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(54) **ROTATOR DEVICE**

ROTATIONSVORRICHTUNG

DISPOSITIF DE ROTATION

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(56) References cited:
DE-C2- 3 943 716

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Description

[0001] This invention concerns a device in connection with a rotary actuator according to the preamble of claim 1.

[0002] Such a device is previously known from for example DE-C2-39 43 716. Here the stop elements are adjustable in the rotational direction by friction means with screws. This device is relatively expensive and complicated to use. Besides it may occur that the stop elements are not sufficiently fastened and that they therefore may be displaced, for example after a certain time of use. A cover is provided for protection which must be removed in order to allow adjustment.

[0003] It is an aim of this invention to provide a device in connection with rotary actuators for limiting the rotational movement which does not suffer from the above drawbacks.

[0004] This is achieved according to the invention in a device as above through the features of the characterizing portion of claim 1.

[0005] By thus a part of the rotation stop housing being adjustable and fixable and that this part is provided with the rotation stop element, it will be considerably more easy to use and the setting of the stop will be simplified. Further, rational manufacture of the rotation limitation device is possible, leading to reduced costs. The invention also provides possibility of providing the adjustable part with a setting scale, which is easily readable from the outside and which allows simple adjustment as well as control that a correct setting has been made. The fastening portion may be a unit which is separate from the rotary actuator housing but attachable thereto or simply an integral part of the rotary actuator housing which in that case provides the necessary connecting elements for allowing setting and fixing of the adjustable portion.

[0006] Through the feature of claim 2, adjustment of two rotation stop elements is obtained, which is desired if the movement of the rotary actuator is to be controlled by the limiting device in both rotational directions.

[0007] By the feature of claim 3, simple, easy used and efficient connection between the rotation stop housing and the rotary actuator is obtained, since an existing part of the latter, namely the rotary shaft, is used for connection allowing rotation and thereby holding the rotation stop housing and controlling it with respect to the rotary actuator.

[0008] These advantages are accentuated by the feature of claim 4, whereby simple setting is obtained by axial displacement to a position where rotation is allowed and fixing by axial displacement to another position.

[0009] The feature of claim 5 further enhances the inventive aspects of claims 3 and 4.

[0010] The feature of claim 8 provides a very advantageous aspect of the invention meaning that a rotation position detector which is inserted into the receiving

channel automatically follows the adjustment of the rotation stop housing and thereby the rotation stop element. This provides a considerable simplification compared to the prior art, wherein separate holders for rotation position detectors are provided which have to be set separately.

[0011] The other dependent claims provide further advantageous aspects of the invention.

[0012] The invention will now be described in more detail following an embodiment and with reference to the annexed drawings, wherein:

Fig. 1 shows a detail of a limiting device according to the invention partly in a section perpendicular to the axis of the device,

Fig. 2 shows the device of Fig. 1 in an axial section, and

Fig. 3 shows the device according to the invention connected to a rotary actuator.

[0013] The device 1 of Fig. 1 for limiting a rotational movement includes an adjustable portion of a rotation stop housing (item 2 is a section through a "second" portion of this housing). The portion 2 is essentially ring-shaped and adjustable in the rotational direction and fixable. Inwardly it provides a rotation stop 3 carrying a rotation stop element 4 which is adjustable by screwing in its axial direction, and which is intended to co-operate, limiting, with contact cushioning elements 5 on a rotary arm 9, which, as usual, is fastened to a shaft 10 of a rotary actuator. The figure further shows a channel 6, which in this case is comprised of a one-way bore, obliquely into the material of portion 2. This channel 6 is intended for receiving a rotation position detector, which is intended to detect a position of the rotary arm 9. As an example of detectors for placement into the channel 6, magnetic detectors may be mentioned, which senses the presence of a magnet 8 being provided outmost on the rotary arm 9. 7 indicates a locking screw for fixing a detector being inserted into the channel 6. Fig. 1 also shows a rotation stop 3' having a rotation stop element 4', both elements belonging to a "first" portion 2' (see Fig. 2) of a device for limiting a rotational movement.

[0014] The above described second portion 2 is shown in Fig. 2 as is also the first portion 2' of the device which is positioned axially displaced with respect to the second portion and which is generally cup-shaped and having a central hole 14 for a rotary actuator shaft bearing 13. The hole 14 further receives a reduced diameter portion 10' of a rotary actuator shaft 10, which is inside said bearing 13 and which further outmost is provided with an axial stop element, here a screw 12, between which element 12 and the bearing 13 a spring 11 is arranged. In function the spring 11 thus presses the bearing 13 and thereby the entire first portion 2' of the rotation stop housing and thus also its other portions 2 in

the direction against the rotary actuator which is indicated with thin lines and is indicated with 18. A fixing portion 17 is fastened to this rotary actuator housing 18 which portion 17 is a part of the rotation stop housing in this embodiment. A first toothing 15 having radially extending teeth, which in the position shown in the Figure prevents relative rotation between the portions 2 and 2', is provided between the first portion 2' and the second portion 2 and in more detail between the axially directed edge surfaces of the cup 2' and the ring. Between the second portion 2 and the fastening portion 17 there is correspondingly provided a second toothing 16 having the same function. This arrangement gives a very rigid locking which can not be obtained by the conventional friction lock arrangement. The locking is also automatic by the axial spring load between the parts. In order to prevent play, also after some use and thereby possible wear between the teeth, they may have a tapering cross-section of a certain angle in the direction of the free ends of the teeth.

[0015] In order to set a desired rotational limitation in two directions, the craftsman firstly only has to grip the envelope surface of the second portion, pull this portion axially to the left in Fig. 3 so that the co-operating teeth of the second toothing are disengaged from each other. Hereby the rotation of the second portion is allowed (in particular together with the first portion) so that the desired rotation stop 3 may be set as desired. After having completed the adjustment, the second portion may again be engaged through the second toothing 16 with the fastening portion 17 with the aid of the force of the spring 11. Fine adjustment may be obtained by screw setting the associated rotation stop element 4 in Fig. 1. In order to set the rotation stop in the other direction of the rotary actuator, the envelope surface of the first portion 2' of the rotation stop housing is gripped, so that the co-operating teeth on the first toothing 15 are disengaged whereupon also the first portion 2' is adjustable in the rotational direction to a desired position of the rotation stop 3'. Fine adjustment may be obtained with the aid of the element 4'.

[0016] The invention thus provides very simple and efficient setting for the craftsman.

[0017] Fig. 3 shows the device 1 for limiting a rotational movement being attached to the housing 18 of a rotary actuator. 19 indicates the cables to the rotation position detectors which are inserted into the respective channel 6 (see Fig. 1).

[0018] The invention is not limited to the shown embodiment but only to what is stated in the following claims.

[0019] The device according to the invention may thus include only one adjustable part, in cases where for example the rotary actuator itself is used for limiting the movement in the other direction. Further, the adjustment may be achieved otherwise than through an axial displacement and turning. It is thus within the scope of the invention to provide also such devices where the setting

rotation may be stopped through other means than be above described axial displacement and co-operating teeth. For example locking pins, screws or other fastening elements may thus be used for this purpose.

[0020] The fastening portion may be a separate part of the rotation stop housing or an integral part of a rotary actuator housing. In the latter case the rotary actuator housing is provided with the necessary elements such as for example toothing, locking recesses or the like for co-operation with the respective adjustable portion of the rotation stop housing.

[0021] The above described central holding of the rotation stop housing, which is connected through a spring to the shaft of a rotary actuator, is highly preferred also if other solutions may come into question, for example such a connection of the relatively moveable parts that the respective portions are axially locked with respect to each other allowing rotation between them during the setting phase. Such connecting elements are per se known to a person skilled in the art.

[0022] The invention provides a cost-effective solution which among other things depends on the parts of the rotation stop housing with integral rotation stop being easily manufactured and easily mounted. The invention also allows the different parts to be manufactured through rational production methods whereby for example die-casting in an aluminium alloy or possibly forming in a plastic material or in a plastic composite are contemplated.

Claims

1. Device (1) in connection with a rotary actuator for limiting a rotational movement of the rotary actuator shaft (10) and including at least one rotation stop element (3,3'), which is adjustable in the rotation direction and fixable and is intended to cooperate in a limiting manner with a rotary arm (9) fastened to the shaft of the rotary actuator and is housed inside a rotation stop housing (2,2') covering said at least one rotation stop element and said rotary arm (9), **characterized in**

- **that** the rotation stop housing comprises a first portion (2'), which is adjustable in the rotational direction and fixable with respect to the rotary actuator housing,
- **that** the rotation stop element (3',4') is rigidly connected to said first adjustable portion (2') of the rotation stop housing, and
- **that** said first portion (2') is adjustable with respect to a fastening portion (17), which is a part being fixable to the rotary actuator housing or an integral part of the rotary actuator housing.

2. Device according to claim 1, **characterized in that** the rotary stop housing is also provided with a sec-

ond adjustable portion (2) which is located axially displaced with respect to said first portion (2') and which is likewise adjustable in the rotational direction and fixable with respect to the rotary actuator housing and to which a second rotation stop element (3,4) is fastened. 5

3. Device according to any of the claim 1 - 2, **characterized in that** the first portion is provided with means (11,12,13) for allowing a rotatable connection to the shaft (10) of the rotary actuator. 10

4. Device according to claim 3, **characterized in that** said means (11-13) for allowing rotatable connection also allows relative axial movement between the respective adjustable portion (2,2') and said shaft (10) and thereby the fastening portion, whereby, in a first axial position of the respective adjustable portion, it is rotationally locked to the fastening portion, and in a second axial position, it is free for rotation with respect to the fastening portion (17). 15 20

5. Device according to claim 4, **characterized in that** said relative axial movement is allowed against the action of a spring (11). 25

6. Device according to any of the previous claims, **characterized in that** the respective adjustable portion (2,2') is fixable with respect to the fastening portion (17) through axially projecting fixing elements (15,16). 30

7. Device according to claim 6, **characterized in that** said fixing elements are comprised of radially extending teeth (15,16). 35

8. Device according to any of the previous claims, **characterized in that** each adjustable portion is provided with a channel (6) for a rotation position detector which is intended to detect the rotational position of the rotary arm (9), which is fastened to the rotary actuator shaft. 40

9. Device according to claim 8, **characterized in that** each rotation stop element (4,4') is adjustable with respect to the respective adjustable portion (2,2'). 45

10. Device according to claim 9, **characterized in that** each rotation stop element (4,4') is adjustable by screwing. 50

11. Rotary actuator, **characterized in that** it includes a device according to the any of the claims 1 - 10.

Patentansprüche

1. Vorrichtung (1) in Verbindung mit einem Drehan-

trieb zur Begrenzung einer Drehbewegung der Drehantriebswelle (10) und mit wenigstens einem Anschlagelement (3, 3'), das dazu bestimmt ist, in einer begrenzenden Art mit einem an der Welle des Drehantriebs befestigten Dreharm (9) zusammenzuwirken, und das in der Drehrichtung einstellbar und feststellbar und innerhalb eines Anschlaggehäuses (2, 2') untergebracht ist, das das wenigstens eine Anschlagelement und den Dreharm (9) abdeckt, **dadurch gekennzeichnet**,

- **daß** das Anschlaggehäuse einen ersten Teil (2') aufweist, der in der Drehrichtung einstellbar und feststellbar bezüglich des Drehantriebsgehäuses ist,
- **daß** das Anschlagelement (3', 4') starr mit dem ersten einstellbaren Teil (2') des Anschlaggehäuses verbunden ist, und
- **daß** der erste Teil (2') einstellbar ist bezüglich eines Feststellteils (17), der ein am Drehantriebsgehäuse befestigbares Teil oder ein integraler Teil des Drehantriebsgehäuses ist.

2. Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, daß** das Anschlaggehäuse auch mit einem zweiten einstellbaren Teil (2) versehen ist, der axial verschoben bezüglich des ersten Teils (2') angeordnet und ebenfalls in der Drehrichtung einstellbar und feststellbar bezüglich des Drehantriebsgehäuses ist und an dem ein zweites Anschlagelement (3, 4) befestigt ist.

3. Vorrichtung nach einem der Ansprüche 1 - 2, **dadurch gekennzeichnet, daß** der erste Teil mit Mitteln (11, 12, 13) versehen ist, welche eine drehbare Verbindung mit der Welle (10) des Drehantriebs ermöglichen.

4. Vorrichtung nach Anspruch 3, **dadurch gekennzeichnet, daß** die Mittel (11-13), welche eine drehbare Verbindung ermöglichen, auch eine relative Axialbewegung zwischen den jeweiligen einstellbaren Teilen (2, 2') und der Welle (10) und damit dem Befestigungsteil ermöglichen, wodurch in einer ersten axialen Position des jeweiligen einstellbaren Teils dieser in Drehrichtung am Befestigungsteil verriegelt ist und er in einer zweiten axialen Stellung bezüglich des Befestigungsteils (17) frei drehbar ist.

5. Vorrichtung nach Anspruch 4, **dadurch gekennzeichnet, daß** die relative axiale Bewegung gegen die Wirkung einer Feder (11) ermöglicht wird.

55 6. Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, daß** der jeweilige einstellbare Teil (2, 2') bezüglich des Befestigungsteils (17) durch axial vorspringende Feststel-

lelemente (15, 16) feststellbar ist.

7. Vorrichtung nach Anspruch 6, **dadurch gekennzeichnet, daß** die Feststellelemente aus radial vorspringenden Zähnen (15, 16) bestehen.

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8. Vorrichtung nach einem der vorangehenden Ansprüche, **dadurch gekennzeichnet, daß** jeder einstellbare Teil mit einem Kanal (6) für einen Drehpositionsdetektor versehen ist, der dazu bestimmt ist, die Drehposition des Dreharms (9) zu detektieren, der an der Drehantriebswelle befestigt ist.

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9. Vorrichtung nach Anspruch 8, **dadurch gekennzeichnet, daß** jedes Anschlagelement (4, 4') bezüglich des jeweiligen einstellbaren Teils (2, 2') einstellbar ist.

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10. Vorrichtung nach Anspruch 9, **dadurch gekennzeichnet, daß** jedes Anschlagelement (4, 4') durch eine Schraubbewegung einstellbar ist.

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11. Drehantrieb, **dadurch gekennzeichnet, daß** er eine Vorrichtung nach einem der Ansprüche 1 bis 10 aufweist.

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Revendications

1. Dispositif (1) associé à un actionneur rotatif pour limiter un mouvement de rotation de l'arbre (10) de l'actionneur rotatif et comprenant au moins un élément (3, 3') de butée de rotation qui est destiné à coopérer d'une manière limitative avec un bras tournant (9) fixé à l'arbre de l'actionneur rotatif et qui est réglable dans la direction de la rotation et peut être fixé et est logé à l'intérieur d'un boîtier (2, 2') de butée de rotation recouvrant ledit, au moins un, élément de butée de rotation et ledit bras rotatif (9), **caractérisé en ce que**

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- le boîtier de butée de rotation comporte une première partie (2') qui est réglable dans la direction de rotation et peut être fixé par rapport au boîtier de l'actionneur rotatif,
- l'élément (3', 4') de butée de rotation est relié rigidement à ladite première partie réglable (2') du boîtier de butée de rotation, et
- ladite première partie (2') est réglable par rapport à une partie de fixation (17), qui est une pièce pouvant être fixée au boîtier de l'actionneur rotatif ou qui forme une seule pièce avec le boîtier de l'actionneur rotatif.

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2. Dispositif selon la revendication 1, **caractérisé en ce que** le boîtier de butée de rotation est également pourvu d'une seconde partie réglable (2) qui est placée axialement de façon décalée par rapport à la-

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dite première partie (2') et qui est réglable de la même manière dans la direction de rotation et peut être fixée par rapport au boîtier de l'actionneur rotatif et à laquelle un second élément de butée de rotation (3, 4) est fixé.

3. Dispositif selon l'une des revendications 1 et 2, **caractérisé en ce que** la première partie est pourvue de moyens (11, 12, 13) destinés à permettre une liaison tournante avec l'arbre (10) de l'actionneur rotatif.

4. Dispositif selon la revendication 3, **caractérisé en ce que** lesdits moyens (11-13) destinés à permettre une liaison tournante permettent également un mouvement axial relatif entre la partie réglable respective (2, 2') et ledit arbre (10) et, par conséquent, la partie de fixation, grâce à quoi, dans une première position axiale de la partie réglable respective, elle est bloquée en rotation à la partie de fixation et, dans une seconde position axiale, elle peut tourner librement par rapport à la partie de fixation (17).

5. Dispositif selon la revendication 4, **caractérisé en ce que** ledit mouvement axial relatif est permis contre l'action d'un ressort (11).

6. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la partie réglable respective (2, 2') peut être fixée par rapport à la partie de fixation (17) au moyen d'éléments de fixation (15, 16) faisant saillie axialement.

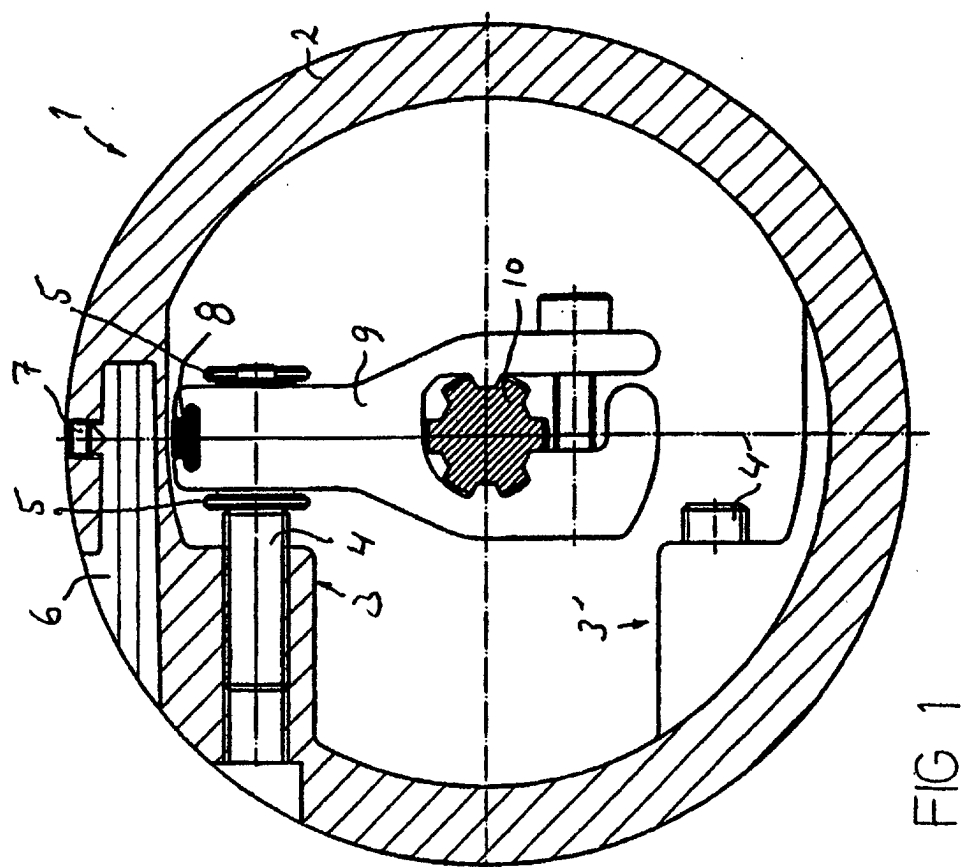
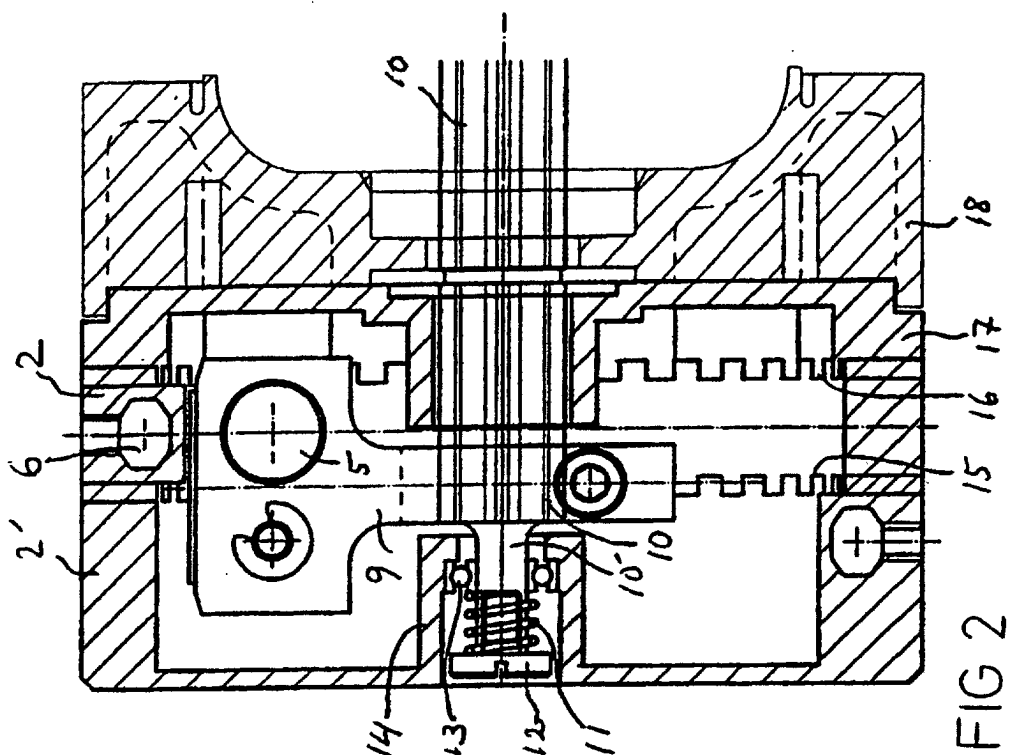
7. Dispositif selon la revendication 6, **caractérisé en ce que** lesdits éléments de fixation sont constitués de dents (15, 16) s'étendant radialement.

8. Dispositif selon l'une quelconque des revendications précédentes, **caractérisé en ce que** chaque partie réglable est pourvue d'une rainure (6) pour un détecteur de position de rotation qui est destiné à détecter la position en rotation du bras rotatif (9), qui est monté sur l'arbre de l'actionneur rotatif.

9. Dispositif selon la revendication 8, **caractérisé en ce que** chaque élément de butée de rotation (4, 4') est réglable par rapport à la partie réglable respective (2, 2').

10. Dispositif selon la revendication 9, **caractérisé en ce que** chaque élément de butée de rotation (4, 4') est réglable par vissage.

11. Actionneur rotatif, **caractérisé en ce qu'il** comprend un dispositif selon l'une quelconque des revendications 1 à 10.



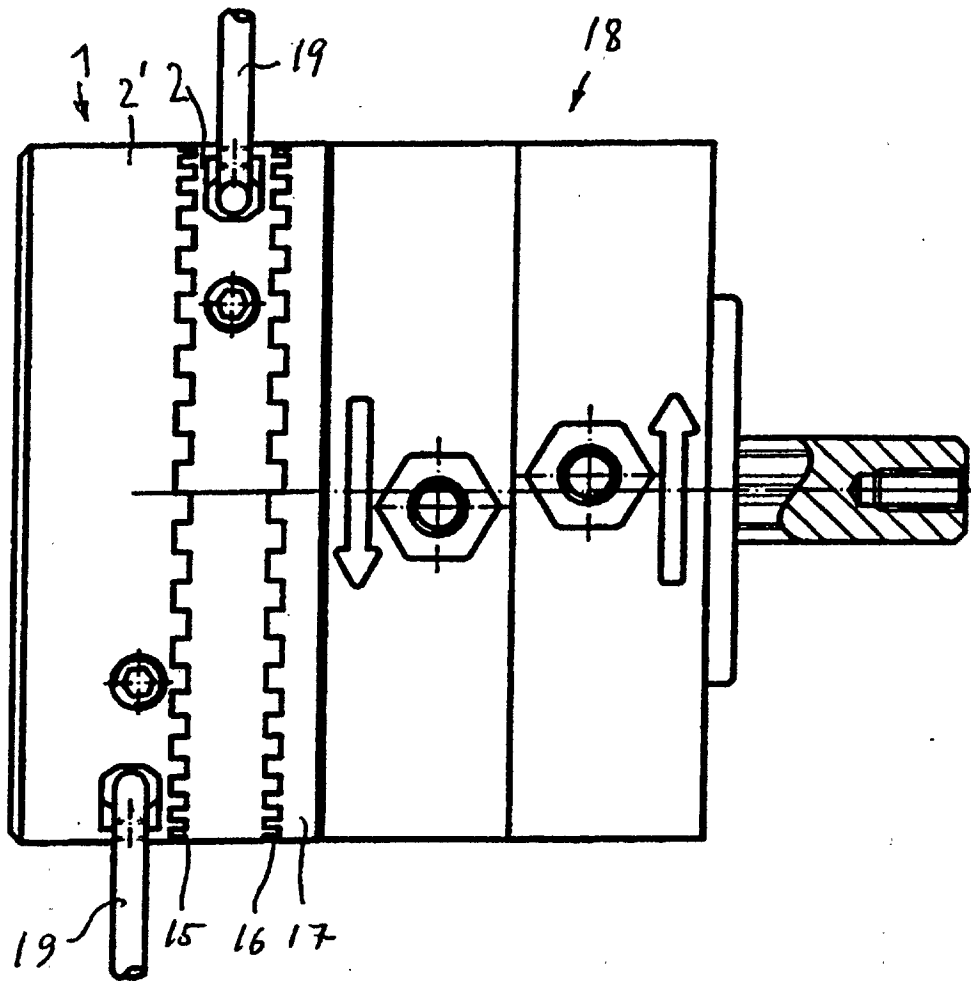


FIG 3