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(54) Linear hydraulic actuator

(57) A linear hydraulic actuator (1; 100), in particular for moving walkways in the nautical field, comprising an outer jacket (2; 101) defining a longitudinal axis (Y), provided with ends (2a; 101a, 101b) that are associated with the walkway, a stem (3; 102) able to slide inside the outer jacket (2; 101) along the longitudinal axis (Y) and provided with a piston (4; 103) that cooperates with a fluid inserted inside the outer jacket (2; 101) to move the walkway, and a pair of shaped heads (5, 6; 104; 105) made from synthetic plastic material, coupled with the ends (2a, 2b; 101a, 101b) of the outer jacket (2; 101) to achieve the seal.

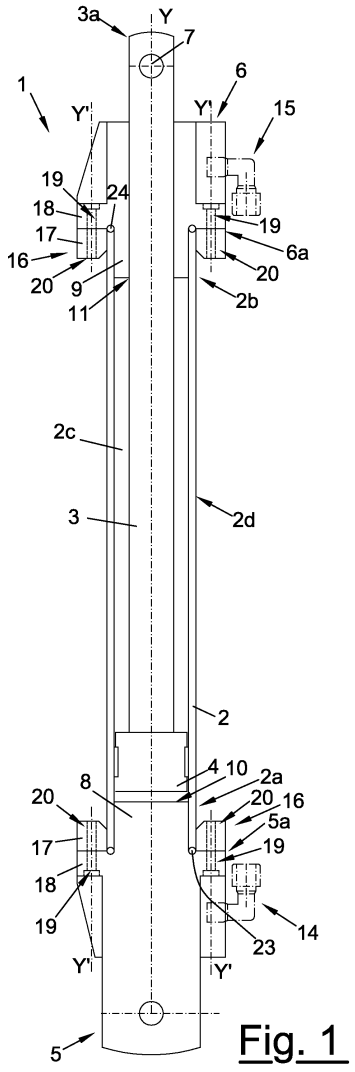

Fig. 1

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Description

[0001] The present invention concerns a linear hydraulic actuator, suitable, in the nautical field, in particular for moving walkways installed on boats of various types for people to board and disembark.

[0002] It is known that some boats, especially pleasure boats, such as yachts and the like, are provided with numerous accessories that make the time spent on them particularly comfortable.

[0003] Amongst these accessories walkways are extremely important, which are associated with the rear part of the boat to allow users to board and disembark easily and safely.

[0004] The types of walkways currently produced by the industry of the field are various and are distinguished from each other according to some criteria.

[0005] A first classification criterion makes it possible to distinguish between walkways actuated or moved automatically and manual walkways.

[0006] Another constructive characteristic according to which walkways are classified is linked to the type of installation on the boat, for which reason walkways are distinguished into external ones, which remain as such even when they are not needed to be used, and built in ones that, after use, are inserted into a suitable slit formed on the boat.

[0007] Moreover, some walkways are of the extending type, thanks to the provision of one or more flat elements each other telescopic, hence the name "telescopic walkways": this being irrespective of whether they are external or built in, automatic or manual.

[0008] Finally, there are so-called "rotary" walkways, i.e. with the possibility of rotating about an axis integral with the boat, thus allowing their use not only for the normal function for which they are intended but also as a crane for lifting/lowering bodies like rubber dinghies, jet skis and so on.

[0009] The invention outlined here is aimed, in particular, at automatic walkways, the moving of which takes place through single or double-effect linear hydraulic actuators, also known in mechanics as "hydraulic jacks" or "hydraulic pistons".

[0010] In the field of application concerned, fluid-dynamic linear actuators comprise a cylinder or jacket made from metallic material, which defines a longitudinal axis and has at least one end associated with the walkway.

[0011] For example, in built in non-rotary telescopic walkways, which therefore work exclusively according to the typically longitudinal plane of the boat, both of the ends of the cylinder are connected to the bottom wall of the walkway.

[0012] On the other hand, in the case of rotary walkways, which work both on a horizontal plane and on inclined planes, just one of the ends is connected to the bottom wall of the walkway, whereas the other is associated with a part of the boat.

[0013] The hydraulic actuator also comprises a stem made from metallic material, for example aluminium, able to slide inside the jacket along the quoted longitudinal axis and provided with a piston that cooperates, as known to the man skilled in the art, with the fluid, generally oil, introduced into the cylinder.

[0014] The hydraulic actuator of the type used for moving walkways also comprises a pair of shaped heads, each associated on one side with the respective end of the cylinder and on the other side with the support structure, as stated the walkway itself or a part of the boat.

[0015] According to the state of the art, the shaped heads are made from metallic material, usually steel. This involves costs that, keeping the other factors involved in the production of the actuators briefly described here unchanged, are high and result in an inevitable loss of competitiveness on the market for the producer.

[0016] One of the problems encountered in known hydraulic actuators for moving walkways is, therefore, connected to their production cost, with the assumption that, in order to obtain the desired mechanical performance, some components currently need to be built in a specific material that precludes any further reduction in costs.

[0017] Another problem associated with linear hydraulic actuators, strictly dependent upon the materials with which its component members are made, derives from their weight that is extremely high.

[0018] The present invention proposes to solve the problems of the prior art introduced here.

[0019] The primary purpose of the present invention is, therefore, to make linear hydraulic actuators for moving walkways in the nautical field that have a lower production cost than equivalent known actuators, where this is technically allowed and it does not cause a loss of efficiency in their operation.

[0020] A further purpose of the invention is to provide linear hydraulic actuators in the nautical field that are less heavy than actuators of the prior art.

[0021] The aforementioned purposes are achieved by a linear hydraulic actuator, in particular for moving walkways in the nautical field, according to the attached claim 1, to which we refer for the sake of brevity.

[0022] Advantageously, the provision, in linear hydraulic actuators for the nautical field, of shaped heads made from synthetic plastic material involves lower costs for materials and production apparatuses than the equivalent

prior art.

[0023] Advantageously, moreover, the linear hydraulic actuator according to the invention weighs less than similar known actuators.

[0024] Consequently, while keeping the other production factors involved the same, a reduction in the overall production costs compared to the prior art is obtained.

[0025] Further characteristics and features of the present invention shall become clearer from the following description, relating to preferred embodiments, given as

non-limiting examples, with reference to the attached tables of drawings, where:

- figure 1 is a side view of the hydraulic actuator according to the invention;
- figure 2 is a sectioned view of a first detail of figure 1;
- figure 3 is an axonometric view of a detail of figure 2;
- figure 4 is a second detail of figure 1;
- figure 5 is a plan view from below of figure 4;
- figure 6 is a partially sectioned and interrupted side view of a variant embodiment of the hydraulic actuator according to the invention;
- figure 7 is a sectioned view of a detail of figure 6.

[0026] The linear hydraulic actuator of the invention, suitable in particular for moving walkways in the nautical field, is shown in figure 1, where it is globally numbered with 1 .

[0027] It should be observed that the fluid-dynamic actuator 1 comprises an outer jacket 2 that defines a longitudinal axis Y, provided with an end 2a suitable for being associated with the walkway, not depicted.

[0028] In this case, the end 2b of the outer jacket 2 is associated with a suitable area of the rear wall of the boat: this takes place by connecting the appendix 3a of the stem 3 to such an area through a pin 7.

[0029] The constructive solution of the actuator 1 that derives from this is adopted should one wish for the walkway to be moved both on inclined and horizontal planes, promoting its use also as a crane.

[0030] In this solution, the moving fluid can irrespectively be single or double-acting.

[0031] The hydraulic actuator 1 also comprises a stem 3, able to slide inside the outer jacket 2 along the longitudinal axis Y and provided with a piston 4 that cooperates with a fluid, for example oil, not visible, inserted inside the outer jacket 2 to move the walkway.

[0032] The actuator 1 also comprises a pair of shaped heads 5, 6 respectively coupled with the ends 2a, 2b of the outer jacket 2 to achieve its seal.

[0033] According to the invention, the shaped heads 5, 6 are made from synthetic plastic material, exclusively preferably polyamide, also known by the trade name nylon.

[0034] Each of the shaped heads 5, 6 is provided at the side edge 5a, 6a with a projecting sleeve 8, 9 that is engaged inside the outer jacket 2.

[0035] Moreover, each of the shaped heads 5, 6 has a central opening 10, 11, coaxial to the longitudinal axis Y of the outer jacket 2 and communicating with the internal volume 2c defined by the outer jacket 2.

[0036] According to the preferred embodiment of the invention described here, both of the shaped heads 5, 6 have a side through opening 12, 13 communicating with the central opening 10, 11 and defining a respective transversal axis X', X" substantially perpendicular to the longitudinal axis Y of the outer jacket 2.

[0037] Figure 1 illustrates that, in this specific case, the central opening 11 of the shaped head 6 passes straight through and receives the stem 3 the appendix 2a of which remains projecting from the head 6.

[0038] Figure 1 also shows that the hydraulic actuator 1 comprises two tubular connectors 14, 15, each of which is inserted in the corresponding side opening 12, 13 of the shaped heads 5, 6 respectively.

[0039] The tubular connectors 14, 15 are arranged so as to place the internal volume 2c of the outer jacket 2 in communication with a hydraulic circulation unit of the fluid, for the sake of ease of explanation not represented, installed on board the boat.

[0040] Such a constructive provision defines a "double-effect" fluid actuator in which the entry of the fluid into the outer jacket 2 takes place alternatively through both of the shaped heads 5, 6 according to whether the walkway must be lifted or lowered.

[0041] There can be embodiments of the invention not illustrated in the following drawings, in which just one of the shaped heads has a side opening, with the consequence that the actuator shall comprise a single tubular connector associated with such a side opening.

[0042] This constructive configuration defines a "single-effect" linear hydraulic actuator.

[0043] Figure 1 shows that each of the shaped heads 5, 6 is connected to the jacket 2 through attachment means, wholly indicated with 16, which comprise:

- a nut 17, coupled on the outside with the side surface 2d of the outer jacket 2 and arranged close to a peripheral ring 18, present in each of the shaped heads 5, 6 and projecting from the side surface 2d of the outer jacket 2;
- a series of threaded through holes 19, more clearly visible in figures 3 and 5, made in the peripheral ring 18 of each of the shaped heads 5, 6 and defining longitudinal axes Y' parallel to each other and to the axis Y of the outer jacket 2;
- a plurality of threaded holes 20, made on the nut 17, coaxial to the through holes 19 of the peripheral ring 18;
- screw means, for the sake of simplicity of explanation not illustrated, engaging in the holes 19 of the peripheral ring 18 and in the holes 20 of the nut 17.

[0044] In other embodiments of the invention, not accompanied by reference drawings, the number of through holes in the peripheral ring of the shaped heads and of the corresponding holes in the nut can be different and in any case not less than two.

[0045] In figures 2 and 4, moreover, it can be seen that each of the shaped heads 5, 6, on the side edge 5a, 6a and at the projecting sleeve 8, 9, has an annular recess 21, 22 in which a sealing ring 23, 24 is received, visible in figure 1, which is arranged close to the thickness of the outer jacket 2.

[0046] Figure 6 shows a variant embodiment of the invention, in which the linear hydraulic actuator, wholly

numbered with 100, is different from the one described previously just for the application for which it is intended.

[0047] Indeed, the embodiment of the hydraulic actuator 100 is the typical one for which reason it is totally installed below the walkway, with both of the ends 101a, 101b of the outer jacket 101 associated with it.

[0048] The embodiment of the stem 102, equipped with the piston 103, is modified with respect to that of the stem 3 just for marginal constructive aspects, within the reach of the man skilled in the art.

[0049] Similarly, the shaped heads 104, 105, again made from synthetic plastic material, have constructive modifications of little importance with respect to those of the hydraulic actuator 1.

[0050] In the case of the shaped head 104, moreover, the system for joining to the walkway, wholly number with 106, is different from the one of the previous case, as can be seen in figure 7, in any case falling within the technical competence of the man skilled in the art in the nautical field.

[0051] The ways of operating the linear hydraulic actuators 1, 100 according to the invention follow the usual operating schemes currently available to the technology of the field.

[0052] Based upon what has been outlined above it can therefore be understood that the linear hydraulic actuator according to the invention accomplishes the predetermined purpose.

[0053] In particular, by making the shaped heads from synthetic plastic material instead of from metallic material, as foreseen in known linear hydraulic actuators, a saving in costs is obtained whilst keeping the other factors unchanged.

[0054] This is accompanied by the typical advantages associated with the use of plastic material instead of metallic material, like being lighter and a better ability for the components to resist atmospheric agents.

[0055] It should be understood that there can be embodiments of the invention in which just one of the shaped heads is made from synthetic plastic material.

[0056] Moreover, it should be specified that the piston associated with the stem can take any shape.

[0057] Finally, it is clear that numerous other variants can be brought to the linear hydraulic actuator in question, without for this reason departing from the novelty principles inherent to the inventive idea, just as it is clear that, in the practical embodiment of the invention, the materials, shapes and sizes of the illustrated details can, according to requirements, be replaced with others that are technically equivalent.

Claims

1. Linear hydraulic actuator (1; 100), in particular for moving walkways in the nautical field, comprising:

   - an outer jacket (2; 101) that defines a longitudinal axis (Y), provided with at least one end (2a; 101a, 101b) suitable for being associated with said walkway;
   - a stem (3; 102) able to slide inside said outer jacket (2; 101) along said longitudinal axis (Y) and provided with a piston (4; 103) suitable for cooperating with a fluid inserted inside said outer jacket (2; 101) to move said walkway;
   - a pair of shaped heads (5, 6; 104; 105), coupled with the ends (2a, 2b; 101a, 101b) of said outer jacket (2; 101) to achieve the seal of said outer jacket (2; 101);

   characterised in that at least one of said shaped heads (5, 6; 104; 105) is made from synthetic plastic material.

2. Actuator (1; 100) according to claim 1, **characterised in that** said synthetic plastic material comprises at least one polyamide.

3. Actuator (1; 100) according to claim 1, **characterised in that** each of said shaped heads (5, 6; 104; 105) is provided at the side edge (5a, 6a) with a projecting sleeve (8, 9) that is engaged inside said outer jacket (2; 101) .

4. Actuator (1; 100) according to claim 1, **characterised in that** each of said shaped heads (5, 6; 104; 105) is connected to said outer jacket (2; 101) through attachment means (16) that comprise:

   - a nut (17), coupled on the outside with the side surface (2d) of said outer jacket (2; 101) and arranged close to a peripheral ring (18), present in each of said shaped heads (5, 6; 104; 105) and projecting from said side surface (2d) of said outer jacket (2; 101);
   - at least two threaded through holes (19), made in said peripheral ring (18) of each of said shaped heads (5, 6; 104; 105) and defining longitudinal axes (Y') parallel to each other and to said longitudinal axis (Y) of said outer jacket (2; 101);
   - at least two threaded holes (20) made on said nut (17), coaxial to said through holes of said peripheral ring (18);
   - screw means, engaging in said holes (19, 20) of said peripheral ring (18) and of said nut (17).

5. Actuator (1; 100) according to claim 1, **characterised in that** at least one of said shaped heads (5, 6; 104; 105) has a central opening (10, 11) coaxial to said longitudinal axis (Y) of said outer jacket (2; 101) and in communication with the internal volume (2c) defined by said outer jacket (2; 101).

6. Actuator (1; 100) according to claim 5, **character-**

ised in that at least one of said shaped heads (5, 6; 104; 105) has a side through opening (12, 13) communicating with said central opening (10, 11) and defining a transversal axis (X', X") substantially perpendicular to said longitudinal axis (Y) of said outer jacket (2; 101).

7. Actuator (1; 100) according to claim 6, **characterised in that** it comprises at least one tubular connector (14, 15), inserted in said side opening (11, 12), suitable for placing said internal volume (2c) of said outer jacket (2; 101) in communication with a hydraulic circulation unit of said fluid.

8. Actuator (1; 100) according to claim 5, **characterised in that** said central openings (10, 11) of at least one of said shaped heads (5, 6; 104; 105) passes straight through and receives said stem (3; 102) the appendix (2a) of which remains projecting from said shaped head (6; 105) .

9. Actuator (1; 100) according to claim 3, **characterised in that** each of said shaped heads (5, 6; 104; 105), in said side edge (5a, 6a) and at said sleeve (8, 9), has an annular recess (21, 22) in which a sealing ring (23, 24) is received that is arranged close to the thickness of said outer jacket (2; 101).

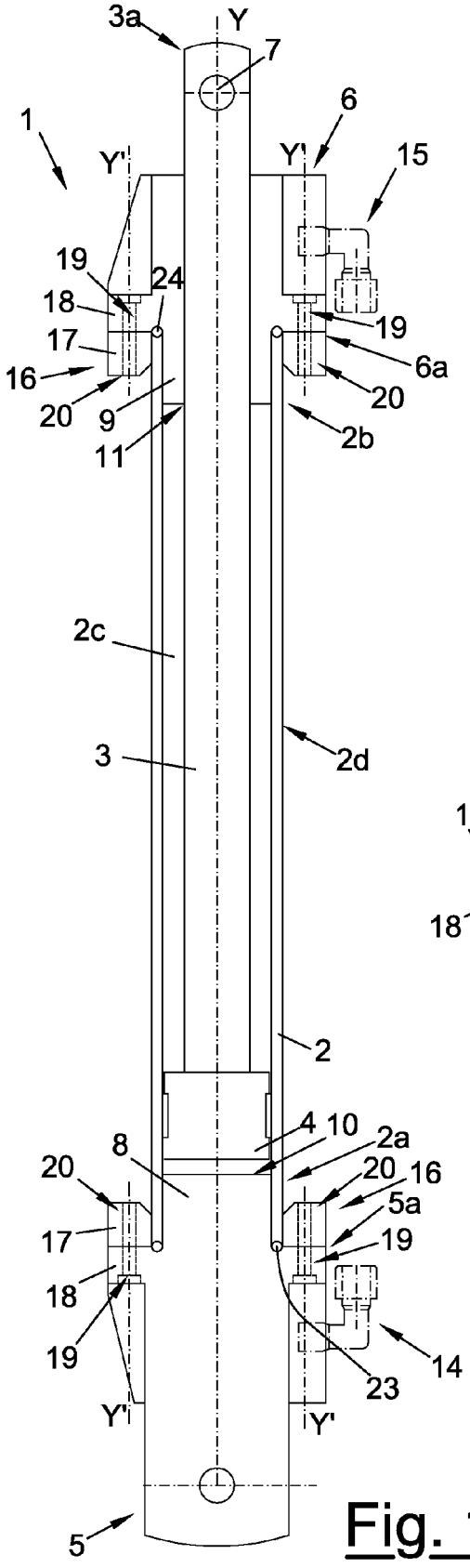

Fig. 1

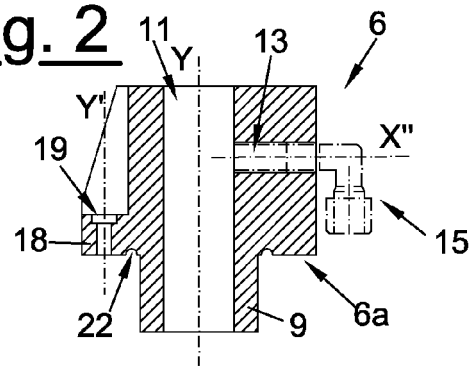

Fig. 2

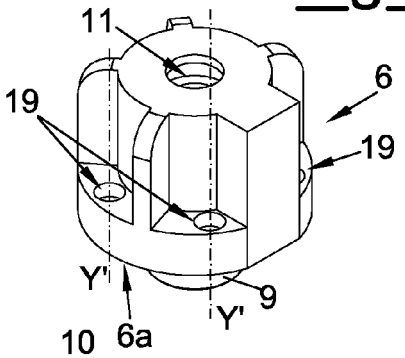

Fig. 3

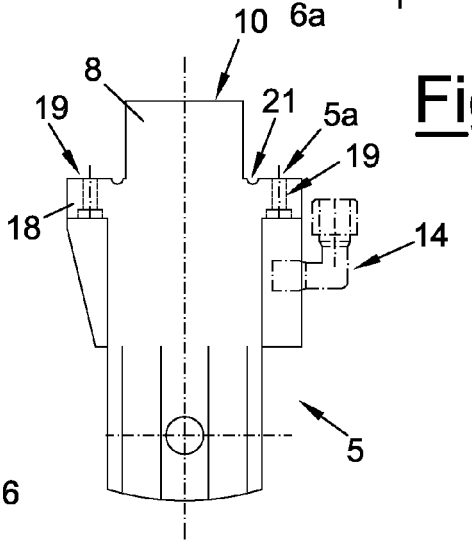

Fig. 4

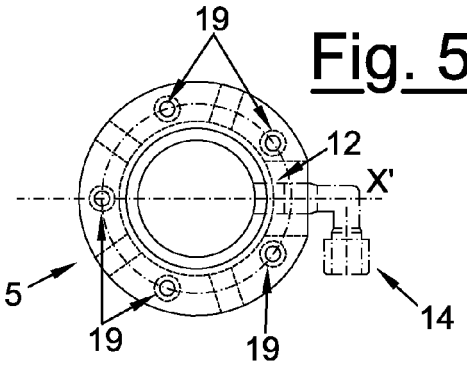

Fig. 5

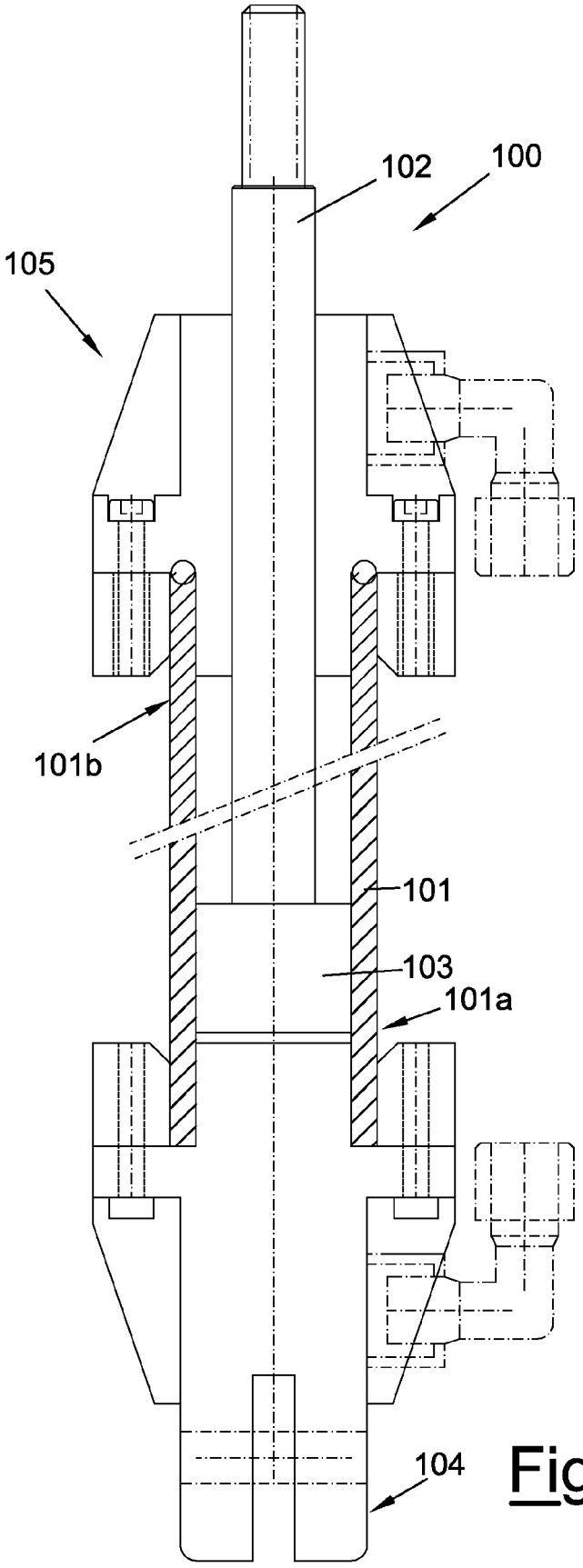

Fig. 6

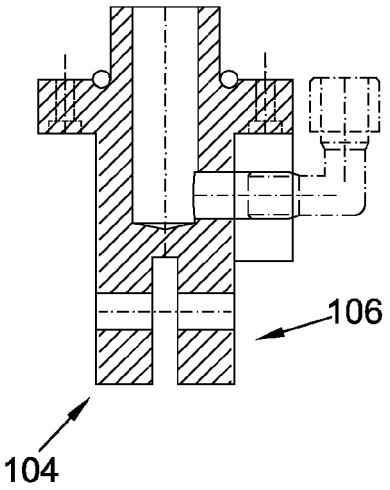

Fig. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 7816

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TECHNICAL FIELDS SEARCHED (IPC)

F15B
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	26 July 2007	Toffolo, Olivier

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