchors, or by injection molding techniques as used in the toothbrush field. Preferably, bristles 32 are not perfectly parallel to the longitudinal axis of lance 4, but are slightly convergent towards one another, for example between 8° and 12°, preferably about 10°, so as to partly narrow the gap between the same.

[0026] The tubular support body 31 provided with bristles 32 - which defines a ciliated body - is arranged inside lance body 3, with its internal hole having the same axis as the nozzle axis.

[0027] According to the illustrated preferred embodiment, the base body 3 of each lance 4 is shaped as a hollow cylinder 33, integral with the cannula of lance 4, with which a cylindrical core 34 may be engaged, said core being provided with a longitudinal through-hole.

[0028] Tubular support 31, provided with bristles 32, is inserted into hollow cylinder 33 and retained there in position - with the bristles projecting from support 31 in the air flow direction - by the subsequent insertion of cylindrical core 34. In the proximity of its front end, core 34 is preferably provided with one or more O-rings 34a, by which a steady coupling with hollow cylinder 33 is guaranteed. One or more further O-rings 34b are provided in the proximity of the rear end of core 34, to guarantee instead the coupling with seat 1a in the main block body 1. Core 34 further has a recessed portion 34c with which a clamp element (not shown) is intended to engage, which tightens lance body 3 on block body 1: for such purpose, hollow cylinder 33 is provided with a hole 33a which grants access to underlying recessed portion 34c, once core 34 has been inserted into cylinder 33.

[0029] Through a suitable sizing of core 34 and of hollow cylinder 33 it is possible to use the lance according

to the invention - provided with ciliated body 31, 32 - in a conventional block body 1, which a pneumatic weaving loom could be already provided with, without having to implement any change.

[0030] Once base body 3 of lance 4 has been inserted into main block body 1, the launch air flow coming from needles 1 runs through the central hole of core 34, then the central hole in tubular support 31, runs through the gap between bristles 32 and freely enters lance 4.

[0031] From studies carried out by the Applicant, it was possible to ascertain that no appreciable load loss occurred, even arranging bristles 32 in a mutually converging manner.

[0032] It has also been detected that, even if bristles 32 were too converging, so as to excessively obstruct the central gap in static conditions, in the weft launch phase the air pressure tends to spread the flexible bristles apart and hence no detrimental chafing of the yarn against the bristles occurs.

[0033] Conversely, the presence of the bristles is an effective tool to avoid an upstream movement of the weft thread, once the air flow has been interrupted. As a matter of fact, they define - seen in the upstream direction - a plurality of spread tips on which the thread tends to get easily entangled.

[0034] Furthermore, due to the flexibility of thin bristles, weft yarn entangling is obtained also upon elastic deformation of the bristles (which are bent compared to their original rectilinear shape); this results in an easy disentangling effect as soon as the regular air flow is established, after the beating phase of the loom: in fact, the air flow straightens the bristles back up into their rectilinear shape to easily free the weft yarn.

[0035] In substance, also with very elastic yarns, air interruption does not cause fraying upstream of the weft. Said weft, as a matter of fact, going back tends to acquire that minimum voluminosity which causes immediate entangling into bristles 32: thereby the free end of the weft remains stuck downstream of bristles 32, inside lance 4, ready to be launched again without causing faults in the fabric upon the subsequent restoration of the compressed air flow.

[0036] This allows to use a pulsating air flow - in sync with weft insertion needs - which hence causes no weft thread damage or untwisting. At the same time, despite using no actuator, weft fraying by the nozzle group is prevented very effectively and at a very low cost.

[0037] No substantial pressure loss is experienced downstream of the ciliated means.

Thereby the objects set forth in the premises have hence been perfectly achieved.

[0038] Moreover, the simplicity and compactness of the proposed ciliated means makes the device of the invention interchangeable with any existing multiple nozzle. As a matter of fact, the lance provided with ciliated means according to the invention can replace any existing lance, regardless of the retaining system previously used, without having to change other components.

[0039] However, it is understood that the invention is not limited to the particular embodiment illustrated above, which represents only a non-limiting example of the scope of the invention, but that a number of changes can be made, all within the reach of a person skilled in the field, without departing from the scope of the invention as defined in the appended claims.

[0040] In particular, it is not strictly necessary that the element defined as ciliated body be provided with bristles consisting of groups of flexible single threads. Vice versa, it may comprise thin flexible laminas, small metal needles or flexible cilia; again, the entire brush body 31, 32 may be in a single body shaped as a bottomless basket, with slightly conical walls defined by a small net. In substance, any ciliated means which does not obstruct the air flow proceeding downstream, but which defines a plurality of entangling flexible needles proceeding upstream falls within the inventive principle set forth above (in order not to introduce important load losses, nor significant chafing against the weft threads during the launch phase).

Claims

1. Weft thread launch nozzle in a pneumatic weaving loom, of the type comprising at least one lance (4), which extends from a respective base body (3), provided with a through-hole through which it is possible to establish a compressed air flow, **characterised in that** ciliated means (31, 32) provided with a central gap for said flow of compressed air are inserted in said base body (3).
2. Launch nozzle as claimed in claim 1), wherein said base body (3) of the lance (4) consists of a hollow cylinder (33) into which a cylindrical core (34) is apt to be introduced, said core being provided with a longitudinal through-hole, said ciliated means being arranged between said core (34) and said hollow cylinder (33).
3. Nozzle as claimed in claim 1) or 2), wherein said ciliated means are shaped as a tubular support (31) provided with bristles (32).
4. Nozzle as claimed in claim 3), wherein said bristles (32) project from a trailing edge downstream of said tubular support (31) along the longitudinal axis thereof.
5. Nozzle as claimed in claim 4), wherein said bristles (32) are mutually converging.
6. Launch nozzle as claimed in any one of the preceding claims, wherein said base body (3) of the lance (4) is engaged with an exit seat of a main block body (1) provided, on the opposite side of said exit seat, with an entry seat with which a needle (2) is engaged.

7. Launch nozzle as claimed in claim 6), wherein said main block body (1) has a plurality of lances (4) mutually converging by their respective open ends.
8. Ciliated means for a nozzle as claimed in any one of the preceding claims, **characterised in that** they consist of a tubular portion (31) from the trailing edge of which a plurality of flexible needle means (32) project along the longitudinal tubular axis.
9. Ciliated means as claimed in claim 8), wherein said flexible needle means are tufts of bristles (33).
10. Pneumatic weaving loom, **characterised in that** it comprises a nozzle and ciliated means as claimed in any one of the preceding claims.

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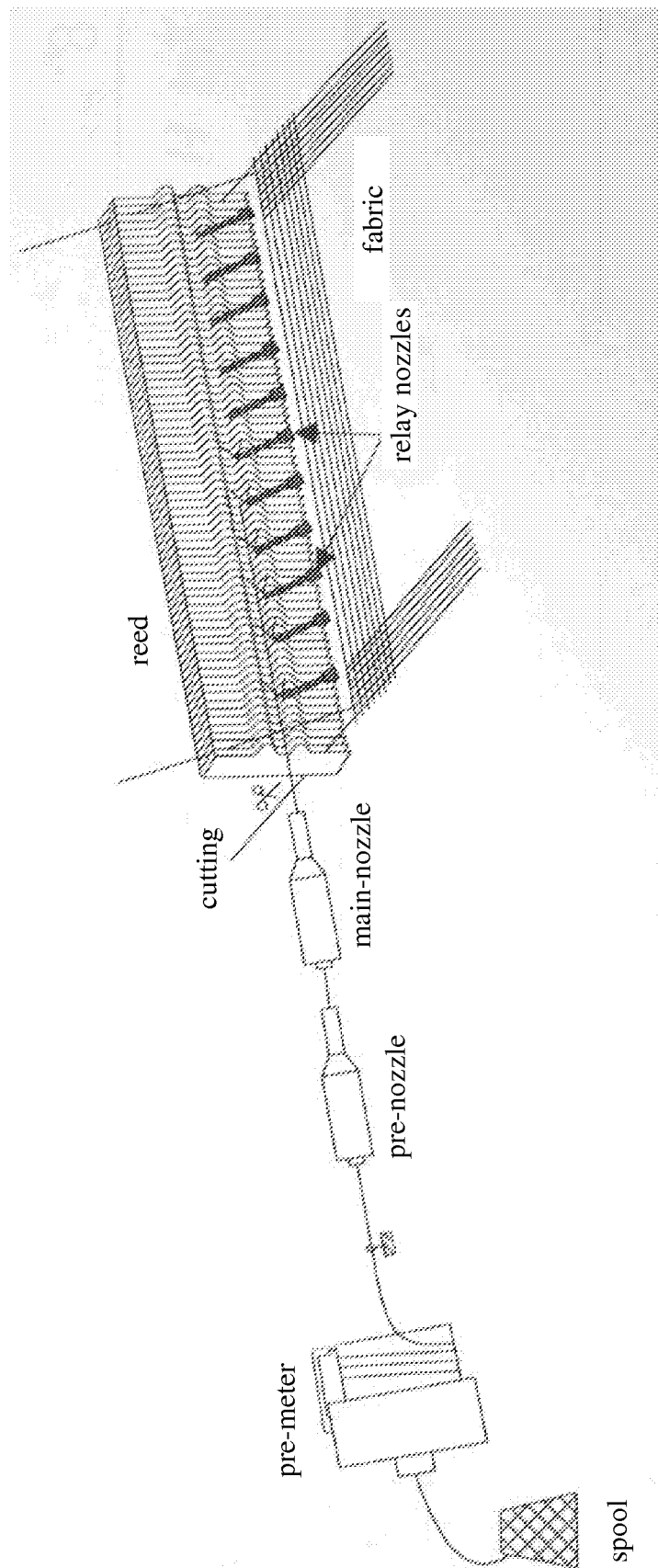


Fig. 1

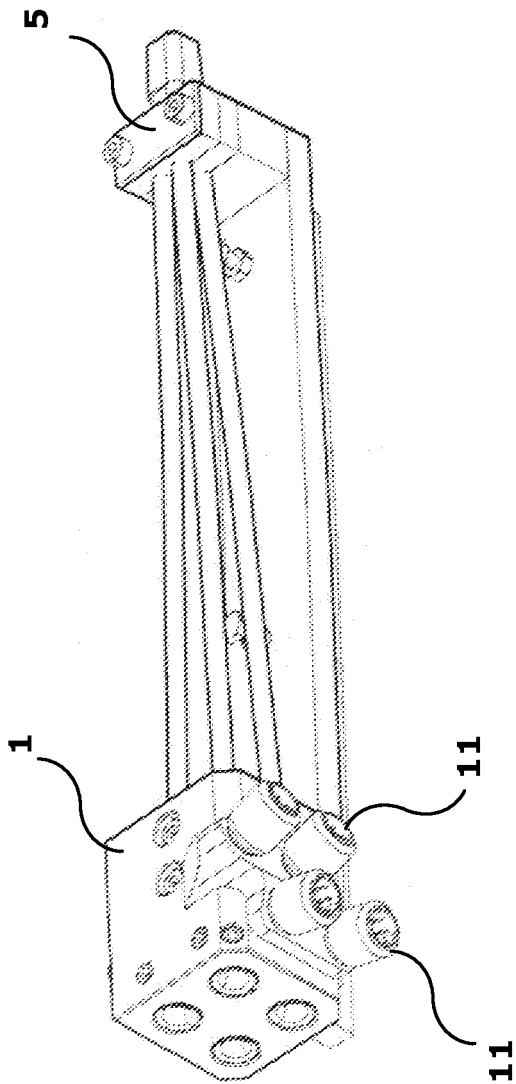


Fig. 2

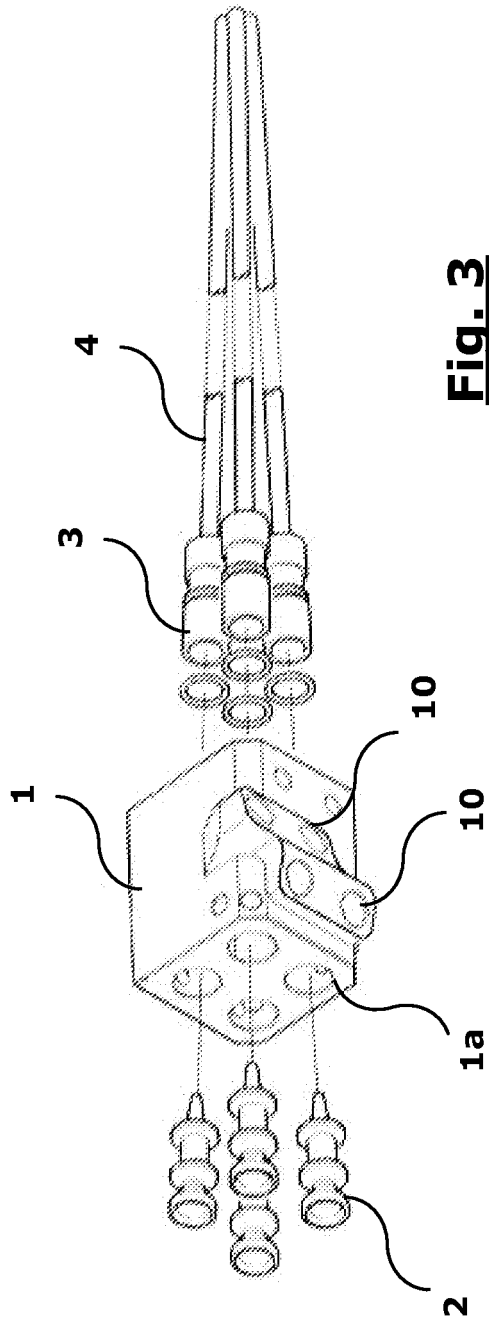


Fig. 3

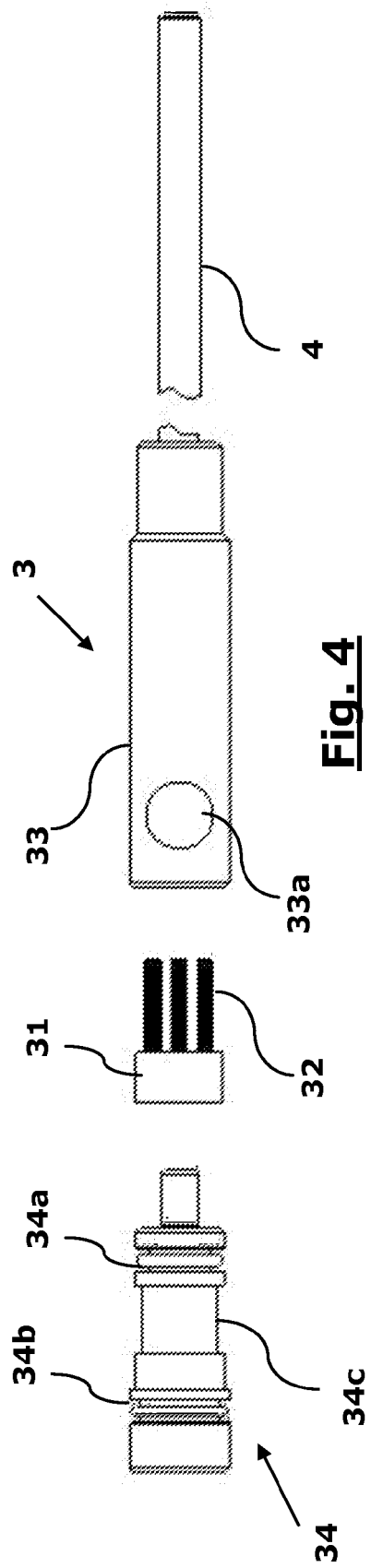


Fig. 4

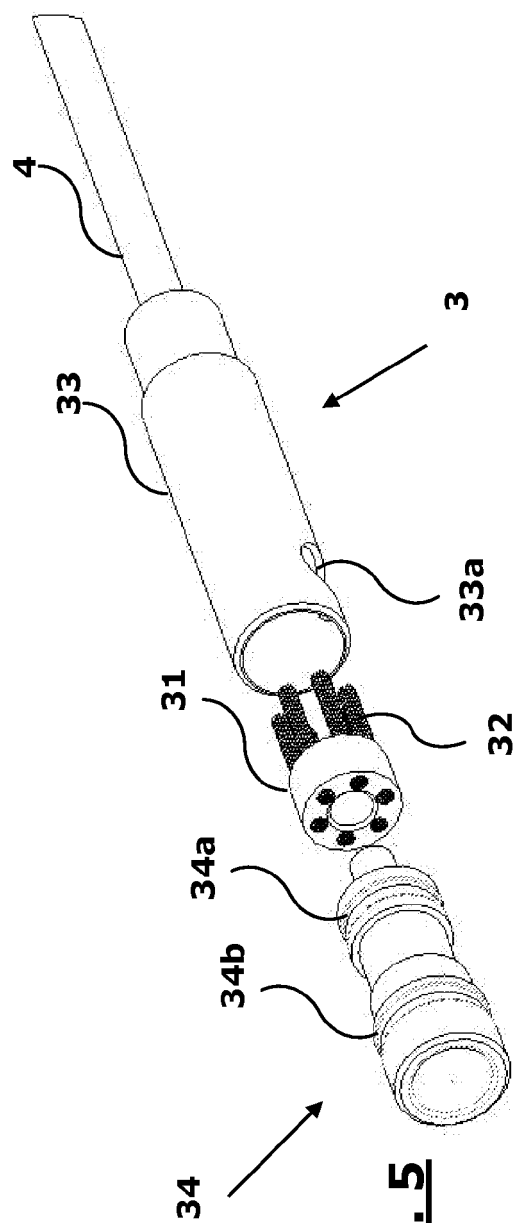


Fig. 5



EUROPEAN SEARCH REPORT

Application Number
EP 10 15 5605

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		2 June 2010	Iamandi, Daniela
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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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
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