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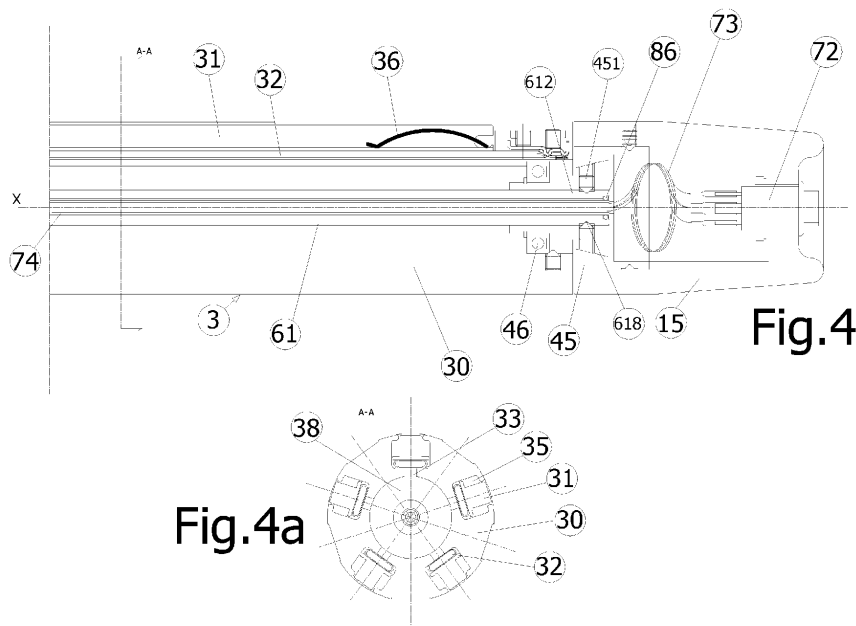
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(54) **DEVICE FOR GRABBING AND ROTATING A ROLL CORE**

(57) Device (1) for grabbing and rotating a roll core which allows axial regulation of the core during its rotation; said device comprising a hollow shaft (2), an expanding mandrel (3), a head (15) adjacent to one end (372) of said expanding mandrel (3), a rotary electric motor (7), a speed regulator (70) for said rotary electric motor (7), a control apparatus (72) for manually controlling said speed regulator (70), a mechanical transmission (6) converting the rotation of said rotary electric motor (7) into

an axial movement of said expanding mandrel (3), said mechanical transmission comprising a sliding tube (61) extending through said hollow shaft (2), able to axially slide relative to said hollow shaft (2), jointly translating but not jointly rotating with said mandrel (3), said head (15) jointly translating but not jointly rotating with said expanding mandrel (3), and said control apparatus (72) is mounted to said head (15).



Description

[0001] A device for grabbing and rotating a roll core is described below.

[0002] In particular, a device for grabbing and rotating a horizontal axis support core, which allows motorized axial adjustment of the same during its rotation is described.

[0003] It is known to make flexible materials, such as materials in the form of wire, tape or film (for example non-woven fabrics, paper, synthetic resins or metals), winding them around a support structure, better known as the "support core", so as to obtain a winding (also called the "roll").

[0004] The material so wound can then be unwound, at a later stage.

[0005] The support cores used to create and support these windings or rolls are also known as "cores", "drums" or "spools".

[0006] These roll support cores comprise an elongated hollow body, for example a generally tubular body, around which the flexible material is wound.

[0007] Occasionally, these support cores can also comprise a pair of parallel elements, generally in the shape of a circular crown, joined to the ends of the generally tubular body (the so-called "flanges") which delimit the space within which the material can be wound.

[0008] Devices are known for grabbing and rotating the support core, in order to then be able to carry out the operations for winding and unwinding the flexible material.

[0009] These devices comprise an expanding mandrel, also commonly known as the "expanding shaft", which is mounted on a shaft, usually connected to an electric motor, or a clutch or a brake (for regulating the speed of rotation of the mandrel).

[0010] The roll support core is fitted onto the expanding mandrel and locked therein by means of radially movable elements, also known as clamps or "strips".

[0011] In particular, expanding mandrels are known in which the clamps of the mandrel are operated pneumatically, in contrast to elastic return means.

[0012] Devices are also known for grabbing and rotating a horizontal axis support core allowing, at the same time, manual axial regulation of the mandrel, when the machine is stationary or even during rotation.

[0013] The national patent 102019000013224 of the same applicant describes a motorized device for grabbing and rotating a horizontal axis support core.

[0014] The currently known devices for grabbing and driving a horizontal axis support core and which allow motorized axial displacement have various drawbacks.

[0015] In particular, the construction of these prior art devices is complex and expensive and incompatible with the installation standards on machines commonly marketed, also requiring external electronic control systems.

[0016] The aim of the inventors is to at least partially solve the problems of the prior art and, in particular, the above-mentioned problems.

[0017] This objective is achieved by means of a device compliant with the provisions of claim 1.

[0018] Further advantages can be obtained by means of the additional features set forth in the dependent claims.

[0019] A possible embodiment of a device for grabbing and rotating a winding or roll support core is described below with reference to the attached drawings in which:

Figure 1 is an overall schematic view of a device for grabbing and rotating a roll support core, comprising the roll;

Figure 2 shows a first detail of the device of Figure 1,

Figure 3 shows a second detail of the device of Figure 1;

Figure 4 shows a third detail of the device of Figure 1;

Figure 4a is a cross-sectional view of the detail of Figure 4;

Figure 5 shows a fourth detail of the device of Figure 1;

Figure 5a shows an enlarged detail of Figure 5;

Figures 6a, 6b, 6c, 6d, 6e, 6f, 6g, 6h, 6i correspond to the same view of Figure 1 but they highlight some mechanical components.

[0020] With reference to the attached drawings, a device for grabbing and rotating a roll core 10 around a horizontal rotation axis X is indicated as a whole with reference number 1.

[0021] The device 1 comprises an expanding mandrel 3, adapted to rotate around a horizontal axis X, which is bound to a bearing hollow shaft 2.

[0022] As used herein, the terms "winding" and "roll" can be considered synonymous and indicate the material wound around the core 10.

[0023] The support core 10 is also known in jargon simply as the "core" or as the "support structure", "drum" or "spool".

[0024] The core 10 can be a conventional support structure which comprises a tubular body in which the expanding

mandrel 3 of the device 1 is inserted.

[0025] The device 1 comprises a bearing hollow shaft 2 (hereinafter also referred to only as the hollow shaft or shaft) which extends along a horizontal rotation axis X.

[0026] The hollow shaft 2 comprises a first end 21 and a second end 22, opposite the first end 21.

[0027] In the illustrated example, the hollow shaft 2 is crossed, along its entire length, by an axial bore 23. The hollow shaft 2 can be made, for example, of steel.

[0028] The device 1 comprises a support 4 for the hollow shaft 2.

[0029] The support 4 comprises one or more roller bearings 41, 42.

[0030] In the illustrated embodiment the support member 4 comprises two roller bearings 41, 42 housed in a barrel 40.

[0031] In the described embodiment, the barrel 40 is rigidly joined to an external support structure 400, also known in jargon as the "machine shoulder" or, more simply, the "shoulder".

[0032] In the illustrated embodiment, the shoulder 4 can comprise two plate-like elements 401, 402 (for example two plate-like steel elements) parallel to each other, extending on a plane orthogonal to the rotation axis X of the hollow shaft 2.

[0033] In a possible embodiment, the barrel 40 is adapted to be housed (or partially housed) in a seat obtained in the shoulder 4.

[0034] The barrel 40 can be bound to the shoulder 400 by means of connecting elements which comprise threaded elements.

[0035] The expanding mandrel 3 comprises a first end 371 and a second end 372, opposite to the first end 371.

[0036] The mandrel 3 comprises a hollow body 30, having a through bore 38 adapted to receive a portion of the hollow shaft 2.

[0037] In the illustrated example, the elongated hollow body 30 of the expanding mandrel 3 has an approximately cylindrical or prismatic shape and can be made, for example, of aluminium alloy.

[0038] The expanding mandrel 3 jointly rotates with the hollow shaft 2 but is capable to translate relative to the hollow shaft 2.

[0039] The rotation of the mandrel 3 allows to carry out (depending on the direction of rotation) the winding or unwinding operation of the flexible material on the core 10.

[0040] The rotation of the mandrel 3 can be obtained, for example, by applying a driving torque to the shaft 2.

[0041] The rotation of the mandrel 3 can also be obtained by applying a driving torque to the support 10 (for example by pulling the wound material).

[0042] The mandrel 3 and the shaft 2 can be mechanically connected, for example, by means of a connecting pin 39, screwed into a radial bore made in the body 30 of the mandrel 3, the head of which is inserted in a groove 29 made on the outer surface of the hollow shaft 2.

[0043] The groove 29 extends axially, that is to say parallel to the extension axis X of the hollow shaft 2.

[0044] A certain mandrel 3 sliding range relative to the hollow shaft 2 is thus allowed, that is to say along the axis X (which range depends on the longitudinal dimensions of the groove 29 and the transverse dimensions of the head of the pin 39).

[0045] Through this solution, the expanding mandrel 3 jointly rotates with the hollow shaft 2 but is capable to translate relative to the latter parallel to the rotation axis X.

[0046] In the illustrated embodiment, the expanding mandrel 3 is a conventional air-operated mandrel (better described below).

[0047] In the illustrated example, a head 15 (also known in jargon as a "knob") is also provided which extends along the X axis and is adjacent to one end 372 of the expanding mandrel 3 (the free end on which the support 10 is inserted).

[0048] The end 22 of the hollow shaft 2 faces the head 15.

[0049] The head 15 can have a substantially and / or generally tapered cross section (decreasing as it moves away from the mandrel 3).

[0050] This kind of head 15 facilitates the assembly operations of the core 10 on the body 30 of the mandrel 3.

[0051] The device 1 is equipped with a rotary electric motor 7 (hereinafter also simply referred to as an electric motor) and a mechanical transmission 6, better described below, to move the mandrel 3 and the head 15 axially relative to the hollow shaft 2.

[0052] In the illustrated example, the motor 7 is a rotary electric motor with an external stator and an internal rotor.

[0053] The motor 7 comprises a shaft 71 which controls the mechanical transmission 6.

[0054] In particular, the motor 7 is a stepper motor, that is to say a synchronous electric motor, without brushes, operating with pulsed direct current.

[0055] An electronic regulator 70 (for example a PWM regulator) is then provided for generating the pulsed direct current necessary to regulate: the starting, stopping and the direction of rotation of the stepper motor 7.

[0056] Furthermore, a control apparatus 72 is provided for manually controlling the regulator 70, in particular for controlling the start, stop and the direction of rotation of the electric motor 7.

[0057] Electric control wires 73 are also provided which connect the control apparatus 72 to the regulator 70 of the

stepper motor 7.

[0058] As used herein, the term "manually operated" comprises a control apparatus that can be operated with a finger, in particular an apparatus which comprises one or more control keys.

[0059] The control key, or keys, of the control apparatus 72 can be positioned on the end of the head 15.

5 **[0060]** By way of example, the manually operated control apparatus 72 can comprise, for example, a four-contact inverter, to control the operation of the electric motor 7 in both directions of rotation.

[0061] The manually operated control apparatus 72 can comprise conventional mechanical members for opening / closing the electric contacts.

[0062] Optionally, the electrical contacts can be opened and closed by means of conventional solid state elements.

10 **[0063]** A support member 9 is provided for connecting the electric motor 7 to an external support structure 400, for example to the shoulder 400.

[0064] This support member 9 of the electric motor 7 can comprise a coupling spider 91 rigidly joined to the external support structure 400.

15 **[0065]** The mechanical transmission 6 which converts the rotation of the electric motor 7 into an axial movement of the expanding mandrel 3 comprises an axially sliding tube 61, passing through the bore 23 of the hollow shaft 2.

[0066] The sliding tube 61 comprises a through bore 610, a first end 611 (facing the motor 7) and a second end 612 (facing the head 15), opposite to the first end.

[0067] The tube 61 slides axially relative to the hollow shaft 2 but does not jointly rotate with the hollow shaft 2.

[0068] Furthermore, the tube 61 jointly translates but not jointly rotates with the expanding mandrel 3.

20 **[0069]** The control apparatus 72 is mounted to the head 15 which jointly translates but not jointly rotates with the expanding mandrel 3.

[0070] Therefore, during the rotation of the mandrel 3 the head 15 remains stationary.

[0071] Consequently, it is possible to act on the command apparatus 72 to regulate the axial position of the mandrel 3, even during the rotation of the mandrel 3.

25 **[0072]** To convert the rotational movement of the shaft 71 into a translational movement of the sliding tube 61, the mechanical transmission 6 can comprise, for example, a conventional nut-and-screw mechanism 60 or a conventional ball screw mechanism.

[0073] The nut-and-screw or ball screw mechanism 60 is housed inside the spider 91.

30 **[0074]** In the described embodiment, a second support 5 is provided for the hollow shaft 2, having at least one roller bearing 51.

[0075] The second support 5 binds one end 21 of the hollow shaft 2 (the end facing the motor 7).

[0076] This solution enhances the mechanical stability of the device 1 and reduces the intensity of any vibrations of the shaft 2 and the mandrel 3.

[0077] The support 5 can be mechanically connected to the shoulder 400 by means of threaded elements.

35 **[0078]** According to the illustrated embodiment, a support member 45, 46 of the body 30 of the mandrel 3 is mounted to the end 612 of the sliding tube 61.

[0079] This support member 45, 46 comprises a hollow element 45 which is inserted in the sliding tube 61 and is rigidly joined to the sliding tube 61.

[0080] The hollow member 45 can have a shape, approximately, of a rotating solid.

40 **[0081]** The hollow element 45 and the sliding tube 61 can be mechanically connected, for example, by means of at least one connecting pin 451, screwed into a radial bore made in the hollow element 45, the head of which is inserted in a groove 618 made on the outer surface of the sliding tube 61.

[0082] The support member 45, 46 further comprises a roller bearing 46 with an internal ring inserted on the hollow element 45 and rigidly joined thereto.

45 **[0083]** The roller bearing 46 is bound to the hollow element 45 by means of a Seeger ring and bound to the elongated hollow body 30 by means of screw elements (cone point socket).

[0084] This solution allows to minimize the vibrations of the mandrel 3 when it is rotating.

[0085] In the illustrated embodiment, the head 15 is also rigidly joined to the hollow element 45; this solution allows the head 15 not to rotate while the mandrel 3 is being rotated.

50 **[0086]** In the illustrated example, the mandrel 3 is an air-operated mandrel and is fed with pressurized air through a plurality of inlet radial bores 33, 33, 33, 33, 33, 33 distributed circumferentially and in communication with the surface of the through bore 38 of the hollow body 30.

[0087] The pressurized air, intended to control the expansion of the clamps of the mandrel 3, passes through a portion of the sliding tube 61, passes into a first chamber 812, defined inside the hollow shaft 2, then arrives in a second chamber 834, defined inside the through bore 38 of the hollow body 30, and finally enters the inlet radial bores 33, 33, 33, 33, 33, 33 of the mandrel 3.

55 **[0088]** In more detail, the compressed air flows into the sliding tube 61, through a first radial bore or inflow bore 613, positioned near the first end 611 of the tube 61, passes through a portion of the sliding tube 61, and flows out through

a second radial bore or outflow bore 614, in the first chamber 812.

[0089] The first chamber 812 is delimited: by the inner surface of the through bore 23 of the hollow shaft 2, by the outer surface of the sliding tube 61 and by seal elements 81, 82 interposed between the inner surface 23 of the hollow shaft 2 and the outer surface of the sliding tube 61.

[0090] The seal elements 81, 82 can be static seals, for example lip seals, distributed along the rotation axis X, which define the longitudinal ends of the chamber 812.

[0091] The lip seals 81, 82 can be housed in annular grooves made inside the axial bore 23 of the hollow shaft 2.

[0092] Preferably the lip seals are arranged symmetrically.

[0093] The second chamber 834 is delimited by the outer surface of the hollow shaft 2, by the inner surface of the bore 38 of the hollow element 30, and by seal elements 83, 84 interposed between the outer surface of the hollow shaft 2 and the inner surface of the through bore 38 of the hollow body 30.

[0094] In the illustrated example, the device 1 comprises a pair of seal elements 83, 84, distributed along the rotation axis X, which define the longitudinal ends of the chamber 834.

[0095] The pneumatic communication between the first chamber 812 and the second chamber 834 is ensured by an outlet radial bore 24 made in the wall of the hollow shaft 2.

[0096] The seal elements 83, 84 which define the second chamber 834 can comprise static seals, for example o-rings which are housed in annular grooves made inside the outer surface of the hollow shaft 2.

[0097] In the illustrated example, the elongated hollow body 30 of the mandrel 3 has a plurality of outer or hollow grooves 35, 35, 35, 35, 35 arranged radially around the axis X.

[0098] A plurality of elongated clamps or "strips" 31, 31, 31, 31, 31 (in the illustrated example five clamps) are also provided, which are arranged radially around the rotation axis X and housed in the grooves 35, 35, 35, 35, 35.

[0099] The clamps 31, 31, 31, 31, 31 of the mandrel 3 are radially movable between a first position, or radially contracted position (to release the roll core 10) and a second position, or radially expanded position (to lock the roll core).

[0100] In the radially expanded position the clamps 31, 31, 31, 31, 31 partially emerge from the outer surface of the elongated hollow body 30.

[0101] In the illustrated example, the expansion movement of the clamps 31, 31, 31, 31, 31 is pneumatically controlled, by means of the expansion of as many inner tubes 32, 32, 32, 32, 32 in the shape of a flat tubular, housed inside the grooves 35, 35, 35, 35, 35 under the clamps 31, 31, 31, 31, 31.

[0102] This expansion movement of the clamps 31, 31, 31, 31, 31 of the mandrel 3 takes place in contrast to an elastic return force obtained by means of special return springs 36, 36, 36, 36, 36 of the clamps (for example leaf springs).

[0103] The inner tubes 32, 32, 32, 32, 32 are supplied with compressed air arriving from the tube 834 through radial bores 33, 33, 33, 33, 33, 33 (distributed circumferentially) which pneumatically connect the grooves 35, 35, 35, 35, 35 to the axial through bore 38 of the elongated hollow body 30.

[0104] In the described embodiment of the device 1 a cable sleeve 74 is included, which is inserted in the sliding tube 61 and is rigidly joined to the latter.

[0105] The cable sleeve 74 houses the electric wires 73 used for connecting the control apparatus 72 to the regulator 70 of the electric motor 7.

[0106] The cable sleeve 74 pneumatically separates the electric wires 73 from the through bore 610 by means of the seal elements 85, 86.

[0107] Due to the cable sleeve 74, the control wires 73 shall remain separate from the pressurized areas avoiding the problems of commercial airtight cable sleeves.

[0108] In an alternative embodiment, not shown, the expanding mandrel cannot be of the mechanically operated type.

[0109] The device 1 can comprise a rotating member 200 which jointly rotates and translates with the hollow shaft 2 to apply a driving torque or a resistant torque to the latter.

[0110] This rotating member 200 can be, for example, a pulley (as in the illustrated example) or a disc of a mechanical brake (not shown).

[0111] The rotating member 200 can be positioned, for example, between the shoulder 400 and the second shaft support 5.

[0112] The coupling spider 91 can include an opening 911 to allow the sliding tube 61 to be connected to a compressed air source (not shown) as well as to allow the passage of the electric cables to power the regulator 70.

[0113] In the illustrated example, the coupling spider 91 is mechanically fastened to the second shaft support 5, for example by means of threaded elements.

Legend.

[0114]

EP 4 253 293 A1

	1	Device for grabbing and rotating a roll core
	10	Support structure or support core
5	15	Head or knob
	2	Bearing hollow shaft
	200	Rotating member
10	21	First end of the hollow shaft
	22	Second end of the hollow shaft
	23	Axial bore of the hollow shaft
	24	Radial bore of the hollow shaft
15	29	Longitudinal groove made in the hollow shaft 2
	3	Expanding mandrel
	30	Elongated hollow body
20	31	Clamps or strips
	32	Inner tubes
	33	Inlet bores in the hollow body
	35	Outer grooves
25	36	Return elastic means
	371	First end of the mandrel
	372	Second end of the mandrel
30	38	Through bore in the elongated hollow body
	39	Connecting pin
	4	Support for the hollow shaft
	40	Barrel
35	41	Roller bearing
	42	Roller bearing
	45	Hollow element
40	451	Connecting pin
	46	Roller bearing
	400	External support structure or Shoulder
	401	Plate-like element
45	402	Plate-like element
	5	Second support for the shaft
	50	Flange
50	51	Roller bearing
	6	Mechanical transmission
	60	Nut-and-screw assembly
	61	Sliding tube
55	610	Through bore of the sliding tube
	611	First end of the sliding tube
	612	Second end of the sliding tube

(continued)

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613	Radial bore for the inflow of compressed air into the sliding tube
614	Radial bore for the outflow of compressed air from the sliding tube
618	Groove made on the outer surface of the sliding tube
7	Electric motor
70	Electronic regulator
71	Crankshaft
72	Control apparatus
73	Electric wires
74	Cable sleeve
81	Seal element
82	Seal element
812	First chamber or Chamber inside the hollow shaft
83	Seal element
84	Seal element
834	Second chamber or Chamber inside the sliding tube
85	Seal element
86	Seal element
9	Support member for the electric motor
91	Coupling spider
911	Opening in the coupling spider
X	Rotation axis

Claims

1. A device (1) for grabbing and rotating a roll core (10), which comprises:

- a) a hollow shaft (2),
 - a1) extending along a rotation axis (X),
- b) a support (4) for said hollow shaft (2),
 - b1) said support (4) comprising one or more roller bearings (41, 42),
- c) an expanding mandrel (3),
 - c1) extending along said rotation axis (X),
 - c2) having a first end (371) and a second end (372),
 - c3) jointly rotating with said hollow shaft (2),
 - c4) capable to translate relative to said hollow shaft (2),
- d) a head (15),
 - d1) extending along said axis (X),
 - d2) adjacent to one end (372) of said expanding mandrel (3),
- e) a rotary electric motor (7),
- f) a regulator (70) for regulating the speed and direction of rotation of said rotary electric motor (7),
- g) a control apparatus (72) for manually controlling said speed regulator (70) of said rotary electric motor (7),
- h) a support member (9) for said rotary electric motor (7),

i) a mechanical transmission (6), for converting the rotation of said rotary electric motor (7) into an axial movement of said expanding mandrel (3), said mechanical transmission comprising a sliding tube (61),

- 11) extending through said hollow shaft (2),
- i2) able to axially slide relative to said hollow shaft (2),
- i3) jointly translating but not jointly rotating with said mandrel (3),

characterized in that

said head (15) is jointly translating but not jointly rotating with said expanding mandrel (3), and **in that** said control apparatus (72) is mounted to said head (15).

2. A device as claimed in claim 2, wherein said mechanical transmission (6) comprises a nut-and-screw assembly (60) interposed between said electric motor (7) and said first tube (61).

3. A device as claimed in claim 1 or 2, wherein said support member (4) comprises a barrel (40) containing said at least one or more roller bearings (41, 42).

4. A device as claimed in any of the preceding claims, wherein a second support (5) is provided for said hollow shaft (2), said second support member comprising at least one roller bearing (51).

5. A device as claimed in any of the preceding claims, wherein said support member (9) for said rotary electric motor (7) comprises a coupling spider (91) for connecting said electric motor (7) to said second support member (5).

6. A device as claimed in any of the preceding claims, comprising

a cable sleeve (74),
inserted in said sliding tube (61) and rigidly joined to said first tube (61),
said cable sleeve (74) housing electric wires (73) for connecting said control apparatus (72) to said electric motor (7).

7. A device as claimed in any of the preceding claims, wherein

said expanding mandrel (3) is an air-operated mandrel
and wherein
said axial bore (23) of said hollow shaft (2) is in pneumatic communication with said first tube (61), said first tube (61) being adapted to be pneumatically connected to an external pressurized air or gas source.

8. A device as claimed in claim 7, wherein said hollow shaft (2) comprises at least one radial bore (24) communicating with said axial bore (23), said radial bore (24) being in pneumatic communication with said mandrel (3).

9. A device as claimed in claim 8, comprising

- a pair of seal elements (81, 82),
- arranged along said axis of rotation (X),
- positioned within said axial bore (23) of said hollow shaft (2)
- defining the longitudinal ends of a chamber (812) interposed between said through bore (23) and the outer surface of said first tube (61),

10. A device as claimed in any of the preceding claims, comprising a rotating member (200)

- said rotating member (200) being jointly rotating and translating with said hollow shaft (2),
- said rotating member (200) being placed between said first supporting member (4) and said second supporting member (5) of said hollow shaft (2).

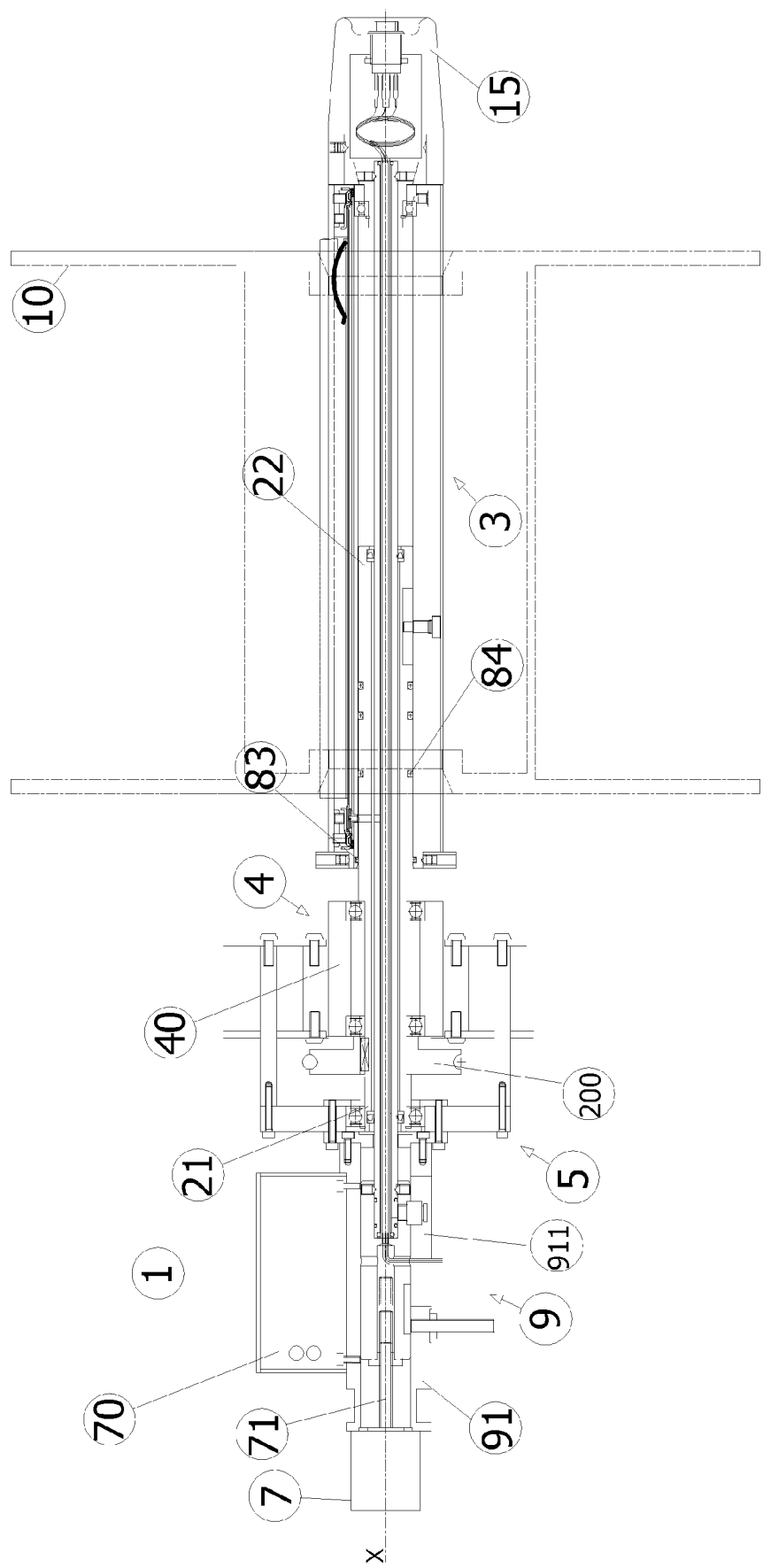


Fig.1

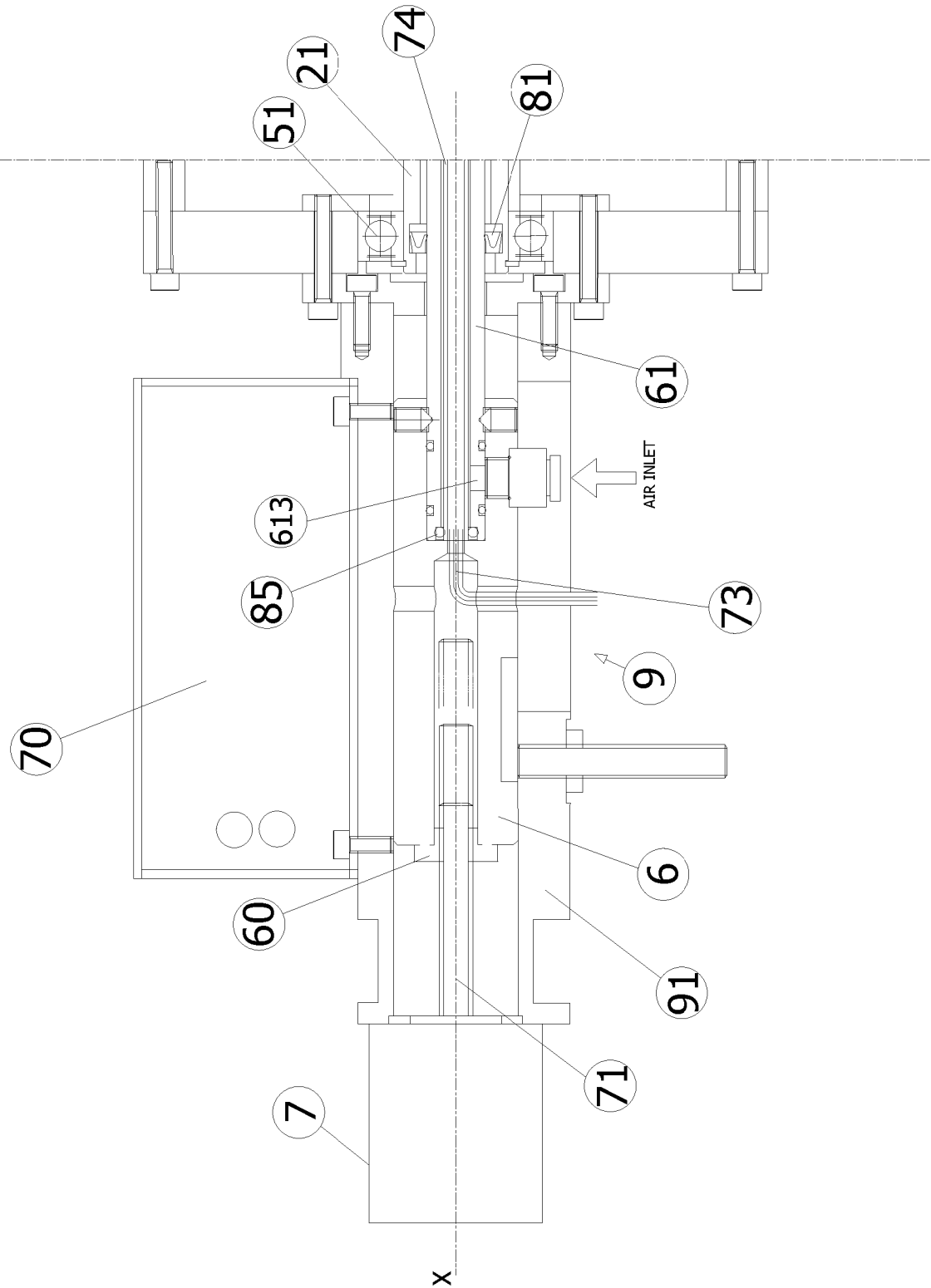


Fig. 2

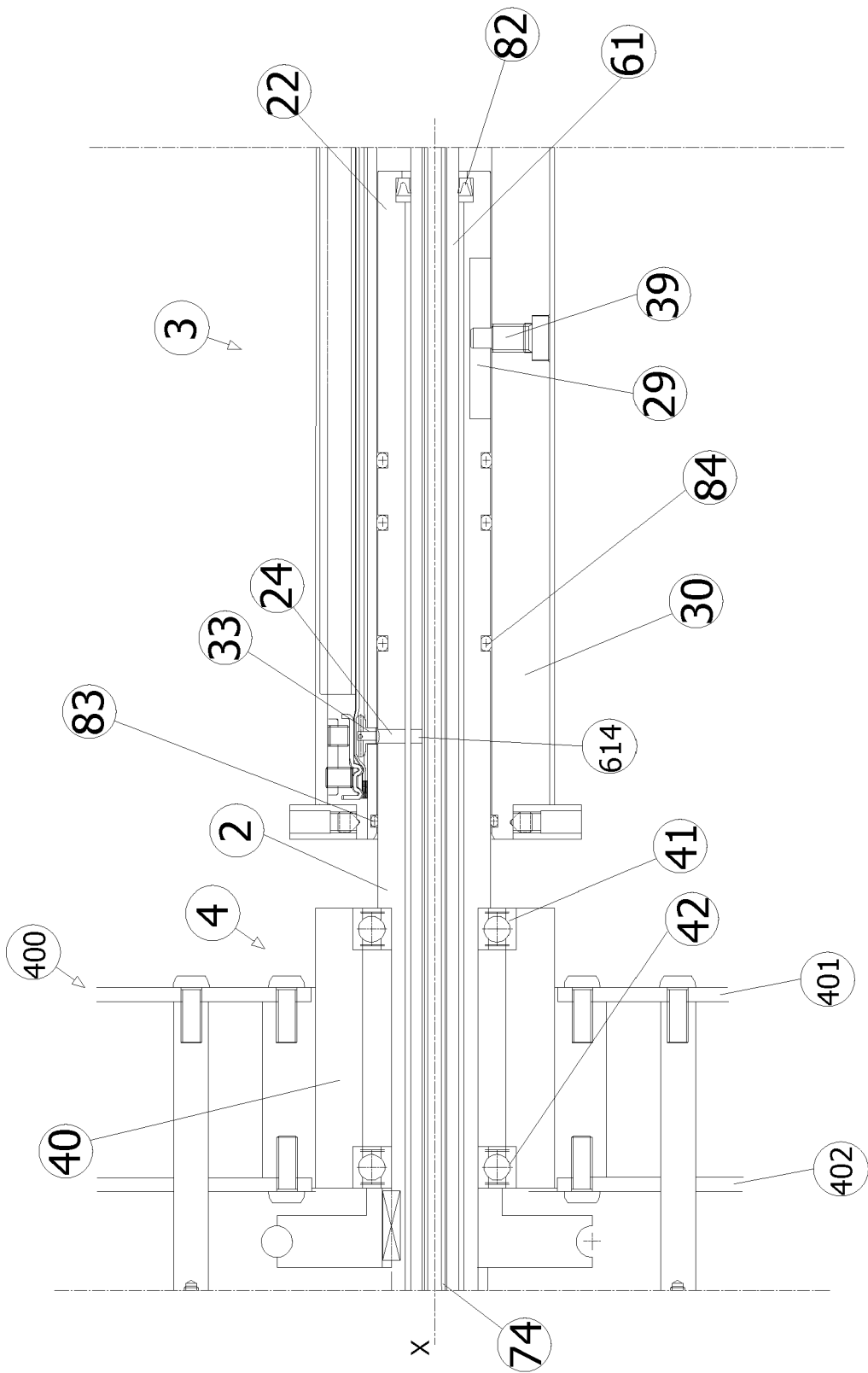


Fig. 3

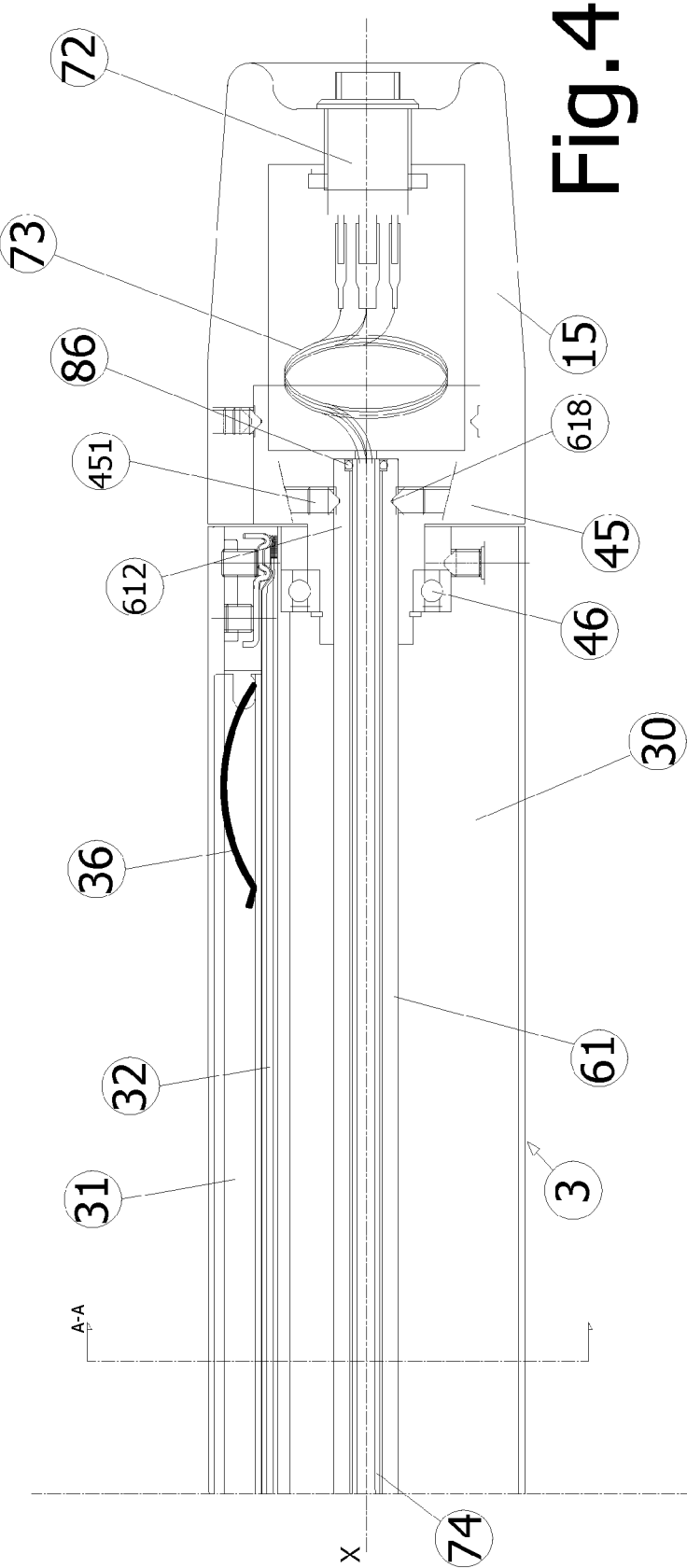


Fig. 4

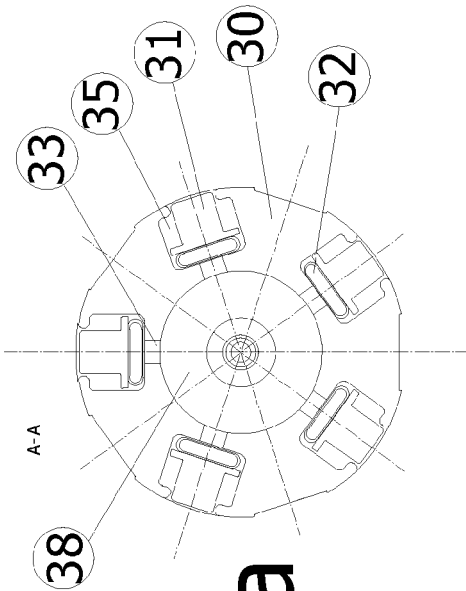


Fig. 4a

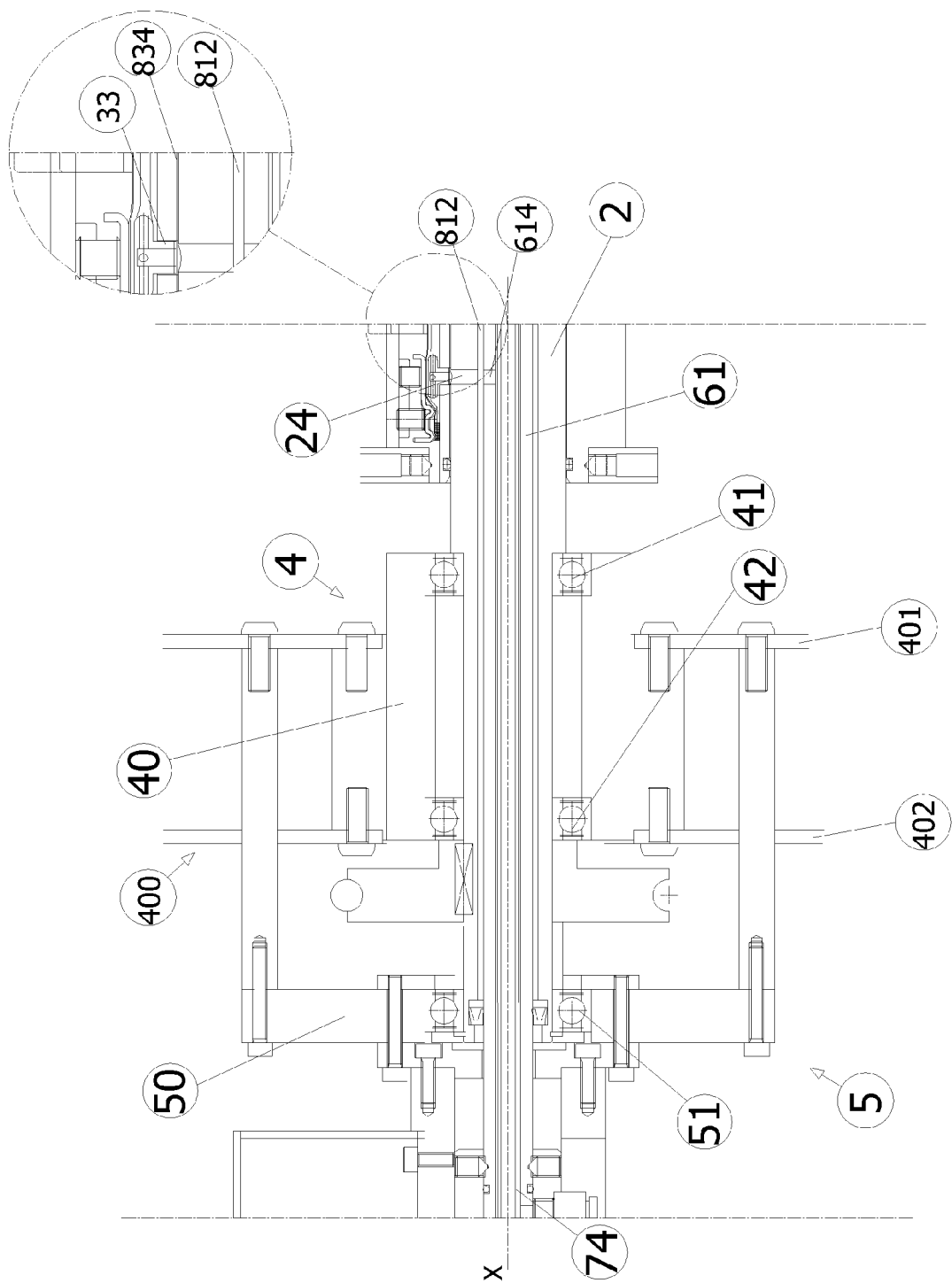
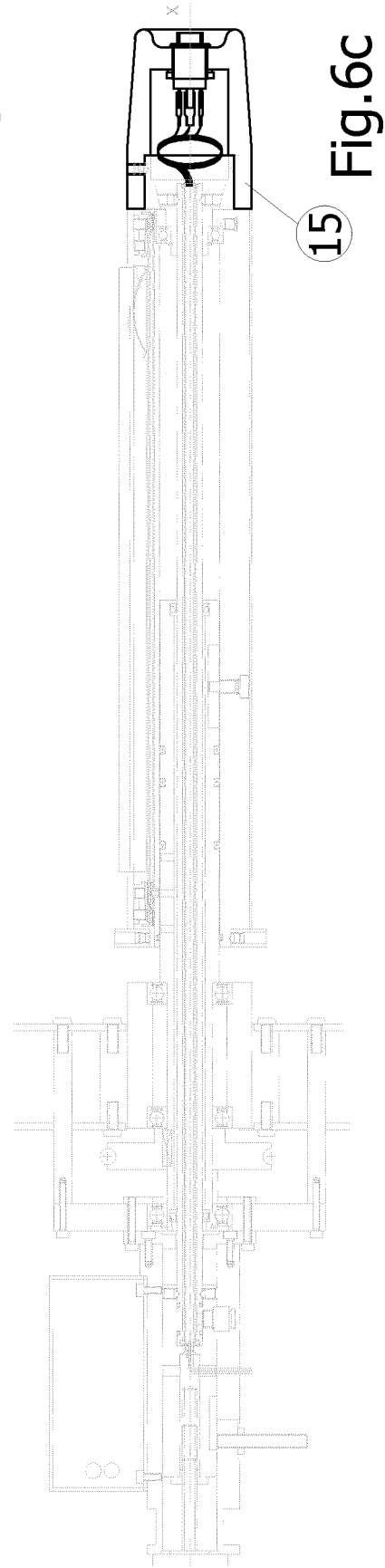
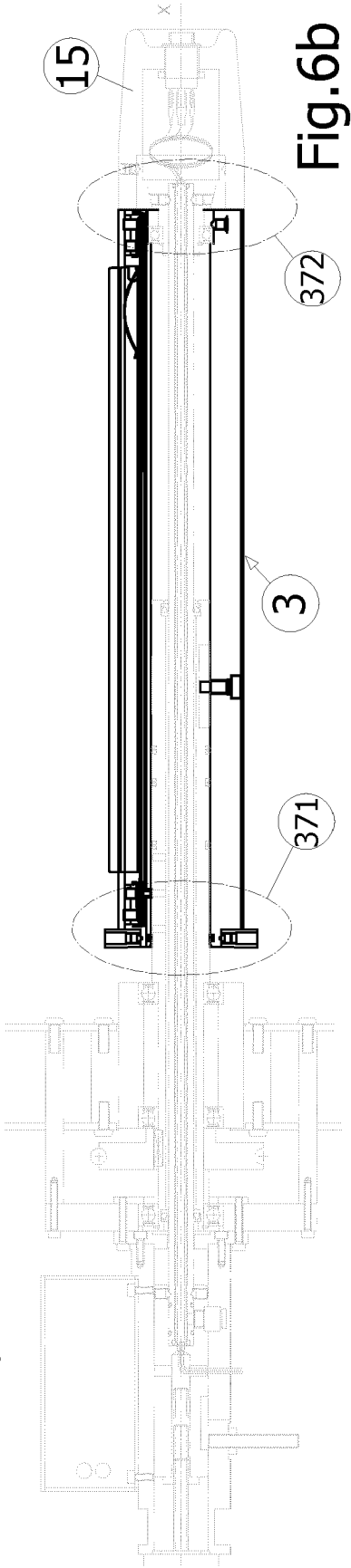
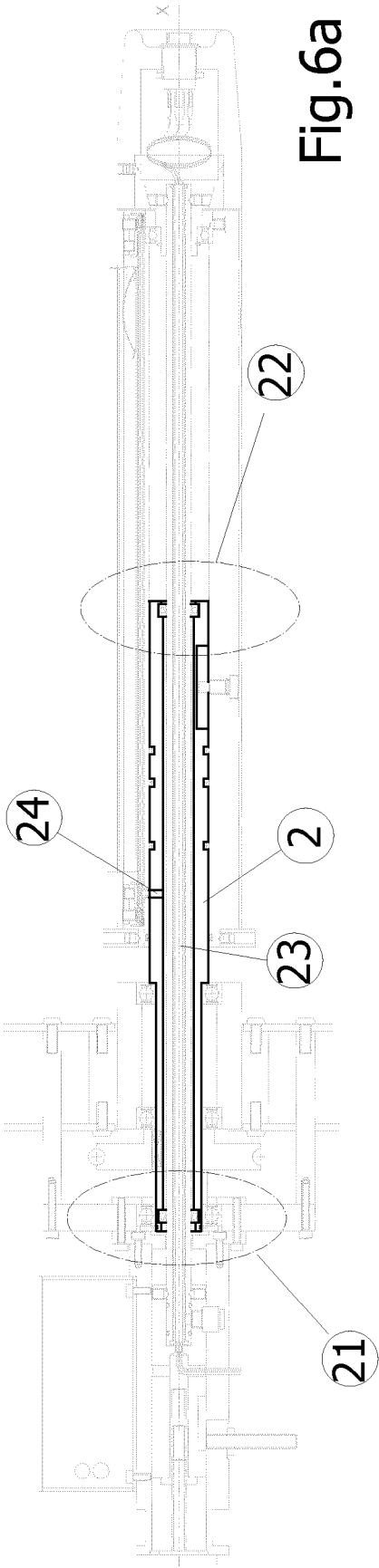
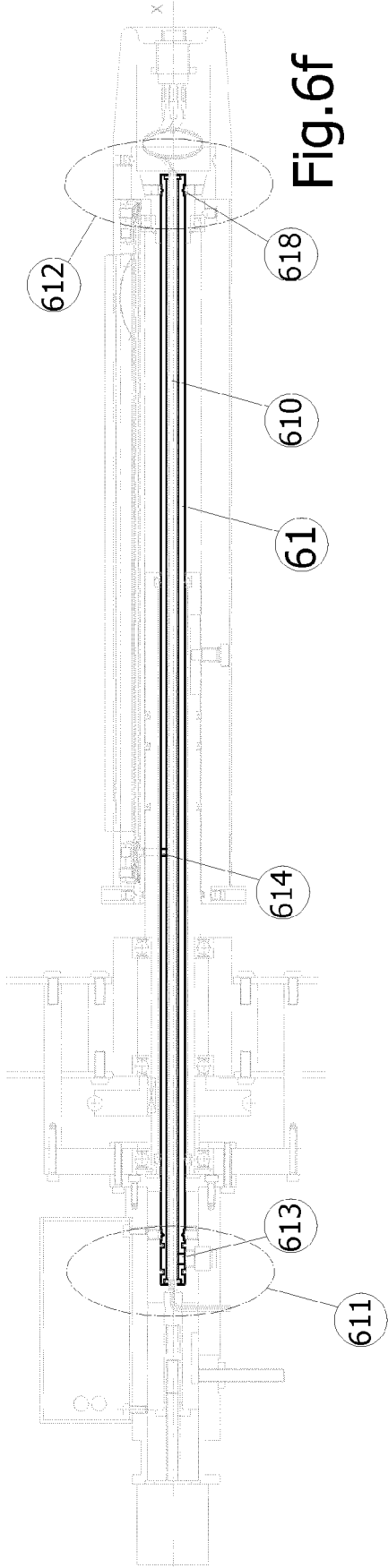
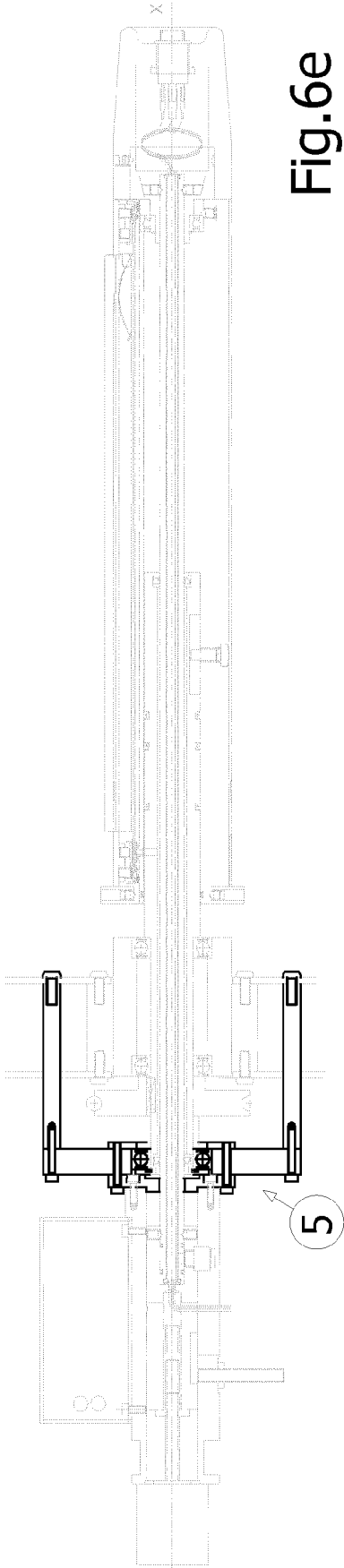
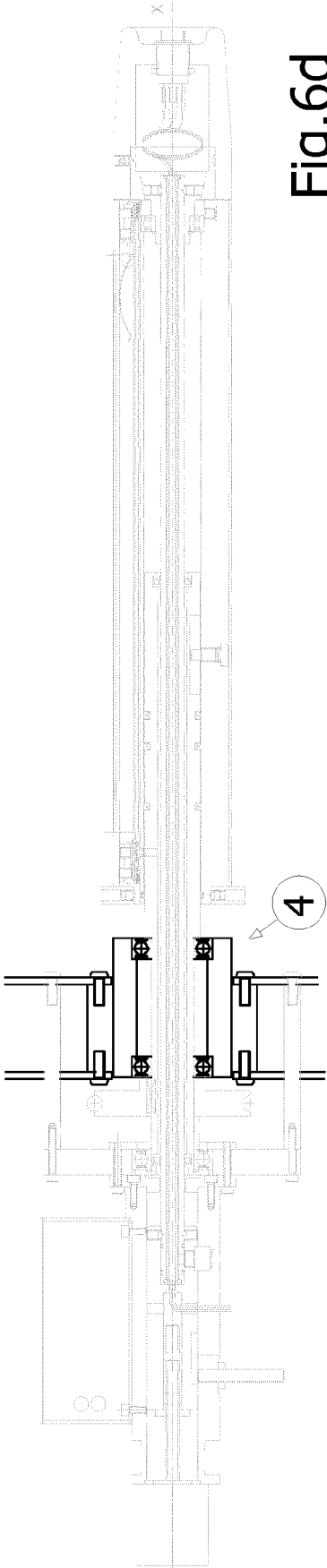
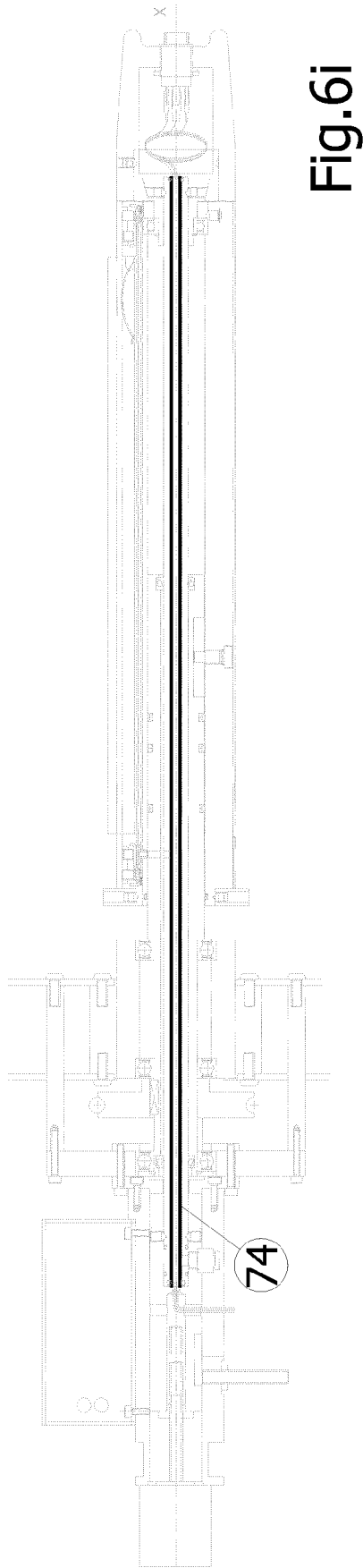
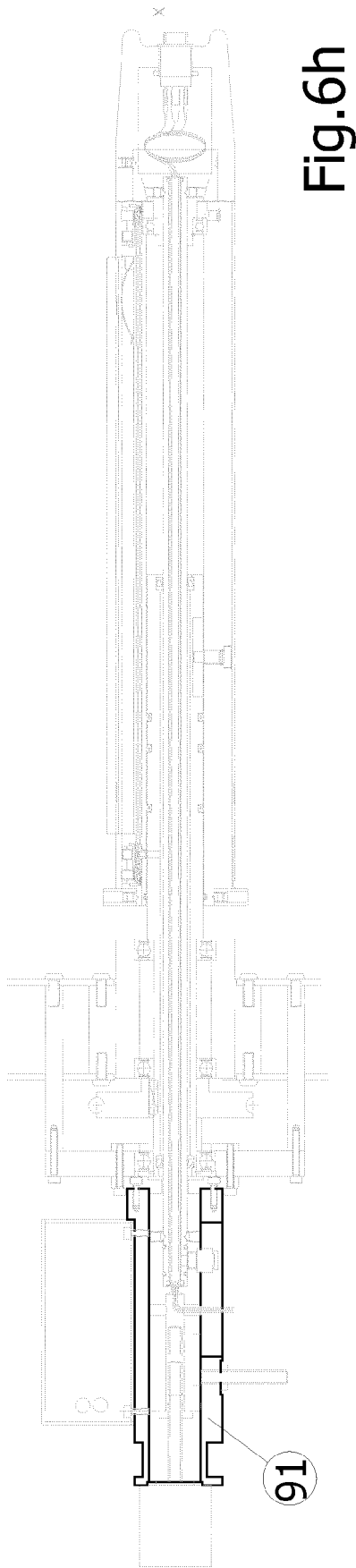
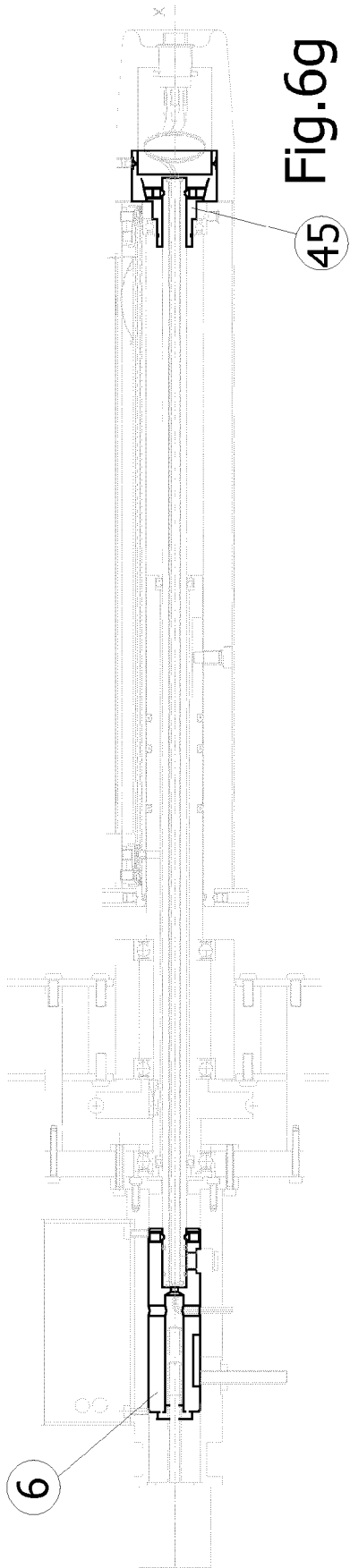


Fig. 5









EUROPEAN SEARCH REPORT

Application Number

EP 23 16 4252

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EPO FORM 1503 03.82 (P04C01)

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2017/334676 A1 (ZAUN JOCHEN [DE]) 23 November 2017 (2017-11-23) * the whole document *	1-10	INV. B65H54/28 B65H54/54 B65H75/24
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			TECHNICAL FIELDS SEARCHED (IPC)
			B65H
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 7 August 2023	Examiner Pussemier, Bart
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	

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

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5 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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07-08-2023

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