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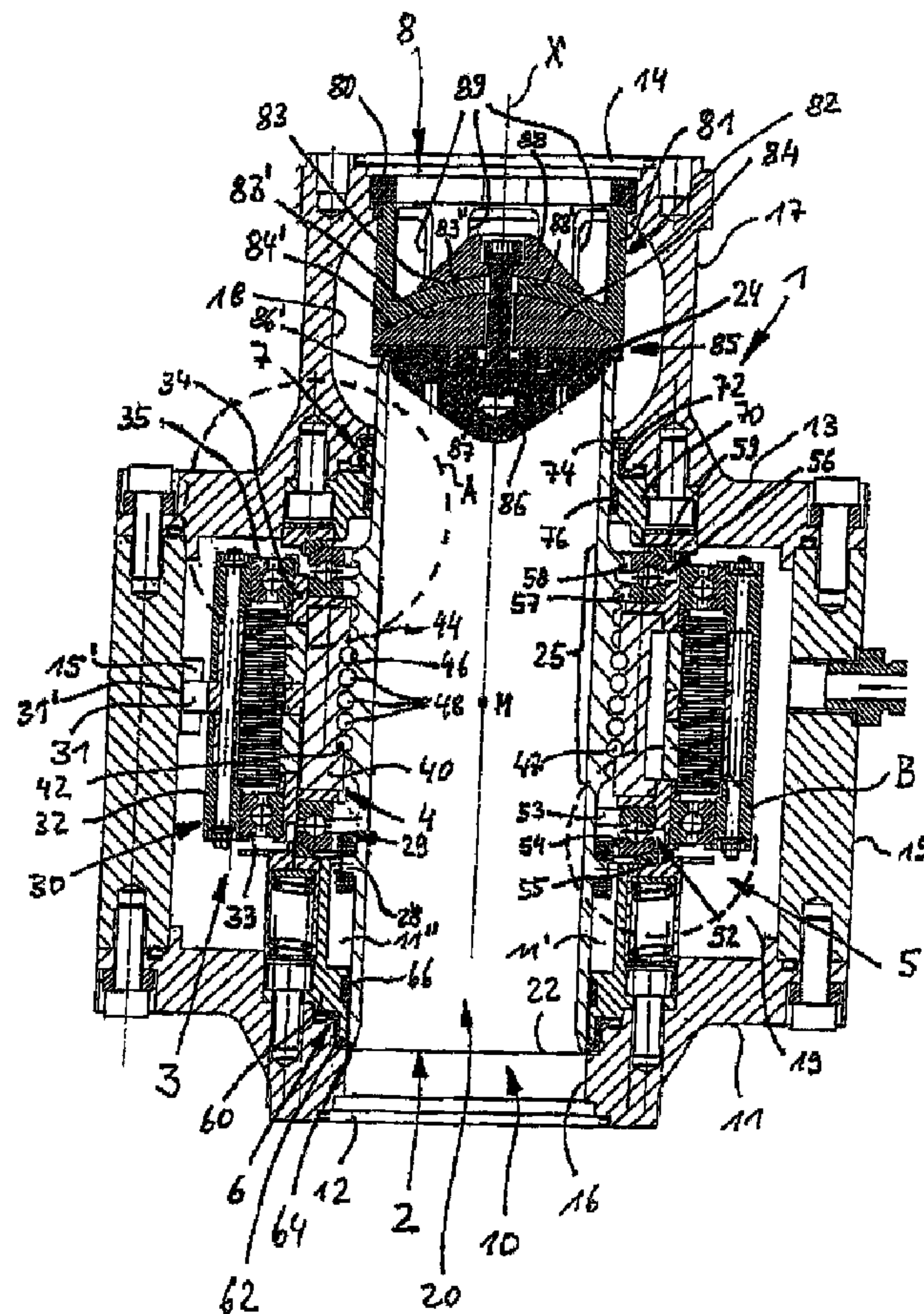
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(54) Title: COAXIAL VALVE



(57) Abrégé/Abstract:

A coaxial valve with a valve box, that has at least one inlet opening and at least one outlet opening and features a common flow channel, a cylindrical valve casing, which is prevented from turning at one segment of the flow channel, but is intended to be axially



(57) **Abrégé(suite)/Abstract(continued):**

movable and which features an opening for the fluid inlet port as well as an opening for the fluid outlet port, both of which join up in the flow channel, a shutoff mechanism located inside the valve box which is positioned coaxially to the valve casing and which is designed to close off the inlet port or the outlet port of the valve housing, and the drive to the axial movement of the valve casing which is marked by the fact that the valve casing is enclosed at least in sections at its outermost surface by at least one grooved external circular groove, that the valve casing at the segment of the grooved external circular groove is enclosed by one drive casing which is coaxial to the drive casing, that it has at its internal diameter at least one inner circular groove, one which is adapted to the outer circular groove so that the inner and outer grooves are engaged via the inside ball bearings, to create a ball planetary gear and ball rotary spindle drive, and that the drive casing in the valve box is turnable, but firmly seated axially and forced to turn by the drive motor which is intended to be inside of the valve box.

ABSTRACT

A coaxial valve with a valve box, that has at least one inlet opening and at least one outlet opening and features a common flow channel, a cylindrical valve casing, which is prevented from turning at one segment of the flow channel, but is intended to be axially movable and which features an opening for the fluid inlet port as well as an opening for the fluid outlet port, both of which join up in the flow channel, a shutoff mechanism located inside the valve box which is positioned coaxially to the valve casing and which is designed to close off the inlet port or the outlet port of the valve housing, and the drive to the axial movement of the valve casing which is marked by the fact that the valve casing is enclosed at least in sections at its outermost surface by at least one grooved external circular groove, that the valve casing at the segment of the grooved external circular groove is enclosed by one drive casing which is coaxial to the drive casing, that it has at its internal diameter at least one inner circular groove, one which is adapted to the outer circular groove so that the inner and outer grooves are engaged via the inside ball bearings, to create a ball planetary gear and ball rotary spindle drive, and that the drive casing in the valve box is turnable, but firmly seated axially and forced to turn by the drive motor which is intended to be inside of the valve box.

P611126/DE/1

COAXIAL VALVE

TECHNICAL BACKGROUND

The invention pertains to a coaxial valve according to the generic term of patent claim 1, in particular a coaxial valve for cryogenic fluids.

Special requirements must be met with valves that serve for the regulating and sealing off of a liquid or gaseous medium under extreme conditions, such as chemical aggressiveness, very high or very low temperatures or under very high pressure. Fields of application for valves that serve to seal off a fluid or gaseous medium are found in power trains in air and space travel. Here valves are exposed to extreme temperatures and extreme temperature changes. For valves used for fluid and gaseous rocket fuels there are additional parameters, which increase the demands on this type of valve, as for example mass flow, high pressure, and short switching time for the opening and closing of the valve or for getting the valve into a special position.

STATE OF THE TECHNOLOGY

A valve with these specifications is known from DE 199 60 330 C2. With this model, the valve shaft is moved axially in relation to the valve's closing mechanism within the flow by means of a lever, which is activated by an electric servo motor from the outside of the valve body.

On account of this servo motor being mounted externally, this valve has relatively large mounting dimensions. In addition, operation using a lever mechanism is complicated and therefore presents increased risks for malfunctioning to an extent which is unacceptable in applications in space aviation.

DESCRIPTION OF THE INVENTION

It is the goal of this invention to design a valve with these specifications which is extremely reliable in its operation because of its compact construction, low friction, low energy requirements and light weight.

This goal has been achieved with the distinguishing features of patent claim 1.

The valve shaft is therefore equipped, section by section, on its outer surface with at least one external adjusting nut with threads and surrounded in each section of this external adjusting nut by a drive sleeve which is coaxial to the valve shaft. The drive sleeve is equipped on its interior with at least one threaded internal adjusting nut, which fits against the outer adjusting nut in such a way that the inner and outer threads match and thus perform the ball screw-driven propulsion of a linear integrated ball screw drive. The drive shaft can turn within the valve casing but is axially secured and rotated by a driving motor installed on the inside of the valve shaft. The driving motor and the driving shaft actuate the drive for the valve shaft by taking into consideration the section of the threaded outer nut and the bearings which are integrated into the valve shaft.

The valve shaft is thus identical with the spindle of the screw-driven propulsion. The advantage of the construction described in this invention is the compact structure of this coaxial valve which is achieved by the integration of the valve shaft with the screw driven propulsion, and the resulting light weight.

Further advantages in the design of this invention will be listed in the sub-claims.

It is especially of advantage when the drive casing is surrounded by the rotor of the drive shaft and is connected to prevent any rotation. This configuration of the motor coaxially with the valve shaft provides for a particularly compact construction of the coaxial valve. It is advantageous that the rotor is surrounded by a stator from the driving motor and that the stator is prevented from turning within the valve casing.

It is also beneficial when the stator's position allows for at least a certain amount of axial shifting because this design will compensate for thermal expansion of the various elements of the drive.

In another advantageous design the rotor can turn inside the stator by means of at least two radial roller bearings. The provision of this roller bearing ensures that the space between the rotor and the stator remains constant during operation, especially under temperature fluctuations.

The driving motor being electrically driven presents an advantage. It is also conceivable that, for example, a hydraulic driving motor could be used.

In another advantageous model the drive shaft is positioned above two axial roller bearings. This placement promotes the attachment of the drive shaft within the valve casing and thus ensures a definite axial positioning of the ball screw driven propulsion.

Optimally, the two axial roller bearings are each provided with a circular, domed convex outer surface within their respective outer bearing rings, where these convex outer surfaces are supported in turn by a corresponding concave inner surface on the interior of the valve casing where the respective spherical and concave and convex surfaces share the same central point on the axis of the valve casing. With this design the entire drive system including the ball screw propulsion is at least to some degree pivotable in all directions around the central point, so that tensions caused in the drive especially by temperature fluctuations are counter-balanced in the casing and/or in the drive in order to guarantee the valve's secure seal and enable an abrasion-free operation of the valve shaft even in the presence of tension within the valve casing and/or in the drive.

These features are improved in the enhanced modification of the design by the provision of the closing mechanism with a first part which has a domed concave surface pointing toward the valve shaft, and where a domed convex surface of a second part can be pivoted in such a way that these two parts are connected in an axial direction, but can move relative to each other along the domed surfaces, while the central point of the domed surfaces of the closing mechanism is aligned with the central point of the two domed axial roller bearings. In this way the second part of the closing mechanism with a tight seal is positioned in a way that allows for pivoting around the same central point, thereby further improving the reliability of the seal even where there is tension within the valve casing and/or in the drive.

In a preferred embodiment the closing mechanism is equipped on the second part with a valve seat which, together with the front-sided rim around the valve port of the neighboring end of the valve shaft effects an even better seal when the valve is closed.

The invention will be more closely described later by means of an example with references to an illustration.

BRIEF DESCRIPTION OF THE ILLUSTRATION

Shown are:

Fig. 1 a cross-section of a coaxial valve as pertaining to the invention;

Fig.2 a detail as shown by A in Fig.1; and

Fig.3 a detail as shown by B in Fig.1.

ILLUSTRATION OF PREFERRED DESIGN EXAMPLES

Fig. 1 shows a cross-section of a coaxial valve. In the valve box 1 a flow channel 10 with a fluid inlet opening 12 and a fluid outlet opening 14 is provided. The fluid inlet opening 12 and the fluid outlet opening 14 on opposite ends of the valve box 1 are constructed in such a way that the flow channel 10 from the fluid inlet opening 12 is level with the fluid outlet opening 14. In the cross-sectional view, flow channel 10, the fluid inlet opening 12 and the fluid outlet opening 14 are arranged in a circular fashion and coaxially to each other, whereby they share a common center line X. In the area of the fluid inlet opening 12 the flow channel 10 is formed by a first cylindrical bore section 16. The first cylindrical bore section 16 is

provided with a first frontal lid section 11 of valve box 1. The fluid outlet opening 14 is provided with a second frontal lid section 13 on the side opposing the first frontal lid section of the valve casing. A cylindrical mid section 15 is situated between the first frontal lid section 11 and the second frontal lid section 13 of the valve box 1. Both lid sections 11, 13 are screwed together with the cylindrical mid section, as illustrated in Fig. 1.

The second frontal lid section 13 shows a cylindrical casing connection 17 protruding forward in the direction of the center line X which has been provided with a fluid outlet opening 14. On the inside of the cylindrical casing connection 17 a basically cylindrical second bore section 18 of the flow channel 10 is built, whereby this bore section possesses a diameter which is greater than that of the first cylindrical bore section 16. Between the first cylindrical bore section 16 and the second basically cylindrical bore section 18 of the flow channel 10, a cylindrical internal space 19 is located in the area of the mid section 15 of the valve box 1, the diameter of which is considerably larger than the diameter in the second basically cylindrical bore section 18.

In the flow channel 10 there is a tubular valve casing 2 coaxial to flow channel 10 between the first cylindrical bore section 16 and the second basically cylindrical bore section 18. The valve casing 2 is made circular in cross-section and free to travel along its axis, which is identical with the center line X. The valve casing 2 is constructed as a straight tube and surrounds an inner channel 20, which is provided with a front-sided inlet port 22 next to inlet opening 12 and a front-sided outlet port 24 which faces toward fluid outlet opening 14. Thus the inner channel 20 provides a central section of flow channel 10 between the first cylindrical bore section 16 and the second basically cylindrical bore section 18.

On the internal space 19 a drive 3 is provided, which acts on the valve casing 2 to move toward the center line X and which will be further described hereafter.

The drive 3 surrounds a drive motor 30, which is arranged inside the internal space 19 and has been constructed as an electric motor and surrounds valve casing 2 and a ball planetary gear 4 which couples the drive of motor 30 and the valve casing 2. Motor 30 and ball planetary gear 4 are also arranged coaxially around the valve casing 2, so that the rotation axis of the motor 30 and the ball planetary gear 4 align with the center line X under normal circumstances when no deformation of valve casing 2, caused by mechanical tensions, has taken place.

The motor 30 is constructed as an internal rotor motor and has an external radial stator 32 as well as an internal radial rotor 34. The stator 32 is prevented from turning by means of at least one radial outward protruding nib 31 on a radially inward turned rib 15' of the cylindrical mid section 15, but can be axially displaced. This possibility for axial displacement facilitates a minimal relative movement in axial direction between the valve box 1 and the drive 3, thus avoiding tensions within drive 3 and in the valve box 1 on account of varying thermal expansion of drive 3 and valve box 1. For the same reason a nib 31' is allowed in addition between the radial outer edge of the nib 31 and the inner wall of the cylindrical mid section 15 which also facilitates a radial relative movement between the drive 3 and the valve box 1.

The stator 32 of the drive motor 30 is equipped with an electrical winding familiar to those versed in the art. The rotor 34 inside the stator 32 is equipped with permanent magnets familiar to those versed in the art around the outer surface. The rotor 34 is pivotable without

friction by means of two radial ball bearings 33, 35 inside stator 32. This positioning of rotor 34 inside stator 32 by means of ball bearings 33, 35 ensures that a constant radial distance is maintained between rotor 34 and stator 32, even when extreme thermal influences have an effect on drive 3.

A cylindrical drive shaft 40 which is part of the ball planetary gear 4 has been provided inside the rotor 34 and is also prevented from turning and axially tightly connected with rotor 34. The drive shaft 40 is also arranged in coaxial order with valve casing 2, and the middle axis of the drive shaft 40 is identical with the center line X of the valve casing 2.

The drive shaft 40 is provided with at least one threaded inner circular groove 42. The drive shaft 40 surrounds a central radial, outwardly tapering section 25 of the valve casing 2. This middle section 25 of the valve casing 2 forms an inner drive element 44, which is integrated with the valve casing 2 and which exhibits a threaded outer circular groove 46 on its exterior circumference which extends in axial direction across almost the entire length of the middle section 25 which is longer in axial direction than the section of the drive shaft 40, which is connected with the inner circular groove 42.

Between the radial outer circumference of the drive element 44 which has been constructed by the section 25 of the valve casing 2 and the inner circumference of the drive shaft there is only a very small space, so that the inner circular groove 42 and the outer circular groove 46 shown in the covering of the ball bearing channel 47 in Fig.1 form a basically circular cross-section, which contains numerous balls 48. This way the inner drive element 44, the balls 48, and the drive casing 40 will form the ball planetary gear 4. Drive 3 and the ball planetary

gear 4 will create a ball rotary spindle drive 5 for the valve casing 2, which is integrated into the ball rotary spindle drive.

The valve casing 2 is constructed within the area of its flow inlet port 22 which has been inserted in the first frontal lid section 11 and has been sealed off with a slide ring gasket sealing washer 6. In the same way the valve casing 2 is constructed in the area of its opposite flow outlet port 24 and has been sealed off with a second slide ring gasket sealing washer 7 axially, whereby the second slide ring gasket sealing washer 7 is inserted in the second frontal lid section 13.

The first slide ring gasket sealing washer 6 consists of a first ring-shaped insert element 60, which surrounds the valve casing 2 and is equipped with a circular seal 62 with a sealing lip 64 fitted to the outer surface of the valve casing 2 and seals it. Axially inward from the sealing lip 64, turned away from the inlet port 22, that is, in the first insert element 60, there is a slide ring 66, which surrounds the outside of the valve casing 2 and turns this with minimal friction.

In an analogous fashion the second slide ring gasket sealing washer 7 shows a second insert element 70, which is tied to the second frontal lid section 13. The second insert element 70 is equipped with a ring-shaped seal 72 which has a radially inward turned sealing lip 74 and surrounds and seals the outer circumference. In the second insert element 70, axially inward from the sealing lip 74, turned away from the flow outlet port 24, there is an slide ring 76, which surrounds the valve casing 2 and turns it with absolutely minimal friction.

The ball rotary spindle drive 5 consisting of the drive motor 3 and the ball planetary gear 4 including the valve casing 2 is situated inside the valve box 1 and can be turned a little in all directions around the ball central point M, so that this ball central point M is positioned on the center line X, as outlined below. This positioning is achieved by means of two ball bearings 52,56 coaxial to the center line X which have corresponding axial inner bearing ring 53,57 and which have been installed on opposite front sides of the rotor 34. The corresponding bearing rings 54,58 of the axial ball bearings 52, 56 are supported by the first frontal lid section 11 and/or the second frontal lid section 13 in a way that will be described later on. In addition, there is a support ring 55 in place coaxially to the center line X and similarly on the second frontal lid section, a support ring 59 is located coaxially to the center line X.

The positioning of the ball rotary spindle drive 5 inside the valve box 1, detail A in Fig. 1 will now be described by means of Fig.2. The description is given using the upper axial ball bearing 56 in Fig.1, where the support of the lower axial ball bearing 52 is achieved in the first frontal lid section 11 in the same way.

The support ring 59 is affixed to the second insert element 70, which is connected with the frontal lid section 13 in a manner familiar to those versed in the art. On its axially and radially inward side the support ring 59 is equipped with a supporting spherical, concave inner surface 59' which has a corresponding ring-shaped, spherical, convex outer surface 58' which is found on the axial and radial outer area of the axial outer support ring 58 of the axial ball bearing 56. In the same way the axially outer bearing ring 54 of the axial ball bearing 52 is equipped with a ring-shaped, spherical, convex outer surface 54 as is the support ring 55

which is affixed to the first insert element 60 of the first frontal lid section 11 with a spherical, concave inner surface 55', as shown in Fig.3.

The convex surfaces 54' and 58' are ring-shaped segments of spheres in a virtual spheres with a central point M on the center line X. Even the concave surfaces 55' and 59' are ring-shaped spherical segments of a virtual sphere with the same central point M. In this manner the entire rotary spindle drive 5 can rotate a little around the center point M with relative movement between inner and outer surfaces 54'' and 55'', as well as surfaces 58'' and 59''.

Furthermore, Fig. 3 shows that the valve casing 2 in the area of the first frontal cover section 11 is fitted with a pivot 26 projecting radially outwards, and a ball bearing 27 is connected to the pivot. Both the pivot 26 and the ball bearing 27 then catch a longitudinal slot 11'' of the first frontal lid section 11 that runs parallel to the center line X, and the ball bearing 27, including its outer ring 27'', will roll off a side wall of the longitudinal slot 11''. In an analogous manner, on the valve casing 2 on the opposite side there is a pivot 28 projecting radially outwards. As shown in Fig. 1, a ball bearing 29 is connected to the pivot and will be steered in the same manner through a longitudinal slot 11'' designated for this side of the first frontal lid section 11. Both these sideways guiding methods in the valve casing 2 will prevent the valve casing 2 from rotating relative to the valve box 1, and will assure that the valve casing 2 – with the exception of a minimal swiveling action around the ball central point M – can only move in the direction of the center line X. Using ball bearings 27 and 29 as guide rollers will minimize any friction in the respective axial guide ways.

The second frontal lid section provides for a shutoff mechanism 8 inside the cylindrical casing connection 17, i.e. in the second mainly cylindrical bore section 18 of the flow channel

10. To open and close the valve, this shutoff mechanism will work in conjunction with the outlet port 24 of the valve casing 2. The shutoff mechanism 8 includes a ring-shaped base section 80 positioned coaxially to the center line X in the area of the fluid outlet opening 14 in the second frontal lid section 13. Connected to the ring-shaped base section 80 is a cylindrical tubular pedestal section 81 which is also positioned coaxially to the center line X. It forms the first part 82 of the shutoff mechanism 8 and extends into the mainly cylindrical bore connection 18 in the direction of the axial flow.

The cylindrical pedestal section 81 is provided in its perimeter wall with a majority of openings 89, which produce a fluid connection between the mainly cylindrical bore section 18 of the flow channel 10 and the fluid outlet opening 14.

The axial front wall 83 of the cylindrical pedestal section 81 pointing inwards into the valve box 1 is designed as a concave wall and is provided with a concave front surface 83'', which is designed dome-shaped and constitutes a spherical segment of a virtual sphere with the central point M. An adapted convex outer surface 84'' of a support element 84 for a valve unit 86 rests in the concave front surface 83''. The support element 84 and the valve unit 86 together form a second part 85 of the shutoff mechanism 8. Also the support element 84 and the valve unit 86 are ordered co-axially to the central line X, whereby the convex outer surface 84'' of the support element 84 likewise forms a dome-shaped spherical segment of a virtual ball with the central point M.

The valve unit 86 is ordered to the side of the support element 84 turned away from the convex outer surface 84'' and points to the outlet port 24 of the valve casing 2. The valve unit 86 is designed conically, whereby in the area of its greatest perimeter it is provided with a

circular step 86'' forming a valve seat, which in sealing works together with the valve seat formed from the perimeter edge of the outlet port 24 of the valve casing 2 near the closed valve.

By means of a screw 87 centrally penetrating the concave front wall 83, which is braced against the front wall via a support element 88 provided on the back side of the concave front wall 83 of the cylindrical pedestal section 81, the valve unit 86 and the support element 84, and the first part 82 are braced against the second part 85 of the shutoff mechanism 8. The support element 88 is thereby provided with a concave front surface 88'' pointing to the front wall 83, which forms a spherical sector of a virtual sphere with the central point M. The convex back surface 83''' of the front wall 83, which is pointing towards the fluid outlet opening 14, is also part of a spherical surface with the central point M.

This shutoff mechanism 8 design, with its spherical surfaces showing the same central point M as the spherical surfaces of the ball rotary spindle drive 5 bearing inside the valve box, also allows the valve unit 86 to pivot a little around the center line M. Therefore, no significant uneven load will occur on the circular step 86''' of the valve unit 86 which controls the valve location of the sealing element 8. That means, even in cases where there is a slight pivoting of the ball rotary spindle drive 5 and the valve unit 86, a dependable seal regarding the valve in the area of the valve unit 86 and the outlet port 24 is guaranteed. Furthermore, this way any external constraining forces will be kept away from the ball rotary spindle drive 5.

Any reference item numbers listed in any claims, descriptions, and drawings are solely provided to better understand the invention. They are in no way intended to limit the scope of protection.

List of Reference Items

Reference Item No.:

1	Valve Box
2	Valve Casing
3	Drive
4	Ball Planetary Gear
5	Ball Rotary Spindle Drive
6	First Slide Ring Gasket Sealing Washer
7	Second Slide Ring Gasket Sealing Washer
8	Shutoff Mechanism
10	Flow Channel
11	First Frontal Lid Section
11 “	Longitudinal Slot
11 “”	Longitudinal Slot
12	Fluid Inlet Opening
13	Second Frontal Lid Section
14	Fluid Outlet Opening
15	Cylindrical Mid Section
15 “	Rib
16	First Cylindrical Bore Section
17	Cylindrical Casing Connection
18	Second Bore Section, Mainly Cylindrical

19	Internal Space
20	Inner Channel
22	Inlet Port
24	Outlet Port
25	Middle Section of 2
26	Pivot
27	Ball Bearing
27 “	Outer Ring
28	Pivot
29	Ball Bearing
30	Drive Motor
31	Nib
31 “	Gap
32	Stator
33	Radial Ball Bearing
34	Rotor
35	Radial Ball Bearing
40	Drive Casing
42	Inner Circular Groove
44	Inner Drive Element
46	Outer Circular Groove
47	Ball Bearing Channel
48	Balls
52	Axial Ball Bearing
53	Axial Inner Support Ring

54	Axial Outer Support Ring
54 “	Convex Outer Surface
55	Support Ring
55 “	Concave Inner Surface
56	Axial Ball Bearing
57	Axial Inner Support Ring
58	Axial Outer Support Ring
58 “	Convex Outer Surface
59	Support Ring
59”	Concave Inner Surface
60	First Insert Element
62	Circular Seal
64	Sealing Lip
66	Slide Ring
70	Second Insert Element
72	Ring-shaped Seal
74	Sealing Lip
76	Slide Ring
80	Ring-shaped Base Section
81	Cylindrical Tubular Pedestal Section
82	First Part of 8
83	Front Wall
83 “	Concave Front Surface
83 “”	Convex Back Surface
84	Support Element

84 “	Convex Outer Surface
85	Second Part of 8
86	Valve Unit
86 “	Circular Step
87	Screw
88	Support Element
88 “	Concave Front Surface
89	Openings
X	Center Line
M	Ball Central Point

Claims

1. Coaxial valve with

one valve box, having at least one fluid inlet opening and at least one fluid outlet opening, featuring a common flow channel connecting the two together;

a tubular shaped valve casing, which is prevented from turning, but is axially pivotable, and which features a fluid inlet port as well as an outlet port, which join inside of a single flow channel;

a shutoff mechanism located inside of the valve box, which is coaxial to the valve casing and is designed to shut off the inlet port or the outlet port of the valve casing; and

a drive to produce the axial movement of the valve casing,

specifically:

the valve casing is provided, at least in sections, with at least one threaded external nut at its outer circular groove;

the valve casing is enclosed by a coaxial drive casing at the location of the outer circular groove;

the drive casing is provided with at least one threaded inner circular groove, which is adapted to the external circular groove so that the ball bearings that run along the inner and outer circular grooves create tension against one another, thus producing the ball planetary gear of ball rotary spindle drive; and

the drive casing located inside of the valve box is pivotable but is firmly seated axially and is made to pivot by a drive motor inside of the valve box.

2. Coaxial valve in accordance with Claim 1,

specifically:

the drive casing is enclosed in a rotor of the drive motor and is prevented from turning.

3. Coaxial valve in accordance with Claim 2,
specifically:

the rotor is enclosed by a stator which is part of the drive motor; and
the stator is firmly seated and prevented from turning inside of the valve box.

4. Coaxial valve in accordance with Claim 3,
specifically:

the stator is axially pivotable within the valve housing.

5. Coaxial valve in accordance with Claim 3 or 4,
specifically:

the rotor is housed inside of the stator along with at least two radial anti-friction ball bearings, and is installed so as to be pivotable.

6. Coaxial valve in accordance with one of Claims 1 to 5,
specifically:

the drive motor is an electric motor.

7. Coaxial valve in accordance with one of Claims 1 to 6,
specifically:

the drive casing is installed on two axial ball bearings inside of the valve box.

8. Coaxial valve according to Claim 7,

specifically:

the two axial ball bearings at their respective axial outer support rings are each provided with a spherical, convex outer surface, designed to correspond with an opposing concave inner surface which support one another inside of the valve box; and

at the same time the corresponding spherical concave and convex surfaces are also located at the center line (X) of the valve box at the central axis of the ball central point (M).

9. Coaxial valve in accordance with Claim 8,

specifically:

the shutoff mechanism features a first part, which is provided with a circular, spherical concave surface pointing towards the valve casing in which one surface belonging to the first part of the shutoff mechanism is installed in such a manner that it is rotatable, so that both parts are axially connected, but can be moved alongside the shell-shaped surfaces relative to one another;

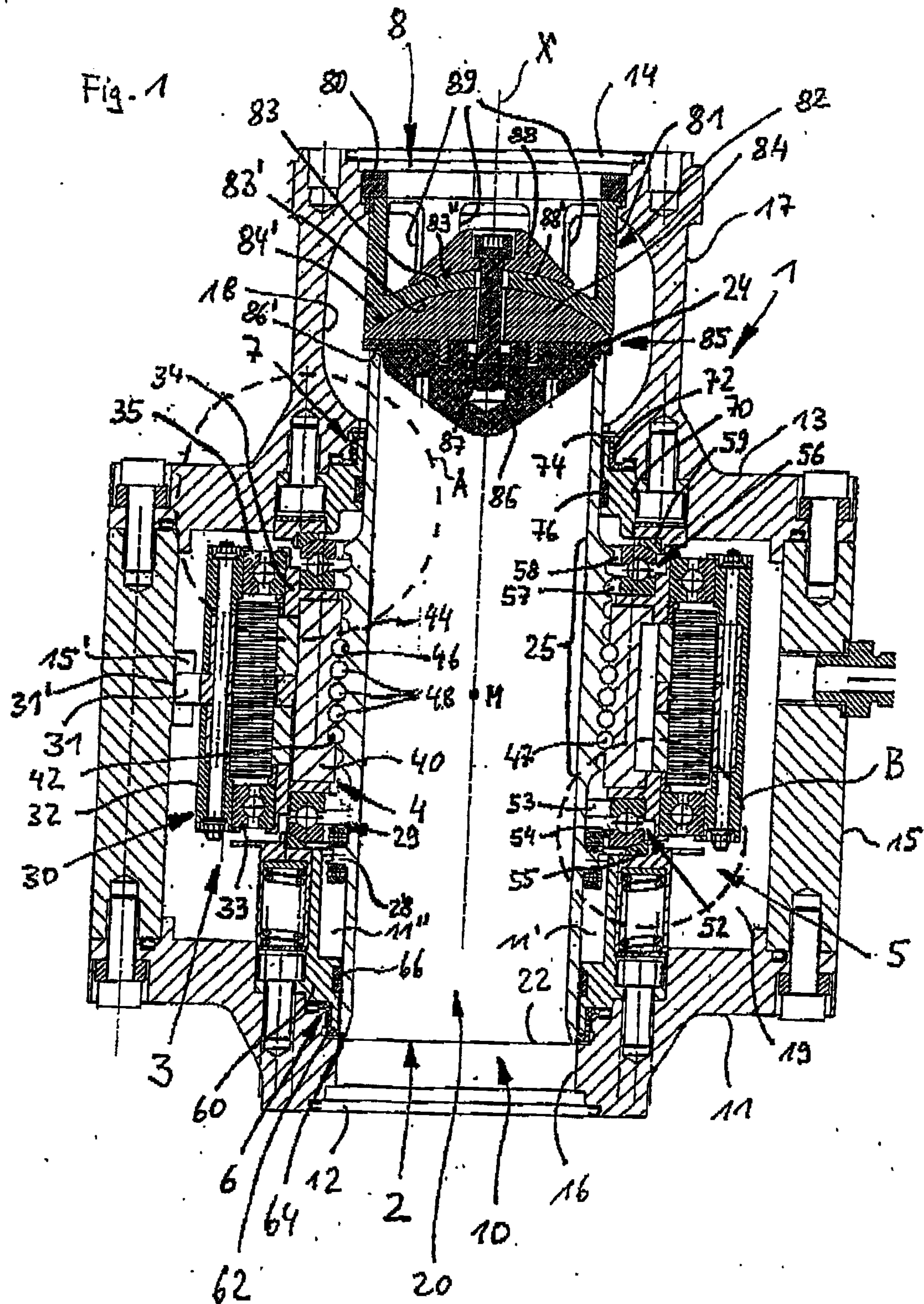
at the same time, the ball central point (M) of the spherical surfaces of the shutoff mechanism aligns with the ball central point (M) of the shell-shaped surfaces and their respective radial roller bearings.

10. Coaxial valve in accordance with Claim 9,

specifically:

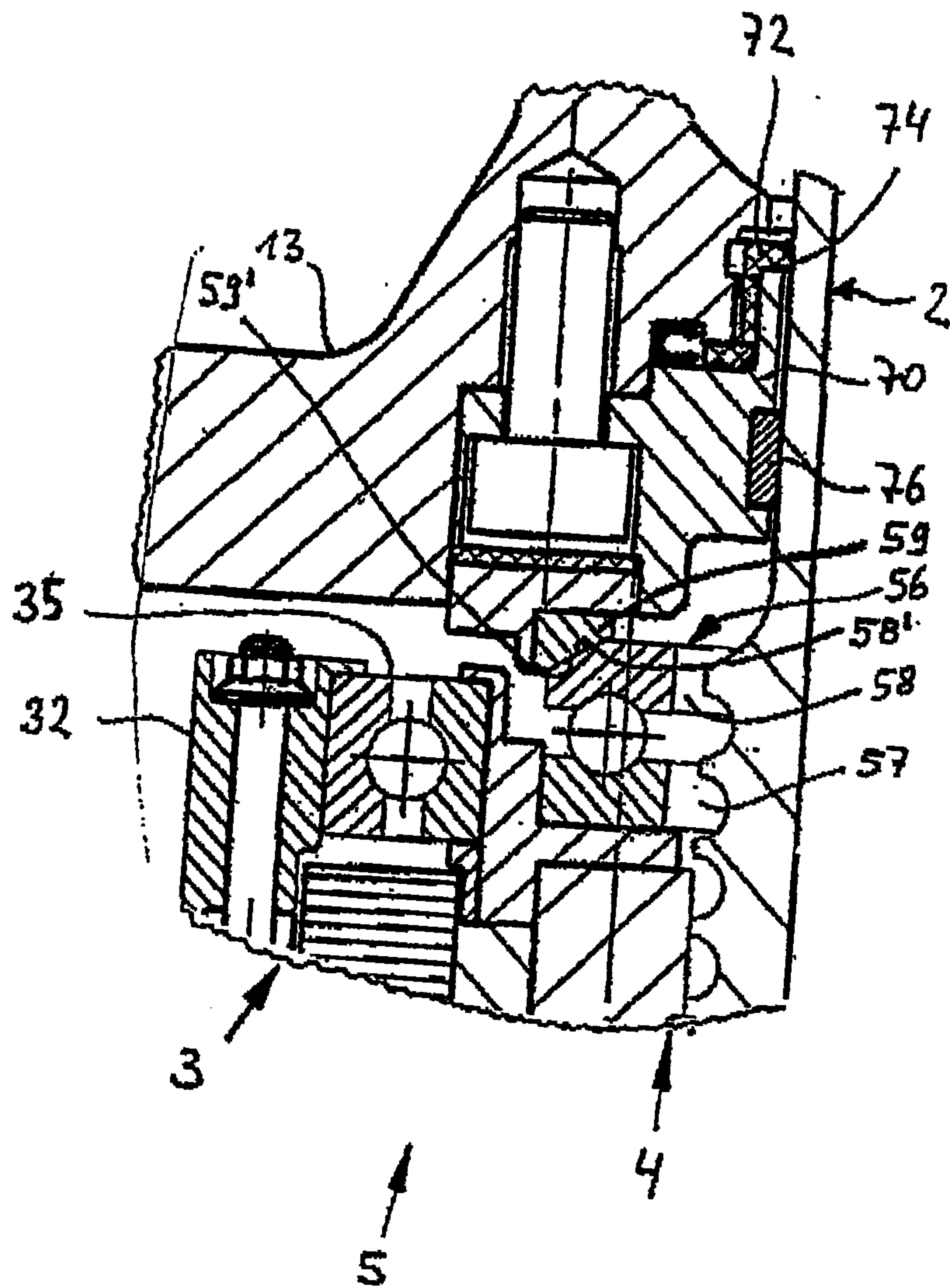
the shutoff mechanism at its second part is provided with a circular step, which together with the adjacent edge of the valve casing, which is restricted by the front side of the rim of the outlet port, functions to create a seal when the valve is closed.

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Fig. 2



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Fig. 3

