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(54) Actuator

(57) Actuator for valves to be readjusted by rotational movement over a given angle, typically being 90°, comprising an essentially cylindric housing (1) for receiving a piston (5) arranged for axial movement in the housing under influence of a pressure fluid, input/output-channels (22,23) in the housing for the pressure fluid, and a screw device (9,26) for transferring the movement of the piston to rotational movement of an output shaft (8) arranged to be connected to a valve. A second piston (6) is arranged in the body (1) axially in line with said (first) piston (5) and arranged for an opposite movement relative to the first piston. Both pistons (5,6) are forcibly (11,12) conducted in the body (1) without rotational movement. An inner rotational unit (7) on the output shaft (8) constitutes a part (26) of the screw device and portions (9) on both of the pistons (5,6) constitutes other co-operating parts of the screw device.

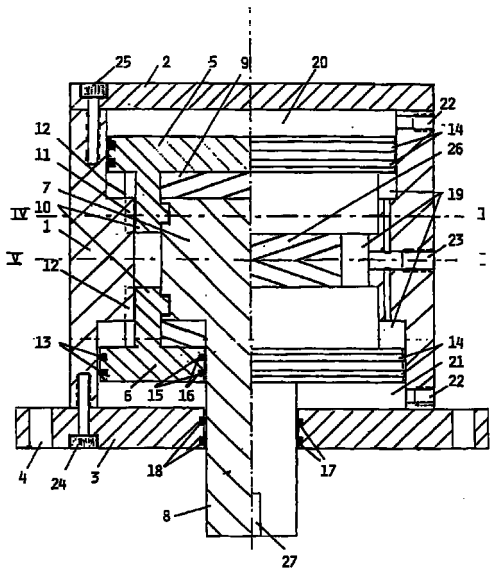

FIG. 1

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Description

[0001] The invention relates to an actuator for valves being readjusted by rotational movement, as is the case with several valves. The rotational movement takes place over a given angle, typically being 90°, but may also be a larger angle.

[0002] Valves of interest in this connection can have relatively large dimensions and require correspondingly high torque for movement of the appurtenant valve bodies. This may, e.g., concern valves for use in oil and gas operations, both offshore and onshore.

[0003] For corresponding purposes there are previously known actuators comprising an essentially cylindric housing for receiving a piston arranged for axial movement in the housing under influence of a pressure fluid, input/output-channels in the housing for the pressure fluid, and a screw device for transferring the movement of the piston to rotational movement of an output shaft arranged to be connected to a valve.

[0004] In many cases a substantial wish or requirement is that actuators of interest in this connection are of compact structure and may exert the required high torques without the requirement for particularly high driving pressure in those fluids or media being used in the actuator. Oil, water or gas being provided from an available pressure source, such as a compressor, may be used as pressure fluid.

[0005] Substantial improvements are according to the invention achieved with an actuator as described above, by the fact that a second piston is arranged in the housing axially in line with said (first) piston and arranged for an opposite movement relative to the first piston, that both pistons are forcibly conducted in the housing without rotational movement, and that an inner rotational unit on the output shaft constitutes a part of the screw device and portions on both the pistons constitutes other co-operating parts of the screw device.

[0006] A substantial advantage with the solution as given here comprises that, in principle, a double torque is achieved wtih the actuator retaining the same weight and volume as previously known actuator embodiments. The driving pressure is assumed to be the same, which also involves that the mechanical strength in the actuator housing and components in the same, may be as in previously known constructions. Alternatively, the same torque as earlier be achieved by means of a halved driving pressure. An additional advantage being achieved, comprises that the pistons do not conduct any rotational movement in the housing. This makes it easier to avoid sealing problems.

[0007] An example of an embodiment of the actuator according to the invention will in the following be described more closely with reference to the drawings, wherein also additional particular features and advantages will appear.

Fig. 1 shows in partly axial section a double-action actuator according one embodiment of the invention.

fig. 2 shows separately a rotational unit with an output shaft, as an important component in the actuator in fig. 1,

fig. 3 shows the top of the rotational unit in fig. 2,

fig. 4 shows a cross section according to line IV-IV in fig. 1, and

fig. 5 shows a cross section according to the line V-V in fig. 1.

[0008] The actuator shown here is built into a essentially cylindric housing 1 having an upper lid 2 and a lower lid 3. The lid 3 has a central hole for an output shaft 8 being provided with a groove with a view to a more or less direct connection to a valve spindle. Gaskets for sealing against shaft 8 are shown at 17 and 18. Further, the lid are provided with mounting holes 4 for the actuator.

[0009] In the housing, two pistons 5 and 6 being arranged to move towards and from each other,respectively, i.e. in an opposite movement relative to each other, depending on the supply of pressure fluid through the channels 22 and 23, respectively. As appearing from fig. 1, the channel communicates with rooms or chambers 19 between the two pistons 5 and 6. A gauge pressure on the channel 23 will then involve that the pistons 5 and 6 are forced apart from each other.

[0010] A completely axial translation movement of the pistons in the housing are ensured by means of wedges 11 and grooves 12, within the housing 1 and on parts of the pistons 5 and 6, respectively. This is among other features advantageous with a view to wear and tear and sealing effect of gaskets as shown at 13 and 14. The two pistons are provided with skirts 10 extending from the actual piston surfaces som fra de egentlige stempelflater towards each other inwardly in the housing 1, and said wedges/grooves are arranged in connection with the outside of these skirts.

[0011] Inside, the skirts 10 and thereby the pistons 5 and 6, respectively, co-operates with a rotational unit 7 on the upper or inner end of the shaft 8. Now, in particular see fig. 2. The unit 7 is provided with two set of threads 26 having opposite pitches and engaging corresponding threads formed radially and inwardly directed on the skirts 10 belonging to the pistons 5 and 6, respectively. As appears from fig. 3 and 4, the rotational unit 7 has six threads 26 (in each directions). With reference to fig. 2, it should be observed that, for practical reasons, usually no sharp transitions will be present between the threads on the to halves, as appears on fig. 2. In other words, the threaded portions on the two piston skirts will not coma into contact with each other when the pistons are in their nearest adjacent positions. For the piston 5, the inner threading is shown at 9 on the inside of the skirt 10.

[0012] The actuator is activated through influence of a fluid under pressure, e.g., oil, water or gas flowing

in through the channels 22, thus urging the pistons 5 and 6 towards each other. Fluid being collected in the gap between the pistons 5 an 6 will for this reason flow out through the channel 23. If the reversed behaviour of the pistons is desired, fluid under pressure will flow in through the channel 23 and, correspondingly, on the other side of the pistons 5 and 6, fluid will flow out through the channel 22. This involves that the movement of the pistons may be controlled by increasing/decreasing the pressure on the fluid flowing in/out of the channels 22,23. If these apertures are blocked and retain the volumes in the volumes occupying the spaces 19 and 20,21, the actuator will be locked in this position, assuming the pressures are balanced.

[0013] The force exerted on the pistons 5 and 6 through the fluid which flows into the space 19, possibly 20,21, under pressure, results in translation movement of the pistons and further the movement of the pistons 5 and 6 is transferred through the inclined groove system / thread portion 9 being cut out in the piston skirts 10 with corresponding cut-out grooves/threads on the rotational unit 7.

[0014] Thus, when the pistons move towards each other and from each other, respectively, the inclined grooves/threads 9 in the skirts 10 which engages the corresponding grooves 26 on the rotational unit 7 will exert a rotational movement on said rotational unit, from wich the rotational movement is transferred through the shaft 8 which is a part of the rotational unit 7.

[0015] Appearing from fig. 1, the diameter of the piston 6 is larger than than the diameter of the piston 5, being connected with the fact that some effective area on both sides of the piston 6 disappears because of the shaft 8 going through this. For this reason the piston 6 is given a larger diameter than the piston 5. As both piston surfaces thus have the same surface area and be affected by the same fluid pressure, the force from each of the pistons 5 and 6 will be the same. Accordingly, each of the pistons will affect the rotational unit 7 with the same force or resulting torque, resulting in a balanced system.

[0016] The thread or screw device being formed of the inclined grooves or threads, 9 and 26 in the piston skirts and rotational unit 7, respectively, constitutes an effective and adequate means for converting the translation movement to rotational movement of the output shaft 8. Here, relative coarse threads should be used with a view to the large forces/torques to be exerted, The thread profile are suitably rectangular, and the thread pitch are adapted among other things in view of normal friction, length of stroke and intended angular movement, which may be, e.g., 90° or more. With other parameters unchanged, it will be realized that an increased magnitude of the angular movement involves an extension of the actuator in the axial direction.

Claims

1. Actuator for valves to be readjusted by rotational movement over a given angle, typically being 90°, comprising an essentially cylindric housing (1) for receiving a piston (5) arranged for axial movement in the housing under influence of a pressure fluid, input/output-channels (22,23) in the housing for the pressure fluid, and a screw device (9,26) for transferring the movement of the piston to rotational movement of an output shaft (8) arranged to be connected to a valve,
characterized in that a second piston (6) is arranged in the housing (1) axially in line with said (first) piston (5) and arranged for an opposite movement relative to the first piston, that both pistons (5,6) are forcibly (11,12) conducted in the housing (1) without rotational movement, and that an inner rotational unit (7) on the output shaft (8) constitutes a part (26) of the screw device and portions (9) on both of the pistons (5,6) constitutes other co-operating parts of the screw device.

2. Actuator according to claim 1,
characterized in that the output shaft (8) extends centrally through said second piston (6).

3. Actuator according to claim 1 or 2,
characterized in that at said second piston (6) has larger diameter than the first piston (5).

4. Actuator according to anyone of claims 1 to 3
characterized in that said piston portions (9) included in the screw device, are located on the inside of cylindric skirts (10) extending axially towards each other from the two pistons (5,6).

5. Actuator according to anyone of claims 1 to 4,
characterized in that axially exdending wedges/grooves (11) radially inside the body (1) and co-operating grooves/wedges (12) radially outside on the pistons, ensuring simple translation movement of the pistons (5,6) axially in the body.

6. Actuator according to anyone of claims 1 to 5,
characterized in that at least one input/output-channel (23) communicates with chambers (19) between the two pistons(5,6).

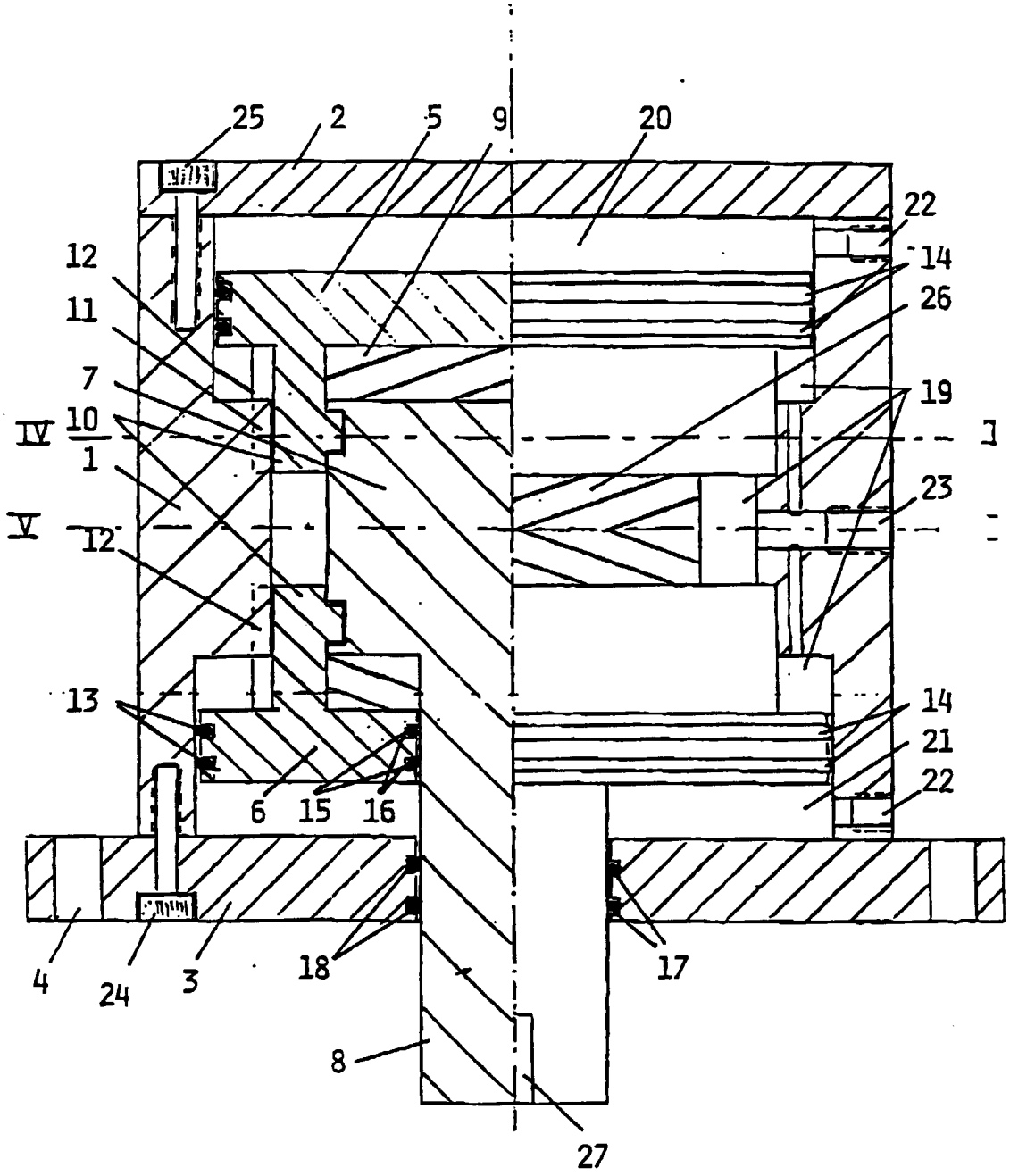
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FIG. 1

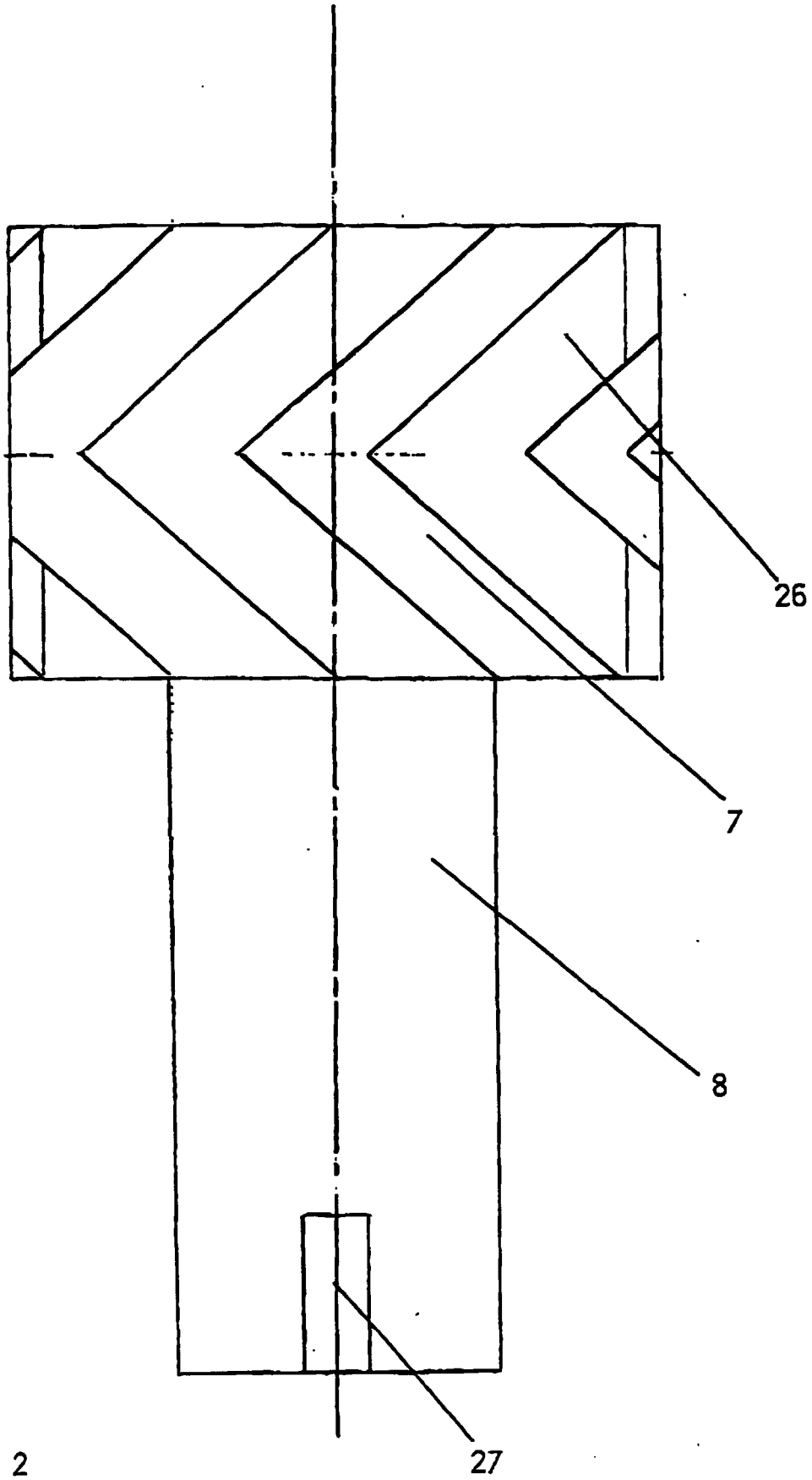

FIG. 2

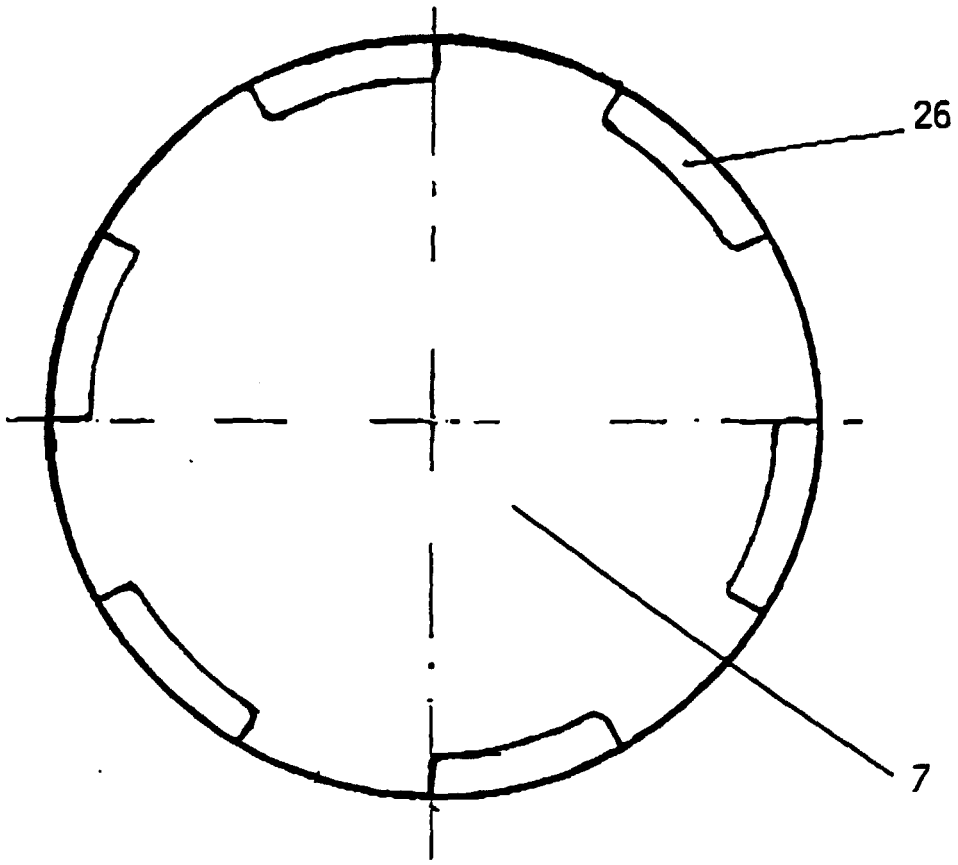

FIG. 3

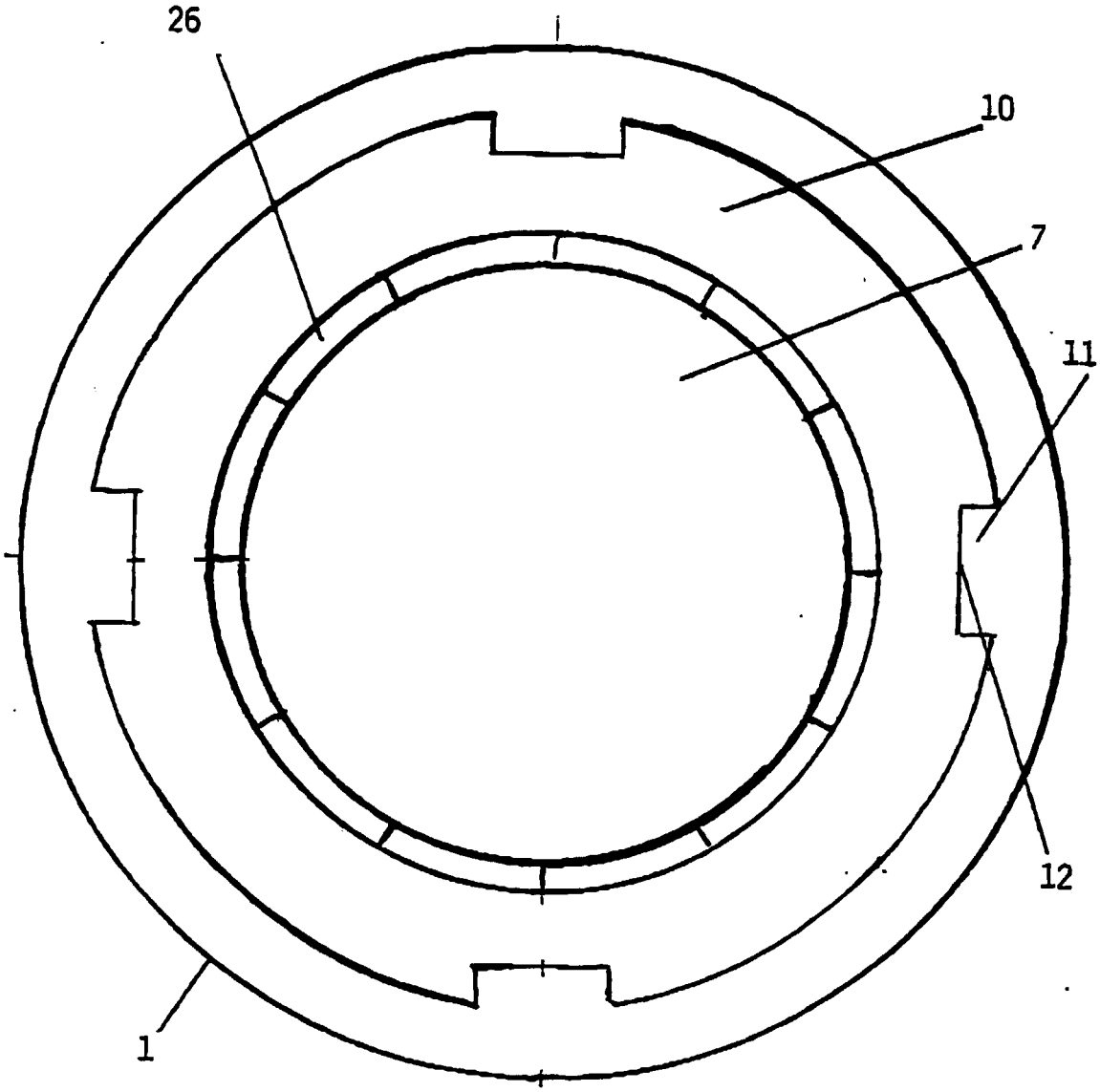

FIG. 4

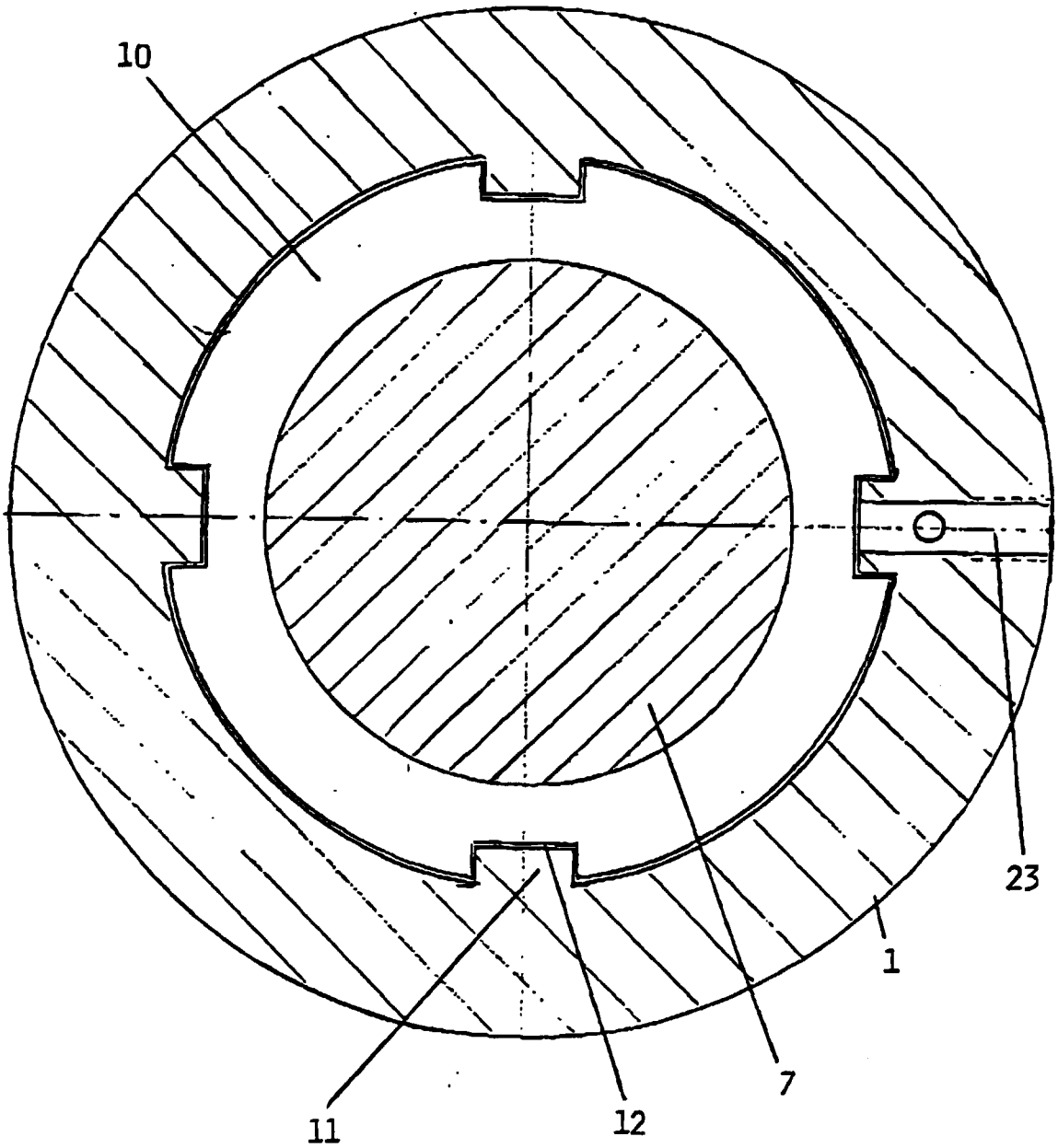

FIG. 5