

(19)



(11)

EP 1 473 466 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
24.01.2007 Bulletin 2007/04

(51) Int Cl.:
F15B 15/16 ^(2006.01) **F15B 15/26** ^(2006.01)

(21) Application number: **04010277.4**

(22) Date of filing: **30.04.2004**

(54) **Telescopic cylinder**

Teleskopzylinder

Cylindre télescopique

(84) Designated Contracting States:
DE DK FR GB

(30) Priority: **01.05.2003 DK 200300658**

(43) Date of publication of application:
03.11.2004 Bulletin 2004/45

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US-A- 4 516 468 **US-A- 4 951 552**

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Description

Field of the Invention

[0001] The present invention concerns a telescopic cylinder including an outer cylinder tube in which is coaxially arranged a number of displacing inner cylinder tubes and at least one ball catch and where ball catch includes at least one locking ball, at least one ball seat and at least one compression spring said ball catch is arranged with at least two locking positions, a first locking position where the said locking ball engages the ball seat and a second locking position where the locking ball is released from the said ball seat and engages a surrounding recess.

Background of the Invention

[0002] By using telescopic cylinders for e.g. elevating platforms, there are two principles by which a telescopic cylinder can be used.

[0003] In the first principle, a telescopic cylinder with a displacing cylinder is used, so that this cylinder/piston rod is the only one that may be extended from the cylinder. This implies that in order to achieve a great elevating height for the elevating platform, a telescopic cylinder of a certain length is to be used, and therefore there is to be used pivoting fastening mechanisms for the telescopic cylinder so that it may turn in relation to the elevating platform when extended.

[0004] With the second principle, a telescopic cylinder with several cylinder tubes and a piston rod is used. This provides the advantage that the telescopic cylinder does not need to be very high since there are several cylinder tubes that may be extended, and finally a piston rod is extended. The problem with this type is, however, that there may be leakages at the transitions between the cylinder tubes, and that these are very sensitive and therefore unstable, whereby uneven lifting of items on the elevating platform may occur.

[0005] On many elevating platforms, the latter principle is used, where a telescopic cylinder with plural cylinder tubes is used as the individual cylinder tubes do not need to be so long, and therefore, some space is saved simultaneously with the elevating platform can be made more simple.

[0006] In order to use a telescopic cylinder with a plurality of cylinder tubes, it is important that control is effected as to when the cylinder tubes are extended, and that they are held fast in the desired positions during extension, and when the telescopic cylinder is extended. Such a cylinder is described in US 4,951,552 which discloses a telescopic cylinder with a cylinder tube and a piston rod, where between the piston rod and the cylinder tube there is provided a ball catch providing that the piston rod, when placed in the extreme position, is retained so that no unanticipated compacting of the telescopic cylinder occurs.

[0007] This is a part of the problem wanted to be solved. Another part is that when the telescopic cylinder is extended, it is important that it is extended in stages so that the telescopic cylinder is extended with the cylinder tubes having the greatest diameter at first, after which the lesser cylinder tubes are extended, and subsequently the piston rod is extended. This furthermore causes that less oil is consumed for extending the piston rod simultaneously with the telescopic cylinder achieves an even and stable extension.

[0008] EP-A-0 581 270 discloses a telescopic cylinder of the type mentioned by way of introduction. The cylinder comprises a number of piston cylinders each of which is closed with a piston head. In each piston head a valve arrangement is provided in order to ensure that hydraulic medium might be transferred from one enclosed piston cylinder chamber to the next enclosed piston cylinder chamber. However the ball catch disclosed is only able to control the contraction whereas the extension is controlled by use of a valve arrangement. Therefore it is necessary to operate the valves in order to control movement of the piston cylinder.

Object of the Invention

[0009] The object of the invention is therefore to optimise a telescopic cylinder so that it is possible to automatically control extension and contraction of the cylinder tube of the telescopic cylinder, whereby a stable and secure operation of the telescopic cylinder is ensured without the need of operating valve arrangements.

[0010] This is achieved with a telescopic cylinder according to the preamble of claim 1, and being peculiar in that a piston rod is arranged displacing and internally of the innermost of the said inner cylinder tubes, that the ball catch in the first locking position fixes the piston rod to the innermost cylinder tube, and that oil pressure on the piston rod and the inner cylinder tubes causes the locking ball to be automatically pressed out into the surrounding recess so that it will always be the cylinder tube with the greatest diameter which is pressed up at first, after which cylinder tubes with less diameter will be pressed up, and at last the piston rod will be pressed up.

Description of the invention

[0011] In order to control the extension and to contract the cylinder tube/piston rod of the telescopic cylinder, a ball catch is used. Such a ball catch is typically designed with a locking ball which is disposed either in a cutout or a hole and a ball seat which engages the locking ball during extension of the inner cylinder tube/piston rod.

[0012] When the inner cylinder tube/piston rod is coming into the desired position, the locking ball will fall out in a recess in the surrounding cylinder tube/top part, providing that the locking ball is released from the ball seat, whereby it locks the two inner cylinder tubes together and/or releases the inner cylinder tube.

[0013] The principle of the invention involving that the ball catch in the first locking position fixes the piston rod to the innermost cylinder tube implies that it is possible to control the extension, so that it will always be the cylinder tube with the greatest diameter which is pressed up at first, after which cylinder tubes with less diameter will be pressed up, and at last the piston rod will be pressed up. This implies a stable transfer of the pressing force from the telescopic cylinder to e.g. the arms of an elevating platform. The cylinder tubes are provided without piston heads and thus there will be no need for valves to control the contraction/extension.

[0014] In the case where the ball catch of the telescopic cylinder is used for locking the piston rod fixed in a certain position, the ball catch functions as described in US 4,951,552.

[0015] In the case where the ball catch of the telescopic cylinder is used mechanically for retaining the piston rod in the inner cylinder tube while this cylinder tube is extended, the ball catch is designed so that it has a first locking position where the locking ball engages the ball seat, whereby e.g. the inner cylinder tube and the piston rod on which the ball seat is secured, are kept together so long that the inner cylinder tube is extended.

[0016] In the second locking position where the locking ball is released from the ball seat and engages a surrounding recess which e.g. is formed by a projection in the top part and an upper end of the inner cylinder tube.

[0017] As the locking ball is released from the ball seat it is enabled that the cylinder tube/piston rod may now be pressed further up through the inner cylinder tube.

[0018] The recess in the top part is surrounding internally and is designed so that irrespectively how many balls there are provided on the piston rod, these will always fall out in the surrounding recess. Oil pressure on the piston rod and the inner cylinder tube causes the locking balls to be automatically pressed out into that surrounding recess.

[0019] In an alternative embodiment of the invention, the ball catch is fixing an inner cylinder tube to a surrounding cylinder tube at the first locking position, implying that the telescopic cylinder can be provided with more than one ball catch, so that the ball catch principle may furthermore be used between two inner cylinder tubes.

[0020] In order to get the opposite effect when the telescopic cylinder is to be contracted, the compression spring is arranged for in mainly unloaded state to support and to lift the ball seat off the surrounding recess.

[0021] This entails that when the telescopic cylinder is to be contracted, the opposite effect is achieved by the piston rod being pressed down into the inner cylinder tube at first, after which an inner cylinder tube is pressed down in the succeeding number of cylinder tubes and at last into the outer cylinder tube.

[0022] This implies in turn that the telescopic cylinder and thereby the elevating platform is provided an even and calm movement.

[0023] In order to avoid that the ball catch is to be ac-

tivated too early and thereby cause that the locking ball immediately falls into the ball seat, thus connecting and pressing down piston rod and inner cylinder tube in the wrong order, it is important that the compression spring placed between a locking ring and a lower end of the piston rod are supporting the piston rod in an unloaded condition and thereby prevent the ball seat from coming so far down that it will be disposed opposite to the locking ball lodged in the surrounding recess in the top part, causing that the locking ball will fall out of the recess and engage the ball seat instead.

[0024] This compression spring will only keep the ball seat free from the locking ball and the surrounding recess as long as the piston rod is pressed down, but as soon as the piston rod is in a bottom position, and the inner cylinder tube is applied a downwards force, the lower part of the piston rod will compress the spring, and thereby the ball seat is moved past the surrounding recess of the top part, and the locking ball will fall into the ball seat and engage and thus connect the piston rod to the cylinder tube.

[0025] In a preferred embodiment of the invention, the telescopic cylinder is designed so that it includes an outer cylinder tube with one top part, an intermediate inner cylinder tube, an inner cylinder tube and a piston rod and a corresponding number of ball catches therebetween.

[0026] In this embodiment of the invention, the telescopic cylinder can extend an inner cylinder tube and the piston rod so that the extension of the telescopic cylinder can occur in two steps.

[0027] As there are ball catches between the inner cylinder tube and piston rod and between the intermediate inner cylinder tube, it is ensured that the telescopic cylinder is always extended/compressed in the right order.

[0028] An alternative to that can be a number of inner cylinder tubes that finally end in a piston rod, and between which there are a corresponding number of ball catches. This implies that by means of a moderate oil pressure it is possible to extend the piston rod some distance from the outer cylinder tube of the telescopic cylinder.

[0029] A further alternative may be a telescopic cylinder that includes an outer cylinder tube with top part, a number of inner cylinder tubes and a piston rod which is disposed displacing internally of one of the cylinder tubes which in turn are disposed displacing in the outer cylinder tube, where between piston rod and inner cylinder tube or the outer cylinder tube there is designed a ball catch that includes at least one locking ball, at least one ball seat, a number of locking rings and at least one compression spring, where the ball catch has two locking positions including a first locking position where the locking ball engages the ball seat at a lower end of the piston rod or a lower end of one of the inner cylinder tubes, a second locking position where the locking ball is released from the ball seat and engages a surrounding recess in the top part, the recess being formed between a projection in the top part and an upper end of the inner cylinder tube.

[0030] Telescopic cylinders, mainly for elevating platforms, are described, but the invention may find application elsewhere, where e.g. an article, or the like, is to be lifted to a certain height, but where there is no great free height under the article, and where an arrangement with a long telescopic cylinder is not possible. It may e.g. be telescopic cylinders for car lifts, boat lifts etc.

Short Description of the Drawings

[0031] The invention is explained in more detail in the following with reference to the drawing, where:

- Fig. 1 shows a picture series of a telescopic cylinder according to the invention;
- Fig. 2 shows a picture series of the cross-section of the telescopic cylinder in Fig. 1;
- Fig. 3 shows a cross-section of a ball catch in a first locking position according to the invention;
- Fig. 4 shows a cross-section of the ball catch in a first position between the first locking position and the second locking position; and
- Fig. 5 shows a cross-section of a ball catch in a second locking position.

Detailed Description of the Invention

[0032] On Fig. 1 is seen a series of pictures of a telescopic cylinder 1 that includes an outer cylinder tube 2 and an intermediate inner cylinder tube 3 and an inner cylinder tube 4, and on the telescopic cylinder 1 to the left an upper part of the piston rod 5 can be seen by an upper part of the cylinder tube 4. On the intermediate picture of the telescopic cylinder 1 is seen how the inner cylinder tube 4 is extended, and piston rod 5 is retained at a fixed position in relation to the cylinder tube 4. On the picture to the right is seen how cylinder tube 4 is fully extended, after which extension of piston rod 5 has been initiated.

[0033] Fig. 2 shows a cross-section of telescopic cylinder 1 at the same position as in Fig. 1, where on the picture to the left is seen how piston rod 5 is retained by means of ball catch 7 in the inner cylinder tube 4, while the inner cylinder tube 4 is extended from the intermediate cylinder tube 3 up through the top part 6. On the intermediate picture is seen telescopic cylinder 1 where the inner cylinder tube 4 is extended in full length, and on telescopic cylinder 1 to the right is seen how ball catch 7 is actuated in the top part 6 so that it is possible to extend piston rod 5 out through the inner cylinder tube 4, but this inner cylinder tube is kept fixed in relation to the intermediate inner cylinder tube 3.

[0034] On Fig. 3 is shown a cross-section of ball catch 7 that includes a locking ball 8, a ball seat 9, a number of locking rings 12 and a compression spring 10. Ball catch 7 is in a first locking position where locking ball 8 engages the ball seat 9, whereby the piston rod 5 is locked to the inner cylinder tube 4. A part of the locking

ball 8 is situated in hole 13 so that an oil pressure on a lower part of the piston rod 5 will cause the inner cylinder tube 4 to be extended simultaneously. On the picture is furthermore seen how the surrounding recess 11 in the top part 6 is formed by a projection 14 in the top part 6 and an upper end 15 of the intermediate cylinder tube 3.

[0035] On Fig. 4 is shown how ball catch 7 is disposed in a position between the first locking position and the second locking position, from which appears that locking ball 8 is about to leave the ball seat 9 in order to be pressed out into the surrounding recess 11 in the top part 6. Locking ball 8 leaves the ball seat 9 by means of the oil pressure used for extending the inner cylinder tube 4 and piston rod 5.

[0036] On Fig. 5 is seen ball catch 7 in the second locking position where locking ball 8 is entirely released from the ball seat 9 and is engaging the surrounding recess 11 so that locking ball 8 retains the inner cylinder tube 4 in a fixed position relative to the intermediate cylinder tube 3, but allows piston rod 5 to be further extended.

[0037] The compression spring 10 is here in a preferably unloaded condition and may, if there is no pressure on e.g. piston rod 5, hold ball seat 9 off the surrounding recess 11 in the top part 6 so that locking ball 8 cannot fall back in engagement with the ball seat 9.

[0038] This entails it is ensured that the piston rod 5 will be the first which is depressed, only when it has reached completely into cylinder tube 4, the lower part of the piston rod 5 will compress the compression spring 10 so that the ball seat 9 becomes disposed opposite to the surrounding recess 11 in the top part 6, and the locking ball 8 will fall back and engage the ball seat 9, whereby the inner cylinder tube 4 is released so that it can be pressed further down into the intermediate inner cylinder tube 3 simultaneously with the piston rod 5 being secured to the inner cylinder tube 4.

[0039] On Fig. 6 is shown how ball catch 7 is still placed in the second locking position, where locking ball 8 engages the surrounding recess 11 while piston rod 5 is further extended through the inner cylinder tube 4.

Claims

1. Telescopic cylinder (1) including an outer cylinder tube (2) in which is coaxially arranged a number of displacing inner cylinder tubes (3, 4) and at least one ball catch (7), and where ball catch (7) includes at least one locking ball (8), at least one ball seat (9) and at least one compression spring (10), said ball catch (7) is arranged with at least two locking positions, a first locking position where the said locking ball (8) engages the ball seat (9) and a second locking position where the locking ball (8) is released from the said ball seat (9) and engages a surrounding recess (11), **characterised in that** a piston rod (5) is arranged displacing and internally of the innermost

- (4) of the said inner cylinder tubes (3,4), that the ball catch (7) in the first locking position fixes the piston rod (5) to the innermost cylinder tube(4), and that oil pressure on the piston rod (5) and the inner cylinder tubes (3,4) causes the locking ball (8) to be automatically pressed out into the surrounding recess (11) so that it will always be the cylinder tube with the greatest diameter which is pressed up at first, after which cylinder tubes with less diameter will be pressed up, and at last the piston rod (5) will be pressed up.
2. Telescopic cylinder (1) according to claim 1, **characterised in that** the ball catch (7) in the first locking position fixes the piston rod (5) to the innermost cylinder tube (4).
3. Telescopic cylinder (1) according to claim 1, **characterised in that** the ball catch (7) in the first locking position fixes an inner cylinder tube to a surrounding inner cylinder tube.
4. Telescopic cylinder (1) according to any of claims 1 -3, **characterised in that** in a mainly unloaded state, the compression spring (10) is adapted to support and lift the ball seat (9) off the surrounding recess (11).
5. Telescopic cylinder (1) according to claim 1, 2 or 4, **characterised in** including one outer cylinder tube (2) with one top part (6), one intermediate inner cylinder tube (3), one inner cylinder tube (4) and one piston rod (5) and a corresponding number of ball catches (7) therebetween.
- druck auf die Kolbenstange (5) und die inneren Zylinderröhre (3, 4) die Verschlusskugel (8) automatisch in die umgebende Ausnehmung (11) hinausdrückt, so dass immer das Zylinderrohr mit dem größten Durchmesser zuerst hochgedrückt wird und danach die Zylinderrohre mit geringeren Durchmessern hochgedrückt werden und zum Schluss die Kolbenstange (5) hochgedrückt wird.
2. Teleskopzylinder (1) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Kugelrastung (7) in der ersten Verschlussposition die Kolbenstange (5) an der innersten Zylinderrohre (4) befestigt.
3. Teleskopzylinder (1) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** die Kugelrastung (7) in der ersten Verschlussposition eine innere Zylinderröhre mit einer umgebenden inneren Zylinderröhre verbindet.
4. Teleskopzylinder (1) gemäß wenigstens einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** in einem im Wesentlichen unbelasteten Zustand die Verdichtungsfeder (10) so verbunden wird, dass sie die Kugelaufnahme (9) unterstützt und von der sie umgebenden Ausnehmung (11) abhebt.
5. Teleskopzylinder (1) gemäß Anspruch 1, 2 oder 4, **dadurch gekennzeichnet, dass** eine äußere Zylinderröhre (2) mit einem oberen Teil (6), eine zwischenliegende innere Zylinderröhre (3), eine innere Zylinderröhre (4) und eine Kolbenstange (5) und eine entsprechende Anzahl von Kugelrastungen (7) hierzwischen umfasst.

Patentansprüche

1. Teleskopzylinder (1) umfassend ein äußeres Zylinderrohr (2), in welchem eine Zahl von versetzt positionierten inneren Zylinderrohren (3, 4) koaxial und mindestens eine Kugelrastung (7) angeordnet sind und wobei die Kugelrastung (7) wenigstens eine Verschlusskugel (8), wenigstens eine Kugelaufnahme (9) und wenigstens eine Verdichtungsfeder (10) umfasst, die Kugelrastung (7) weist wenigstens zwei Verschlusspositionen, eine erste Verschlussposition, bei welcher die Verschlusskugel (8) in die Kugelaufnahme (9) eingreift und eine zweite Verschlussposition, bei welcher die Verschlusskugel (8) von der Kugelaufnahme (9) freigegeben und in eine angrenzende Ausnehmung (11) eingreift, auf, **dadurch gekennzeichnet, dass** eine Kolbenstange (5) versetzt und innerhalb des innersten (4) der inneren Zylinderrohre (3, 4) angeordnet ist, dass die Kugelrastung (7) in einer ersten Verschlussposition die Kolbenstange (5) mit der innersten Zylinderröhre (4) verbindet und dass der Öl-

Revendications

1. Vérin télescopique (1) comprenant un tube de vérin extérieur (2) dans lequel sont agencés de manière coaxiale un certain nombre de tubes de vérin intérieurs (3, 4) mobiles et au moins un dispositif de retenue à bille (7), et dans lequel le dispositif de retenue à bille (7) comprend au moins une bille de verrouillage (8), au moins un siège de bille (9) et au moins un ressort de compression (10), ledit dispositif de retenue à bille (7) est agencé avec au moins deux positions de verrouillage, une première position de verrouillage dans laquelle ladite bille de verrouillage (8) est engagée dans le siège de bille (9) et une deuxième position de verrouillage dans laquelle la bille de verrouillage (8) est dégagée dudit siège de bille (9) et engagée dans un évidement environnant (11), **caractérisé en ce qu'**une tige de piston (5) est agencée mobile et à l'intérieur du tube le plus à l'intérieur (4) desdits tubes de vérin intérieurs (3, 4), **en**

ce que le dispositif de retenue à bille (7) dans la première position de verrouillage fixe la tige de piston (5) au tube de vérin le plus à l'intérieur (4), et **en ce qu'**une pression d'huile sur la tige de piston (5) et les tubes de vérin intérieurs (3, 4) font que la bille de verrouillage (8) est automatiquement poussée vers l'extérieur dans l'évidement environnant (11) de sorte que le tube de vérin ayant le plus grand diamètre sera toujours poussé vers le haut en premier, après quoi des tubes de vérin ayant un plus petit diamètre seront poussés vers le haut, et en dernier la tige de piston (5) sera poussée vers le haut.

2. Vérin télescopique (1) selon la revendication 1, **caractérisé en ce que** le dispositif de retenue à bille (7) dans la première position de verrouillage fixe la tige de piston (5) au tube de vérin le plus à l'intérieur (4).
3. Vérin télescopique (1) selon la revendication 1, **caractérisé en ce que** le dispositif de retenue à bille (7) dans la première position de verrouillage fixe un tube de vérin intérieur à un tube de vérin intérieur environnant.
4. Vérin télescopique (1) selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** dans un état principalement détendu, le ressort de compression (10) est agencé pour supporter et lever le siège de bille (9) par rapport à l'évidement environnant (11).
5. Vérin télescopique (1) selon la revendication 1, 2 ou 4, **caractérisé en ce qu'**il comprend un tube de vérin extérieur (2) présentant une partie supérieure (6), un tube de vérin intérieur intermédiaire (3), un tube de vérin intérieur (4) et une tige de piston (5) et un nombre correspondant de dispositifs de retenue à bille (7) entre eux.

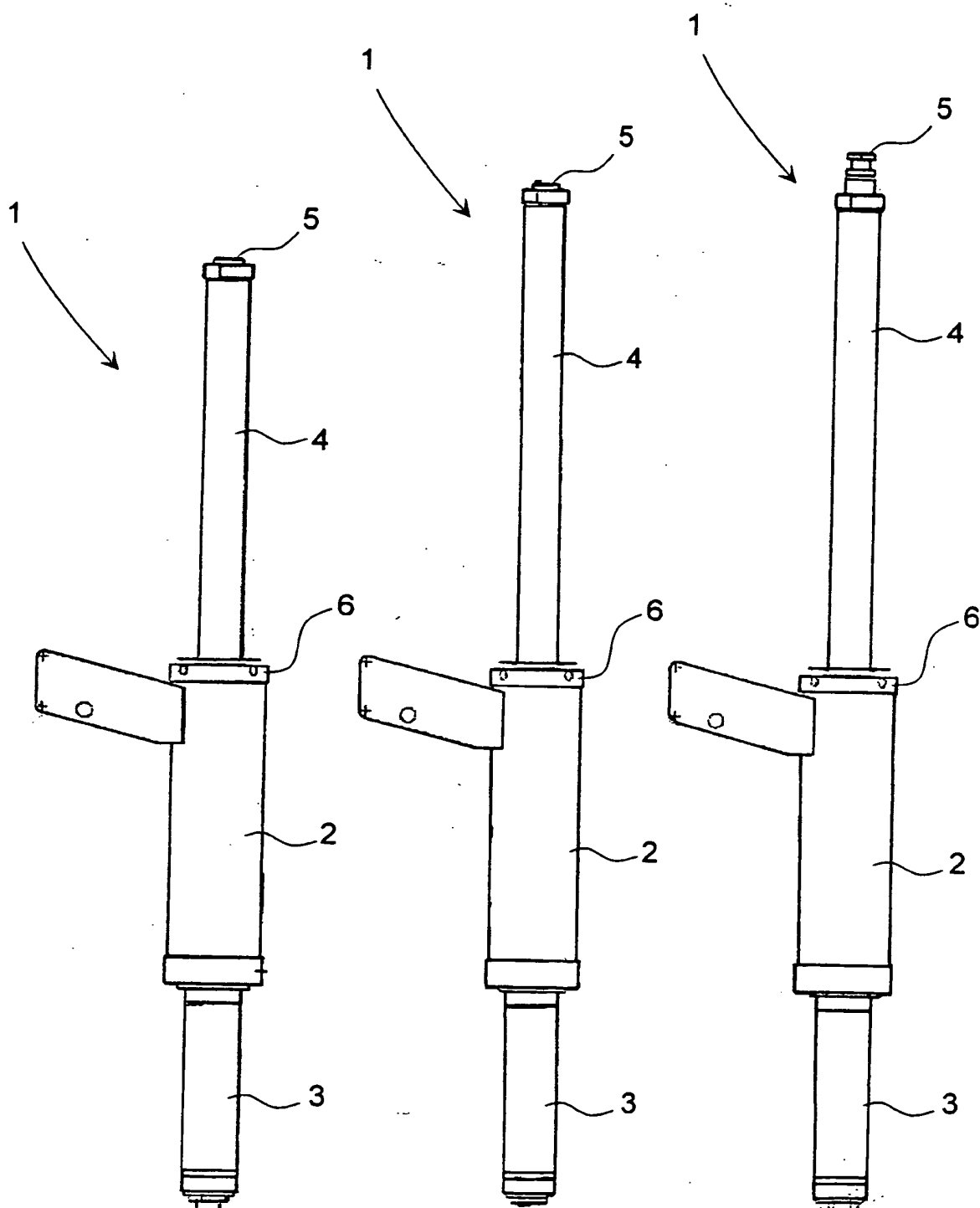


Fig.1

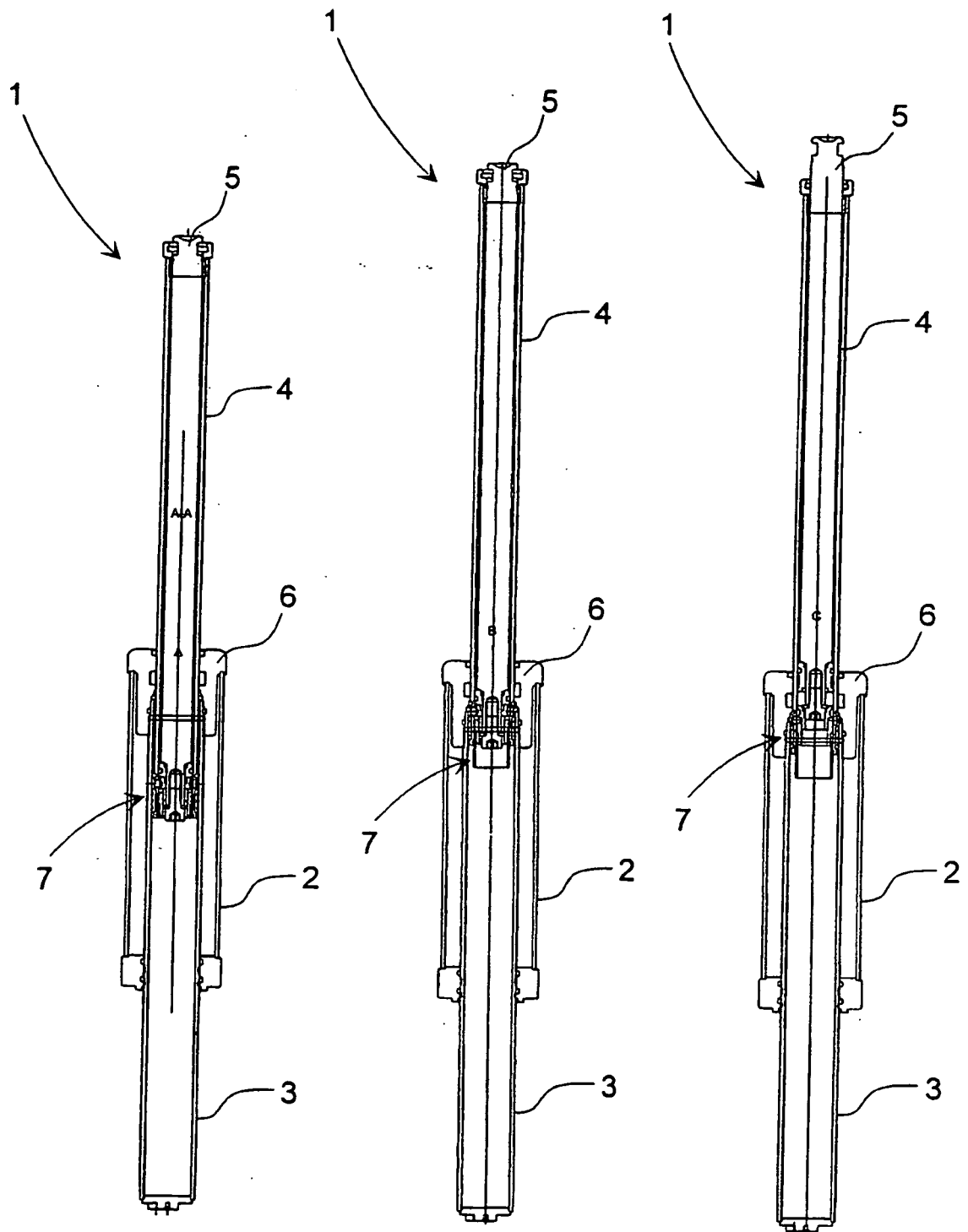


Fig.2

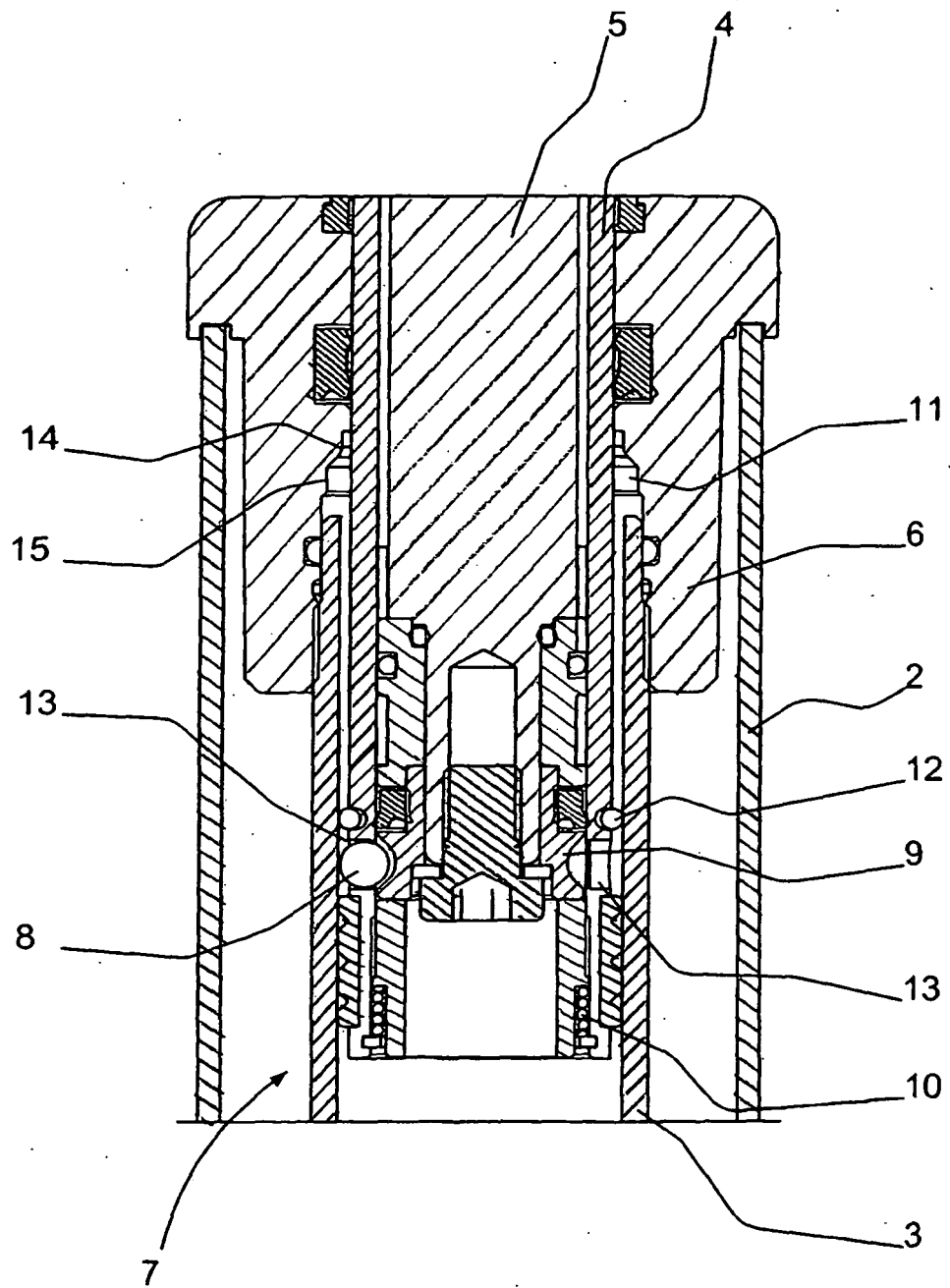


Fig.3

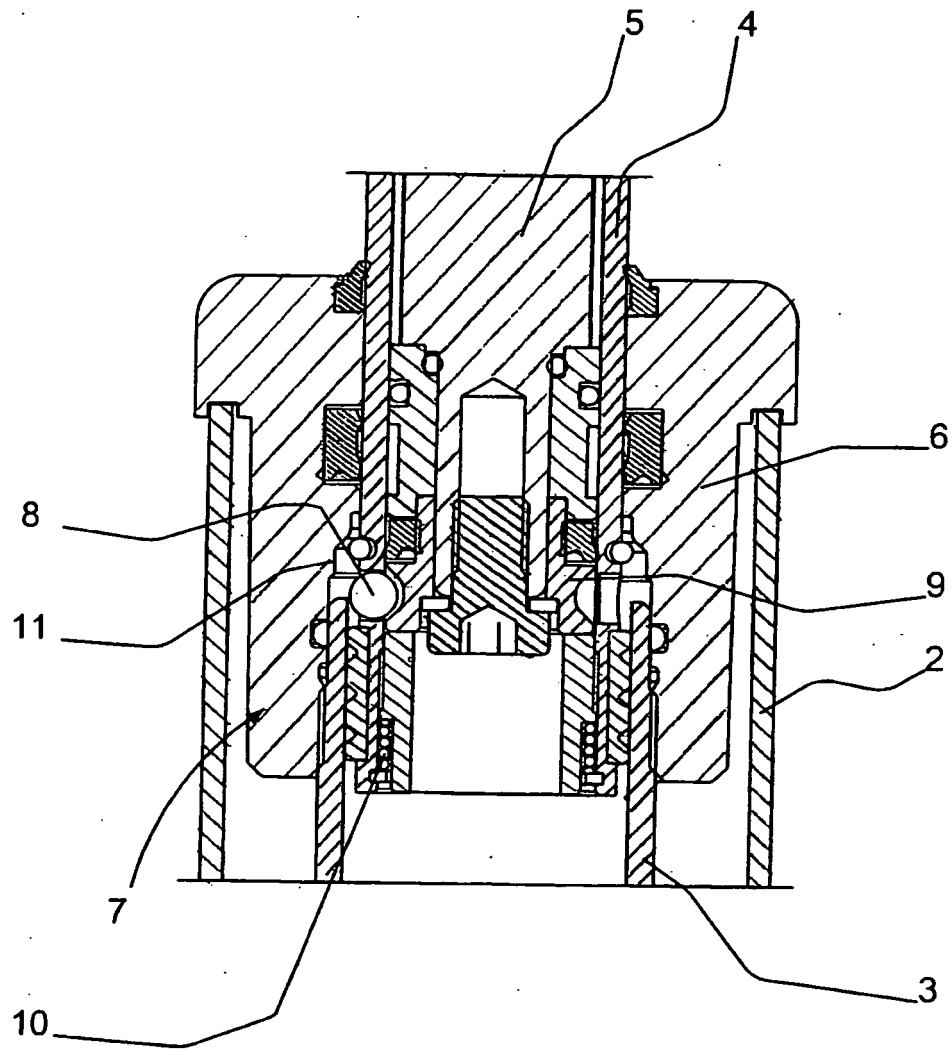


Fig.4

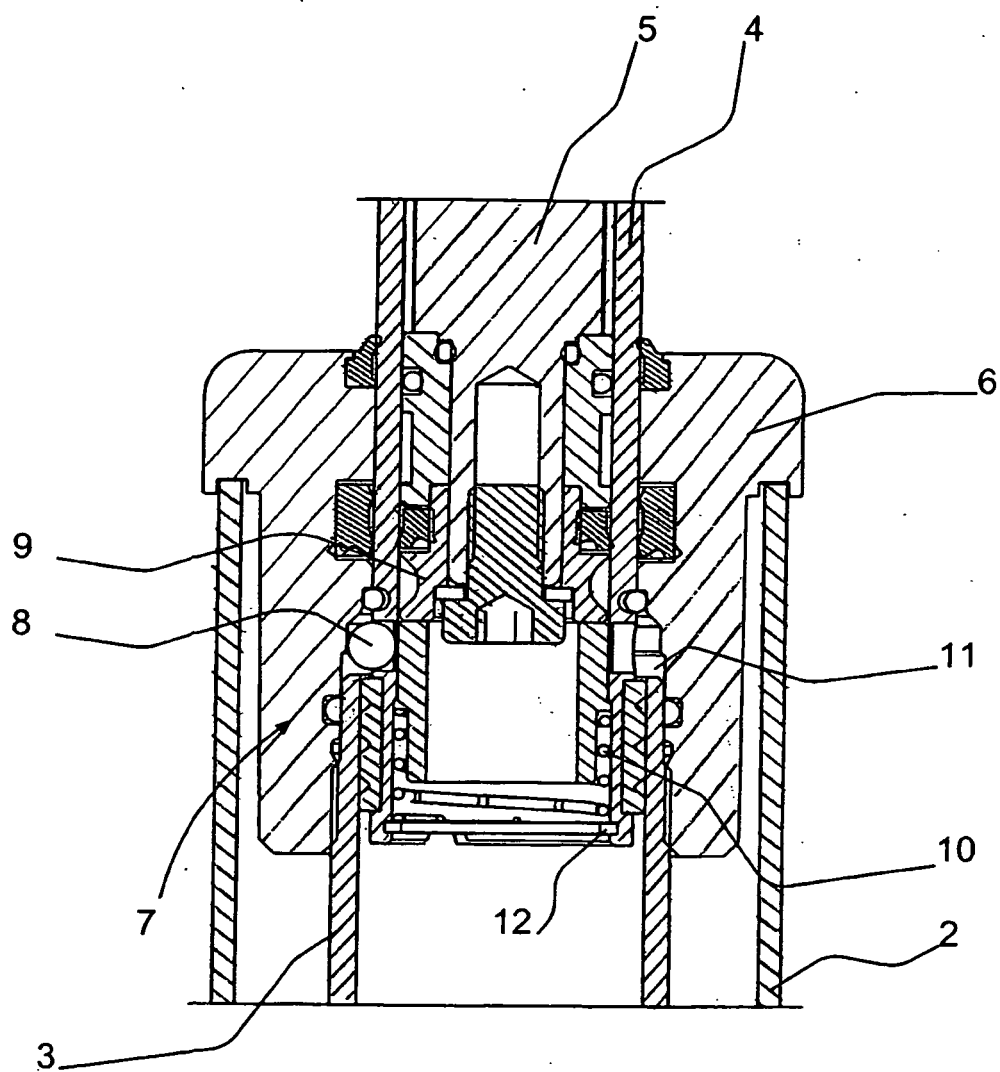


Fig.5

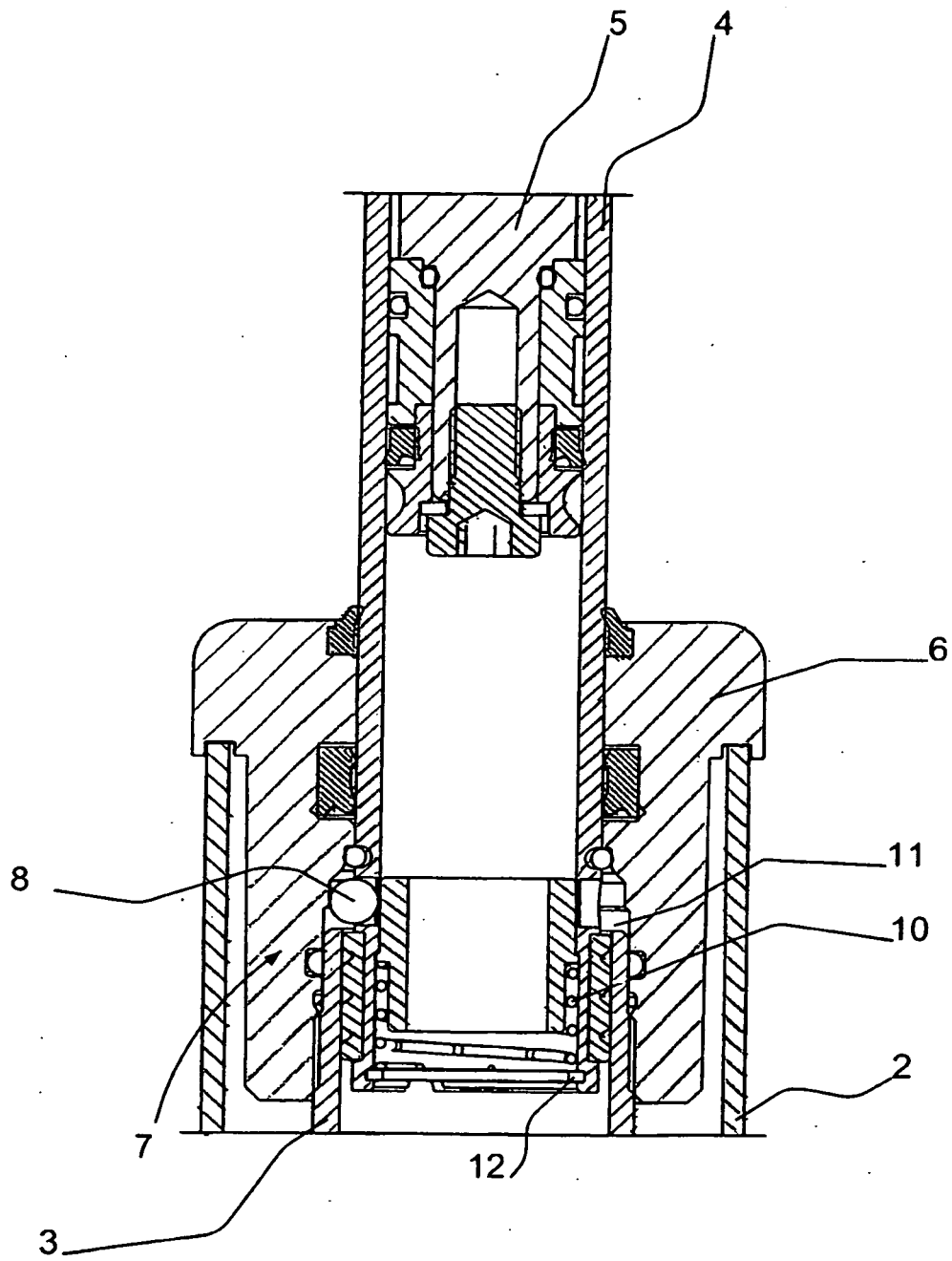


Fig.6