

**Rotating Regulating Device**

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The invention relates to a rotating regulating device, especially for valves comprising a pivotable or rotatable valve body, the said device comprising at least one actuating device for rotating a regulating element which can be connected to the valve body in a moveable manner.

Such a rotating regulating device is for example known from practice with various valves in the field of oil production. Such valves comprise a ball-shaped or disc-shaped valve body which is supported in a valve bore in a pivotable or rotatable manner. Depending on the position of the valve body, more or less fluid can pass through the valve bore. The corresponding valve body is for example connected at a point on its circumference to a pintle which is supported in the valve housing in a rotatable manner. With this pintle as regulating element an actuating lever or actuating wheel is, for example, connected in a moveable manner as actuating device on manually actuated valves.

Such manual rotating regulating devices for valves are especially of disadvantage when they are located below sea level. The actuation of such a rotating regulating device can then only be carried out with difficulty and requires substantial resources in personnel and time. In addition, with these manual rotating regulating devices the actual position of the valve body can be only found or adjusted inadequately and with poor reproducibility.

The object of the invention is to improve a rotating regulating device of the type mentioned at the beginning such that it can be actuated exactly and reproducibly and especially automatically.

This object is solved in relation to the characteristics of the generic term of Claim 1 in that the regulating element is a rotating collar which is rotationally positioned in relation to a bearing collar, and the actuating device comprises at



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least one mechanism which converts a linear movement into a rotational movement.

The mechanism is drive-connected with a suitable actuator or also servomotor and converts a suitable linear movement from the actuator or servomotor into a rotational movement of the rotating collar as regulating element. The corresponding rotation of the rotating collar is converted through the movement linkage to the valve body into an appropriate pivoting or rotation of the valve body and therefore into a corresponding opening or closing of the valve.

In order to be able to employ such a rotating regulating device in a simple manner with normal valves and normal actuators or similar, the rotating regulating device can be realised as an installation module. This can, for example, be flange-connected between the actuator and the valve.

With the relative positioning of the rotating collar and bearing collar the rotating collar can be rotationally supported on an external surface of the bearing collar or at least outside of the bearing collar. With another method the rotating collar can at least be rotationally supported within the bearing collar. With an arrangement within the bearing collar the rotating collar is protected by it and needs essentially no dedicated bearing or fixing outside of the rotating regulating device.

A simple method of providing rotational support of the rotating collar in the bearing collar can be seen in that ball and/or roller bearings are arranged between them.

In order to rotate the rotating collar relative to the bearing collar, the rotating collar and bearing collar can each comprise at least one guide slot in their circumferential surfaces, of which one of the slots runs essentially straight and the other essentially diagonal to the longitudinal direction of the collar, whereby an engaging element of the mechanism engages both slots. If this engaging

element moves along both slots, then, due to the diagonal alignment of the guide slots, a movement of the engaging element in the longitudinal direction of both collars is converted into a corresponding rotational movement of the rotating collar. Here, the guide slot running straight or diagonal to the longitudinal direction can be formed in the rotating collar and correspondingly the other guide slot can be formed in the bearing collar.

There is the possibility that the guide slots are arranged in the rotating collar and the bearing collar in oppositely positioned circumferential surfaces of the collars. This means, for example, that the guide slot in the rotating collar is arranged on one side and the guide slot is arranged on the opposite side in the bearing collar.

For the easy production and assignment of the guide slots it may however be regarded as advantageous if they are arranged in the rotating collar and bearing collar in facing circumferential surfaces of the collars, i.e. on one side of the longitudinal direction.

A further improvement in the rotating properties of the rotating collar relative to the bearing collar can arise in that the guide slots are realised in pairs in the rotating collar and the bearing collar, whereby each pair of guide slots is positioned diametrically opposite the corresponding collar in the circumferential surface.

For reasons of simplified production the guide slots can be essentially equally long in projection onto the longitudinal direction of the collars.

Improved and easier rotating characteristics of the rotating collar can be obtained if the guide slots in the rotating collar run spiral shaped, i.e. guide slots running diagonally to the longitudinal direction are formed in the rotating collar.

A constructively simple engaging element can be seen in that the said element is an engaging pin running transverse to the longitudinal direction.

The guide slots can be realised more simply if they exhibit the same width so that the engaging pin engages paired, oppositely positioned guide slots at both its end sections, both in the rotating collar and also in the bearing collar.

In order not to directly introduce the engaging pin in the guide slots, the engaging pin can be surrounded in the region of the guide slots by ball and/or roller bearings.

The guide slots and the engaging pin form parts of the mechanism according to the invention. In order to facilitate a simple regulation of the engaging pin in the longitudinal direction of the collars and consequently in the longitudinal direction of the guide slots, the engaging pin can be held rotationally rigidly essentially in its central section in a feed element which is supported in a manner allowing displacement along a longitudinal hole in the rotating collar. This feed element forms another part of the mechanism.

In order to enable, apart from a simple rotation of the rotating collar relative to the feed element, guidance of the rotating collar at the same time, the feed element and longitudinal hole can exhibit at least partially a circular cross-section. In this connection it is also convenient if a completely circular cross-section especially of the feed element is only not present in the region where it holds the central section of the engaging pin.

In order to regulate the feed element and therefore the engaging pin in a simple way in the longitudinal direction of the collars, the feed element can be connected releasably with an actuating element of an actuator device. Such an actuator device is for example known from EP 1024422A1. With such an actuator device the actuating element is electrically controlled for extension and withdrawal relative to a suitable actuator housing. Through the releasable

connection of actuating element and feed element the appropriate linear movement of the actuating element is transferred to the feed element and therefore to the engaging pin.

In order to be able to mount the modular-type rotating regulating device in a simple manner on an appropriate actuator device, the bearing collar can exhibit a radially outwards protruding ring flange on at least one mounting end which can be connected to a connecting end of the actuator device.

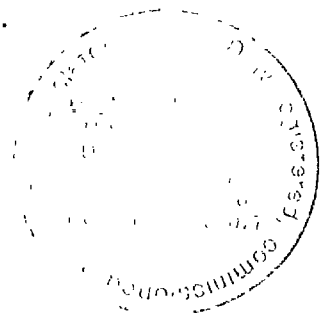
In order to essentially close off the rotating regulating device opposite the ring flange of the bearing collar, a terminating ring with a radially outwards protruding ring flange can be releasably mounted on the bearing collar opposite the mounting end.

In this connection, in order to ensure good rotating properties of the rotating collar, but to essentially fix it axially, at least one axial bearing can be arranged for the axial fixation of the rotating collar relative to the bearing collar between the rotating collar and the terminating ring.

In order to facilitate a suitable support of the rotating collar also opposite the terminating ring, at least one axial bearing can be arranged between the ring flange of the bearing collar and the rotating collar and/or between the terminating end of the actuator device and the rotating collar.

In order to support resetting of the rotating collar to its initial position, the engaging pin and/or the feed element can be subject to a force in the direction of the ring flange of the bearing collar.

Such an applied force can be obtained in a simple manner in that at least one spring element is arranged in or on the rotating regulating device.



A simple method of arranging the spring element can be seen in that it is arranged effectively between the ring flange and the engaging pin. Here, the arrangement can occur between the ring flange of the terminating ring and also between the ring flange of the bearing collar and the engaging pin. In one case the spring must be realised as a compression spring and in the other case as a tension spring.

In order to be able to arrange the spring in a simple manner during assembly of the rotating regulating device, a spring bearing collar can be pushed, so that it can be moved in the longitudinal direction, onto the bearing collar, in which ends of the engaging pin engage and which exhibits a radially outwards protruding edge flange, between which and the ring flange of the terminating ring a compression spring is arranged as spring element.

In order to be able to fix an initial position or an end position of the spring bearing collar relative to the rotating regulating device in a simple manner, the edge flange can be in contact with the ring flange of the bearing collar in an end position of the spring bearing collar.

In order to be able to mount the spring bearing collar in a simple manner during assembly of the rotating regulating device, the spring bearing collar can exhibit, open in the direction of the edge flange, two longitudinal slots in which the ends of the engaging pin engage and the said ends are adjacent to the slot ends opposite the edge flange.

In the following, an advantageous embodiment of the invention is explained in more detail based on the figures enclosed in the drawing.

The following are shown:

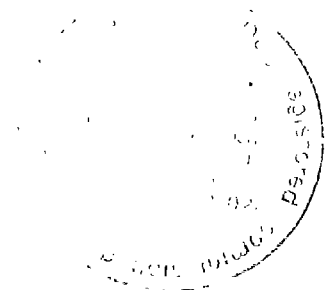


Fig. 1 shows a longitudinal section through an embodiment of a rotating regulating device according to the invention which is releasably connected to an actuator device;

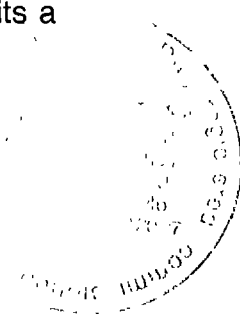
Fig. 2 shows an enlarged illustration of the embodiment of the rotating regulating device according to the invention shown in Fig. 1 and

Fig. 3 shows a section along the line III-III in Fig. 2.

In Fig. 1 a longitudinal section is shown through a rotating regulating device 1 according to the invention. It is realised as an installation module 7 and is flange-connected to a mounting end 27 of an actuator device 25.

The actuator device 25 includes at least one electric motor 43. This motor drives a ball screw drive 44, whereby a ball nut 46 can be rotated by the electric motor 43. The ball nut 46 is supported for rotation, but cannot be displaced axially in the actuator device 25. By rotating the ball nut 46 a recirculating ball spindle 45 of the ball screw drive 44 is moved in the longitudinal direction of the actuator device 25. An actuating element 24 connected to the recirculating ball spindle 45 is correspondingly displaced and therefore also a feed element 22 of the rotating regulating device 1.

The feed element 22 is supported in a moveable manner in a longitudinal hole 23 of a rotating collar 4 of the rotating regulating device 1. The rotating collar 4 is supported in a rotatable manner by ball and/or roller bearings 8 in the inside of a bearing collar 5. The bearing collar 5 is releasably attached at its mounting end 27 facing the connection end 28 of the actuator device 25 to the actuator device 25. At the mounting end 27 the bearing collar 5 exhibits a radially outwards protruding ring flange 26. At its end opposite the mounting end 27, the bearing collar 5 is connected to a terminating ring 29. This ring also exhibits a radially outwards protruding ring flange 30.



The rotating collar 4 is supported for rotation, but axially fixed in relation to terminating ring 29, which is connected to the bearing collar 5, by the axial bearing 31 and similarly at the connecting end 28 of the actuator device 25 by the axial bearing 32.

For the transfer of the movement of the actuating element 24 in the linear direction into a rotational movement of the rotating collar 4 relative to the bearing collar 5, a mechanism 6 is arranged as actuating device 2 between the two collars. The mechanism 6 includes the feed element 22, an engaging pin 17 as engaging element 16, ball/roller bearings 20 and guide slots 11, 12 in the rotating collar 4 as well as guide slots 13, 14 in the bearing collar 5.

A central section 21, see Fig. 2, of the engaging pin 17 is held in the feed element 22 and end sections 18, 19 protruding on both sides out of the feed element, see again Fig. 2, are fitted with the ball/roller bearings 20. These end sections 18, 19 are each supported in a moveable manner with a ball/roller bearing 20 in the various guide slots 11 to 14 in the longitudinal direction 15 of the rotating regulating device 1.

The guide slots 13, 14 of the bearing collar 5 run straight in the longitudinal direction 15, whereas the guide slots 11, 12 in the bearing collar 5 run diagonally to the longitudinal direction 15 and especially in a spiral shape.

The engaging pin 17 engages by its extreme ends 35, 36, see also Fig. 2, in the longitudinal slots 39, 40 of a spring bearing collar 34. These longitudinal slots are open in the direction of the ring flange 26 of the bearing collar 5. In the region of the ring flange 26 the spring bearing collar 34 also exhibits a radially outwards protruding edge flange 37 which in the end position 38 of the spring bearing collar 34 illustrated in Fig. 1 makes contact with the ring flange 26. A compression spring is arranged as spring element 33 between the edge flange 37 and the ring flange 30 of the terminating ring 29. This spring acts in a

direction opposite to the regulating direction of the actuating element 24 on the actuating device 2 of the rotating regulating device 1.

The rotating regulating device 1 according to Fig. 1 is shown enlarged in Fig. 2. The same parts in this figure as well as in Fig. 3 bear the same reference symbols as in Fig. 1 and only some are mentioned.

In Fig. 2 it can especially be seen that ends 35, 36 of the engaging pin 17 are adjacent to the slot ends 41, 42 of the longitudinal slots 39, 40, whereby the slot ends 41, 42 define the limits of the longitudinal slots 39, 40 opposite the edge flange 37 in the spring bearing collar 34. Inside the guide slots 11 to 14 the engaging pin 17 makes contact with the ends positioned closer to the actuator device 25. The end sections 18, 19 of the engaging pin 17 are surrounded by the ball/roller bearings 20 which roll within the guide slots 11 to 14 when the engaging pin 17 moves in the longitudinal direction 15 of the rotating regulating device 1.

The guide slots 11, 12 and 13, 14 exhibit in projection on the longitudinal direction 15 essentially the same length, whereby the guide slots 11, 12 run spirally and the guide slots 13, 14 run linearly.

The central section 21 of the engaging pin 17 is surrounded by the feed element 22 and held rotationally rigidly in it. The feed element 22 exhibits a radially outwards protruding shoulder 48 which partially overlaps the ball/roller bearings 20 assigned to the guide slots 11, 12. By displacing the feed element 22 in the direction of the terminating ring 29 using the actuating element 24 of the actuator device 25, the engaging pin 17 can as engaging element 16 be displaced along the guide slots 11, 12 up to their ends towards the terminating ring 29. Here, the engaging pin 17 is displaced along the linear guide slots 13, 14 of the bearing collar 5 which is firmly connected to the actuator device 25. Due to the spiral shape of the other guide slots 11, 12 of the rotating collar 4, the rotating collar 4 is rotated by a corresponding angle when the engaging pin

17 is displaced along the guide slots 13, 14 and due to the simultaneous engaging of the engaging pin 17 in the guide slots 11, 12. The rotated angle is given by the diagonal run of the guide slots 11, 12 relative to the guide slots 13, 14.

The rotating collar 4 is used in this connection as a regulating element 3 for especially a valve body of a valve not shown in the figures. Especially an insertion end 47 of the rotating collar 4 engages an appropriate connection element which is connected to the valve body so that one rotation of the rotating collar 4 can be transferred to the valve body for opening or closing the valve.

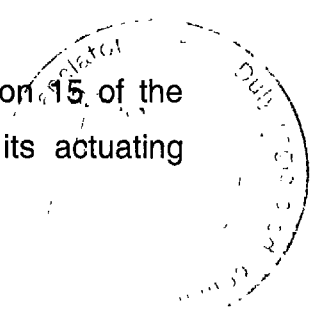
A section along the line III-III in Fig. 2 is illustrated in Fig. 3.

The spring bearing collar 34 essentially completely surrounds the bearing collar 5 and rotating collar 4 arranged inside it. The engaging pin 17 is arranged with its ends 35, 36 in the region of the longitudinal slots 39, 40, whereby the ends 35, 36 are arranged flush with the surrounding surface of the spring bearing collar 34.

The bearing collar 5 and the rotating collar 4 exhibit a circular-shaped cross-section which is interrupted by the corresponding guide slots 11, 12 and 13, 14. In these guide slots the corresponding ball/roller bearings 20 are located which are attached to the end sections 18, 19 of the engaging pin 17. A central section 21 of the engaging pin 17 is held in the feed element 22. This exhibits at least partially a circular-shaped cross-section, whereby the feed element is flattened on its sides facing the ball/roller bearings 20.

In the following the functioning principle of the rotating regulating device according to the invention is briefly explained based on the figures.

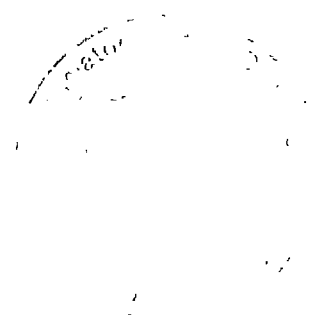
The feed element 22 can be displaced in the longitudinal direction 15 of the rotating regulating device 1 using the actuator device 25 via its actuating



element 24. When the feed element is displaced, the engaging pin 17, which it holds, is correspondingly displaced. Its end sections 18, 19 are surrounded by ball/roller bearings 20 and are guided in the guide slots 11 to 14. The guide slots 11 and 12 are arranged in the rotating collar 4 and the guide slots 13, 14 in the bearing collar 5, in pairs in each case, whereby pairs of guide slots 11, 12 / 13, 14 are located diametrically opposed. The guide slots 11, 14 are formed in circumferential surfaces 9, 10 of the respective collars 4, 5. Here, the guide slots 13, 14 run linear and essentially parallel to the longitudinal direction 15 and the guide slots 11, 12 run diagonally to the guide slots 13, 14 and especially spiral-shaped. When the engaging pin 17 moves along the linear guide slots 13, 14, then, due to the simultaneous engagement in the spiral-shaped guide slots 11, 12, the rotating collar 4 as regulating element 3 is rotated about the longitudinal direction 15 by a certain angle.

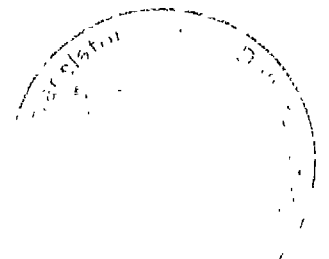
The rotating collar 4 is intended as a regulating element for a valve body of a valve which is not shown and an appropriate rotation of the rotating collar is converted into a rotation of the valve body and therefore into opening or closing of the valve.

In order to support resetting of the regulating element 3 into the end position of the spring bearing collar 34 illustrated in Figs. 1 and 2, a compression spring 33 is arranged between the ring flange 30 of the terminating ring 29 and the edge flange 37 of the spring bearing collar 34. Here, the spring bearing collar 34 is carried along by the engaging pin 17 when the engaging pin 17 is displaced in the direction of the terminating ring 29, the ends 35, 36 of the said engaging pin being adjacent to the slot ends 41, 42 of the longitudinal slots 39, 40 formed in the spring bearing collar 34.



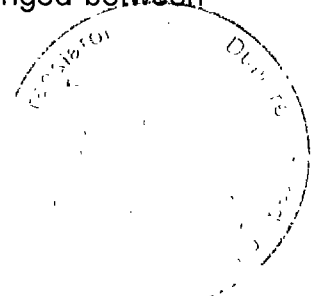
### Claims

1. A rotating regulating device (1), especially for a valve comprising a pivotable or rotatable valve body, said device comprising at least one actuating device (2) for rotating a regulating element (3) which can be connected to the valve body in a moveable manner, **characterised in that** the regulating element (3) is a rotating collar (4) which is rotationally positioned in relation to a bearing collar (5), and the actuating device (2) comprises at least one mechanism (6) which converts a linear movement into a rotational movement.
2. Rotating regulating device according to Claim 1, **characterised in that** the rotating regulating device (1) is formed as an installation module (7).
3. Rotating regulating device according to Claim 1 or 2, **characterised in that** the rotating collar (4) is at least rotationally supported inside the bearing collar (5).
4. Rotating regulating device according to one of the previous claims, **characterised in that** ball and/or roller bearings (8) are arranged between the rotating collar (4) and the bearing collar (5).
5. Rotating regulating device according to one of the previous claims, **characterised in that** the rotating collar (4) and bearing collar (5) in their circumferential surfaces (9, 10) each exhibit at least one guide slot (11, 12, 13, 14), of which one runs essentially straight and the other essentially diagonal to the longitudinal direction (15) of the collars (4, 5), whereby an engaging element (16) of the mechanism (6) engages both slots (11, 12, 13, 14).



6. Rotating regulating device according to one of the previous claims, **characterised in that** the guide slots (11, 12, 13, 14) in the rotating collar (4) and bearing collar (5) are arranged facing one another in the circumferential surfaces (9, 10) of the rotating collar (4) and bearing collar (5).
7. Rotating regulating device according to one of the previous claims, **characterised in that** the guide slots (11, 12, 13, 14) are formed in pairs in the rotating collar (4) and the bearing collar (5), whereby each pair of guide slots (11, 12, 13, 14) of the corresponding collar (5) is positioned diametrically opposite in the circumferential surfaces (9, 10).
8. Rotating regulating device according to one of the previous claims, **characterised in that** the guide slots (11, 12, 13, 14) are essentially equally long in projection onto the longitudinal direction (15) of the collars (4, 5).
9. Rotating regulating device according to one of the previous claims, **characterised in that** the guide slots (11, 12) run spiral-shaped in the rotating collar (4).
10. Rotating regulating device according to one of the previous claims, **characterised in that** the engaging element (16) is an engaging pin (17) running transverse to the longitudinal direction (15).
11. Rotating regulating device according to one of the previous claims, **characterised in that** the engaging pin (17) engages at both its end sections (18, 19) in the paired oppositely positioned guide slots (11, 12, 13, 14), both in the rotating collar (4) and in the bearing collar (5).

12. Rotating regulating device according to one of the previous claims, **characterised in that** the engaging pin (17) is surrounded in the region of the guide slots (11, 12, 13, 14) by ball and/or roller bearings (20).
13. Rotating regulating device according to one of the previous claims, **characterised in that** the engaging pin (17) is essentially held rotationally rigidly in its central section (21) in a feed element (22) which is supported for movement along a longitudinal hole (23) of the rotating collar (4).
14. Rotating regulating device according to one of the previous claims, **characterised in that** the feed element (22) and the longitudinal hole (23) exhibit at least partially a circular cross-section.
15. Rotating regulating device according to one of the previous claims, **characterised in that** the feed element (22) can be releasably connected to an actuating element (24) of an actuating device (25).
16. Rotating regulating device according to one of the previous claims, **characterised in that** the bearing collar (5) exhibits a radially outwards protruding ring flange (26) on at least one mounting end (27) which can be releasably connected to a connecting end (28) of the actuator device (25).
17. Rotating regulating device according to one of the previous claims, **characterised in that** a terminating ring (29) with radially outwards protruding ring flange (30) is releasably attached to the bearing collar (5) opposite the mounting end (27).
18. Rotating regulating device according to one of the previous claims, **characterised in that** at least one axial bearing (31) for the axial fixation of the rotating collar relative to the bearing collar (5) is arranged between the rotating collar (4) and the terminating ring (29).



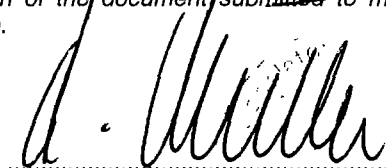
19. Rotating regulating device according to one of the previous claims, **characterised in that** at least one axial bearing (32) is arranged between the ring flange (26) of the bearing collar (5) and the rotating collar (4) and/or between the connecting end (28) of the actuator device (25) and the rotating collar (4).
20. Rotating regulating device according to one of the previous claims, **characterised in that** the engaging pin (17) and/or the feed element (22) is subjected to a force in the direction of the ring flange (26) of the bearing collar (5).
21. Rotating regulating device according to one of the previous claims, **characterised in that** at least one spring element (33) is arranged for applying a force in or on the rotating regulating device (1).
22. Rotating regulating device according to one of the previous claims, **characterised in that** the spring element (33) is effectively arranged between the ring flange (26, 30) and engaging pin (17).
23. Rotating regulating device according to one of the previous claims, **characterised in that** a spring bearing collar (34) is in the longitudinal direction (15) pushed on the bearing collar (5) and in the said spring bearing collar the ends (35, 36) of the engaging pin (17) engage and the said spring bearing collar exhibits a radially outwards protruding edge flange (37), between which and the ring flange (30) of the terminating ring (29) a compression spring is arranged as spring element (33).
24. Rotating regulating device according to one of the previous claims, **characterised in that** in an end position (38) of the spring bearing collar (34) the edge flange (37) makes contact with the ring flange (26) of the bearing collar (5).

25. Rotating regulating device according to one of the previous claims, **characterised in that** the spring bearing collar (34) exhibits two elongated slots (39, 40), open in the direction of the edge flange (37) and in which the ends (35, 36) of the engaging pin (17) engage and make contact with the slot ends (41, 42) opposite the edge flange.

As a state-certified, duly registered and commissioned translator for the English language, publicly appointed and generally sworn by the President of Munich I Regional Court (Landgericht München I), I hereby certify that the foregoing English translation of the document submitted to me in the German language as an original copy is correct and complete.

Munich I Regional Court Reg. No. UE 131/91

Munich, 09 April 2003



Sworn translator's signature and seal