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(54) Benævnelse: **Styreanordning for et to-hjulet køretøj, navnlig en cykel med en front-affjedring**

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PATENT DESCRIPTION

Steering device of a two-wheeled vehicle, in particular a bicycle with a front suspension

The invention relates to a steering device of a two-wheeled vehicle, in particular a bicycle with a handlebar stem suspension according to the preamble of Claim 1.

A generally known steering device of a two-wheeled vehicle, in particular a bicycle has a frame-side head tube in which a fork stem of a front wheel fork is pivotably accommodated. A threaded headset in which an adjustment ring is screwed onto the fork stem or alternatively a threadless headset having a clamping sleeve is used for securing the position of the fork stem in the head tube and for setting a bearing play. When using a threaded headset the fork stem ends at the top side of the head tube whilst in the case of a threadless headset the fork stem projects upwards out of the head tube where it is held where applicable with the interposition of rings as so-called spacers by means of a clamping sleeve of the handlebar stem.

In order to increase the cycling comfort with a two-wheeled vehicle, in particular with a bicycle, suspension systems are generally known for the handlebar stems and/or saddle supports and/or forks and/or rear suspensions. Sprung front-wheel forks are mostly configured here as telescopic forks and consist substantially of a fork bridge as well as stand or dip tubes with suspension and/or damping elements. The fork stem is positioned centrally on the fork bridge and is mounted in pivotal manner in the steering head bearing in the head tube. The dip tubes are arranged opposite one another on the fork bridge and when travelling over uneven ground and/or during braking manoeuvres project into the associated stand tubes. At the lower end of the stand tubes lies the front wheel hub and mostly on one side a brake body, for example a brake disc for a front wheel brake. A characteristic of a telescopic fork of this kind is the large spring path, in particular during braking decelerations which results disadvantageously in a reduction in the coasting time and the control angle. Mounting the front wheel brake on one side furthermore disadvantageously leads to entanglement in the front wheel fork during braking. These properties lead to a reduction in the cycling stability and additionally

increase the wear on the sliding surfaces of the stand and dip tubes so that there are high maintenance costs.

A fundamentally different type of handlebar stem suspension is further known in which a telescopic fork is not used but rather a rigid fork and the handlebar with its front stem is mounted in a resiliently resetting manner with respect to the head tube when travelling over uneven ground and/or during braking manoeuvres. For this the handlebar stem suspension has a telescopic arrangement in which a handlebar stem arrangement consists of a vertical handlebar stem shaft and a horizontal handlebar stem supporting the handlebars, and the handlebar stem shaft is accommodated secured against rotation and resiliently supported in the fork stem. The handlebar stem arrangement comprising the vertical handlebar stem shaft and the horizontal handlebar stem can be made in one piece or two pieces. Embodiments are known for this (EP 3 115 289 A1; DE 297 15 537 U2; CZ 993 U1) in which relatively complicated and expensive arrangements of spiral springs are used which are contained in the fork stem and which are to be covered and sealed with respect to the surroundings. The installation space available for the spring assemblies in the fork stem is only very restricted so that the freedom for configuring the arrangement of several spiral springs is only very low. It is further known to arrange instead a spiral spring assembly in the fork stem an elastomer body on which a handlebar stem shaft is resiliently supported in a telescopic arrangement (FR 1.312.987).

A steering device of the generic type of a two-wheeled vehicle, in particular a bicycle with a handlebar stem suspension according to the preamble of Claim 1 is further known (see document DE 9207057U1) having a frame-side head tube in which a fork stem of a front wheel fork is pivotably accommodated, with a threaded headset in which an adjustment ring is screwed onto the fork stem or alternatively with a threadless headset having a clamping sleeve both for securing the position of the fork stem in the head tube and for setting a bearing play. The handlebar stem suspension has a telescopic arrangement in which a handlebar stem shaft of a handlebar stem arrangement consisting of a vertical handlebar stem shaft and a horizontal handlebar stem is accommodated in a torsion-proof manner and

supported resiliently in the fork stem. For resiliently supporting the handlebar stem between the adjustment ring or alternatively between the clamping sleeve and the handlebar stem there is arranged an elastomer annular element having free circumferential surfaces through which elastomer annular element the handlebar stem shaft is guided and led further into the fork stem such that in the event of a travel-induced supporting force on the handlebar stem the handlebar stem shaft dips into the fork stem wherein the elastomer annular element is deformable in a resetting manner.

The object of the invention is to further develop a steering device of the generic type of a two-wheel vehicle, in particular a bicycle with a handlebar stem suspension, through a simple functionally reliable arrangement for securing the position and for adjusting the prestress.

This is achieved with the features of Claim 1.

According to Claim 1 a screw is guided from above through a bore in the handlebar stem shaft, the screw being screwed into a rebound stop part which is supported from below on an annular stop in the fork stem, wherein a screw head is supported at the top on the handlebar stem. This rebound stop part has the function of a pull-out lock for the handlebar stem shaft at the top. Prestress can thus be applied in the elastomer annular element which can be adjusted in size dependent on the screw-in position. The response behaviour of the handlebar stem suspension can thus be adapted and adjusted both by the dimensioning of the elastomer annular element, as regards its geometry and elastomer material, as well as by the prestress which is set.

The term “elastomer” is in this context a collective term for elastically deformable materials, in particular for rubber, PUR or similar materials.

The elastomer annular element can be practically wear-free and maintenance-free wherein the passage of the handlebar stem shaft through the elastomer annular element can be tight and close-fitting so that no further sealing measures are

required. Through the free circumferential surfaces of the elastomer annular element the elastomer material can be deformed relatively freely during compression and can buckle at the circumferential surfaces so that there is a relatively great freedom available for design, in particular relatively large spring paths are also possible. The spring paths are here conditioned by design lower than in the case of all-terrain bicycles than mountain bikes with telescopic front wheel forks. With the handlebar stem suspension structured more simply compared to these, it is possible to improve the cycling comfort in the case of two-wheeled vehicles, in particular bicycles which are driven over relatively flat cycle paths in town or country areas. They can also preferably be used also in electric cycles, so-called E-bikes which are comparatively heavy owing to the electric drive and in which the cycling comfort can be noticeably increased with a handlebar stem suspension according to the invention.

The elastomer annular element can be easily made from polyurethane as a PUR annular damper with a cylindrical basic shape, where applicable with circumferential indentations. The rebound stop part can also be configured as an elastomer buffer in which in particular a stable core with internal thread has a pad of elastomer material.

The elastomer annular element has expediently an upper and a lower flat supporting surface wherein the handlebar stem and the adjustment ring or alternatively the clamping sleeve in each case have an associated flat supporting surface of approximately identical area.

In a concrete configuration the torsion-proof telescopic arrangement is constructed in such a manner that the handlebar stem shaft has a non-circular, preferably square cross section in the form of a square shaft. A corresponding tubular inner contour is fixedly provided in the fork stem as a receiving contour in which the handlebar stem shaft lying on sliding surfaces can dip and be displaced longitudinally. Thus, a steering moment can be transferred from the handlebar via the handlebar stem and handlebar stem shaft to the fork stem in conjunction with a longitudinal displacement of the telescopic arrangement. The tubular inner contour with the

sliding surfaces is preferably provided in a bushing which is mounted fixedly, in particular pressed or screwed, in the fork stem. A bushing of this kind can advantageously be mounted in a commercially available front wheel fork as an initial fitting and where applicable also as a subsequent retrofit.

For easy guiding, the sliding surfaces in the tubular inner contour are formed in a particularly preferred further development by needle bearings. In the case of a square cross section of the tubular inner contour four needle bearings are arranged correspondingly square with needles arranged rotatable in the axial direction one above the other.

The axial length of the elastomer annular element can be in the non-prestressed state between 10% to 50%, preferably between 20% to 30% of the length of the head tube, whereby on the one hand spring paths can be achieved which improve the cycling comfort, and on the other hand the handlebar stem suspension does not unfavourably change the usual customary appearance of the entire bicycle.

As already mentioned, the handlebar stem suspension according to the invention can be used both in conjunction with a threaded headset or alternatively with a clamping sleeve, a so-called Ahead-system. With a conventional generally known Ahead system the clamping sleeve is a component part of the handlebar stem. In conjunction with the handlebar stem suspension according to the invention however the clamping sleeve is a separate component with the elastomer annular element arranged above same and can where applicable be extended upwards as an adapter, configured in such manner that the cross section of the fork stem (not the fork stem) is continued upwards and there, as well as where applicable in the upper region of the fork stem the telescopic arrangement is formed with a displaceable handlebar stem shaft, the sliding surfaces, where applicable with a mounted bushing and needle bearings, and the rebound stop part. The elastomer annular element is then arranged between the adapter as an extension of the clamping sleeve and the handlebar stem. An adapter design of this kind is particularly simple and can be used cost-effectively as a retrofit part with which a two-wheeled vehicle, in particular a bicycle, can be fitted with a handlebar stem suspension in a workshop

or in a do-it-yourself mode.

Embodiments of the invention will now be explained in further detail with reference to the drawings in which:

Fig. 1 shows a perspective view in the region of a frame-side head tube of a bicycle with a handlebar stem suspension;

Fig. 2 shows a vertical longitudinal section through the illustration in Fig. 1;

Fig. 3 shows an exploded view of the individual parts;

Figs. 4,5,6 show sectional views of the assembly sequence;

Fig. 7 shows a sprung state of the handlebar stem suspension according to Fig. 2; and

Fig. 8 shows a sectional view of an alternative second embodiment.

Fig. 1 shows the perspective view of a bicycle 1 in the region of a frame-side head tube 2, with a front wheel fork 3 pivotably accommodated in the head tube 2 and with a handlebar stem 4, wherein a handlebar which can be mounted on the handlebar stem 4 is not shown.

The individual parts of a first embodiment will now be explained below using a sectional view according to Fig. 2 of a fully assembled handlebar stem suspension as well as an exploded view according to Fig. 3.

An upper headset 5 with an upper bearing disc and a clamping ring, as well as a lower headset 6 are accommodated in the frame-side head tube 2.

A fork stem 7 of a front wheel fork 3 is pivotably accommodated in the head tube

2 or in the upper and lower headset 5, 6 wherein an adjustment ring 8 with an internal thread is screwed onto the fork stem 7 which has an outer counter thread (the threads are not shown in detail) and is supported on the clamping ring of the upper headset 5 whereby the fork stem 7 can be secured in position in the head tube 2 in conjunction with setting a bearing play. This first embodiment according to Figs. 1 to 6 can thus be a configuration with a threaded headset in which the adjustment ring is screwed onto the fork stem 7.

A tubular stop 9 is formed with an axial bore in the fork stem 7 in a central longitudinal region. A bushing is mounted fixedly, in particular pressed or screwed, as a sliding bushing 10 above this in the fork stem 7. The sliding bushing 10 has for this a cylindrical outer surface as well as a tubular inner contour 11 with square cross section on which sliding surfaces 12 are formed by four inserted needle bearings 13.

The handlebar stem 4 is a component part of a handlebar stem assembly 14 which moreover has a vertical handlebar stem shaft 15 with a 4-edge outer contour associated with the inner contour 11. A bore 16 having a lower bore expansion of larger diameter than the bolt guide 17 extends through the handlebar stem shaft 15.

A rebound stop part 18 which is supported with a plate part 19, where applicable with an elastomer pad, on the stop 9 from below in the fork stem 7, is inserted from below into the fork stem 7. The rebound stop part 18 is held with a long screw 20 which is pushed from above through the bore 16 of the handlebar stem shaft and is screwed into an internal thread of an upwardly protruding bolt 21 of the rebound stop part 18 wherein the bolt 21 engages into the bolt guide 17.

Between the adjustment ring 8 having an upper flat supporting surface 22 and the handlebar stem having a lower flat supporting surface 23 is inserted with corresponding counter surfaces an elastomer annular element 24 of cylindrical basic shape as a PUR annular damper, here with circumferential annular grooves, in which depending on the screwed-in position a prestress can be applied with the screw 20.

The individual assembly steps will now be explained in further detail below with reference to the sectional drawings:

Fig. 4 shows the sliding bushing 10 already fixed in the fork stem. The needle bearings 13 are furthermore inserted for forming a square inner contour in the sliding bushing 10. The adjustment ring 8 is further already screwed onto the fork stem 7 at the top whereby the upper headset 5 and the lower headset 6 are tensioned against one another, so that the fork stem 7 is secured from sliding out downwards and a bearing play is set.

In Fig. 5 the elastomer annular element 24 is further placed on the adjustment ring 8. The handlebar stem arrangement 14 is set up with its handlebar stem 15 as a square shaft to be inserted through the elastomer annular element 24 into the sliding bushing 10 with its sliding surfaces 12 out from the needle bearings 13.

Fig. 6 shows the handlebar stem 15 already inserted into the sliding bushing 10 and lying with its lower supporting surface 23 at the top on the elastomer annular element 24. The rebound stop part 18 is now inserted from below into the fork stem 7 so far until its plate part 19 bears against the stop 9 from underneath wherein the bolt 21 protrudes with its inner thread upwards through the stop 9. The long screw 20 is then inserted from above down through the bore 16 and is screwed with an outer thread into the bolt 21 of the rebound stop part 18, wherein the bolt 21 engages in the lower bolt guide 17 of the handlebar stem shaft 15. The screw 20 is now screwed in so far until the parts bear against one another and where applicable a prestress is built up in the elastomer annular element 24. The assembling of the handlebar stem suspension is thus concluded and its basic position set, as shown in Fig. 2.

Fig. 7 shows a compressed state of the handlebar stem suspension: through a cycling-induced force on the handlebars (not shown) and thus the handlebar stem 4 the latter is loaded from above so that the handlebar stem shaft 15 dips into the sliding bushing 10 again whereby the elastomer annular element 24 is compressed

and deformed. The plate part 19 of the rebound stop part 18 withdraws down from the stop 9 corresponding to the spring path. A force load triggered from above, for example by an uneven ground, is absorbed elastically damped which obviously increases the cycling comfort. At the end of the force action a return to the preceding basic position takes place again through the resetting action of the elastomer annular element 24.

Fig. 8 shows a second embodiment in a sectional view in which a threadless upper headset 5 is used without an adjustment ring as a so-called Ahead system. The fork stem 7 then projects with an overhang 25 upwards over the head tube 2. This overhang 25 is enclosed by a clamping sleeve 26. After the clamping sleeve 26 is fixedly screwed onto the overhang 25 the fork stem 7 is secured against pulling out downwards and the bearing play can be set.

In order to achieve the handlebar stem suspension according to the invention the elastomer annular element 24 can be inserted between the clamping sleeve 26 and the supporting surface 23 of the handlebar stem 4 wherein the remaining parts can be arranged corresponding to the first embodiment in the fork stem 7, in particular in the overhang 25.

In the embodiment shown in Fig. 8 however an extension 27 for forming an adapter 28 adjoins the clamping sleeve 26 fixedly connected at the top so that the components for the handlebar stem suspension, in particular the sliding bushing 10 and the fork stem 7 dipping therein, are arranged substantially in the region of the adapter 28. A handlebar stem suspension with adapter 28 is thus particularly well suited for fitting out/ retrofitting a standard bicycle with an Ahead system.

PATENTKRAV

1. Styreanordning for et to-hjulet køretøj, navnlig en cykel med en styrestangsaffjedring, med et ramme-side styrerør (2), i hvilket en gaffelstamme (7) for en forhjulsgaffel (3) svingbart er modtaget, med et gevindstyresæt, i hvilket der er indskruet en indstillingsring (8) på gaffelstammen (7) eller alternativt med en klembøsning (26) til henholdsvis positionssikring af gaffelstammen (7) i styrerøret (2) og til indstilling af et lejespillerum, hvorved styrestangsaffjedringen omfatter et teleskopisk arrangement, i hvilket en styrestammeaksel (15) i et styrestammearrangement (14), der består af en lodret styrestammeaksel (15) samt en horisontal styrestamme (4), er modtaget torsionssikret og fjedrende understøttet i gaffelstammen (7),
hvorved der med henblik på elastisk understøtning af styrestammen (4) mellem indstillingsringen (8) eller alternativt mellem klembøsningen (26) og styrestammen (4) er arrangeret et elastomer-ringelement (24) med frie periferiflader, gennem hvilket elastomer-ringelement styrestangsakslen (15) er ført og videreledet ind i gaffelstammen (7), således at, ved en kørselsbetinget understøtningskraft på styrestammen (4), styrestangsakslen (15) dykker ind i gaffelstammen (7), hvorved elastomer-ringelementet (24) kan deformeres på tilbagestillende måde, **kendetegnet ved, at** en skrue (20) fra oven er ført gennem en boring i styrestammen (15), hvilken skrue er skruet ind i en rebound-anslagsdel (18), som fra neden er understøttet på et ringformet anslag (9) i gaffelstammen (7) som en udtrækningssikring og til anlægning af en indstillelig forspænding på elastomer-ringelementet (24).

2. Styreanordning ifølge krav 1, **kendetegnet ved, at** elastomer-ringelementet (24) er en PUR-ringdæmper, og/eller **ved, at** rebound-anslagsdelen (18) er udformet som en elastomer-buffer.

3. Styreanordning ifølge krav 1 eller 2, **kendetegnet ved, at** elastomer-ringelementet (24) omfatter en øvre og en nedre, flad understøtningsflade, og **ved, at** styrestammen og den respektive indstillingsring eller alternativt klem-

bøsningen omfatter en tilknyttet, flad understøtningsflade (22, 23) med cirka samme areal.

4. Styreanordning ifølge et af kravene 1 til 3, **kendetegnet ved, at** det vridningssikre, teleskopiske arrangement er konstrueret på en sådan måde, at styrestangsakslen (15) har et ikke-cirkulært, fortrinsvis et kvadratisk, tværsnit som en firkantaksel, og

ved, at der i gaffelstammen (7) foreligger en tilsvarende, rørformet, indre kontur (11), i hvilken styrestangsakslen (15), som ligger an mod glidefladerne (12), kan dykke ned og forskydes i længderetningen.

5. Styreanordning ifølge krav 4, **kendetegnet ved, at** den rørformede, indre kontur er frembragt med glidefladerne (12), navnlig med et kvadratisk tværsnit i en bøsning som glidebøsning (10), der er fastmonteret, navnlig presset eller indskruet i gaffelskaftet (7).

6. Styreanordning ifølge krav 4 eller 5, **kendetegnet ved, at** glidefladerne (12) i den rørformede inderkontur (10) er dannet af nålelejer (13).

7. Styreanordning ifølge et af kravene 1 til 6, **kendetegnet ved, at** den aksiale længde af elastomer-ringelementet (24) i den ikke-forspændte tilstand er mellem 10 % og 50 %, fortrinsvis mellem 20 % og 30 % af styrerørets (2) længde.

8. Styreanordning ifølge et af kravene 1 til 7, **kendetegnet ved, at,** ved en udførelsesform med et gevindløst styresæt samt en klembøsning (26), sidstnævnte forlænges som en adapter (28) opad på en sådan måde, at gaffelstammens (7) tværsnit ledes længere opad deri, og der, og eventuelt i gaffelstammens (7) øvre område, det teleskopiske arrangement med den forskydelige styrestangsaksel (15) med glidefladerne (12) eventuelt er udformet med nålelejer (13) i en monteret bøsning (10) og udtrækningsanslaget (9, 18),

og

ved, at elastomer-ringelementet (24) er arrangeret mellem adapteren (28) og styrestammen (4).

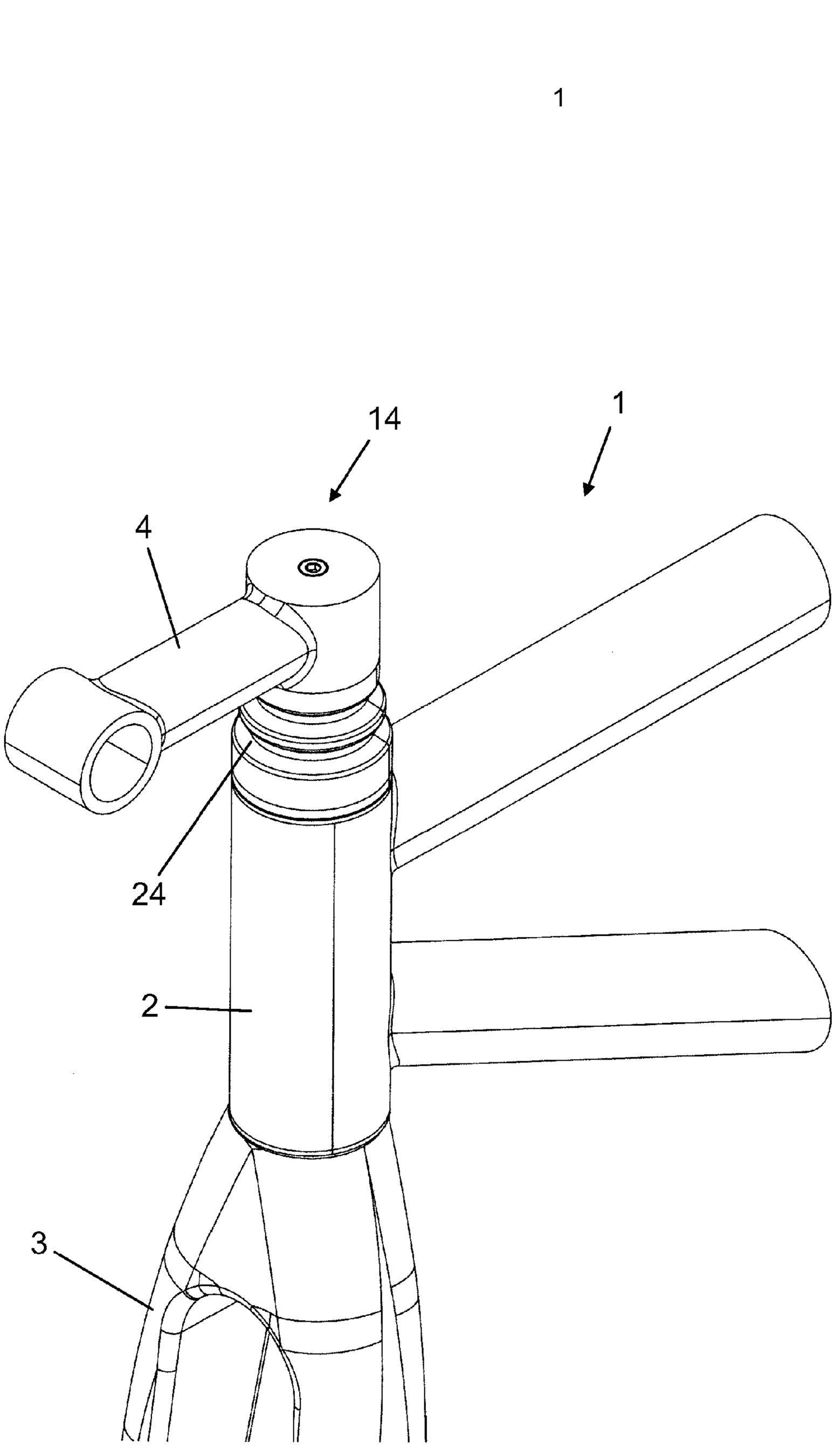

Fig. 1

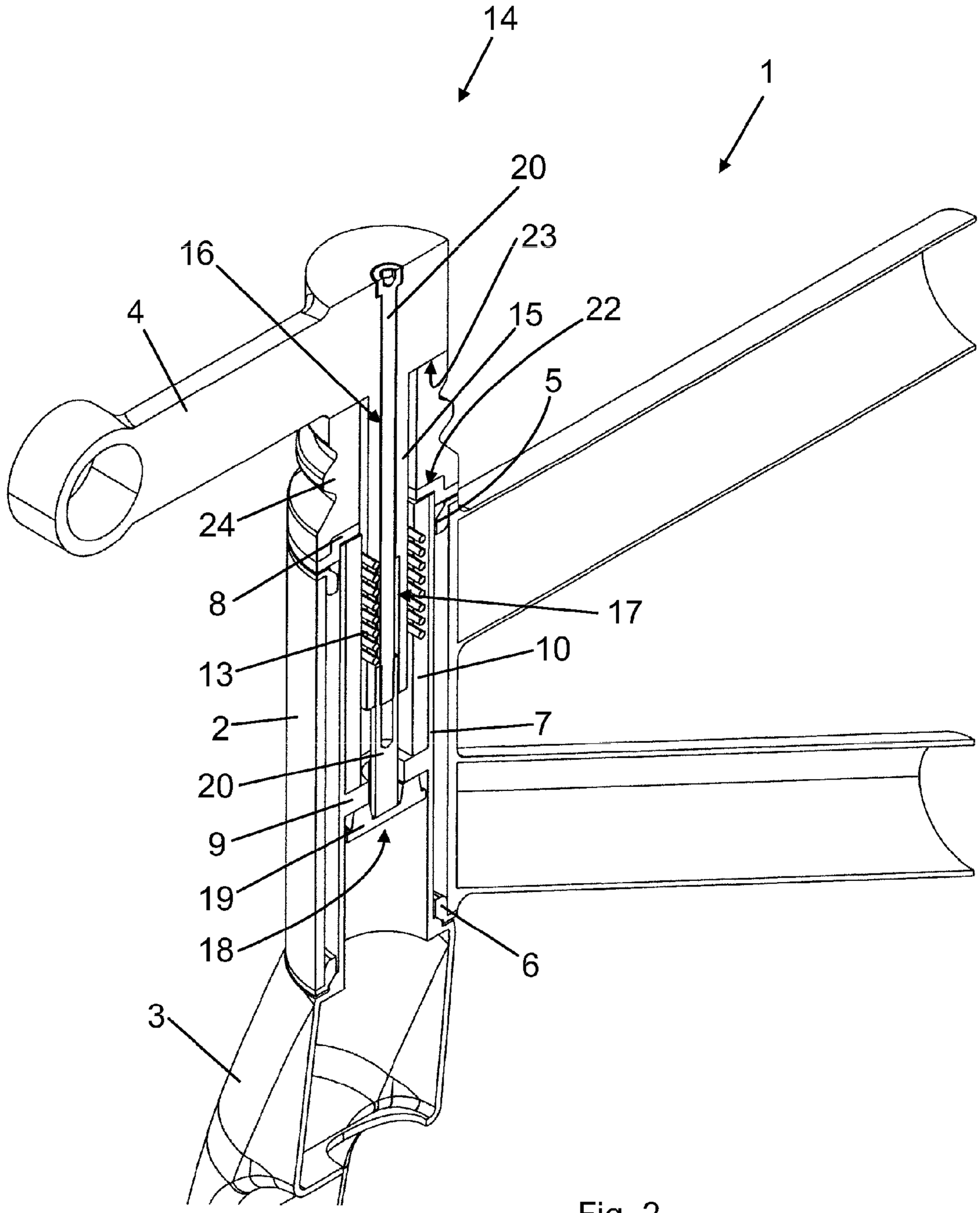

Fig. 2

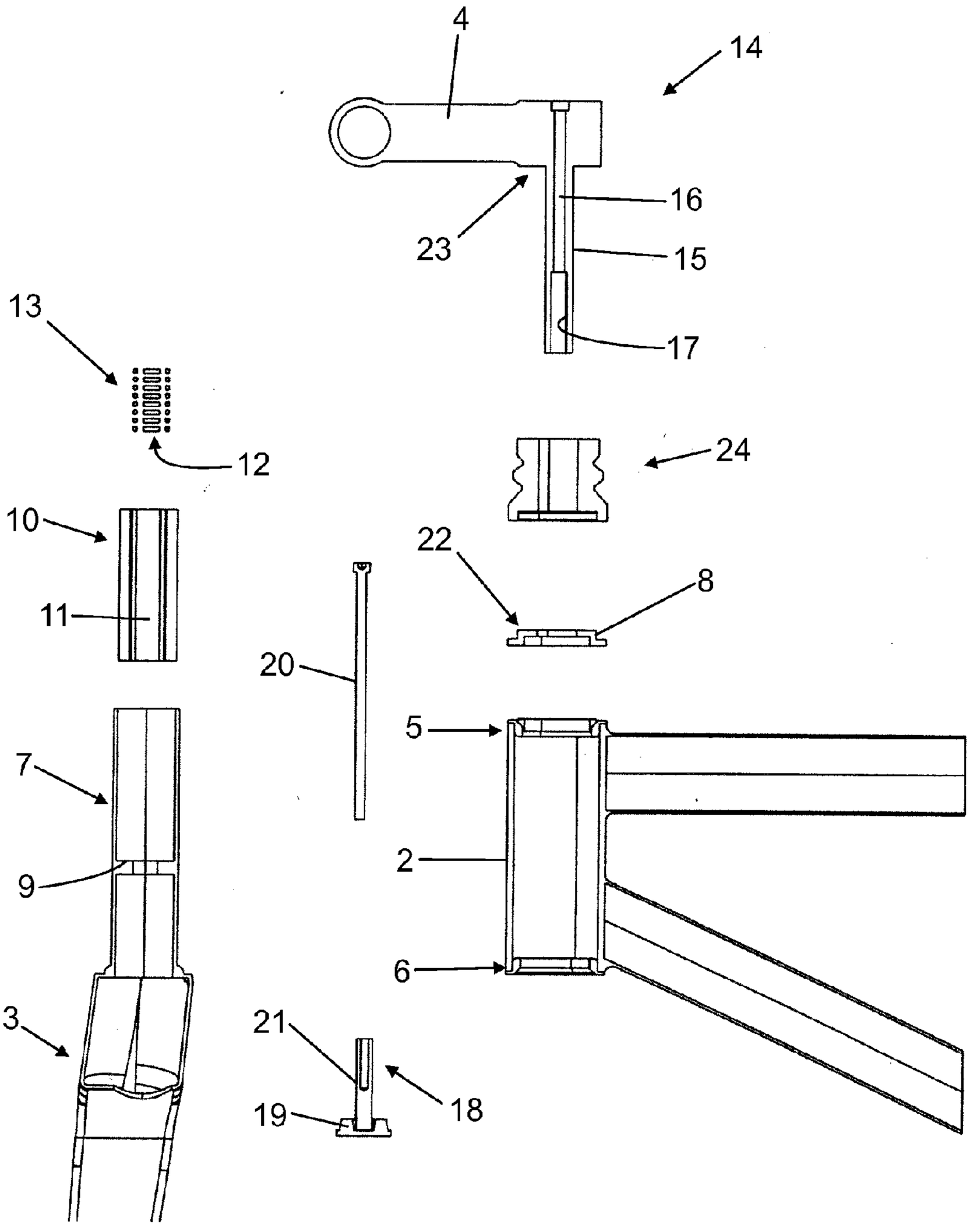

Fig. 3

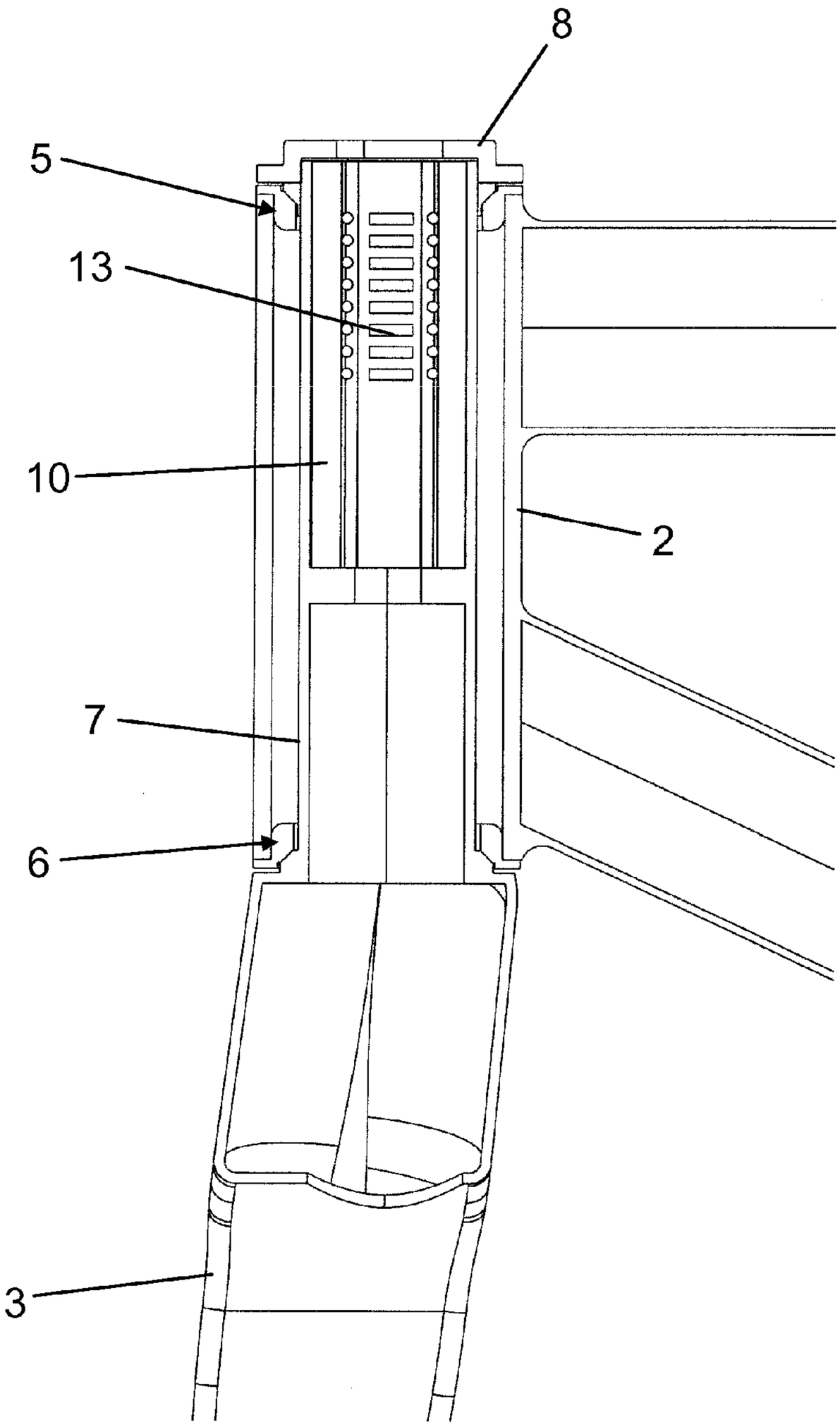

Fig. 4

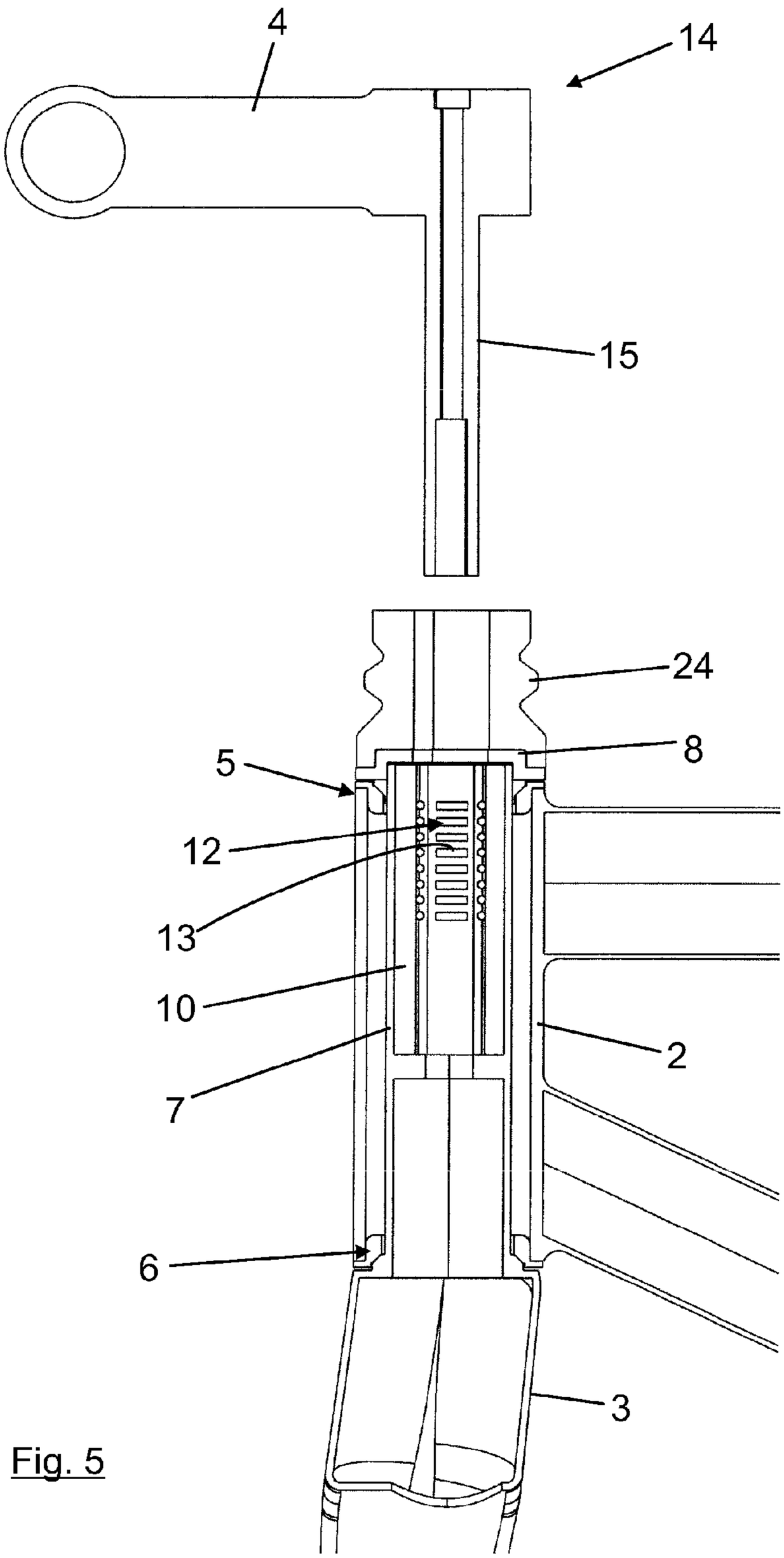

Fig. 5

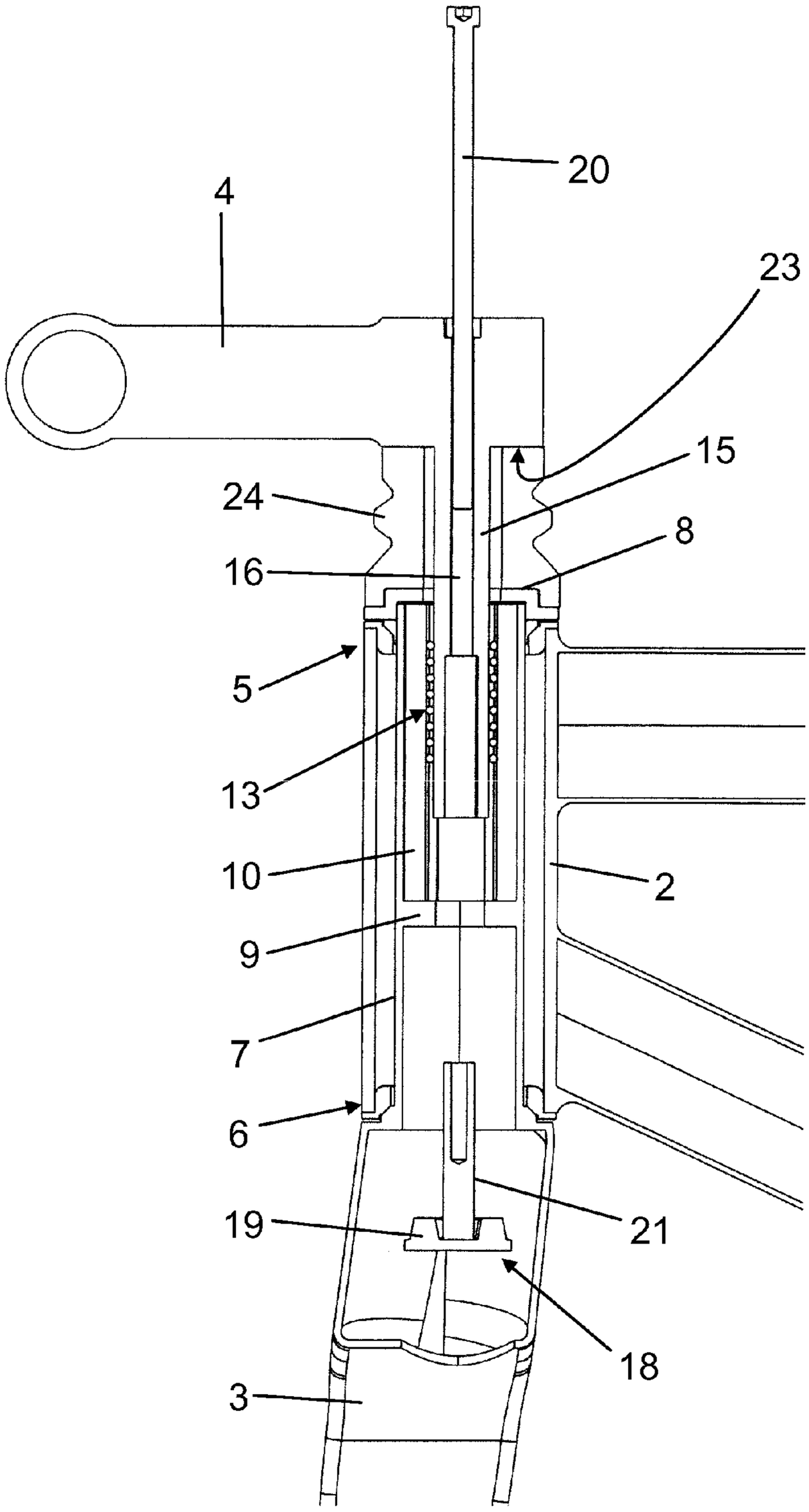

Fig. 6

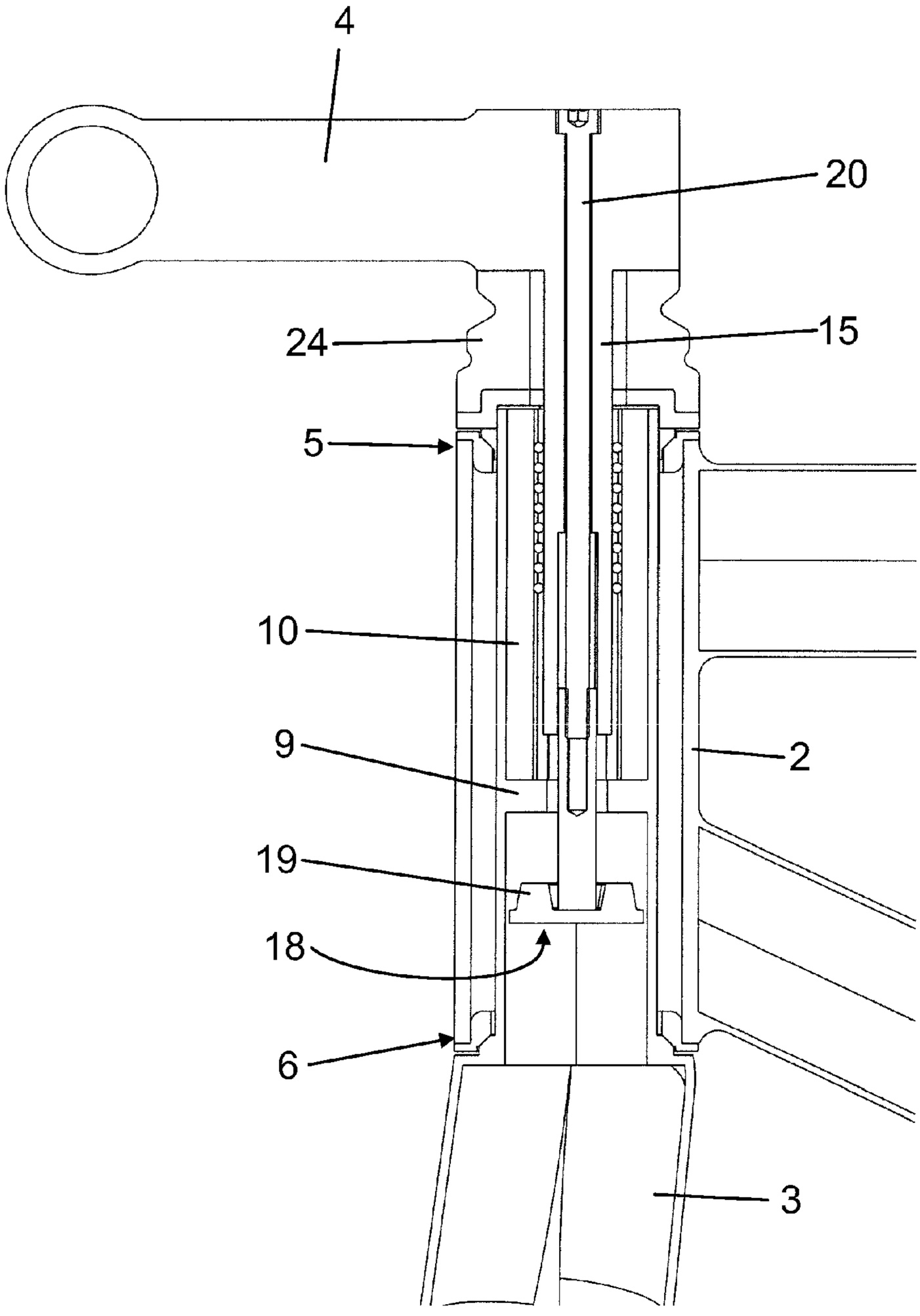

Fig. 7

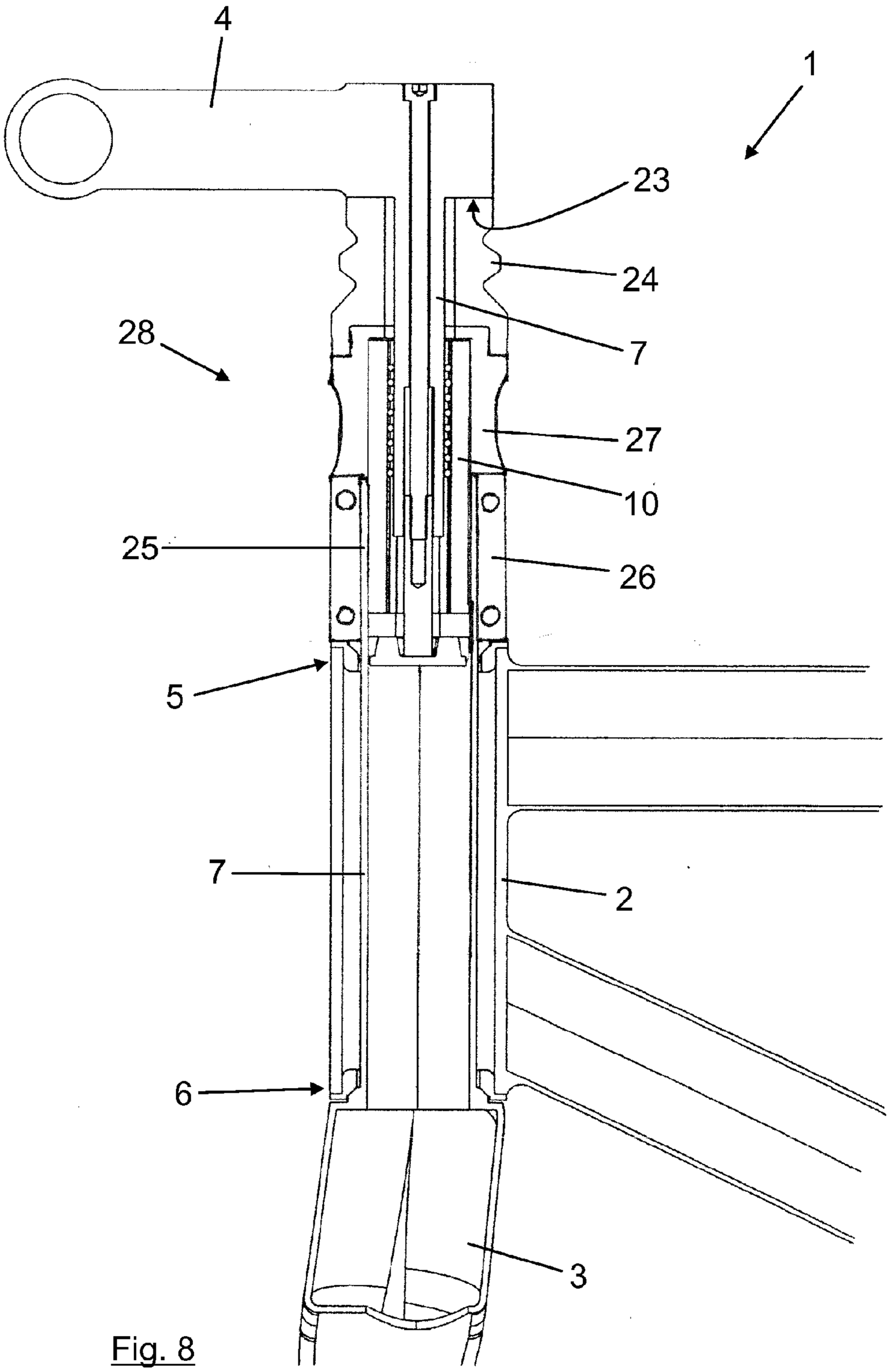

Fig. 8