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(54) Compacting assembly, with a thread insertion unit, for an automatic cigarette filter manufacturing machine

(57) A compacting assembly (1) for an automatic cigarette filter manufacturing machine; the compacting assembly (1) having: a jet (5) through which filtering material is fed; an insertion finger (6) downstream from the jet (5); and an insertion unit (14) for inserting a thread (15) inside the filtering material, and which has a guide tube (16) defining a feed channel through which the thread (15) is run, and an adjusting device (17) for adjusting the position of an outlet opening of the guide tube (16); the guide tube (16) of the insertion unit (14) being connected to a fixed part by means of a spherical joint (18), which allows rotation of the guide tube (16) with respect to the fixed part about two perpendicular axes of rotation.

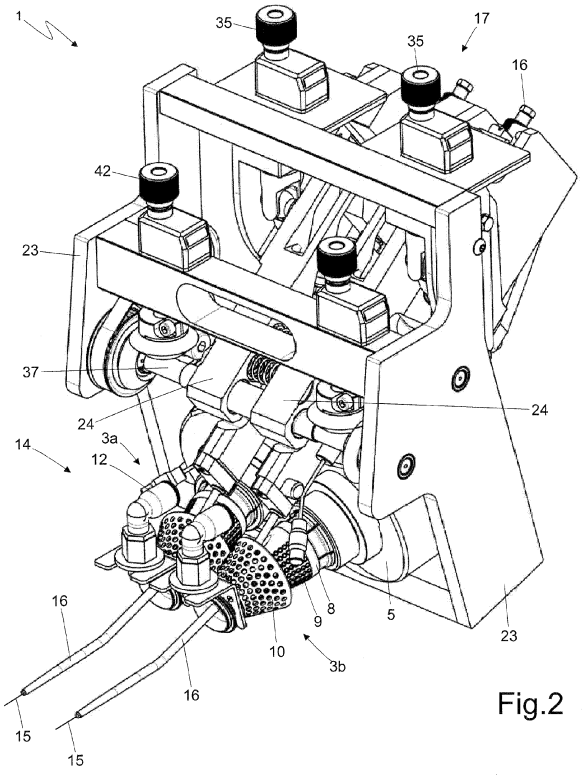

Fig.2

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Description

TECHNICAL FIELD

[0001] The present invention relates to a compacting assembly, with a thread insertion unit, for an automatic cigarette filter manufacturing machine.

[0002] Here and hereinafter, the term 'compacting assembly' is intended to mean an assembly for forming at least one continuous cigarette filter rod from a substantially flat strip of filtering material (cellulose acetate).

BACKGROUND ART

[0003] Cigarette filters have been proposed, in which at least one piece of thread is inserted centrally to embellish the filter (i.e. using a thread of a different colour from the conventional white filtering material) and/or to aromatize the filter (using a thread impregnated with volatile aromatic substances).

[0004] To insert the thread inside the filter, automatic cigarette filter manufacturing machines are equipped with a thread feed unit, on which the thread is unwound off a spool; and an insertion unit, which receives the continuous thread from the feed unit, and inserts it into a strip of filtering material at a compacting assembly, which compacts the strip of filtering material into a rope.

[0005] The compacting assembly normally comprises a funnel-shaped pneumatic conveyor - known as and hereinafter referred to as a jet - which receives the strip of filtering material at the input, and feeds it to an insertion finger, which completes the compacting operation and terminates in a forming beam, on which the rope of filtering material is wrapped in a gummed paper strip. Known insertion units comprise a guide tube defining a feed channel along which the thread is run; and one end of the guide tube, terminating with a thread outlet opening, is located inside the insertion finger to feed the thread into the centre of the filtering material as it is compacted.

[0006] An essential feature of centre-threaded cigarette filters is that the thread be centred perfectly with respect to the filter. To ensure this, the insertion unit is equipped with an adjusting device for adjusting the position of the guide tube - in particular, the outlet opening of the guide tube - thus enabling a skilled technician to adjust the position of the guide tube to centre the thread perfectly inside the filter.

[0007] Known adjusting devices, however, have proved complicated to operate (i.e. to achieve the required position setting), and rarely provide for precise centring of the thread inside the filter.

DESCRIPTION OF THE INVENTION

[0008] It is an object of the present invention to provide a compacting assembly, with a thread insertion unit, for an automatic cigarette filter manufacturing machine, designed to eliminate the above drawbacks, and which is cheap and easy to produce.

[0009] According to the present invention, there is provided a compacting assembly, with a thread insertion unit, for an automatic cigarette filter manufacturing machine, as claimed in the accompanying Claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] A non-limiting embodiment of the present invention will be described by way of example with reference to the attached drawings, in which:

Figure 1 shows a three-dimensional view, with parts removed for clarity, of an end portion of a compacting assembly in accordance with the present invention;
Figure 2 shows a schematic view in perspective, with parts removed for clarity, of the remaining part of the Figure 1 compacting assembly connected to a thread insertion unit in accordance with the present invention;
Figure 3 shows a view in perspective of a guide tube of the Figure 2 insertion unit;
Figures 4, 5 and 6 show three different views in perspective of a tubular end body of a jet forming part of the compacting assembly and shown in Figure 2;
Figure 7 shows a longitudinal section of the tubular body in Figures 4, 5 and 6;
Figure 8 shows a horizontal section of Figure 2, with parts removed for clarity;
Figures 9 and 10 show two different vertical sections of Figure 2, with parts removed for clarity;
Figures 11 and 12 show views in perspective of two details of an adjusting device of the Figure 2 insertion unit.

PREFERRED EMBODIMENTS OF THE INVENTION

[0011] Number 1 in Figures 1 and 2 indicates as a whole a compacting assembly of a dual (i.e. two-line) automatic cigarette filter manufacturing machine. In known manner, compacting assembly 1 receives two strips of filtering material (not shown), compacts the strips of filtering material into two ropes of filtering material (not shown), and feeds the ropes of filtering material to two forming beams 2 (Figure 1).

[0012] On each forming beam 2, the rope of filtering material is fed, in known manner not shown, onto a gummed paper strip, which is then wound transversely about the rope of filtering material to form a continuous filter rod.

[0013] Compacting assembly 1 comprises two side by side compacting lines 3a and 3b. Each compacting line 3a, 3b comprises a jet 5 (Figure 2) through which the rope of filtering material is fed to a respective insertion finger 6 (Figure 1) terminating in forming beam 2.

[0014] To allow the compressed air blown through blow holes in each jet 5 to expand freely (and so avoid counterpressure phenomena), each jet 5 is connected to a

slightly conical, perforated tubular body 8 (Figure 2) having a number of through holes 9 and located directly downstream from jet 5.

[0015] Body 8 is partly inserted inside an input funnel 10 of finger 6. Input funnel 10 also has a number of through holes 11.

[0016] Inside the two parallel, side by side fingers 6, the two strips of filtering material fed pneumatically by jets 5 are gathered so that, by the time they reach the output ends of fingers 6, i.e. the inputs of beams 2, they are cylindrical in shape.

[0017] As shown schematically in Figure 2, in addition to jets 5, fingers 6, tubular bodies 8 and funnels 10, compacting assembly 1 also comprises an insertion unit 14 for inserting a thread 15, on each compacting line 3a, 3b, into the filtering material as it is compacted. Each thread 15 must be inserted centrally with respect to the corresponding rope of filtering material formed in compacting assembly 1, and may serve to embellish the filters (i.e. using a thread 15 of a different colour from the conventional white filtering material) and/or to aromatize the filters (using a thread 15 impregnated with volatile aromatic substances).

[0018] For each compacting line 3a, 3b, insertion unit 14 comprises a guide tube 16, which defines a feed channel, through which thread 15 is run, and terminates with an outlet opening from which thread 15 is inserted into the filtering material. The end portion of each guide tube 16 is inserted inside a corresponding insertion finger 6, so that the outlet opening of guide tube 16 is roughly located in the middle of insertion finger 6. Insertion unit 14 also comprises an adjusting device 17 for adjusting the position of the outlet opening of each guide tube 16, to position respective thread 15 correctly inside the filtering material.

[0019] As shown in Figures 3 to 7, each guide tube 16 is connected to a fixed part of compacting assembly 1 (preferably, to tubular body 8 of corresponding compacting line 3a, 3b) by a spherical joint 18, which allows guide tube 16 to rotate about two perpendicular axes of rotation with respect to the fixed part (i.e. with respect to tubular body 8 of the corresponding compacting line 3a, 3b). In other words, each guide tube 16 is hinged to a fixed part of compacting assembly 1 (to tubular body 8 of corresponding compacting line 3a, 3b) by a spherical joint 18, so as to rotate freely about two perpendicular axes of rotation.

[0020] Each spherical joint 18 comprises a spherical cap 19 (Figure 3) integral with guide tube 16 (and preferably formed by locally enlarging guide tube 16); and a spherical seat 20 (Figures 4-7), which is integral with the fixed part (i.e. tubular body 8 of corresponding compacting line 3a, 3b), negatively reproduces the shape of spherical cap 19, and houses spherical cap 19 itself. In a preferred embodiment, each spherical joint 18 is located at an annular edge 21 of an outlet opening of tubular body 8, i.e. spherical seat 20 of spherical joint 18 is adjacent to, and locally interrupts, annular edge 21 of the outlet opening of tubular body 8 (as shown clearly in Figures 5 and 6).

[0021] In a preferred embodiment, each tubular body 8 has a recess 22, which is located upstream from spherical joint 18 (i.e. upstream from spherical seat 20 of spherical joint 18), gradually increases in depth towards spherical joint 18, and loosely houses the portion of guide tube 16 directly upstream from spherical joint 18. Each recess 22 terminates in, and blends seamlessly with, spherical seat 20 of spherical joint 18, so that spherical seat 20 of spherical joint 18 forms a seamless extension of recess 22. The increasing depth of recess 22 performs an important function, by gradually and 'gently' making space for guide tube 16 inside the filtering material coming out of tubular body 8 and entering insertion finger 6. In other words, in actual use, the partly compacted filtering material is fed out of tubular body 8 into insertion finger 6; and, by virtue of the increasing depth of recess 22, the filtering material inside tubular body 8 is deformed gradually (i.e. gently) to make space in which to receive guide tube 16 outside tubular body 8. The presence of guide tube 16 thus has no negative effect on the compacting process.

[0022] In alternative embodiments not shown, the fixed part of compacting assembly 1 supporting each guide tube 16, with the interposition of spherical joint 18, is other than tubular body 8 of jet 5.

[0023] Each spherical joint 18 is located at an intermediate portion of guide tube 16, and adjusting device 17 acts mechanically on the part of guide tube 16 upstream from spherical joint 18, to adjust the position of the part of guide tube 16 downstream from spherical joint 18 and terminating in the outlet opening. In other words, spherical joint 18 of each guide tube 16 forms a fulcrum dividing guide tube 16 into a controlled arm (terminating in the outlet opening) and a control arm; and adjusting device 17 acts mechanically on the control arm (upstream from spherical joint 18) to adjust the position of the controlled arm (downstream from spherical joint 18).

[0024] As shown in Figures 8, 9 and 10, adjusting device 17 comprises a fixed frame 23 integral with a fixed frame of compacting assembly 1 (i.e. of the automatic manufacturing machine). Adjusting device 17 comprises two supporting bodies 24 fitted side by side to fixed frame 23 to translate, with respect to fixed frame 23 and independently of each other, in an adjustment direction 25 perpendicular to guide tubes 16. Adjusting device 17 also comprises two supporting bodies 26, each of which directly supports a respective guide tube 16 (i.e. guide tube 16 is fixed directly to and therefore rigidly integral with supporting body 26), and is fitted to a respective supporting body 24 to translate, with respect to supporting body 24 and independently of the other supporting body 26, in an adjustment direction 27 perpendicular to guide tubes 16 and crosswise to adjustment direction 25.

[0025] Each supporting body 26 fitted rigidly with (i.e. connected rigidly to) a respective guide tube 16 is therefore fitted to fixed frame 23 (with the interposition of cor-

responding supporting body 24) to translate, with respect to fixed frame 23, in two different adjustment directions 25 and 27.

[0026] Each supporting body 26 comprises a slide 28, and the corresponding supporting body 24 comprises a guide 29, to which slide 28 is fitted to run in adjustment direction 27. In other words, each slide 28, integral with supporting body 26, is mounted to slide along guide 29 of supporting body 24 in adjustment direction 27. For each supporting body 26, adjusting device 17 comprises a screw 30 parallel to adjustment direction 27 and fitted to supporting body 24 (i.e. supporting body 24 supports screw 30 in such a manner as to allow screw 30 to rotate about its longitudinal axis). For each supporting body 26, adjusting device 17 also comprises a nut screw 31 formed in supporting body 26 and engaged by screw 30, so that rotation of screw 30 produces a corresponding translation of supporting body 26 in adjustment direction 27.

[0027] In a preferred embodiment, each screw 30 is fitted with a take-up spring 32 for taking up slack between the threads of the screw 30/nut screw 31 connection. For each supporting body 26, adjusting device 17 also comprises a control shaft 33, which is mounted for rotation inside corresponding supporting body 24, is inclined with respect to screw 30, and is connected angularly integral with screw 30 by a universal joint 34. On the opposite side to universal joint 34, each control shaft 33 projects from supporting body 24, and has a manually rotated micrometric screw 35. An operator thus rotates each micrometric screw 35 manually to produce a corresponding rotation of control shaft 33, and therefore of screw 30; and the rotation of screw 30 translates nut screw 31 (and therefore supporting body 26 integral with nut screw 31) in adjustment direction 27.

[0028] In a preferred embodiment, each supporting body 26 comprises a fork 36, which is mechanically connected (loosely) to a pin inserted inside supporting body 24 to 'prevent rotation' of supporting body 26.

[0029] For each supporting body 24, adjusting device 17 comprises a screw 37 parallel to adjustment direction 25 and fitted to fixed frame 23 (i.e. fixed frame 23 supports screw 37 in such a manner as to allow screw 37 to rotate about its longitudinal axis). For each supporting body 24, adjusting device 17 also comprises a nut screw 38 formed in supporting body 24 and engaged by screw 37, so that rotation of screw 37 produces a corresponding translation of supporting body 24 in adjustment direction 25. The two screws 37 are parallel to each other in adjustment direction 25, and extend through both supporting bodies 24: a first screw 37 meshes with nut screw 38 of a first supporting body 24, but is idle with respect to the second supporting body 24; and a second screw 37 meshes with nut screw 38 of the second supporting body 24, but is idle with respect to the first supporting body 24. As a result, rotation of the first screw 37 translates the first supporting body 24, but has no effect on the second supporting body 24; and rotation of the second screw 37 translates the second supporting body 24, but has no effect on the first supporting body 24.

[0030] In a preferred embodiment, each screw 37 is fitted with a take-up spring 39 for taking up slack between the threads of the screw 37/nut screw 38 connection. For each supporting body 24, adjusting device 17 also comprises a control shaft 40, which is mounted for rotation inside fixed frame 23, is perpendicular to screw 37, and is connected angularly integral with screw 37 by a bevel gear pair 41. On the opposite side to bevel gear pair 41, each control shaft 40 projects from fixed frame 23, and has a manually rotated micrometric screw 42. An operator thus rotates each micrometric screw 42 manually to produce a corresponding rotation of control shaft 40, and therefore of screw 37; and the rotation of screw 37 translates nut screw 38 (and therefore supporting body 24 integral with nut screw 38) in adjustment direction 25.

[0031] As shown in Figure 11, one bevel gear pair 41 is connected angularly integral with corresponding screw 37 by a belt drive 43, which comprises a pulley integral with the bevel gear pair, a pulley integral with screw 37, and an endless belt looped about the two pulleys. As shown in Figure 12, the other bevel gear pair 41 is fitted directly to corresponding screw 37.

[0032] As shown in the attached drawings, the four control shafts 33 and 40 are all parallel and positioned vertically, to make it easier for the operator to set the corresponding micrometric screws 35 and 42 to adjust the position of threads 15.

[0033] In a preferred embodiment shown in Figure 10, each guide tube 16 is mounted to slide axially on corresponding supporting body 26; and, for each guide tube 16, adjusting device 17 comprises an elastic member 44 (in particular, a Belleville washer) compressed between guide tube 16 and supporting body 26 to push guide tube 16 axially. Each guide tube 16 can thus slide axially with respect to corresponding supporting body 26, to compensate for the variation in its length caused by the arc-chord effect produced by guide tube 16 rotating at spherical joint 18 as a result of the linear translation imposed upstream from spherical joint 18. In other words, each guide tube 16 is bound to rotate at spherical joint 18, so, for guide tube 16 to translate linearly, spherical joint 18 must be allowed to slide axially to compensate for the difference between the arc (the trajectory of guide tube 16 forced to rotate) and the chord (the trajectory of supporting body 26 translating linearly).

[0034] In actual use, the operator can adjust the position of each thread 15 inside the corresponding filtering material using corresponding micrometric screws 35 and 42, which rotate the corresponding guide tube 16 in adjustment direction 27 and adjustment direction 25 respectively. The position of thread 15 inside the corresponding filtering material can thus be adjusted easily by the operator selecting the appropriate movement to impart to thread 15 (i.e. vertical movement using micrometric screw 35, or horizontal movement using micrometric screw 42).

[0035] In a further embodiment, not shown, the ciga-

rette filter manufacturing machine is a one-line type, and so comprises one forming beam 2 for producing one continuous filter rod; in which case, compacting assembly 1 comprises one compacting line 3 with one jet 5, one insertion finger 6, and an insertion unit 14 with one guide tube 16. Similarly, the cigarette filter manufacturing machine may be a three- or four-line type, and so comprise three or four forming beams for producing three or four continuous filter rods; in which case, compacting assembly 1 comprises three or four compacting lines 3, each with a respective jet 5, respective insertion finger 6, and respective guide tube 16.

[0036] Compacting assembly 1 described has numerous advantages.

[0037] Firstly, compacting assembly 1 described provides for optimum adjustment of the position of each thread 15 inside the corresponding filtering material. This is achieved by virtue of the position of each thread 15 being adjustable both accurately and easily (intuitively).

[0038] Secondly, compacting assembly 1 described is also cheap and easy to implement.

Claims

1. A compacting assembly (1) for an automatic cigarette filter manufacturing machine; the compacting assembly (1) comprising:

at least one jet (5) through which filtering material is fed;
an insertion finger (6) located downstream from the jet (5) and connectable to a filter rod forming beam; and an insertion unit (14) for inserting a thread (15) inside the filtering material, and which comprises a guide tube (16) defining a feed channel through which the thread (15) is run, and an adjusting device (17) for adjusting the position of an outlet opening of the guide tube (16);
the compacting assembly (1) being **characterized in that** the guide tube (16) of the insertion unit (14) is connected to a fixed part by means of a spherical joint (18), which allows rotation of the guide tube (16) with respect to the fixed part about two perpendicular axes of rotation.

2. A compacting assembly (1) as claimed in Claim 1, wherein the spherical joint (18) comprises a spherical cap (19) integral with the guide tube (16); and a spherical seat (20), which is integral with the fixed part, negatively reproduces the shape of the spherical cap (19), and houses the spherical cap (19) itself.

3. A compacting assembly (1) as claimed in Claim 1 or 2, wherein the fixed part fitted with the spherical joint (18) is the jet (5) upstream from the insertion finger (6).

4. A compacting assembly (1) as claimed in Claim 3, wherein the jet (5) terminates with a conical tubular body (8) fitted with the spherical joint (18).

5. A compacting assembly (1) as claimed in Claim 4, wherein the tubular body (8) is perforated, and has a number of through holes (9) formed through a top portion of the tubular body (8).

6. A compacting assembly (1) as claimed in Claim 4 or 5, wherein the spherical joint (18) is located at an annular edge (21) of an outlet opening of the tubular body (8).

7. A compacting assembly (1) as claimed in Claim 6, wherein the tubular body (8) has a recess (22), which is located upstream from the spherical joint (18), increases gradually in depth towards the spherical joint (18), and houses the portion of the guide tube (16) directly upstream from the spherical joint (18).

8. A compacting assembly (1) as claimed in Claim 7, wherein the recess (22) terminates in, and blends seamlessly with, a spherical seat (20) of the spherical joint (18), so that the spherical seat (20) of the spherical joint (18) forms a seamless extension of the recess (22).

9. A compacting assembly (1) as claimed in one of Claims 1 to 8, wherein the spherical joint (18) is located at an intermediate portion of the guide tube (16); and the adjusting device (17) acts mechanically on the part of the guide tube (16) upstream from the spherical joint (18), to adjust the position of the part of the guide tube (16) downstream from the spherical joint (18) and terminating in the outlet opening.

10. A compacting assembly (1) as claimed in Claim 9, wherein the adjusting device (17) comprises a fixed frame (23); and a first supporting body (26), which supports the guide tube (16), and is fitted to the fixed frame (23) to translate, with respect to the fixed frame (23), in two adjustment directions (25, 27) crosswise to each other.

11. A compacting assembly (1) as claimed in Claim 10, wherein:

the first supporting body (26) is connected rigidly to the guide tube (16), and is fitted to a second supporting body (24) to translate in a first adjustment direction (27) with respect to the second supporting body (24); and
the second supporting body (24) is fitted to the fixed frame (23) to translate in a second adjustment direction (25) with respect to the fixed frame (23).

12. A compacting assembly (1) as claimed in Claim 11, wherein the first supporting body (26) comprises a slide (28); and the second supporting body (24) comprises a guide (29), to which the slide (28) is connected to run in the first adjustment direction (27).

13. A compacting assembly (1) as claimed in Claim 12, wherein the adjusting device (17) comprises a first screw (30) fitted to the second supporting body (24) and parallel to the first adjustment direction (27); and a first nut screw (31) formed in the first supporting body (26) and engaged by the first screw (30), so that rotation of the first screw (30) produces a corresponding translation of the first supporting body (26) in the first adjustment direction (27).

14. A compacting assembly (1) as claimed in Claim 13, wherein the adjusting device (17) comprises a first control shaft (33), which is rotated to translate the first supporting body (26) in the first adjustment direction (27), is inclined with respect to the first screw (30), and transmits rotation to the first screw (30) by means of a universal joint (34).

15. A compacting assembly (1) as claimed in one of Claims 11 to 14, wherein the adjusting device (17) comprises a second screw (37) fitted to the fixed frame (23) and parallel to the second adjustment direction (25); and a second nut screw (38) formed in the second supporting body (24) and engaged by the second screw (37), so that rotation of the second screw (37) produces a corresponding translation of the second supporting body (24) in the second adjustment direction (25).

16. A compacting assembly (1) as claimed in Claim 15, wherein the adjusting device (17) comprises a second control shaft (40), which is parallel to the first control shaft (33), is rotated to translate the second supporting body (24) in the second adjustment direction (25), is perpendicular to the second screw (37), and transmits rotation to the second screw (37) by means of a bevel gear pair (41).

17. A compacting assembly (1) as claimed in one of Claims 10 to 16, wherein the guide tube (16) is mounted to slide axially on the first supporting body (26); and the adjusting device (17) comprises an elastic member (44) compressed between the guide tube (16) and the first supporting body (26) to push the guide tube (16) axially.

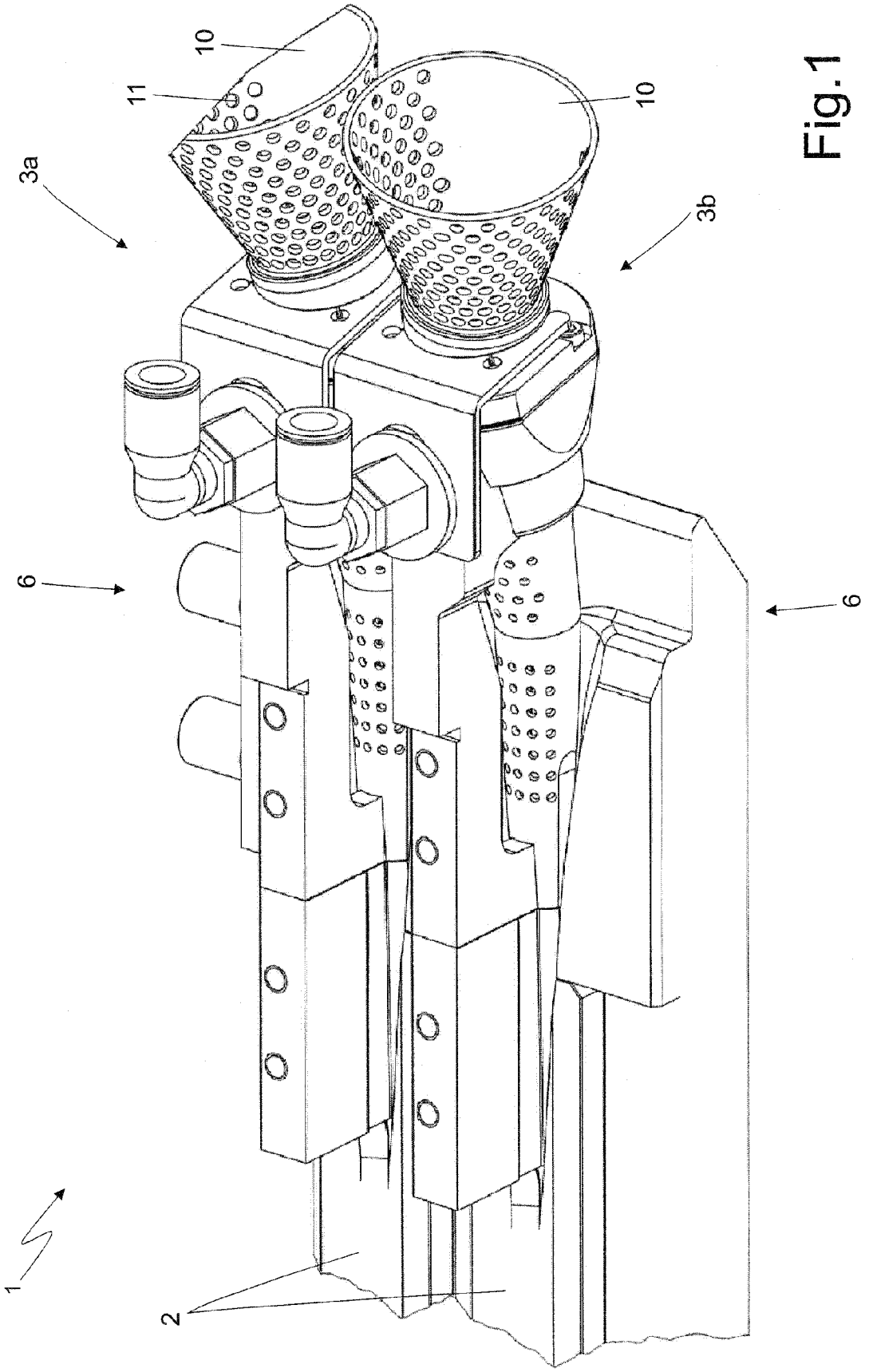


Fig.1

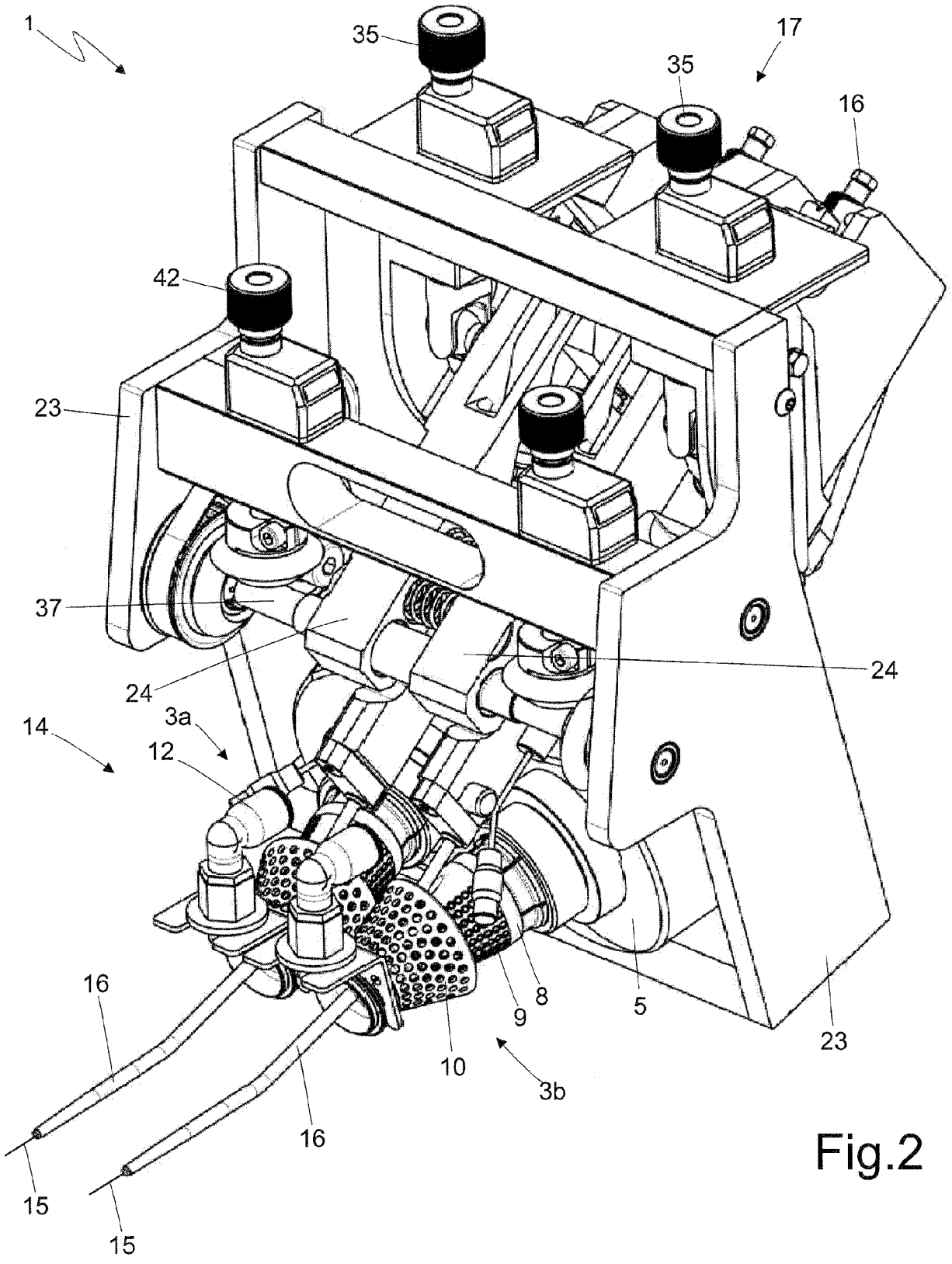


Fig.2

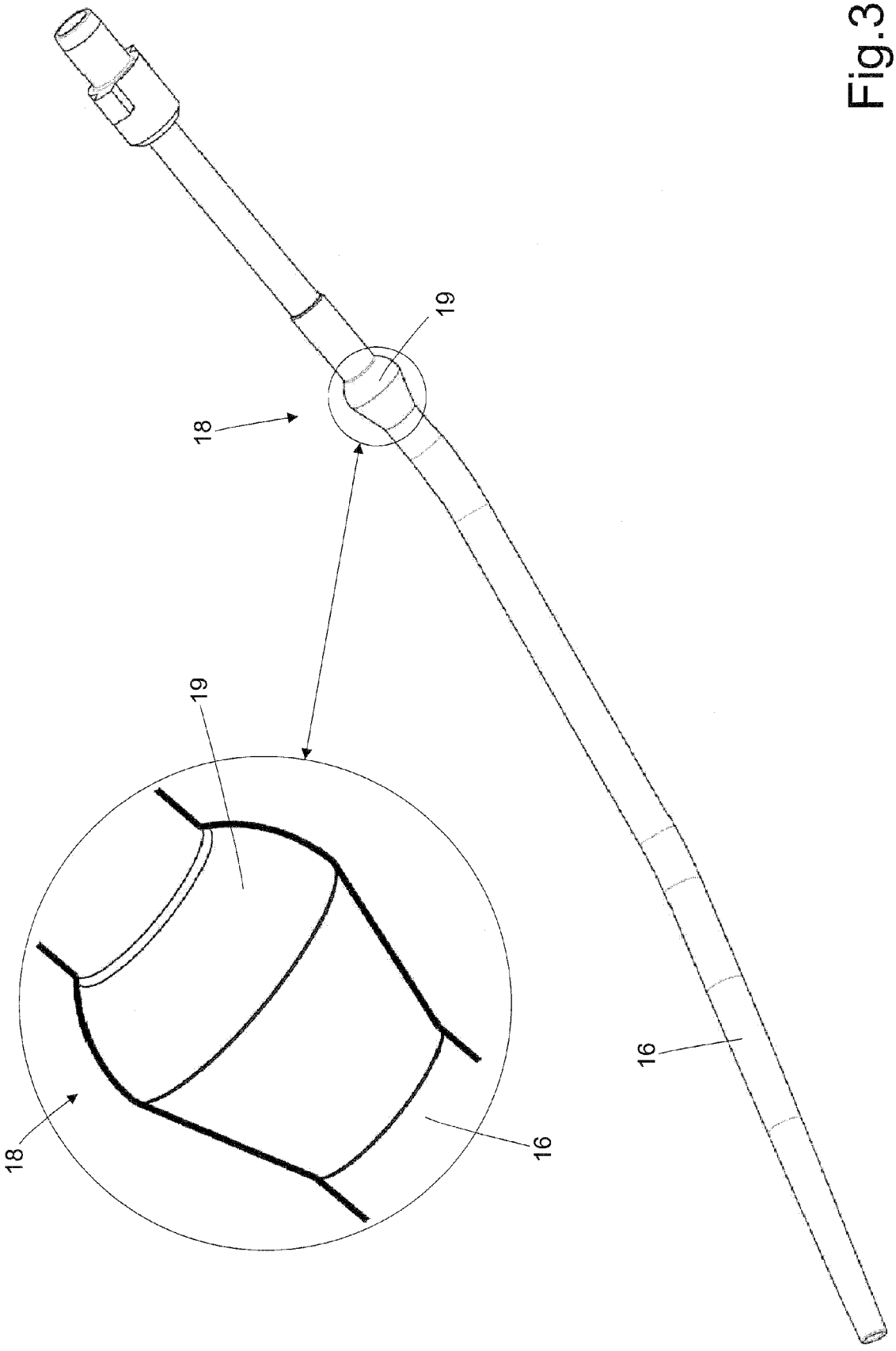


Fig.3

Fig.4

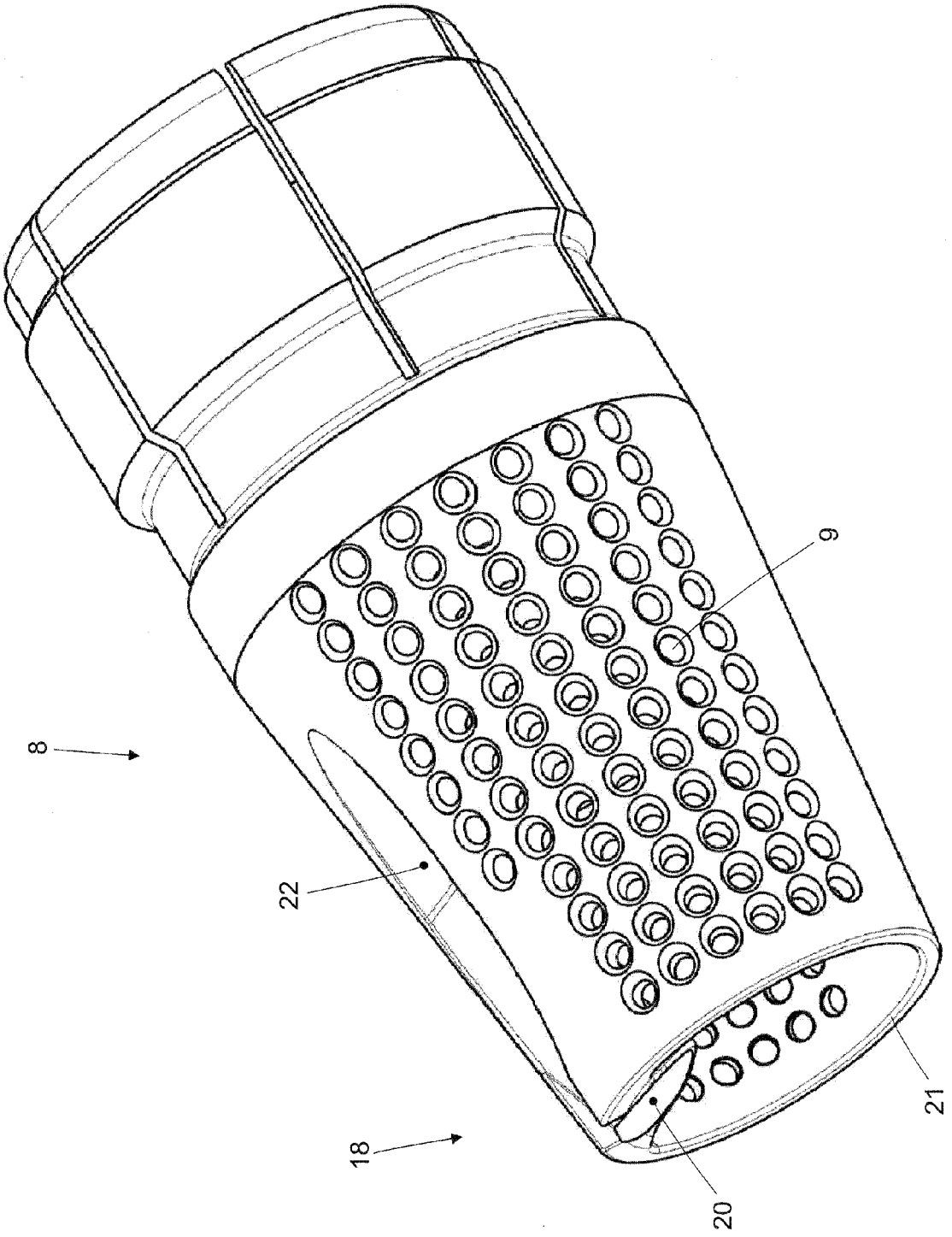
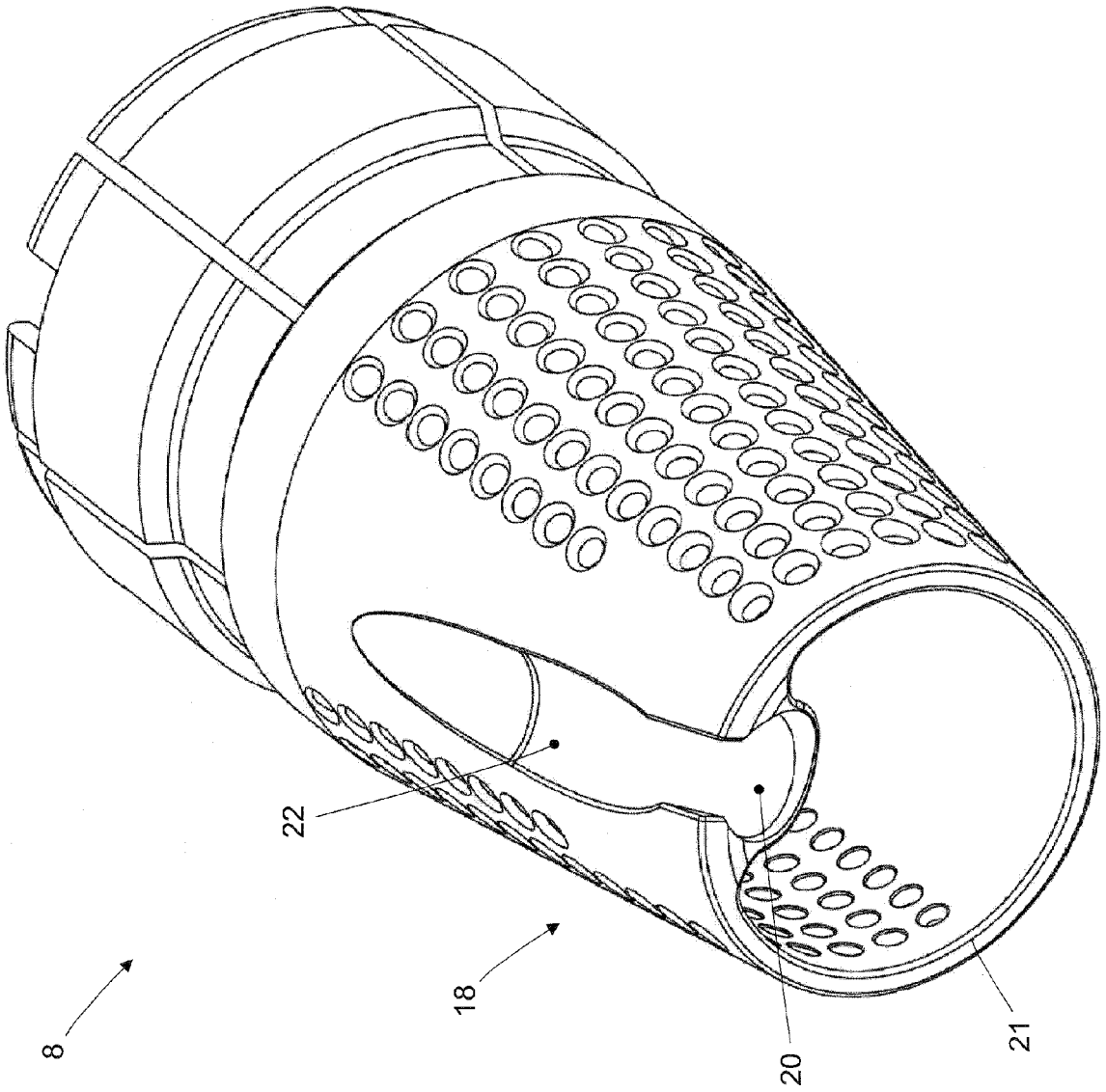


Fig.5



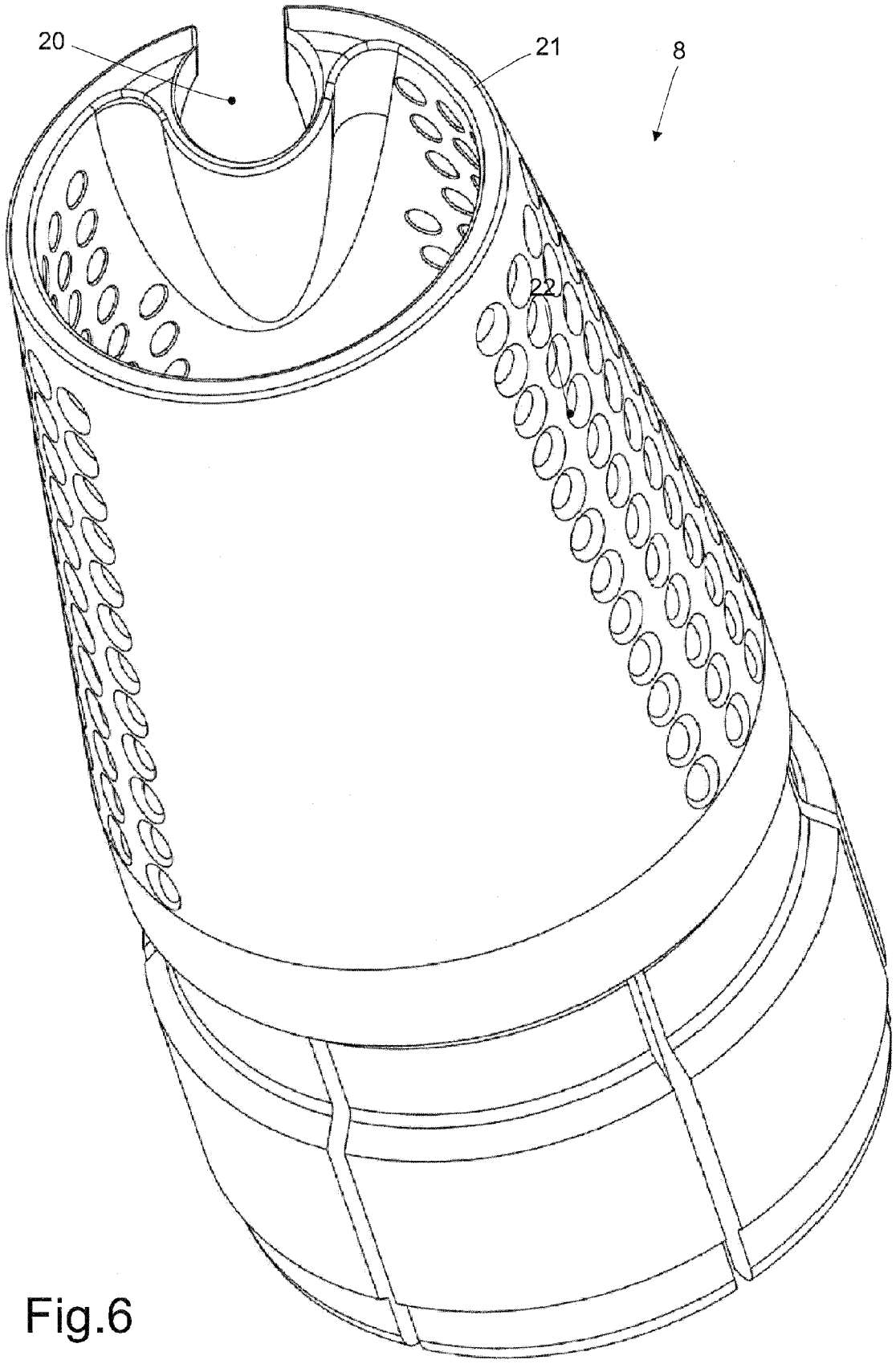


Fig.6

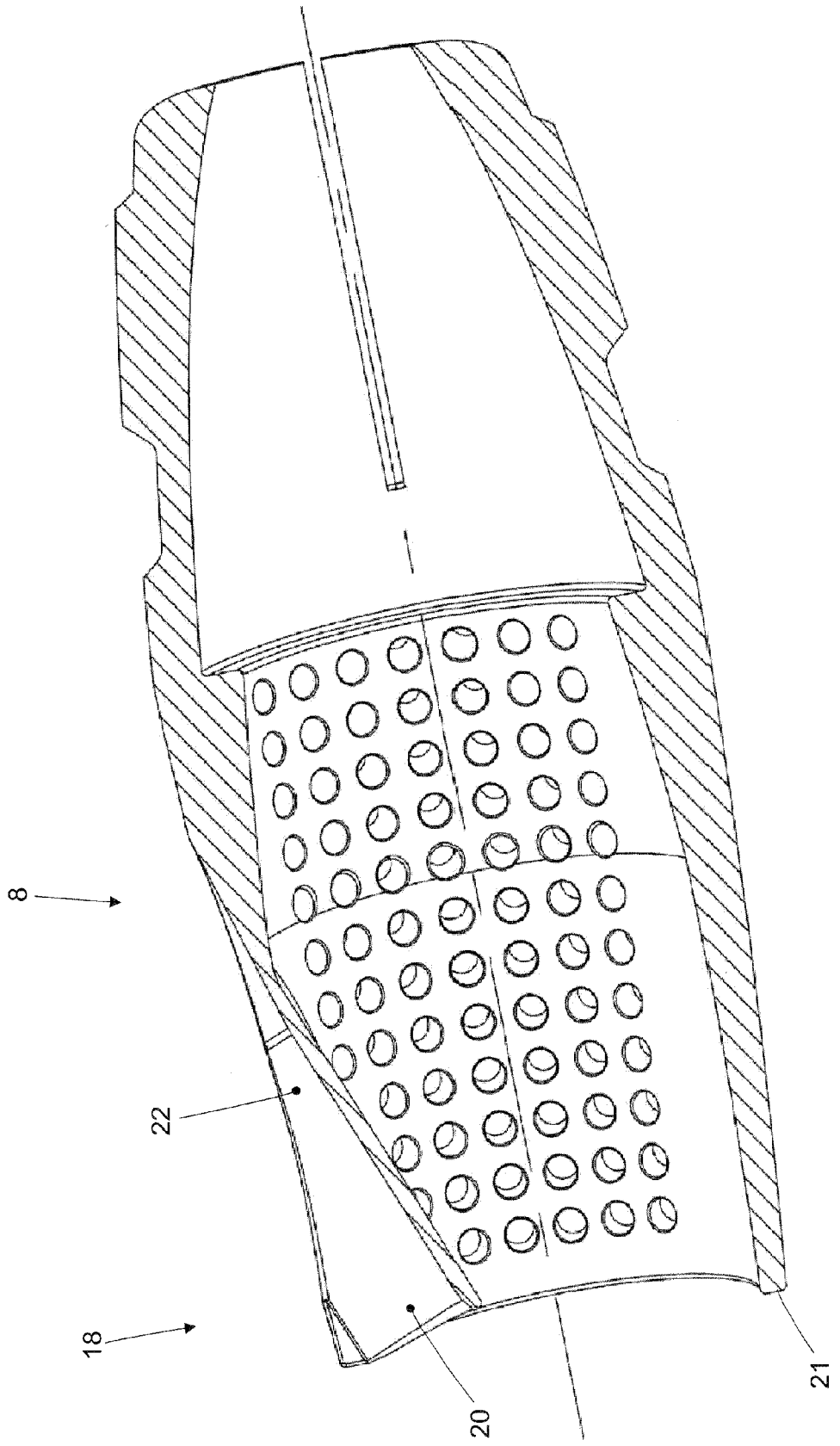


Fig.7

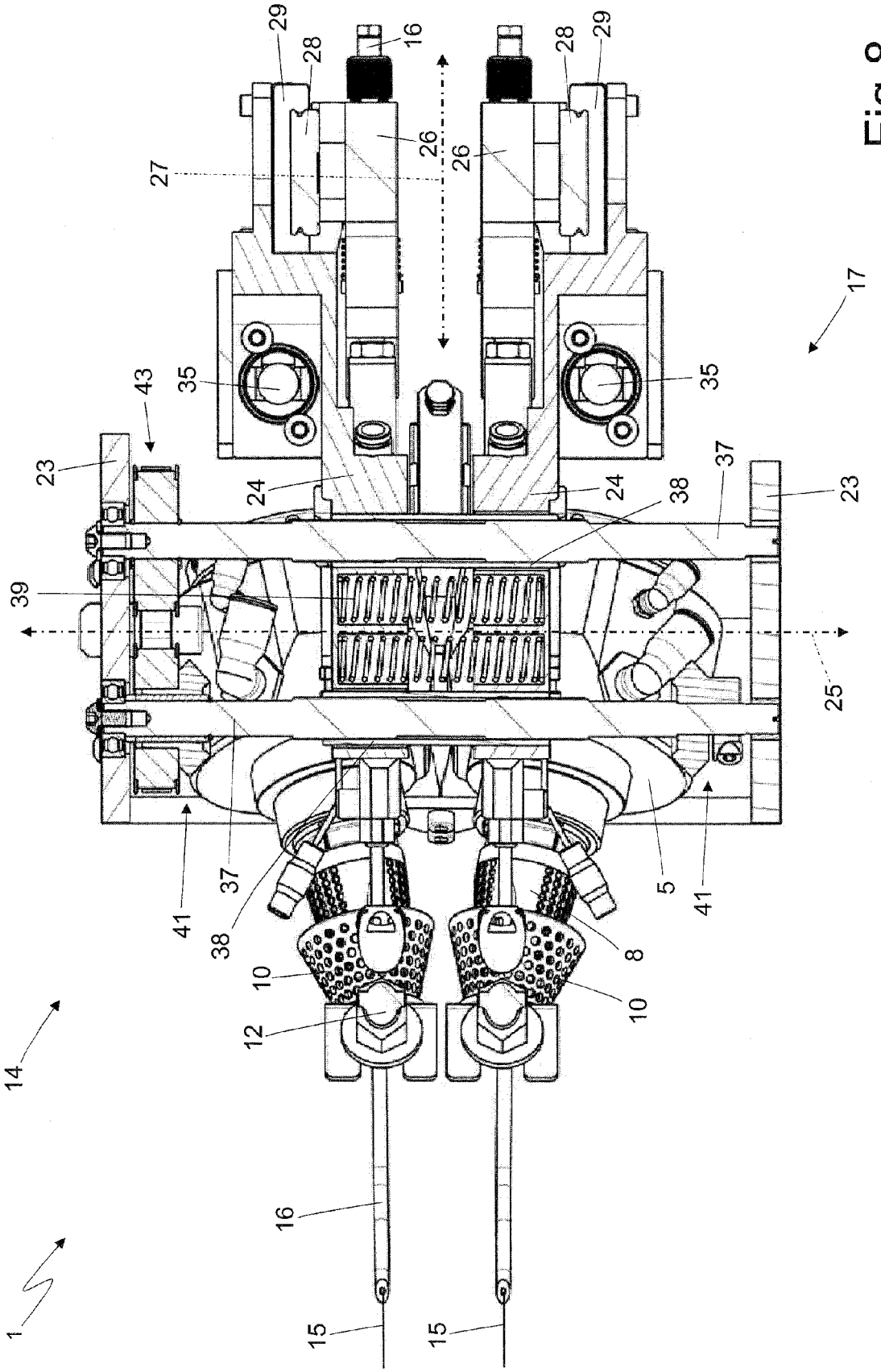

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Fig.8

Fig.9

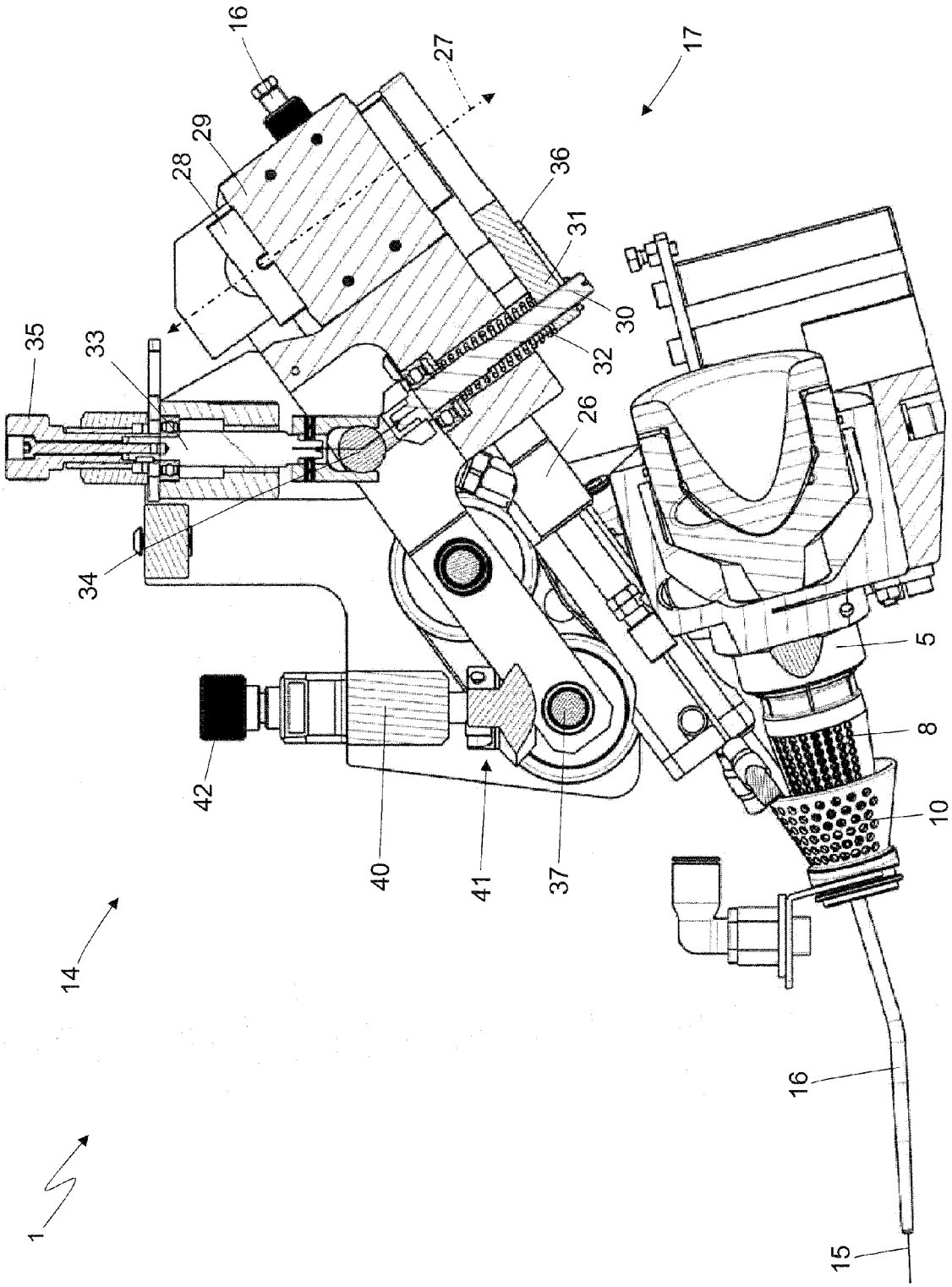


Fig.10

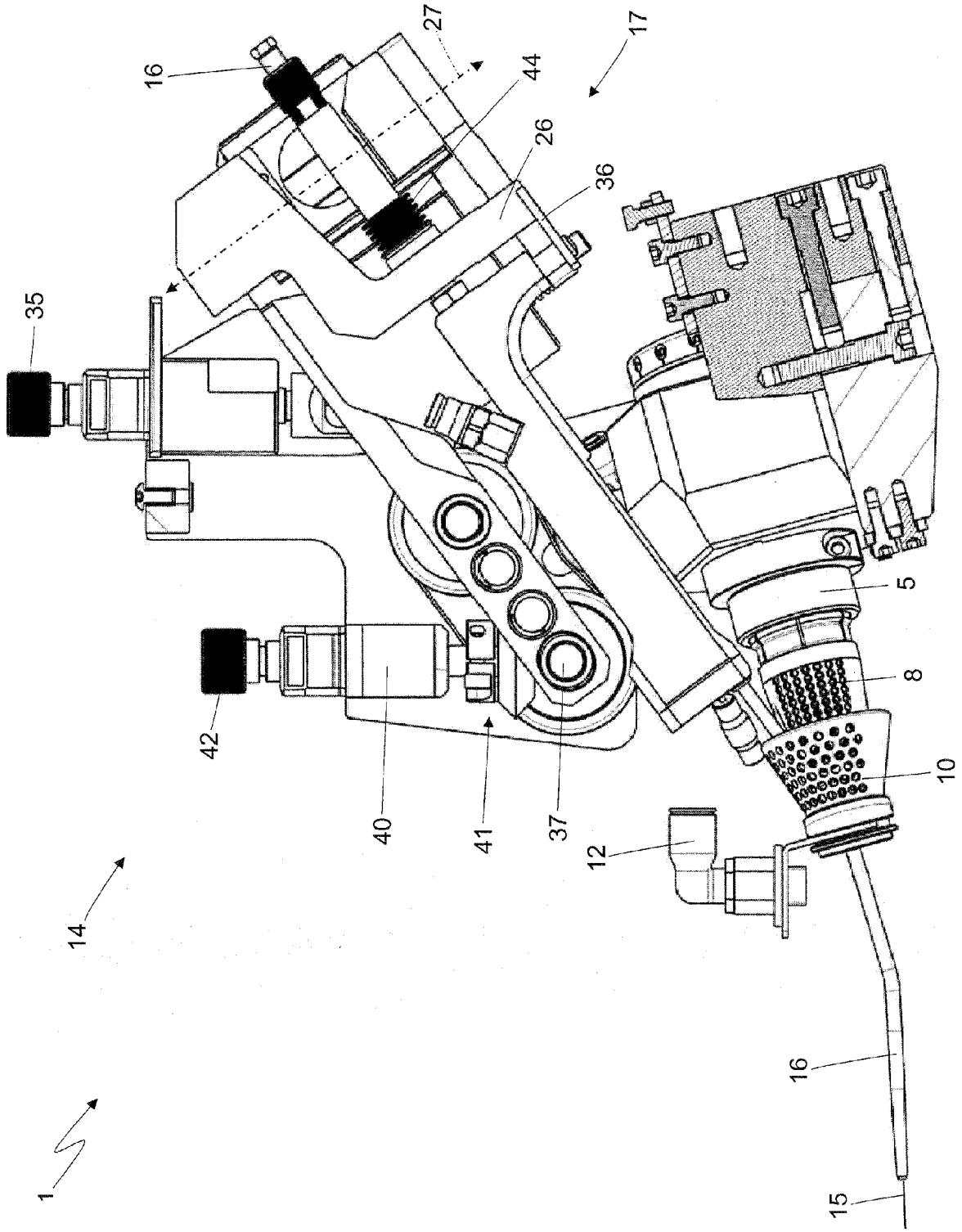


Fig.12

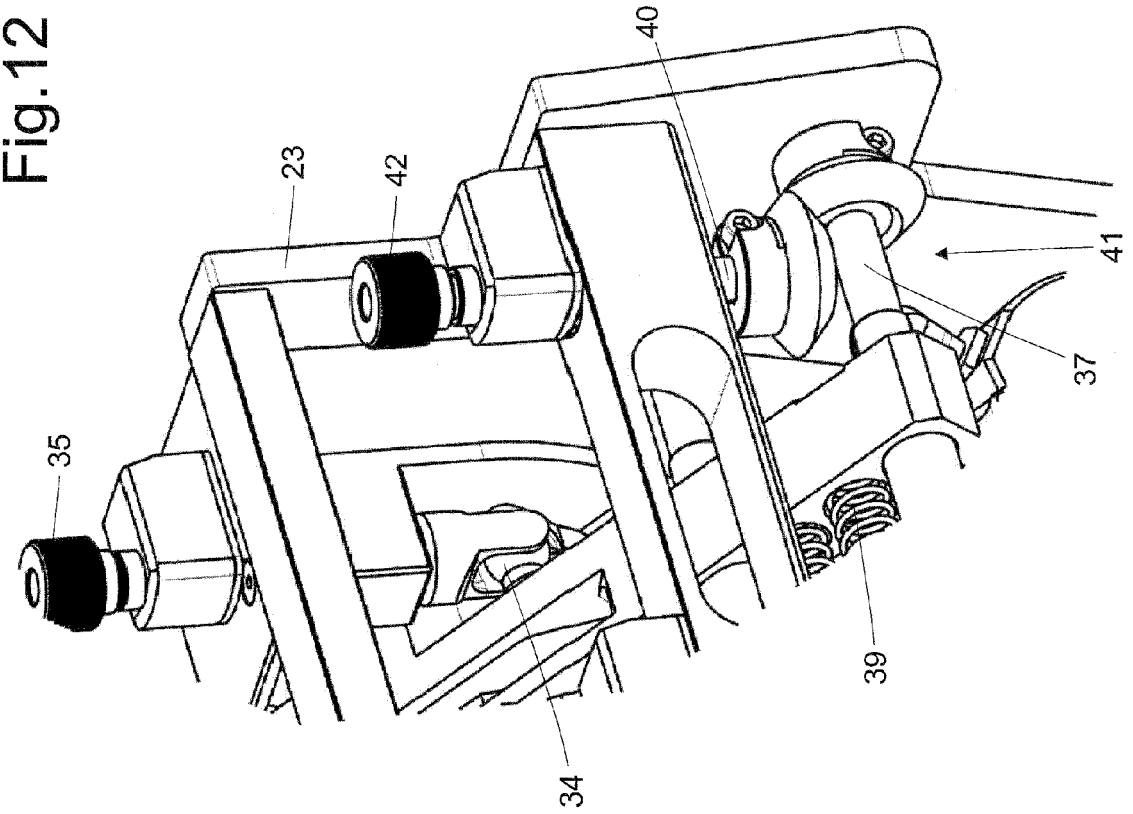
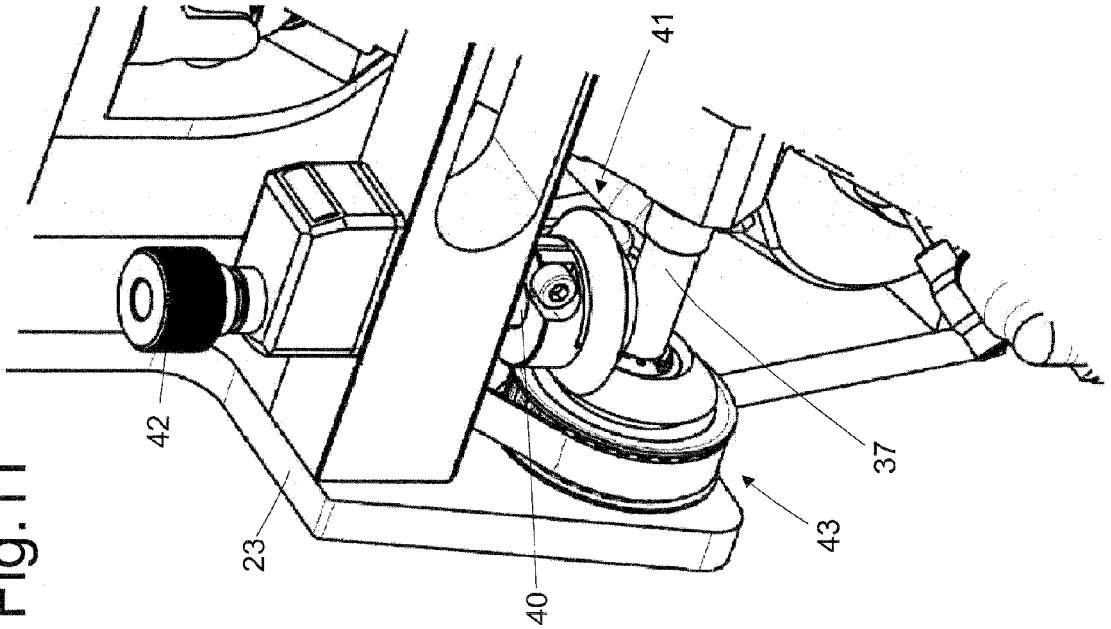


Fig.11



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EUROPEAN SEARCH REPORT

Application Number
EP 12 19 7353

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 2007/085830 A2 (BRITISH AMERICAN TOBACCO CO [GB]; WHITE PETER REX [GB]; LEWIS WILLIAM) 2 August 2007 (2007-08-02) * page 41, line 19 - page 42, line 21; figures 8,9 *	1-17	INV. A24D3/02
A	WO 2010/108740 A1 (BRITISH AMERICAN TOBACCO CO [GB]; DAVIS ANDY [GB]; LEWIS DAVID [GB]) 30 September 2010 (2010-09-30) * page 8, line 22 - page 9, line 18; figures *	1-17	
A	GB 2 416 662 A (C B KAYMICH & COMPANY LTD [GB]) 8 February 2006 (2006-02-08) * the whole document *	1-17	

TECHNICAL FIELDS SEARCHED (IPC)

A24D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	18 March 2013	Marzano Monterosso

CATEGORY OF CITED DOCUMENTS

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