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(12) (19) (CA) **Demande-Application**

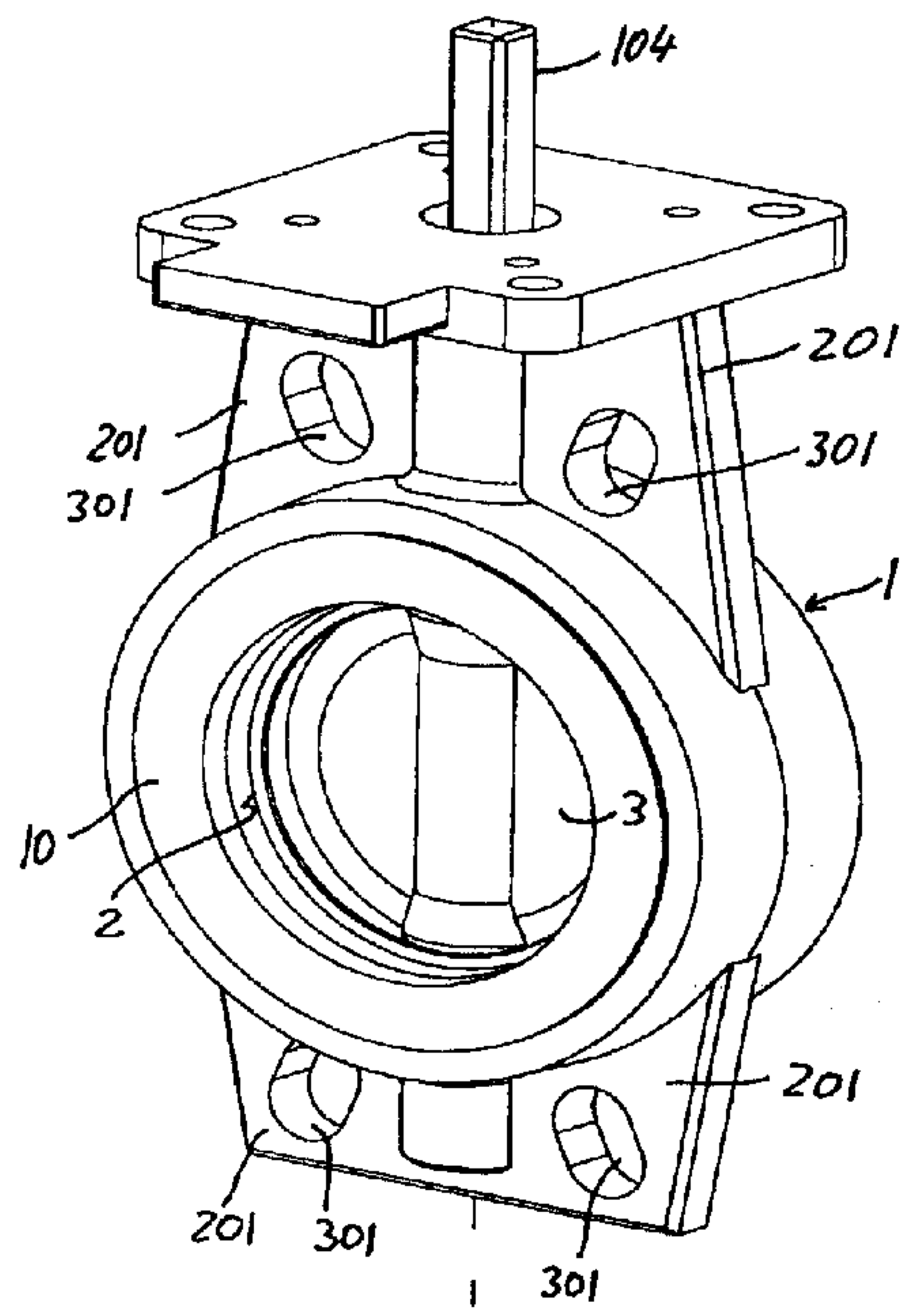
(21) (A1) **2,286,033**
(86) 1998/04/06
(87) 1998/10/22

(72) TUBARO, BRUNO, IT
(71) TECNOPLASTIC SPA, IT

(51) Int.Cl.^{6} F16K 1/228, F16K 31/53, F16K 27/02
(30) 1997/04/11 (SV97A000018) IT

(54) **ROBINET D'ETRANGLEMENT**

(54) **THROTTLE VALVE**



(57) L'invention concerne un robinet d'étranglement. Ce robinet comprend une tige de robinet (3) qui coopère avec un siège de soupape (2,5,6) et possède un joint d'étanchéité (5) sensiblement annulaire qui, lorsque la tige (3) est en position de fermeture, adhère avec une certaine force de compression, transversale au sens d'écoulement, au bord d'extrémité périphérique de la tige (3). Selon l'invention, au moins une partie de la force de compression agissant entre le joint d'étanchéité (5) et le bord d'extrémité de la tige (3) est exercée par la pression hydrostatique du fluide intercepté lorsque la soupape est dans la position de fermeture. Le joint d'étanchéité (5) comporte des surfaces de compression (605) qui, dans une position extérieure, dans le sens radial par rapport à la surface, entrent en contact avec le bord d'extrémité périphérique de la tige (3), et se situent

(57) A throttle valve comprising a throttle plug (3), which cooperates with a valve seat (2, 5, 6), having a substantially annular gasket (5) which, when the throttle plug (3) is in the closing position, adheres with a certain compressive force, transverse to the flow direction, against the peripheral end edge of the plug (3). According to the invention, at least a part of the compressive force acting between the gasket (5) and the end edge of the plug (3) is exerted by the hydrostatic pressure of the fluid intercepted when the valve is in the closing condition. The gasket (5) has compression surfaces (605), in a radially outer position with respect to the surface contacting the peripheral end edge of the plug (3), turned opposite the contact surface between the gasket (5) and the plug (3), and being oriented in such a way that at least one of their directional components is

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à l'opposé de la surface de contact entre le joint d'étanchéité (5) et la tige (3), et sont orientées de telle sorte qu'au moins un de leurs composants directionnels est parallèle à l'écoulement. Cette disposition permet de générer une compression perpendiculaire à l'écoulement. Ces surfaces (605) sont accessibles et exposées au fluide intercepté.

parallel to the flow, in order to generate a compression perpendicular to the flow. Said surfaces (605) are accessible and exposed to the intercepted fluid.

PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : F16K 1/228, 27/02, 31/53	A1	(11) International Publication Number: WO 98/46918 (43) International Publication Date: 22 October 1998 (22.10.98)

(21) International Application Number: PCT/EP98/01995

(22) International Filing Date: 6 April 1998 (06.04.98)

(30) Priority Data:
SV97A000018 11 April 1997 (11.04.97) IT

(71) Applicant *(for all designated States except US)*: TECNOPLASTIC SPA [IT/IT]; Via Fontanelle, 22, Loc. Sarissola, I-16012 Busalla (IT).

(72) Inventor; and
(75) Inventor/Applicant *(for US only)*: TUBARO, Bruno [IT/IT]; Via N. Gallino, 34/2, I-16010 Savignone (IT).

(74) Agent: KARAGHIOSOFF, Giorgio, A.; Via Pecorile, 27/B, I-17015 Celle Ligure (IT).

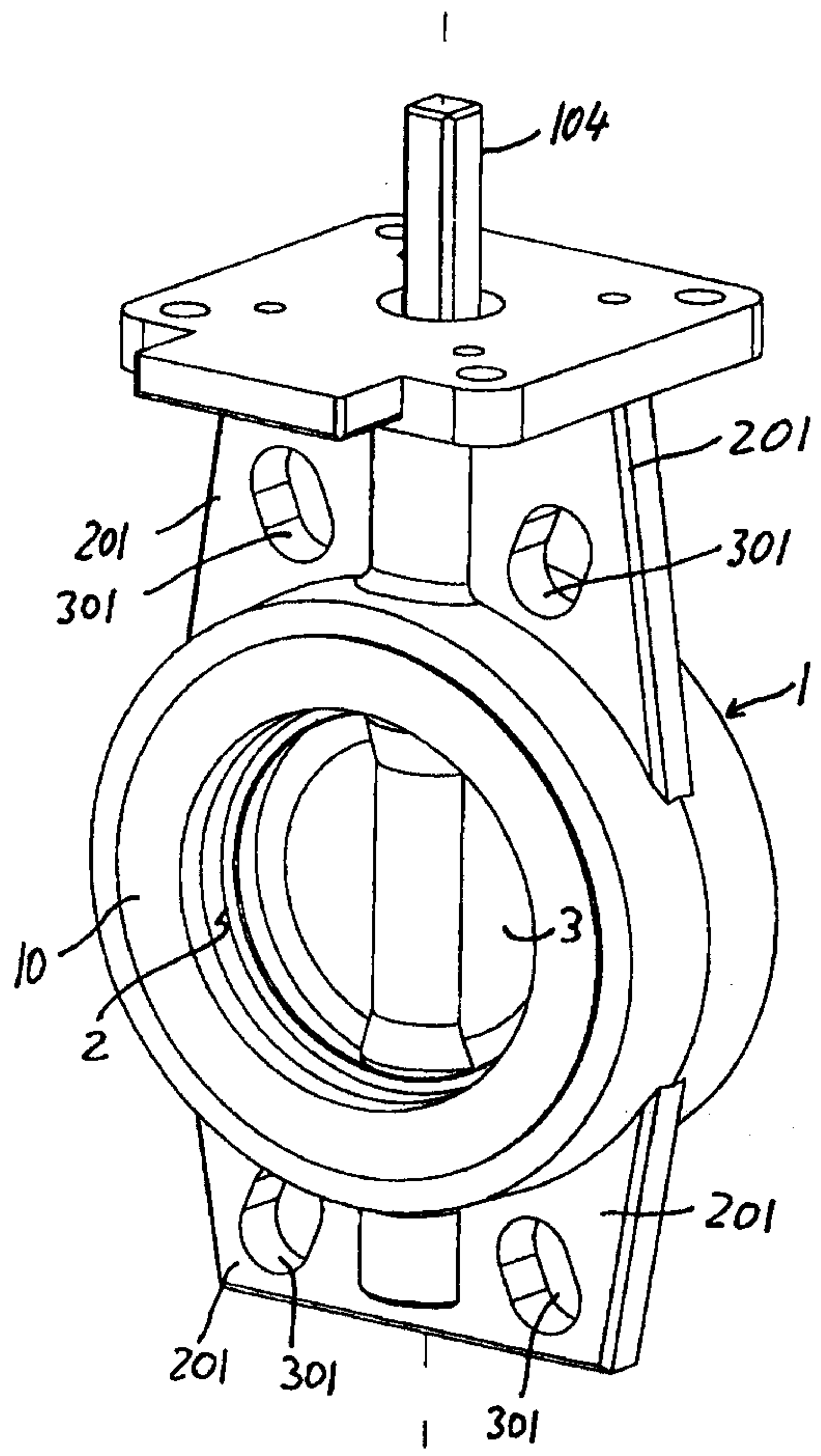
(81) Designated States: AU, BR, CA, CN, CZ, HU, IL, JP, KR, MX, PL, RO, RU, SG, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.

(54) Title: THROTTLE VALVE

(57) Abstract

A throttle valve comprising a throttle plug (3), which cooperates with a valve seat (2, 5, 6), having a substantially annular gasket (5) which, when the throttle plug (3) is in the closing position, adheres with a certain compressive force, transverse to the flow direction, against the peripheral end edge of the plug (3). According to the invention, at least a part of the compressive force acting between the gasket (5) and the end edge of the plug (3) is exerted by the hydrostatic pressure of the fluid intercepted when the valve is in the closing condition. The gasket (5) has compression surfaces (605), in a radially outer position with respect to the surface contacting the peripheral end edge of the plug (3), turned opposite the contact surface between the gasket (5) and the plug (3), and being oriented in such a way that at least one of their directional components is parallel to the flow, in order to generate a compression perpendicular to the flow. Said surfaces (605) are accessible and exposed to the intercepted fluid.



Throttle valve

The invention relates to a throttle valve, comprising a throttle plug which cooperates with a valve seat, said seat having a substantially annular gasket which, when the throttle plug is in the closing position, adheres with a certain compressive force, transverse to the flow direction and/or to the axis of the valve seat, against the peripheral end edge of the throttle plug.

In prior art throttle valves of this type, in order to ensure a sufficient sealing effect between the peripheral end edge of the plug and the annular gasket, the gasket and the plug have to be compressed against each other with a relatively strong force, being sufficient to oppose the action of the pressure of the intercepted fluid. In these valves, the sealing contact surfaces between the throttle plug and the gasket are oriented substantially parallel to the flow direction. Pressure is exerted by the fluid against the lateral faces of the plug and of the gasket, i.e. tangentially or perpendicularly to the radial compressive force between the plug and the gasket, which ensures the sealing action. This condition is very unfavorable. The fluid performs a wedging action between the two surfaces and the pressure of the intercepted fluid is not used to contribute to the sealing contact between the plug and the gasket. Therefore, prior art throttle valves of this type are manufactured in such a way that, when closing the valve, the plug presses with a predetermined force the gasket, which has a certain elasticity and compressibility so that the two parts are preloaded against each other to such an extent as to oppose the strong pushing action of the intercepted fluid flow.

However, this condition requires a considerable force to move the throttle plug form one to the other of the closing and opening positions, which is generally added to the force exerted by the pressure of the fluid on the throttle plug, when the latter is moved to the closing position.

In these two conditions, prior art valves require a very strong construction on the plug controls, which have to ensure a sufficient resistance to the necessary moving forces. Furthermore, in the hand controlled version, the operation is driven by operating levers, which have to be very long, in order to enable people having a medium physical strength to overcome the resistance to the plug movement.

This considerable resistance to the throttle plug movement involves even more serious drawbacks, when the valve is required to be controlled by a motor-driven actuator. In this case, the motor-driven actuator must be properly dimensioned since it has to provide the power required to move the plug. In these types of valves, because of the aforementioned resistance to movement, the actuators become by far the most burdensome element. Moreover, the considerable stress acting thereupon increases wear, limiting their medium life, and requiring more frequent maintenance interventions, and even early replacements of the actuators. Further, the choice among actuator types is restricted to those motor types allowing for the required power supply.

Hence, the invention is based on the problem of improving a valve of the type described hereinbefore, so that, thanks to relatively simple and cheap expedients, the plug offers a lower resistance to be moved into its two opening and closing positions, while ensuring a better sealing effect and lower costs for the servo-controlled actuators.

The invention solves the above problems, by providing a valve of the type described hereinbefore, in which at least a part of the gasket compressive force against the end edge of the plug is exerted by the hydrostatic pressure of the intercepted fluid, the gasket being provided, in at least some areas, preferably and substantially for its whole extension, and in a radially outer position with respect to the surface contacting the peripheral end edge of the plug, with compression surfaces which are turned opposite said surface contacting the plug, and oriented in such a way that at least one of their directional components is parallel to the flow, and said surfaces being accessible or exposed to the intercepted fluid.

Advantageously, the annular gasket has a radially outer annular part, and a radially inner part, whereas the valve body has a seat for holding said gasket including a seat for clamping said radially outer part, and a seat for housing the radially inner part of the sealing gasket, which is slightly bigger than said radially inner part of the gasket, and is conformed in such a way as to have ducts, apertures, and/or passages for the fluid on the side of the inner part of the gasket, which is provided with the compression surfaces having at least one directional component parallel to the flow, in order to generate a compression perpendicular to the intercepted fluid.

A preferred embodiment provides that the compression surfaces of the gasket, pressing against the plug, consist of the lateral walls of two substantially median coincident annular grooves, formed in the two faces of the annular gasket, said grooves forming an annular neck for connecting the inner part and the outer part of the gasket. The seats for clamping the outer part and those for housing the inner part of the gasket are jointed by an annular compressing narrowing, having, on the side facing the compression walls of the inner part of the gasket, lateral walls which extend at a certain distance from said compression walls, thereby forming, where the housing seat is wider than the thickness of the inner part of the gasket, substantially annular chambers, which may be accessed by the intercepted fluid, on the corresponding side of the throttle plug.

The seat for housing the inner part of the gasket and said inner part of the gasket have cooperating annular sealing contact surfaces, which are oriented transverse to the axis of the gasket and to the flow direction and particularly, are exposed to the hydrostatic pressure of the fluid and have at least one component transverse to the flow direction of the fluid, whereby the hydrostatic pressure of the fluid also acts in the direction of axial sealing compression of the lateral faces of the inner part of the gasket, against the corresponding opposite lateral wall of the seat for housing it.

When the annular sealing gasket is disposed in a housing seat which terminates at a certain distance from the peripheral end edge of the plug contacted by the inner part of the gasket, the combined effect of the hydrostatic pressure of the intercepted fluid, acting both radially and axially with respect to the gasket causes the inner part of the gasket to be substantially wedged between the peripheral end edge of the plug and the lateral wall of the housing seat, opposite to the intercepted fluid.

Thanks to the above-mentioned characteristics, the plug of the throttle valve according to the invention has a lower resistance to movement, since the compressive force required to ensure the sealing effect between the gasket and the plug is at least partially generated by the hydrostatic pressure of the fluid intercepted when the plug is in the closing position.

The gasket may be dimensioned in such a way that it is possible to calibrate the division of the plug compression against the gasket into the mechanical compression of the plug on the gasket, and the compression exerted by the hydrostatic pressure of the fluid, so as to reach the best sealing assurances, and the lowest resistance to the movement of the plug.

The mechanical compression of the gasket against the plug is substantially given by the difference between the inside diameter of the gasket and the outside diameter of the plug, and by the elasticity or compressibility of the gasket, whereas the compression exerted by the flow depends on how big is the component of the useful surface being oriented parallel to the axis of the gasket and, obviously, on the pressure of the intercepted fluid.

Therefore, both the manual operation and the operation by servocontrollable actuators, may be performed by exerting a minimum operating force on the plug. This has positive effects on the cost and on the dimensions of the valve controls, both hand- and motor-operated, as well as on the life and reliability of the valve.

Since the sealing compression between the plug and the gasket is at least partially exerted by the pressure of the fluid the highest functional reliability of the valve is reached for increasing fluid pressures. As the fluid pressure on the plug and on the gasket increases, the compression of the surfaces between which said two parts are meant to seal increases accordingly, whereas the gasket, i.e. the inner active part thereof, is wedged by a higher force, between the two parallel contact surfaces, which are transverse to the flow direction or to the axis of the gasket and/or to the passage span.

Moreover, since the precompression of the gasket must not be determined as dependent on the highest operating pressure, but on the lowest operating conditions, an enormous difference is observed in the operating effort especially at low pressures, said benefits being attenuated at higher pressures, as the maneuverability depends increasingly on the friction of the maneuver axle in the seats.

According to a further characteristic of the invention, which may be provided either separately or in combination, the control spindle of the plug is operated by a gear and worm drive. Particularly, when the valve is almost wholly made of plastic, the worm and gear drive may also be made of plastic, the worm being advantageously of the so-called globoidal type. In this case, the peripheral axial edge of the gear teeth has a shape substantially corresponding to the inside diameter of the worm thread, whereas the thread extending all along the worm does not wind about a cylindrical surface, but about a recessed surface, whose recess corresponds to the gear radius.

While this type of drive is very expensive when it is manufactured from metal, its manufacture from plastic is much simpler, and the gear and the worm may be manufactured through a usual injection molding process.

From a mechanical point of view, the precise shape coupling between the gear and the worm allows several teeth to engage, substantially for their whole extension, with the worm, whereby the drive, though being made of plastic, is arranged to withstand notably higher stresses, without producing an early deterioration or wear of the worm nor of the gear. This is achieved while keeping the manufacturing and maintenance costs at a low level.

A further important consideration about the throttle valve according to the invention is that it is a throttle valve being perfectly symmetrical with respect to the flow direction. The plug and the gasket have sealing contact surfaces having no substantial component transverse to the flow direction, but only being oriented substantially parallel thereto. Moreover, said sealing contact surfaces are centered with respect to the median plane of the valve, which is transverse to the flow direction, and contains the axis of rotation of the plug. The plug disc is mounted in such a way as to be centered with respect to the diametrical axis of rotation thereof, and cooperates with the gasket 5, i.e. with the part 405 thereof, by its annular peripheral rim, which is substantially cylindrical, or even possibly slightly crowned, particularly having the form of a sphere sector, anyway always being symmetrical to the median plane of the plug 3, which contains the axis of rotation. The surface of the part 405 of the gasket 5, cooperating with the plug disc, is also cylindrical. This construction is advantageous in that it provides that the valve is perfectly symmetrical with respect to the flow direction, allowing it to be mounted in pipelines which can carry fluids in both flow directions, with no need to account for correct positioning of the valve with respect to the relevant flow direction. As far as construction is concerned, the valve according to the invention may be manufactured less expensively than other types of valve, particularly valves having a plug which is eccentric with respect to the axis of rotation, and having conical plug/gasket contact surfaces. In fact, these valves require more complex molds, particularly made of plastic and manufactured by injection molding, and in addition, the conical surfaces often require an additional manufacturing phase, in which they are ground.

The symmetry of the valve according to the invention allows to obtain two diametrically opposite closing positions for the plug. This involves the advantage that the driving means of the plug and of the gasket are prevented from being worn in one direction or on one side only.

With respect to well-known valves having a symmetrical construction, the valve according to the invention has the advantages of a lower resistance to drive the plug, which advantages are obtained thanks to the eccentric arrangement of the axis of rotation to the plug disc. These advantages are obtained while keeping the advantages deriving from the centered or symmetrical position of the axis of rotation to the plug disc, and obviating, at the same time, the drawbacks of the asymmetrical or eccentric arrangement of the axis of rotation to the plug disc.

The invention also relates to other characteristics, which form the subject of the dependent claims.

The characteristics of the invention and the advantages derived therefrom will appear more clearly from the following description of a preferred embodiment illustrated, not by way of restriction, in the annexed drawings, in which:

Fig. 1 is a perspective view of a throttle valve according to the invention.

Fig. 2 is a frontal view of the valve according to fig. 1, as seen in the direction of the axis of the passage opening for the fluid flow.

Fig. 3 is a cross section with respect to a plane parallel to the median central axis of the plug and of the valve seat.

Fig. 4 is a perspective view of the sealing gasket for the valve according to the previous figures.

Fig. 5 shows the gasket according to fig. 4, through half exposed and half sectional views.

Fig. 6 is a cross section of the gasket with respect to a median plane, parallel to the axis of the gasket.

Fig. 7 is a magnified sectional view of a detail, relating to the gasket, to the peripheral end edge of the plug, and to the valve seat.

Fig. 8 is a view like fig. 7, in which a predetermined hydrostatic pressure is exerted by the intercepted fluid on the plug and on the gasket.

Fig. 9 is a sectional view of the valve according to the previous figures, with respect to a plane parallel to the axis of the control spindle.

Fig. 10 is a top plan view of the drive according to fig. 9.

Fig. 11 is a magnified view of the detail relating to the area in which the worm is engaged with the gear.

Fig. 12 is a perspective view of a variant embodiment of the valve according to the previous figures.

Fig. 13 shows the valve of fig. 12 associated to the two flanges, illustrated with dotted lines, and to spacers, illustrated with continuous lines.

Referring to the figures, a throttle valve comprises a valve body 1, in which there is provided a passage duct 2, having a substantially cylindrical shape. The passage duct forms a valve seat cooperating with a throttle plug 3, having the form of a disc. A transverse spindle 4, perpendicular to the passage duct is radially fixed to the throttle plug, and projects out of the peripheral edge of the latter on both diametrically opposed sides, whereas one of the ends of the control spindle 4 projects outwardly with a non-round grip end 104, which may be connected to a hand-controlled lever or to a member of the motor-driven actuator.

In the intermediate region between the non round grip end 104 and the plug, the spindle 4 has an annular throat 204, in which a sealing gasket of the o-ring type 304 is inserted. The opposite end 404 of the spindle 4 is held in a hole of the valve body 1, a bush 18 made of a material having a very low friction factor being interposed therebetween, whereas the bottom of the hole is outwardly open, by means of a vent or relief duct 101.

Coinciding with the plug, which is perfectly perpendicular to the axis of the passage duct 2, the valve seat has a substantially annular gasket 5, which is held in an annular groove 6, formed in the wall of the passage duct 2, for cooperation with the peripheral end edge of the throttle plug. The latter has a shape which substantially corresponds to the span of the passage duct 2, and its outside diameter is slightly shorter than the inside diameter of the passage duct.

The gasket 5 has an annular closed shape, with two integral rings 105, made of the same material, at the spindle 4 level. The rings 105 are oriented in such a way that their axis is substantially diametrical to the annular gasket and are coaxial to each other. When the gasket is in the mounted condition, the end sides of the rings 105, facing the plug, cooperate with coaxial annular flattings 103, of the end edge of the plug 3, which, at the area for junction with the control spindle 4 has an annular shape, coaxial to that of the rings 105, and surrounds the end connecting the spindle 4 to the plug.

An annular throat for housing the annular gasket 5 is provided in the duct 2, in a position coinciding with and coaxial to the end edge of the plug 3. In the areas intended for the passage of the spindle 4, the throat has a shape corresponding to that of the rings 105. Advantageously, the rings 105 have radially inner and radially outer end surfaces, with respect to the axis of the passage duct 2, which are inclined symmetrically with respect to the median plane of the throat 6. This inclination is such that, the ideal prolongations of said end surfaces of the rings 105 intersect at the axis of the spindle 4, in a radially outer direction with respect to the axis of the passage duct 2. The annular flattenings 103 around the areas for junction the spindle 4 to the plug are also inclined substantially accordingly.

With reference to figs. 4 to 7, the annular gasket 5 has two branches 205, having an annular sector, which are symmetrically identical with respect to the axis of the rings 105. Said two branches 205 consist of a radially outer part and a radially inner part, indicated as 305 and 405 respectively. The two parts are connected by an intermediate thin area 505, formed by two substantially intermediate and coincident grooves on the two faces of the annular gasket. The radially outer part 305 has a substantially polygonal section, particularly exagonal, whereas the radially inner part 405 terminates with one radially inner substantially flat end, particularly having rounded corners.

The throat forming the housing 6 has a clamping narrowing 106, locking the gasket in position, corresponding to the grooves 505 of the annular gasket 5. While the radially outer part of the throat is dimensioned in such a way as to adhere against the radially outer part of the annular gasket 5, locking it in position, the radially inner part of the throat, with respect to the narrowing 106, which is indicated as 206, is wider that the radially inner part 405 of the gasket 5. Further, the clamping neck or narrowing 106 has such a conformation that, when the gasket 5 is in the mounted position, its lateral walls 406 facing the radially inner part 405 of the gasket 5 are at a certain distance from the lateral wall connecting the grooves 505 to the radially inner part 405 of the gasket 5, forming two C-shaped chambers, like an annular sector which, thanks to the smaller width of the radially inner part 405 of the gasket 5 with respect to the associated part of the throat 206, communicate with the passage duct. The whole is dimensioned in such a way that the diameter of the gasket is slightly longer than the outer edge of the mouth of the throat 6, 206 for housing and clamping the gasket 5, whereas the outside diameter of the plug disc 3 substantially corresponds to, or is slightly shorter, within tolerance limits, than that of the passage duct 2.

The projection of the inner part of the gasket 5 is such that, by moving the plug 3 into the closing position, the plug exerts a certain compression on the inner part of the annular gasket, requiring, however, a small effort, and ensuring a sufficient sealing effect when intercepting fluid at very low pressure. This compression is calibrated, by appropriate dimensioning operations, in such a way as to reduce to a certain level the necessary effort to move the plug 3.

The walls 605 connecting the throat 505 to the radially inner wall 305 of the gasket 5, has an inclined orientation, such as to provide a component transverse and a component parallel to the flow direction, i.e. to the axis of the passage duct 2.

By increasing the pressure of the intercepted fluid on the plug 3 when the latter is in the closing condition, the fluid, also penetrating the C-shaped chambers, exerts a hydrostatic pressure on the surfaces 605, generating a component of axial compression of the inner part of the gasket 5 against the lateral wall of the radially inner part 206 of the housing throat 6, and a component of radial compression of the inner part 405 of the gasket 5 against the end edge of the plug 3. Particularly, the inner part 405 of the gasket 5 is pushed by the hydrostatic pressure of the intercepted fluid to wedge against the walls, transverse to each other and consisting of the end edge of the plug 3, and of the lateral wall of the inner part 206 of the housing throat 6. The inclination of the surfaces 605 and their extension are chosen in such a way that the radial compressive force of the inner part of the gasket 5 against the plug 3 is stronger than the push exerted radially, but in the direction of the gasket 5 moving away from the end edge of the plug 3, by the pressure of the fluid, tending to wedge between said two mutual contact surfaces. This condition is illustrated in fig. 8.

Thanks to the expedients described hereinbefore, by a predetermined minimum effort, the sealing effect is ensured up to predetermined very low pressures of the intercepted fluid, since the difference between the diameter of the plug and the diameter of the gasket provides a first minimum mutual compression of said two parts. As the hydrostatic pressure in the intercepted fluid increases, the fluid pressure itself contributes to the increase of the compression between the gasket 5 and the plug, to a greater extent than the force exerted by the pressure in the direction of detachment and penetration between the gasket 5 and the plug.

Therefore, moving the plug 3 from one to the other of the two positions is much less fatiguing, since the plug does not have to press the gasket with the force required to ensure the sealing effect, even for high pressures of the intercepted fluid. This allows for small sizes of the valve parts, especially of the driving means, which will not have to support considerable loads and dynamic stresses.

According to a preferred embodiment, the throat region consists of two parts, which divide it along the median transverse plane of symmetry. One of the parts is integrally formed in the valve body 1, whereas the other consists of a removable ring 10, which is clamped against the gasket 5, and against the valve body 1, by specifically provided screws, or by means for clamping flanges of the corresponding union to the valve.

In this way, the throat for housing and clamping the gasket 5 is completely accessible laterally, and the gasket 5 may be simply slipped into its correct position, with the help of the ring 10, thus substantially maintaining a one-piece construction of the valve body.

With reference to figures 9 to 11, the invention provides that the spindle 4 for controlling the plug 3 be rotatably driven by a gear 15 and worm 16 drive. Since said drive may be exposed to strong stresses, advantages may be taken from providing the worm 16 and the gear 15 with so-called globoidal profiles, in which the rib forming the thread of the worm is not wound around a cylindrical surface, but around a rotatably symmetrical surface, which is arched to an extent corresponding to the radius of curvature of the gear 15, whereas the teeth 115 of the gear 15 are not straight, but curved conjugately with respect to a radius of curvature of the worm 16, particularly conjugately to the minimum radius of curvature of the worm 16.

Thanks to this expedient, the worm and the gear do not only engage for a few teeth and substantially at the mutually tangent surfaces, but more teeth of the gear 15 simultaneously cooperate with the thread of the worm 16. This type of drive allows for a reduction of wear and especially for the use of weaker materials, such as plastics, for its manufacture. Thanks to this type of drive, the gear 15 and the worm 16 may be made of plastic, like the rest of the valve.

The use of plastic allows for a considerable reduction of difficulties and costs for manufacturing the drive, since the gear and the worm may be made through injection molding. This manufacturing technique allows to easily obtain constructive parts with a complex shape.

The expedient according to figs. 9 to 11 may be also provided separately from the particular manufacture of the throttle valve, and may be used in any type of valves, so as to provide, with little expense and in a functionally effective manner, a reduction of the effort for the manual operation of the valve. The dimensions and the particular conformation of the gear 15 and of the worm 16 may vary depending on needs and on applications.

By providing a gear and worm drive of the globoidal type, plastic may be used for its manufacture, thus obtaining safe, reliable and functionally lasting drives.

With reference to a variant illustrated in figs. 12 and 13, in this case the valve body 1 has a circular aspect also externally, the reinforcing wings, indicated as 201 in figs 1 and 2 of the previous embodiment having been removed.

In the embodiment of figs. 1 and 2, the valve body has an annular part, especially cylindrical, with coaxial and opposite extensions for housing the spindle 4, said extensions being connected to the valve body by means of reinforcing wings 201, provided with radial slots 301 for the passage of the bolts for clamping the flanges. The latter are clamped against each other by the bolts and, at the same time, against the valve body 1.

In the second embodiment, the lack of the wings 201 weakens the valve body 1, so the relief hole 101, connecting the hole for housing the end 404 of the spindle 4 with the outside is advantageous, as it allows the seat of the gasket 5, that is the radially outer part thereof, to communicate with the outside. In both embodiments, in case of strong water hammers or high pressures, the fluid under pressure may penetrate between the gasket 5 an the inner wall of the radially outer area of the valve body, and in this case, and especially in the second embodiment, the valve body is subjected to high pressures. The relief duct 101 allows said pressures to be released without stressing the valve body. On the other hand, this allows to use a valve having a construction according to the example of figs. 12 and 13, with considerable material savings and a considerable simplification of molds.

With particular reference to fig. 13, since, with the lack of the reinforcing wings 201, centering guides for the two opposite flanges for connection to the inlet and outlet ducts are also lacking, there are provided spacing bushes 20, whose thickness corresponds to the radial distance of the clamping bolt from the valve body 1.

While in the previous example, in order to ensure that different flanges with different dimensions are used, the passage holes 301 in the reinforcing wings 201 have the form of radially oriented slots, in the second embodiment, there may be provided spacing bushes 20, having walls with different thickness according to the type of flange used. According to an improvement, the outer peripheral wall of the valve body may have shapes complementary to those of the bushes, for example, one or more recesses, whose axial section has the shape of a circular sector, with a radius substantially corresponding to that of the bushes, or V-shaped notches, which may prevent the circular bushes to roll down along the outer periphery of the valve body. Alternatively, the bushes themselves may have an outer profile complementary to that of the valve body, in the mutual contact area.

Naturally, the invention is not limited to the embodiment described and illustrated herein, but may be greatly varied, especially as regards construction, without departure form the guiding principle disclosed above and claimed below.

CLAIMS

1. A throttle valve comprising a throttle plug (3), which cooperates with a valve seat (2, 5, 6), said seat having a substantially annular gasket (5) which, when the throttle plug (3) is in the closing position, adheres with a certain compressive force, transverse to the flow direction and/or to the axis of the valve seat, against the peripheral end edge of the throttle plug (3), characterized in that at least a part of the compressive force acting between the gasket (5) and the end edge of the plug (3) is exerted by the hydrostatic pressure of the fluid intercepted when the valve is in the closing condition, The gasket (5) having compression surfaces (605), at least in some areas, preferably for its whole extension, and in a radially outer position with respect to the surface contacting the peripheral end edge of the plug (3), turned opposite the contact surface between the gasket (5) and the plug (3), and being oriented in such a way that at least one of their directional components is parallel to the flow, in order to generate a component (F) perpendicular to the flow, and said surfaces (605) being accessible and exposed to the intercepted fluid.

2. A valve as claimed in claim 1, characterized in that the annular gasket (5) has a radially outer annular part (305), and a radially inner annular part (405), whereas the valve body has a seat (6) for holding said gasket (5) including a seat for clamping said radially outer part (305), and a seat for housing the radially inner part (405) of the sealing gasket

(5), which is slightly bigger than said radially inner part (405) of the gasket, so as to allow the axial and radial movement within predetermined limits.

3. A valve as claimed in claims 1 or 2, characterized in that the housing seat (6), i.e. its part associated to the radially inner part (405) of the gasket is conformed in such a way as to have ducts, apertures, passages and/or chambers (C) accessible to the fluid on the side of the inner part (405) of the gasket (5), which is provided with the compression surfaces (605) having at least one directional component parallel to the flow, in order to generate a compression perpendicular to the intercepted fluid.

4. A valve characterized in that the gasket (5), i.e. its radially inner part (405) and the housing seat (206) associated thereto respectively have ducts, apertures, passages and/or chambers (C) accessible to the fluid on both sides with respect to a median transverse plane, particularly the construction of said two parts being symmetrical with respect to this plane.

5. A valve as claimed in one or more of the preceding claims, characterized in that the compression surfaces (605) of the gasket (5), pressing against the plug (3), consist of the lateral walls of two substantially median coincident annular grooves (505), formed in the two faces of the annular gasket (5), said grooves (505) forming an annular neck for connecting the inner part (405) and the outer part (305) of the gasket (5), the seats for clamping the outer part (305) and those (206) for loosely housing the inner part

(405) of the gasket being jointed by an annular compressing narrowing (106), said narrowing (106) having, on the side facing the compression surfaces of the inner part (405) of the gasket (5), lateral walls which extend at a certain distance from said compression walls (605), thereby forming, where the housing seat (206) is wider than the thickness of the inner part (405) of the gasket (5), substantially annular chambers (C), which may be accessed, on the corresponding exposed side of the throttle plug (3), by the fluid intercepted when the plug is in the closing position.

6. A valve as claimed in one or more of the preceding claims, characterized in that the seat (206) for housing the radially inner part (405) of the gasket (5) and said radially inner part (405) of the gasket (5) have cooperating annular sealing contact surfaces, which are oriented transverse to the axis of the gasket and to the flow direction, in combination with surfaces or walls (605), and particularly, are exposed to the hydrostatic pressure of the fluid and have at least one component transverse to the flow direction of the fluid, whereby the hydrostatic pressure of the fluid also acts in the direction of axial sealing compression of the lateral surfaces and/or walls of the gasket (5), against the corresponding walls and/or surfaces of the housing seat (206).

7. A valve as claimed in claim 7, characterized in that the seat (206) for housing and the seat for clamping the two parts (305, 405) of the gasket (5)

consist of a throat having a median narrowing (106), so that the lateral faces on the inner part (405) of the gasket (5) cooperate with the corresponding opposite lateral wall of the housing seat (206) to provide sealing contact surfaces, transverse to the flow direction.

8. A valve as claimed in claim 7, characterized in that the throat (6) which forms the seats for clamping and housing the gasket (5, 305, 405) is made of two removably fixable parts, which are separated substantially along the median transverse plane of symmetry of the annular throat (6).

9. A valve as claimed in claim 8, characterized in that the valve body (1) is substantially made of one piece, and has an annular cavity in the area of the throat (6), which forms the seats for clamping and housing (206) the gasket (6), there being provided an annular insert (10), which may be removably fixed in said annular cavity, and the opposite faces of the annular cavity and of the annular insert being provided with grooves, whose profile corresponds to one half of the cross section of said throat (6).

10. A valve as claimed in one or more of the preceding claims, characterized in that the annular sealing gasket (5) projects, to a certain extent, beyond the opening of the housing seat (206), towards the end edge of the plug (3), whereas the plug (3) has a diameter, which is substantially identical or slightly shorter than that of the passage duct (2), but longer than the inside diameter of the gasket (5).

11. A valve as claimed in one or more of the preceding claims, characterized in that the end edge of the plug (3), when the latter is in the passage (2) closing position, and the lateral wall of the seat (206) for housing the radially inner part (405) of the gasket (5), respectively facing the side exposed to pressure of the intercepted fluid form two substantially angling surfaces, which wedge the radially inner part (405) of the gasket (5) when the hydrostatic pressure of the intercepted fluid acts thereupon.

12. A valve as claimed in one or more of the preceding claims, characterized in that the plug (3) is provided with a control spindle (4), which is radial with respect to the annular gasket (5), the latter has an integral sealing ring (105) at the control spindle (4) level, whose axis is parallel to the axis of the control spindle (4), i.e. perpendicular to the axis of the gasket (5), and being meant to surround it, which ring (105) is held on a corresponding throat in the valve seat, which is connected to the throat (6) and cooperates with a peripheral annular surface (103), corresponding to the plug (3), which is placed at the point in which the spindle (4) is inserted in the plug (3) and is connected without breaks to the rest of the peripheral end edge of the plug (3).

13. A valve as claimed in claim 12, characterized in that the spindle (4) also extends on the diametrically opposite side of the plug (3), whereas the gasket (5), the plug (3) and the valve seat have

the same construction as claimed in the preceding claim 12, also at said diametrically opposite side.

14. A valve as claimed in one or more of the preceding claims, characterized in that the control spindle (4) of the plug (3) is operated by a gear and worm drive (15, 16), in which the worm (16) and/or the gear (15) have teeth or mutual engagement surfaces with a globoidal profile.

15. A valve as claimed in claim 14, characterized in that the gear and the worm are made of plastic.

16. A valve as claimed in one or more of the preceding claims 14 or 15, characterized in that the axial peripheral edge of teeth of the gear (15) is profiled so as to substantially correspond to the minor diameter of the thread of the worm (16), whereas the thread extending along the worm has an exterior surface which is inwardly curved according to the radius of curvature of the gear (15).

17. A valve as claimed in one or more of the preceding claims, characterized in that the valve body has at least one relief duct (101) communicating with the outside and with the seat for housing the annular gasket or with the seat for housing the plug control spindle (4, 404).

18. A valve as claimed in one or more of the preceding claims, characterized in that it comprises an annular, especially cylindrical valve body, having coaxial opposite extensions for housing the spindle (4), said extensions and the valve body being connected by reinforcing wings (201), provided with radial slots

(301), for the passage of the flange clamping bolts.

19. A valve as claimed in one or more of the preceding claims 1 to 17, characterized in that it comprises an annular, especially cylindrical valve body, having coaxial opposite extensions for housing the spindle (4), there being provided, for each bolt for clamping opposite flanges connecting to the valve body (1), a corresponding spacing and centering bush, whose wall thickness corresponds to the appropriate distance between the bolt and the valve body (1), there being provided bushes having different wall thicknesses, corresponding to the different types of flanges and to the different radial positions of the clamping bolts.

20. A valve as claimed in claim 19, characterized in that the spacing and centering bushes, and at least the contact areas of the valve body (1), associated thereto, may have, the former, the latter or both, complementary profiles for mutual positioning.

21. A throttle valve as claimed in one or more of the preceding claims, characterized in that the plug (3) and the gasket (5, 405) have sealing contact surfaces having no substantial component transverse to the flow direction, but only being oriented substantially parallel to said direction.

22. A throttle valve as claimed in claim 21, characterized in that said sealing contact surfaces are centered with respect to the median plane of the valve, or of the driving axis of the plug (3), which is transverse to the flow direction, and contains the axis

of rotation of the plug.

23. A throttle valve as claimed in one or more of the preceding claims, characterized in that the contact surfaces between the plug (3) and the gasket (5, 405) are annular and substantially cylindrical, consisting of the facing peripheral rims of the gasket (5, 405) and of the plug (3), the one, the other or both surfaces possibly being slightly crowned or rounded.

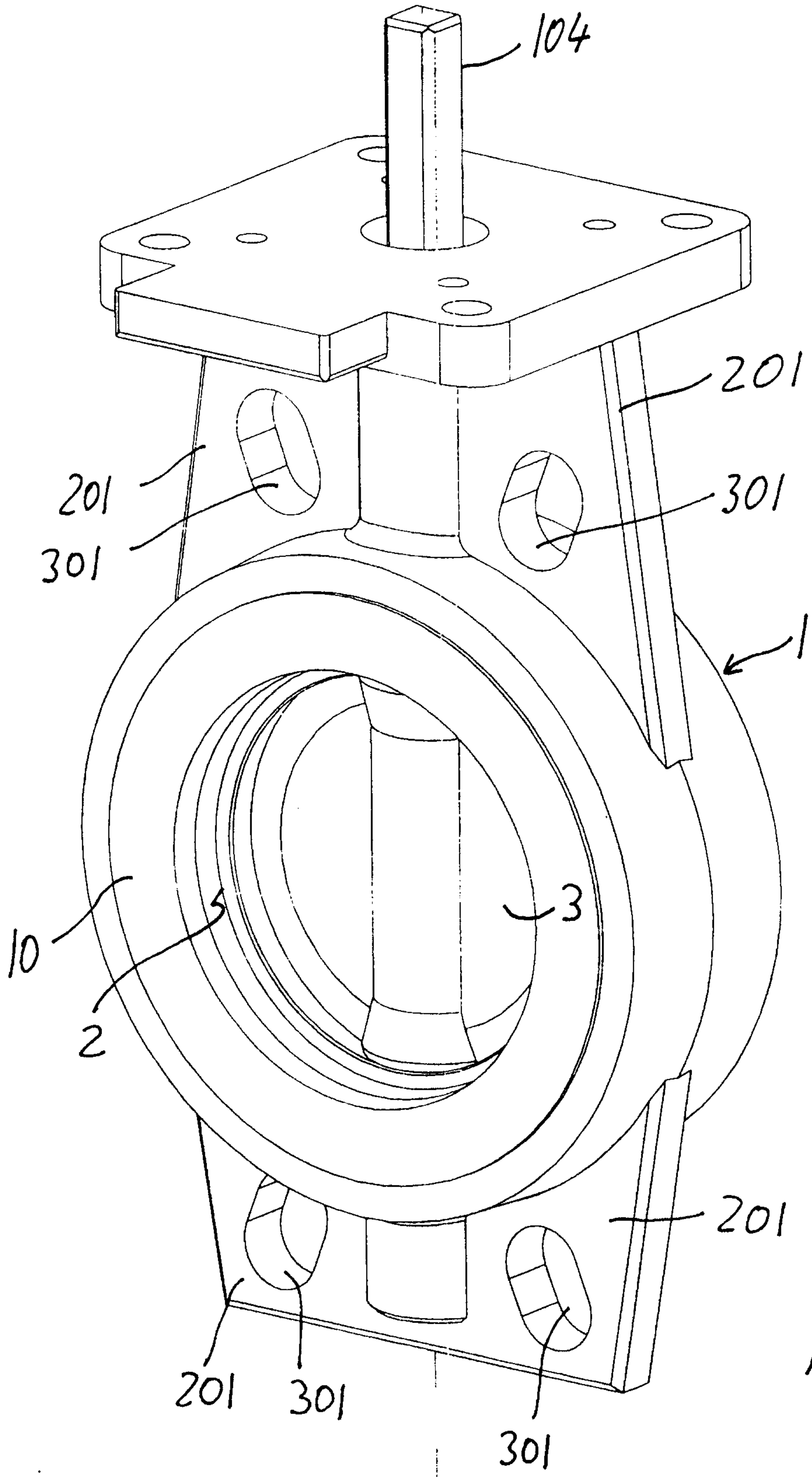


Fig. 1

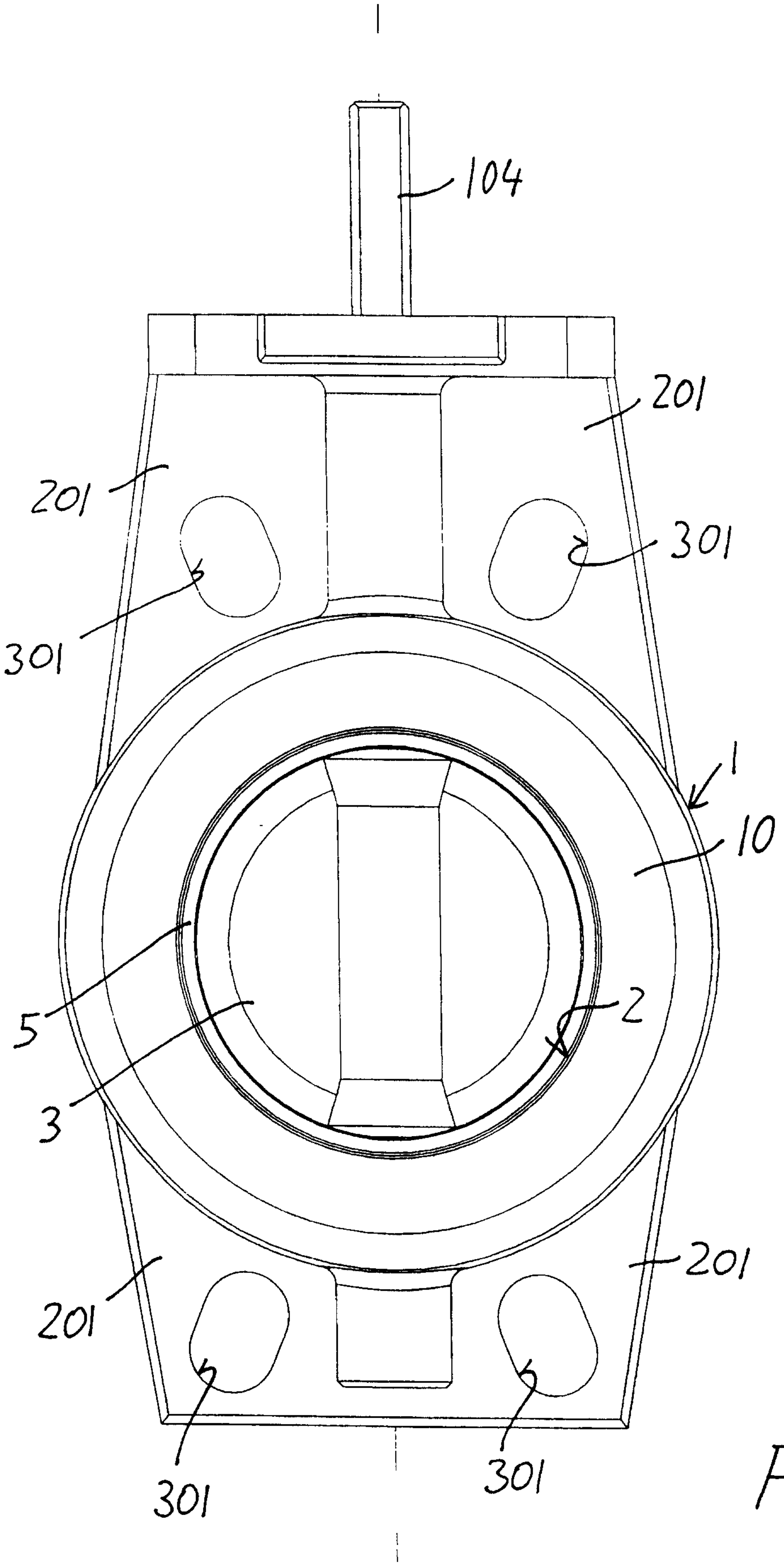


Fig. 2

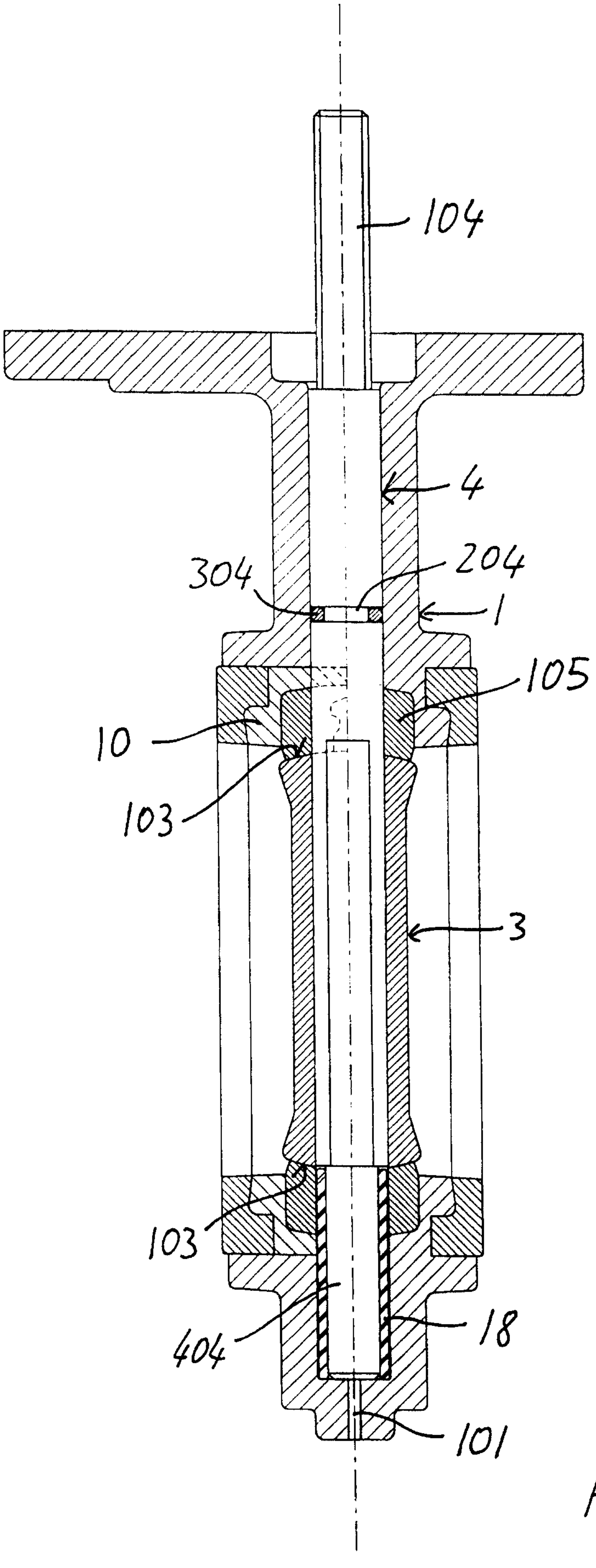


Fig. 3

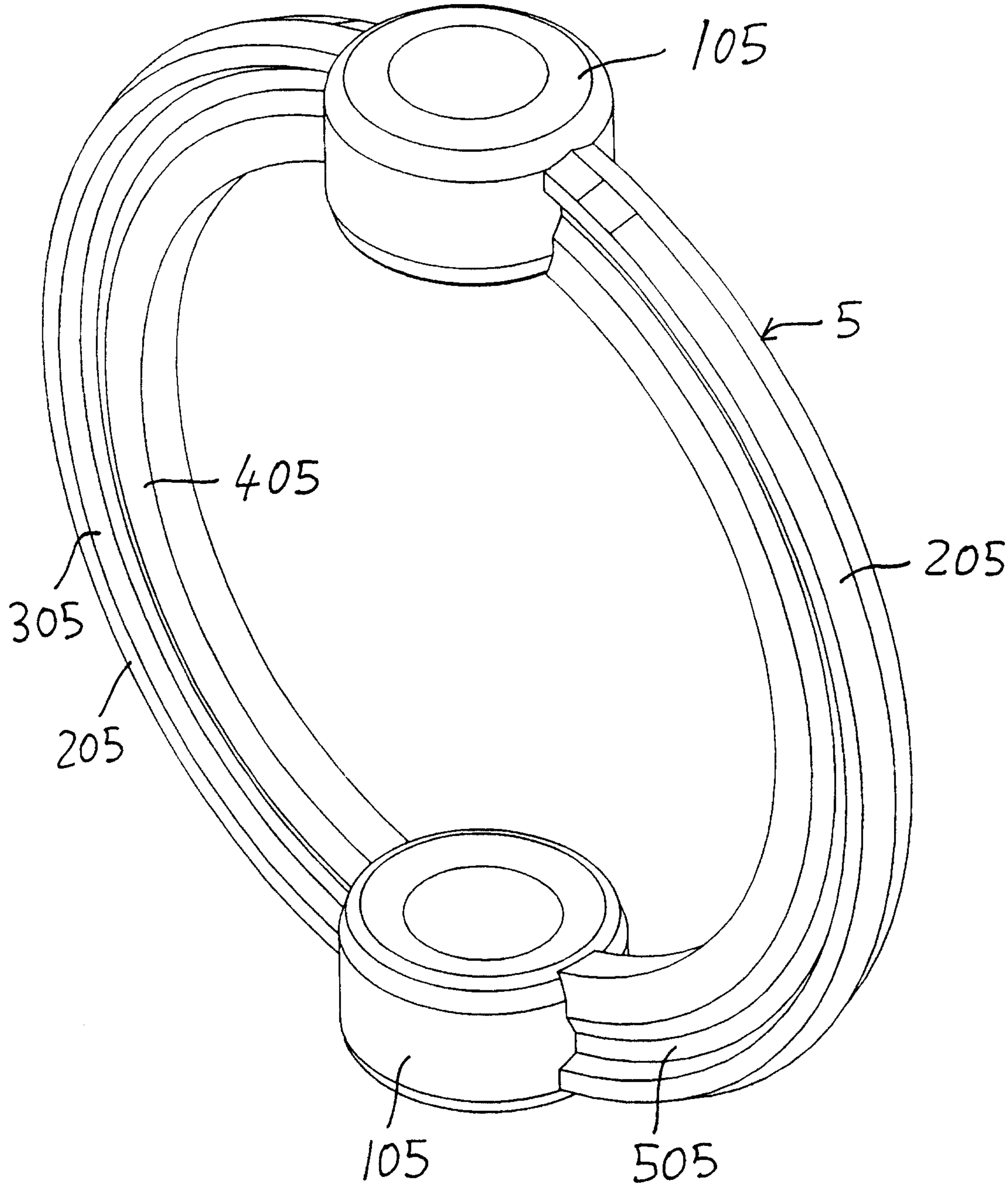


Fig. 4

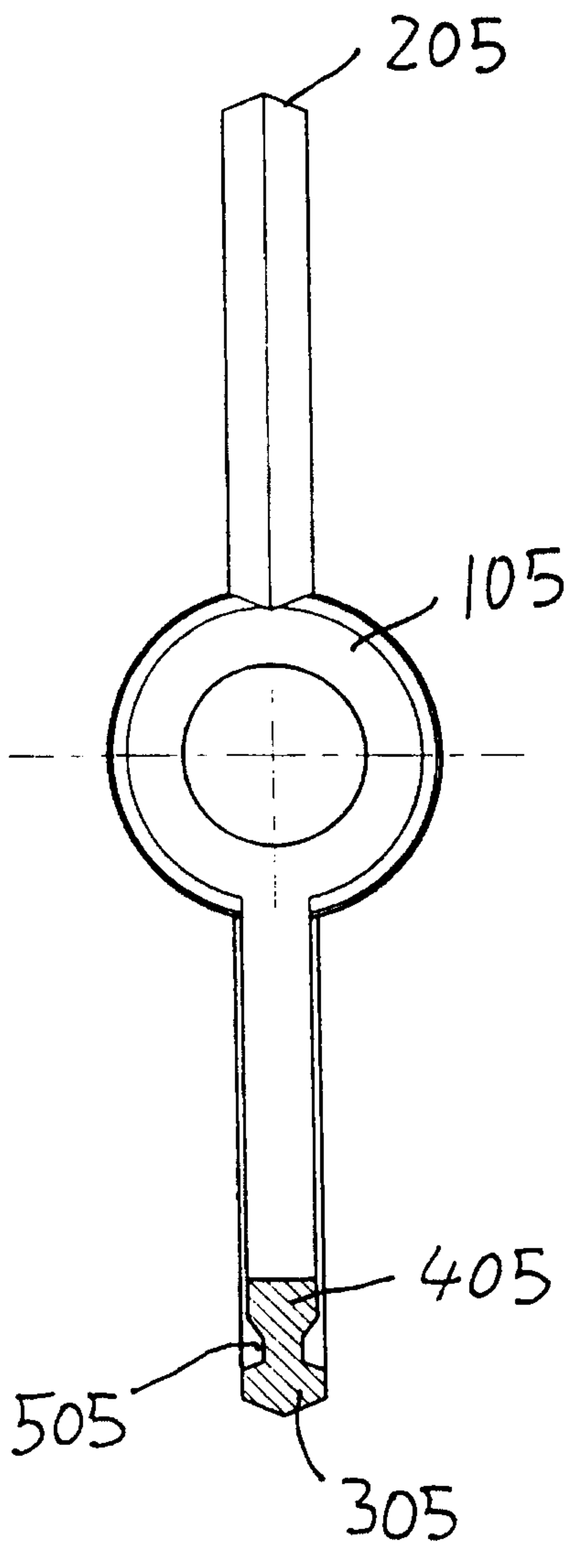


Fig. 5

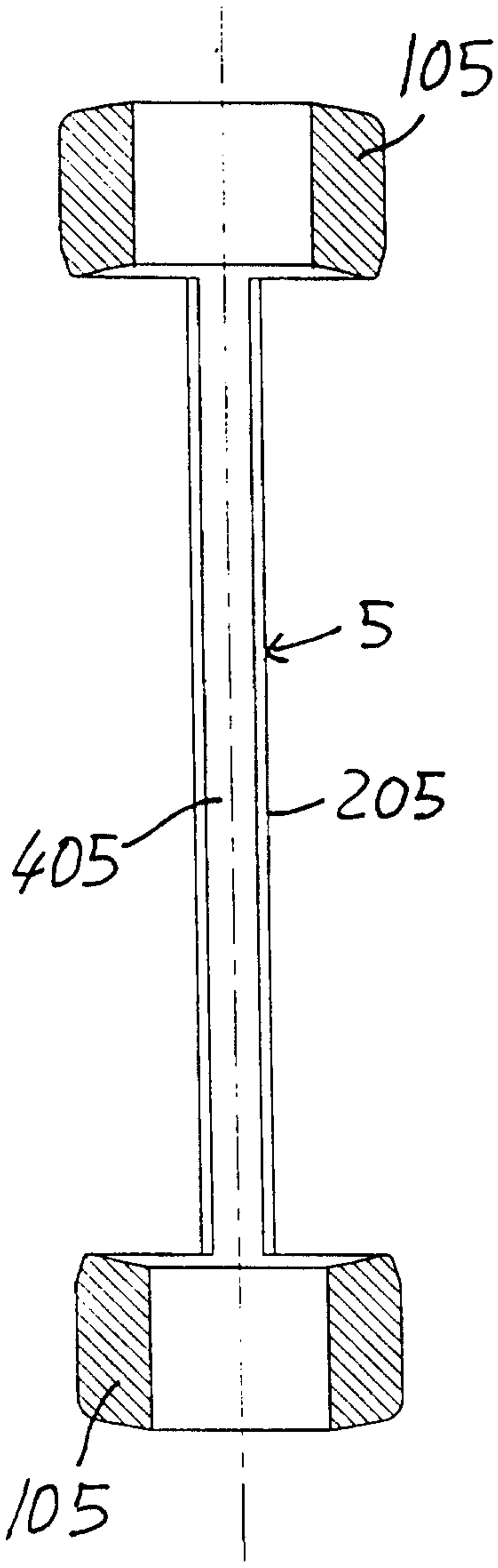


Fig. 6

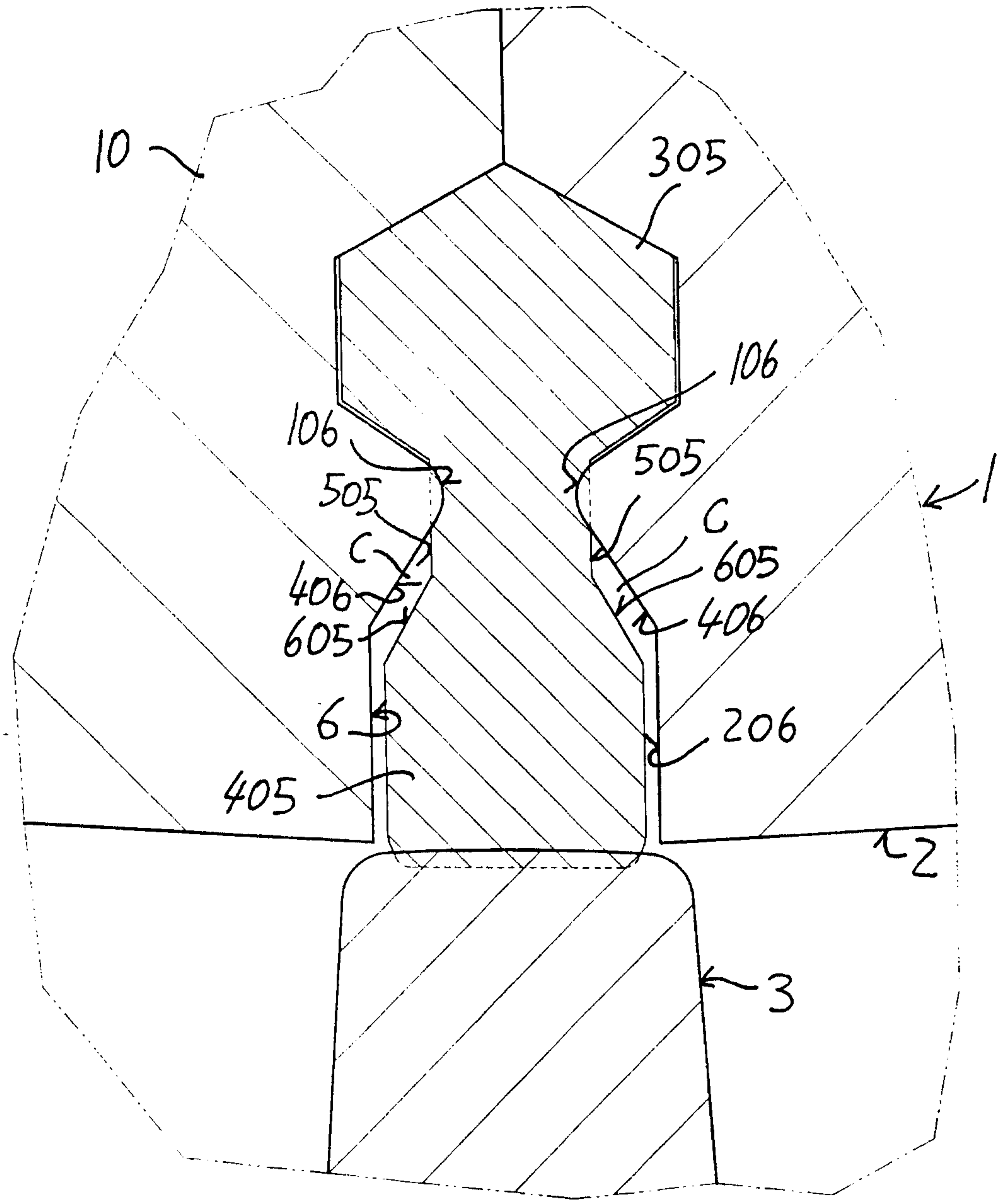


Fig. 7

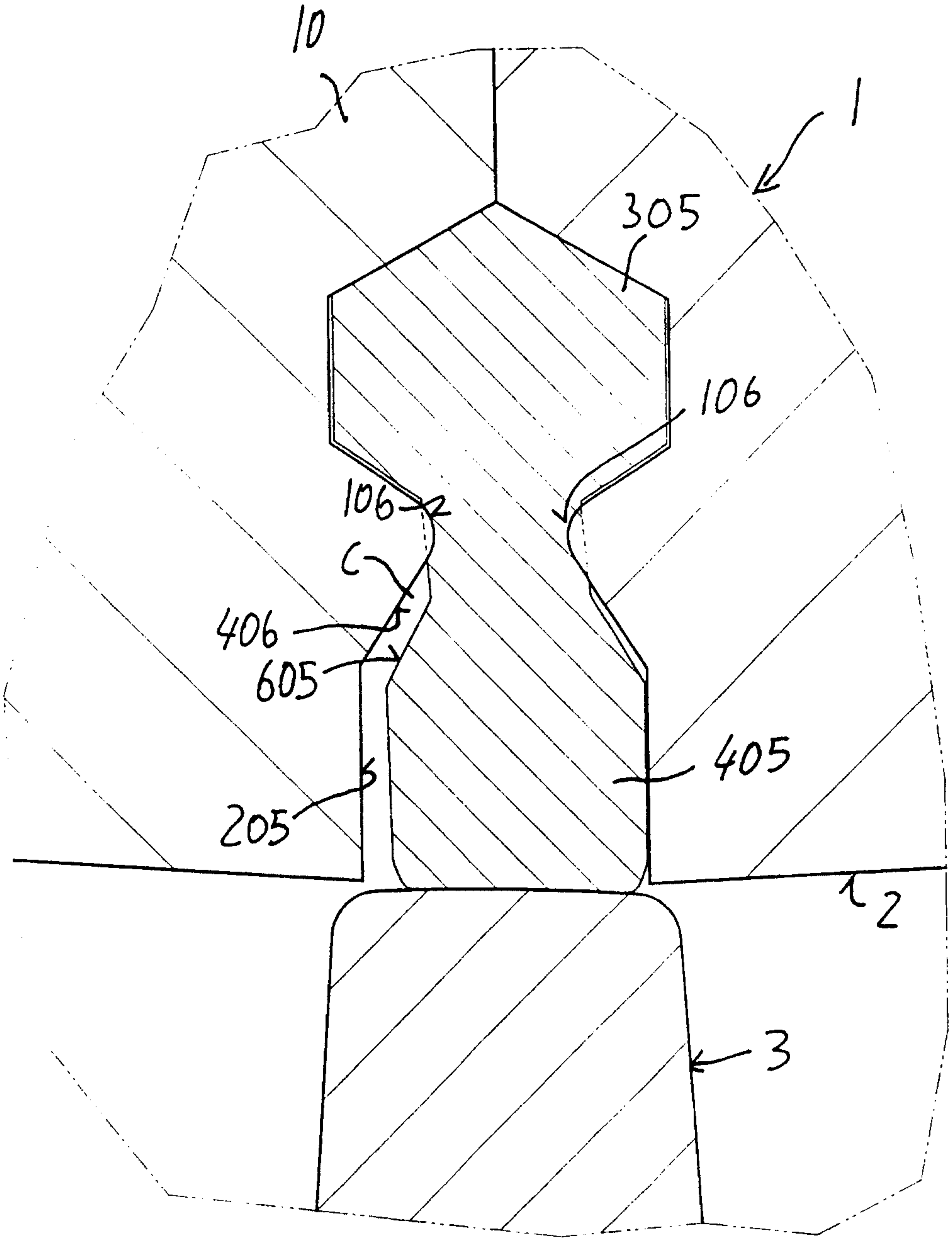


Fig. 8

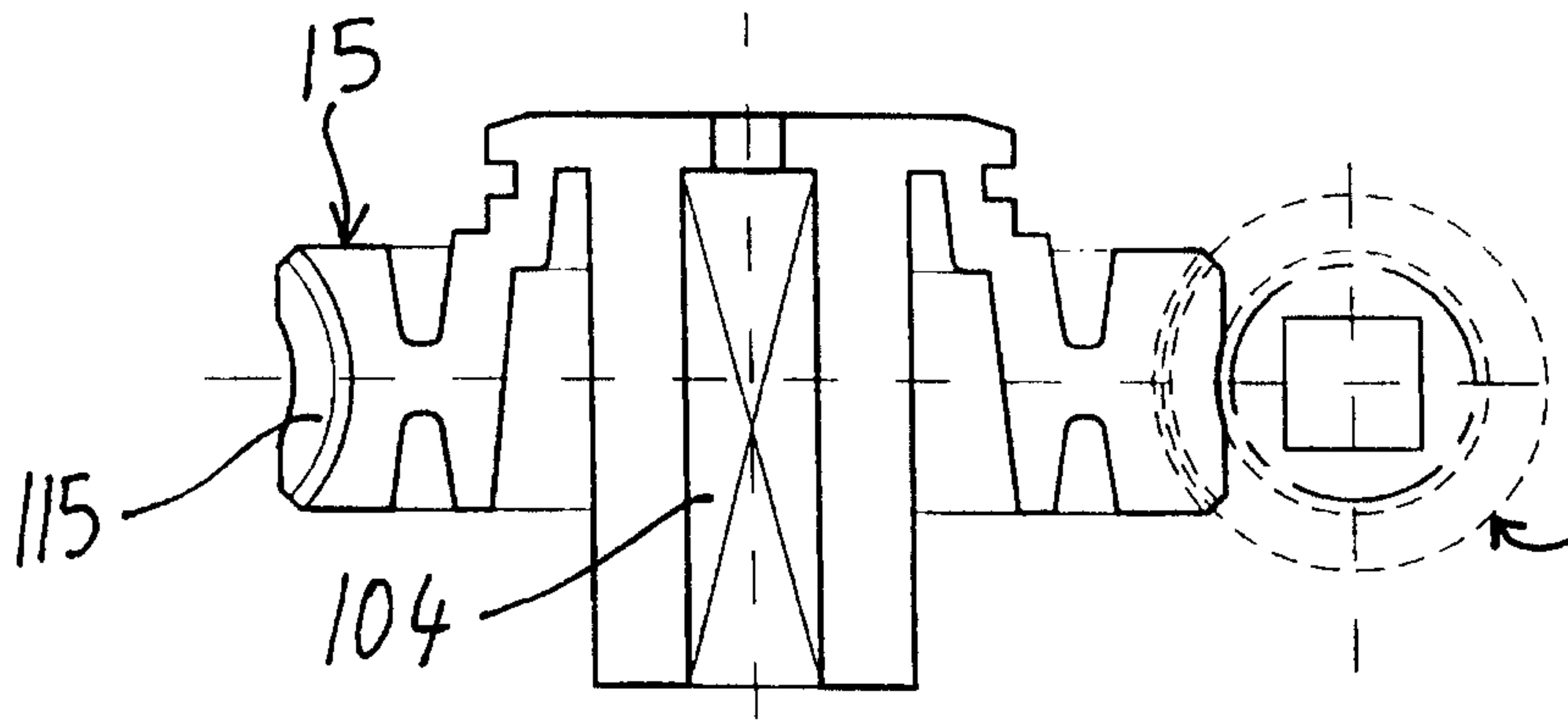


Fig. 9

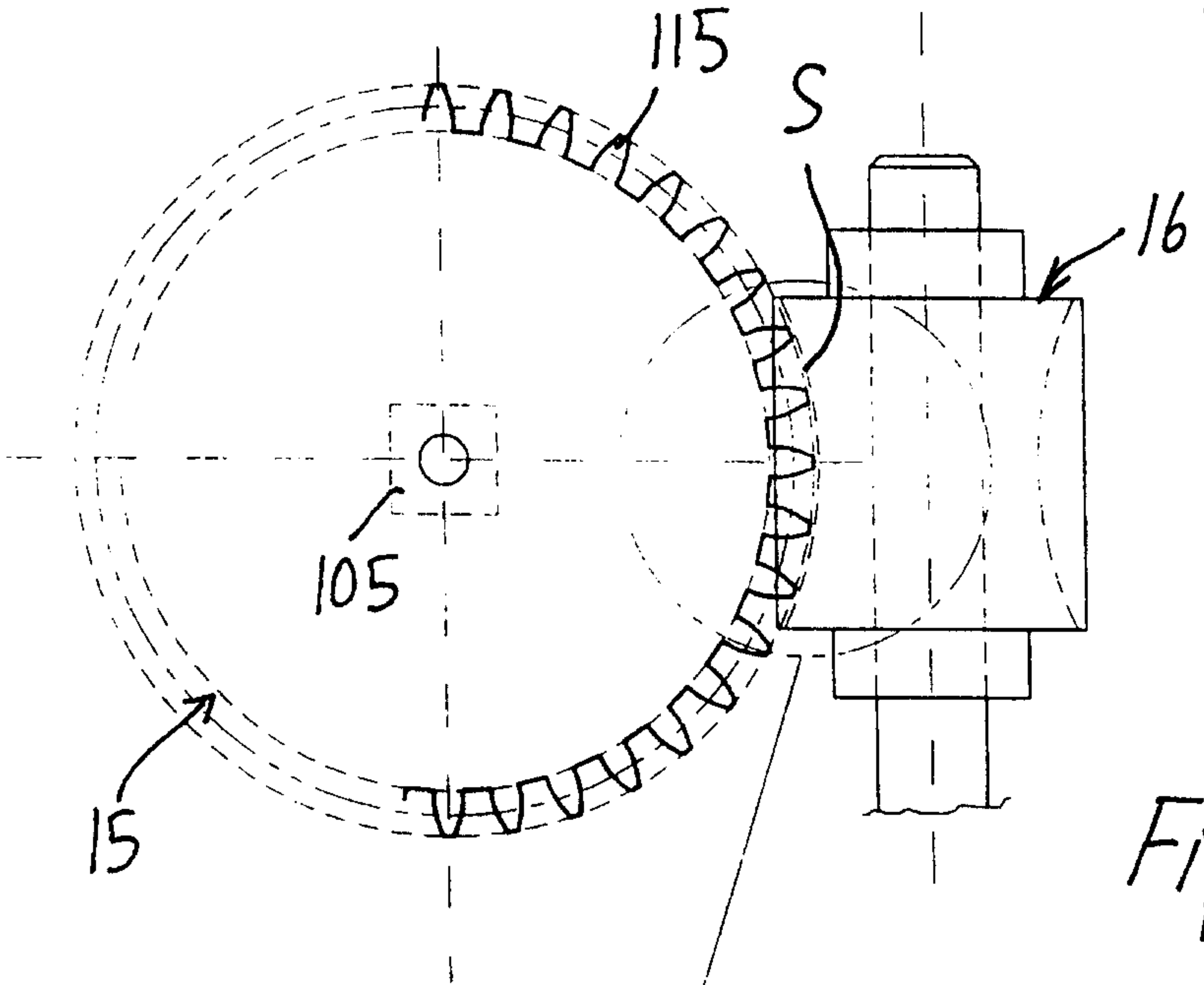


Fig. 10

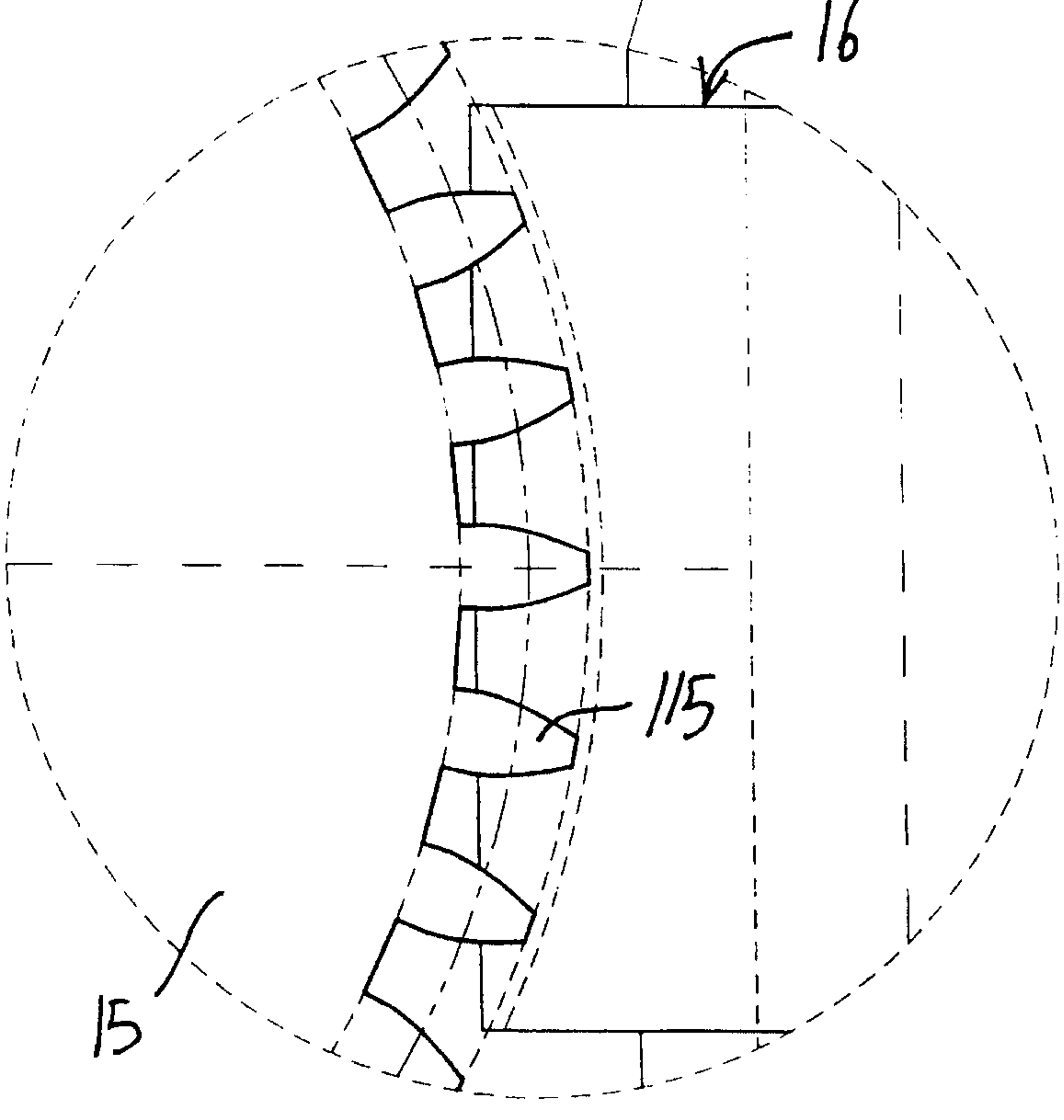


Fig. 11

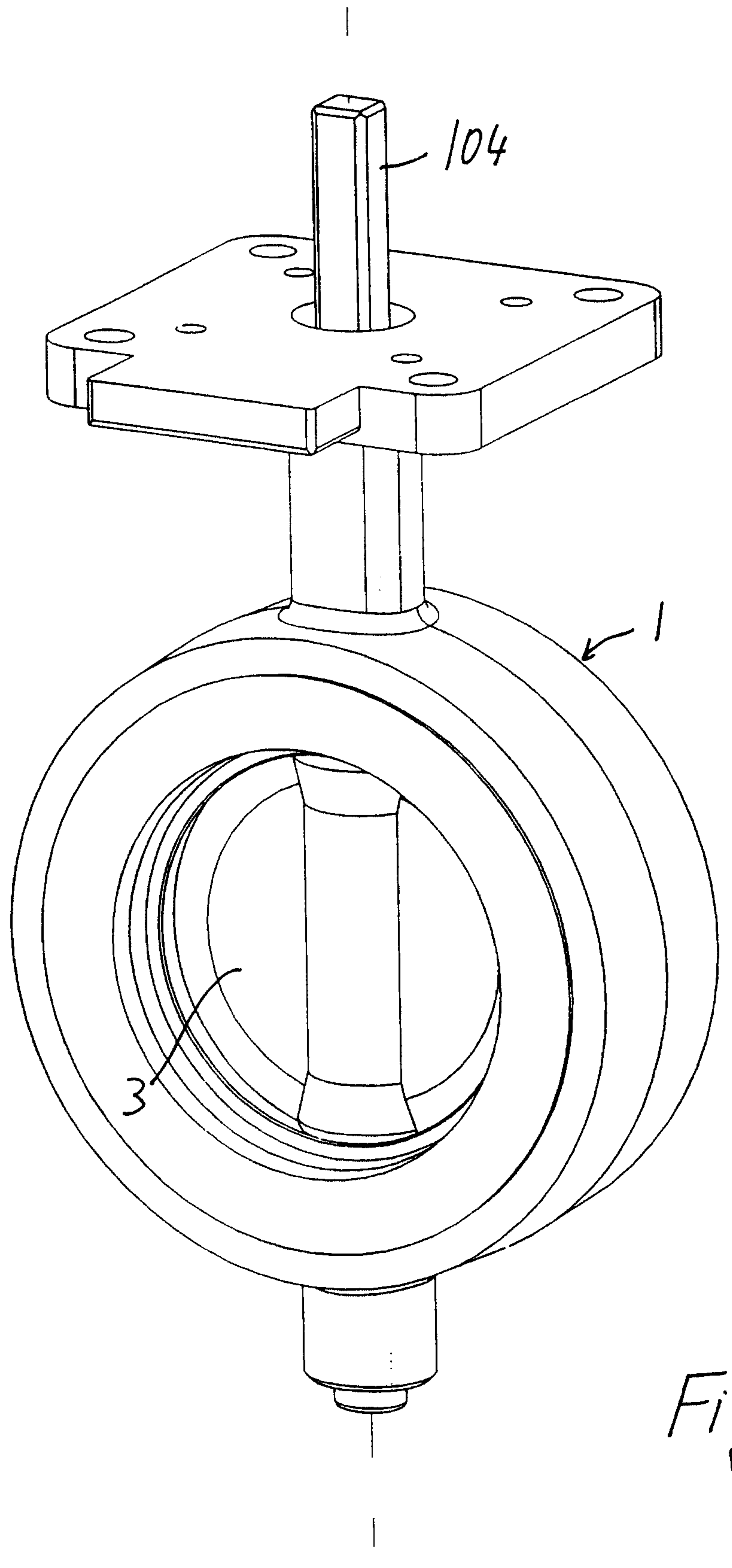


Fig. 12

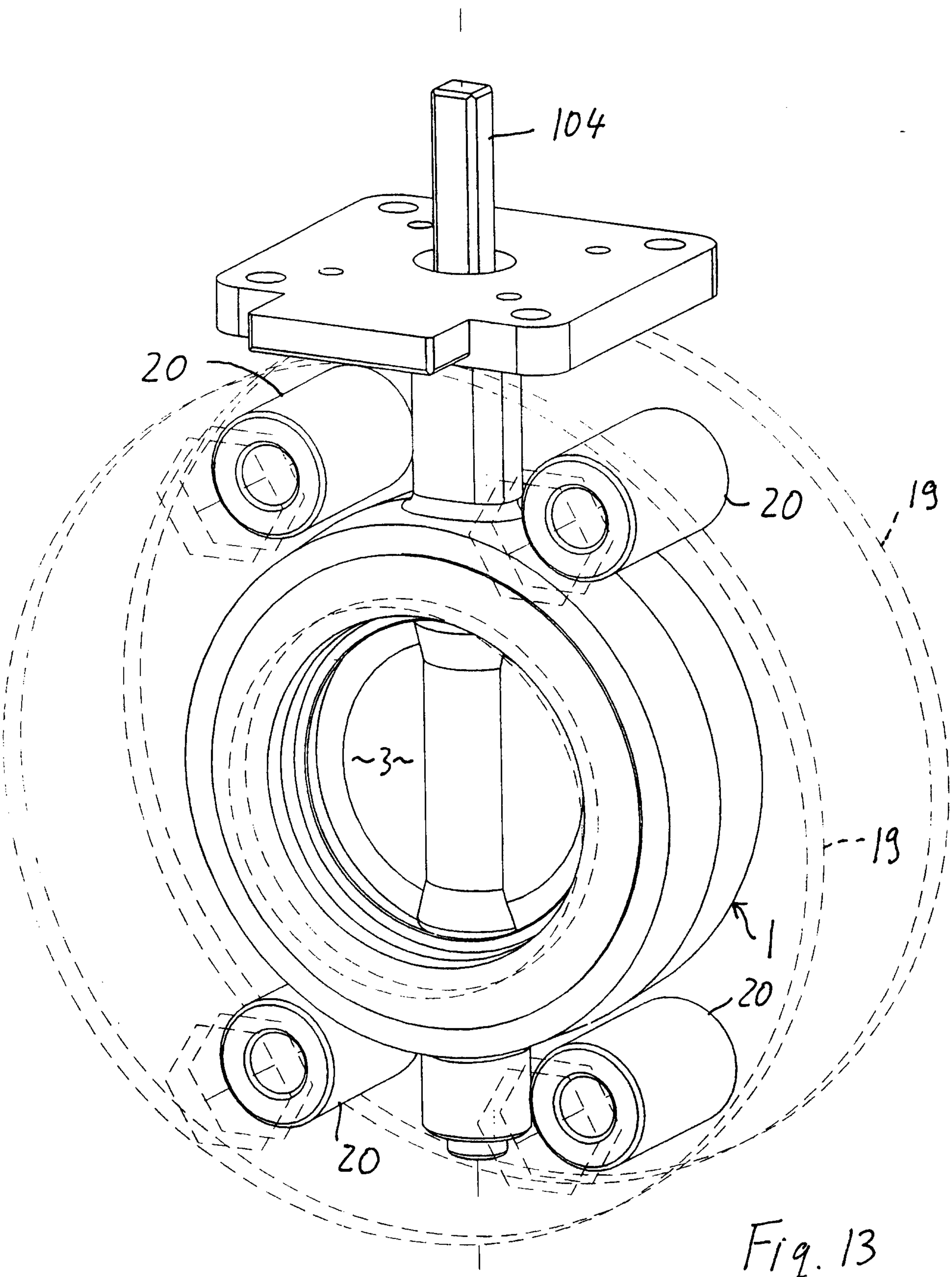


Fig. 13