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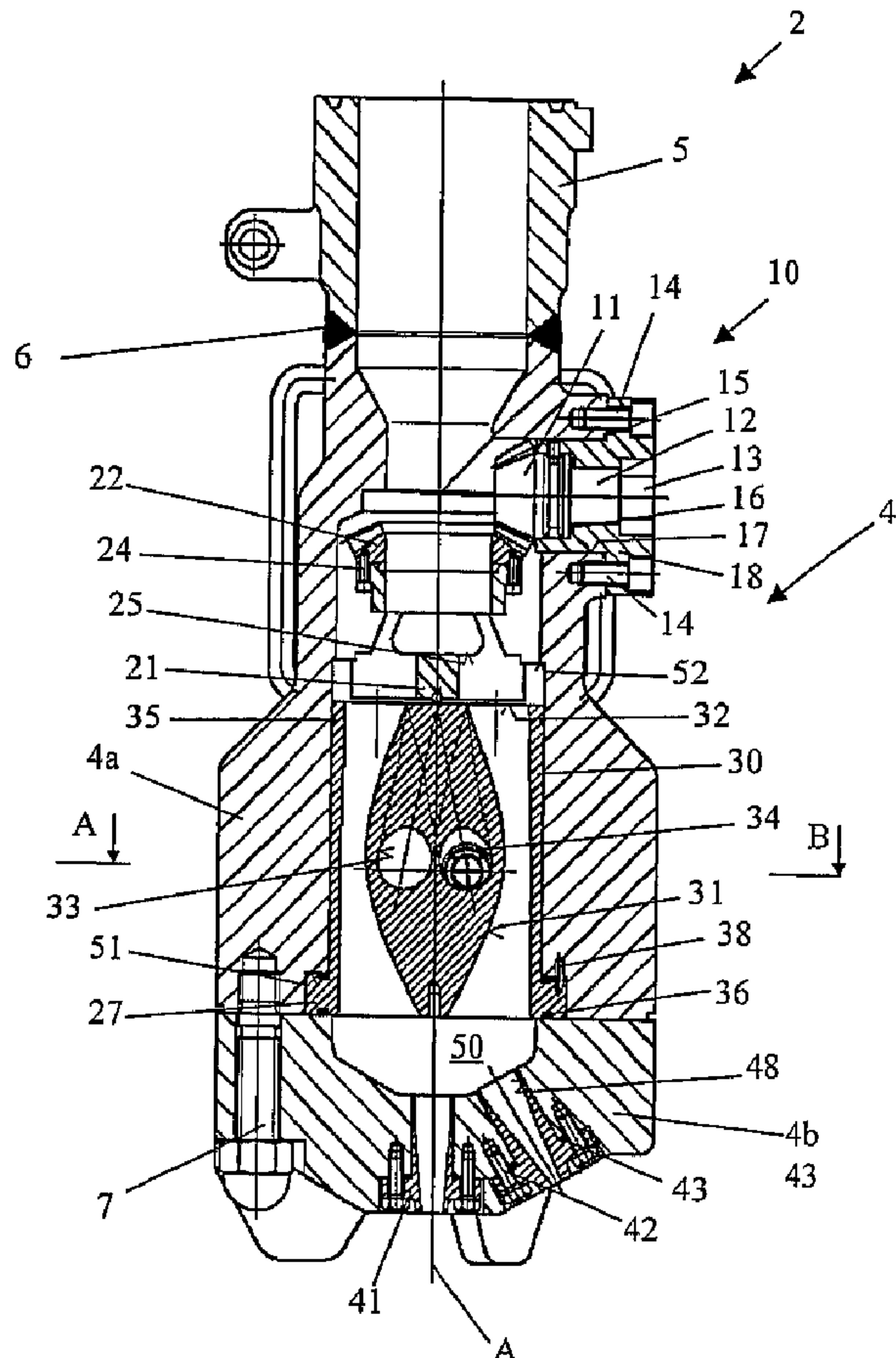
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(54) Title: TOOL FOR COMMUNUTING COKE



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

water flowing through the boring rod and the housing, through the cutting nozzle and the boring nozzle are arranged on or inside said housing. In order to provide a tool for comminuting coke that has a simple design and can be reliably used and maintained, the invention provides that at least two flow channels are made inside the housing that each extend between individual inflow openings, which are assigned to the respective flow channel, and the cutting nozzle and the boring nozzle. The valve for closing and opening the inflow openings is placed in the area of the inflow openings.

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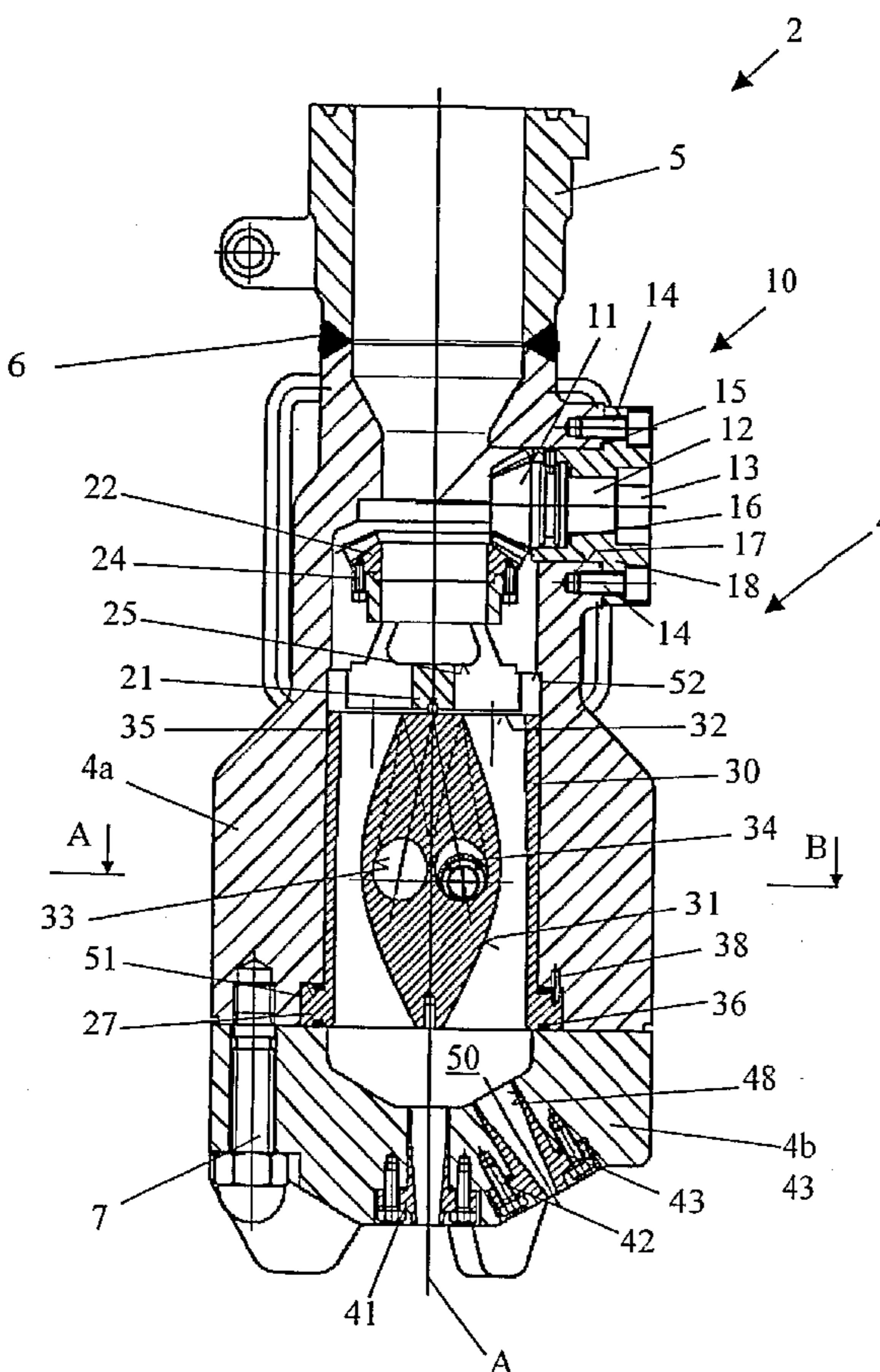
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(54) Title: TOOL FOR COMMUNTING COKE

(54) Bezeichnung: WEKZEUG ZUM ZERKLEINERN VON KOKS



**(57) Abstract:** The invention relates to a tool for comminuting coke comprising a housing which, during operation, is fastened to a boring rod. At least one cutting nozzle for cutting, a boring nozzle for boring coke, and at least one valve for controlling a direction of flow of the water flowing through the boring rod and the housing, through the cutting nozzle and the boring nozzle are arranged on or inside said housing. In order to provide a tool for comminuting coke that has a simple design and can be reliably used and maintained, the invention provides that at least two flow channels are made inside the housing that each extend between individual inflow openings, which are assigned to the respective flow channel, and the cutting nozzle and the boring nozzle. The valve for closing and opening the inflow openings is placed in the area of the inflow openings.

**(57) Zusammenfassung:** Die Erfindung betrifft ein Werkzeug zum Zerkleinern von Koks mit einem Gehäuse, das im Betriebszustand an einer Bohrstange befestigt ist, und an oder in dem mindestens je eine Schneiddüse zum Schneiden und eine Bohrdüse zum Bohren von Koks und mindestens ein Ventil zur Steuerung einer E'lußrichtung des die Bohrstange und das Gehäuse durchströmenden Wassers durch die Schneiddüse und die Bohrdüse angeordnet ist. Um ein Werkzeug zum Zerkleinern von Koks bereitzustellen, das einen besonders einfachen Aufbau aufweist sowie sicher einzusetzen und zu warten ist, wird vorgeschlagen, dass innerhalb des Gehäuses mindestens zwei 'Strömungskanäle ausgebildet sind, die sich jeweils zwischen einzelnen dem jeweiligen Strömungskanal zugeordneten Zuströmöffnungen und der Schneiddüse und der Bohrdüse erstrecken, wobei das Ventil zum Verschliessen und Öffnen der Zuströmöffnungen im Bereich der Zuströmöffnungen angeordnet ist.

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*Zur Erklärung der Zweibuchstaben-Codes und der anderen Abkürzungen wird auf die Erklärungen ("Guidance Notes on Codes and Abbreviations") am Anfang jeder regulären Ausgabe der PCT-Gazette verwiesen.*

## TOOL FOR COMMINUTING COKE

The invention relates to a tool for crushing coke, including

- a casing which, in the operational state is connected to a drill rod and on or in which
- at least one cutting nozzle each for cutting and one drill nozzle for drilling of coke and
- at least one valve for controlling a direction of flow of the water flowing through the drill rod and the casing through the cutting nozzle and the drill nozzle is arranged.

In oil refineries the last, otherwise no longer usable fraction of the crude oil is converted into coke. The conversion is brought about by feeding this fraction into drums which, as the operation proceeds, become filled with coke. Once the maximum filling level of the drums has been attained, the coke is cut out of the drums.

This so-called "de-coking" is conventionally performed with high pressure water jets which crush the coke and flush it out of the drums. The tool for generating these high pressure water jets is introduced by way of a drill rod mechanism from above into the drum. The "de-coking" is performed in two steps. To begin with, an aperture is drilled by the tool in the drum, then the tool is, once again, taken to the upper end of the drum and the coke is now crushed by high pressure water jets generated by the cutting nozzles approximately at about right angles to the axis.

The tool which is, for example, known from WO 03/01461 A1 representing the genus, is accordingly designed for two operating conditions, firstly for the drilling of an aperture which is necessary for moving the tool and for the subsequent discharge of crushed coke and, secondly, for the cutting of the coke across the cross section of the drum. Accordingly, the drill nozzles direct high pressure water jets essentially parallel or at an acute angle to an axis, which is formed by the drill rod and by the aperture formed during drilling. The

cutting nozzles, on the other hand, generate high pressure water jets which are directed essentially at right angles or at a shallow angle to the axis formed by the drilling rod and the aperture in the drum.

The change-over between the operational states of drilling and cutting must proceed rapidly and simply. The nozzles which are used in the tool, due to the high water pressure, suffer wear and tear and must be replaced at regular intervals. Accordingly, the tool must be so designed that a replacement of the nozzles can be performed rapidly and reliably.

The wear and tear of the nozzles is increased by the fact that in known tools of the afore mentioned type, water under high pressure is forced into an annular space which communicates with all nozzles, from where the water enters non-directionally into whichever nozzles are opened, in the course of which no reorientation whatsoever of the flow in the direction of the respective nozzles takes place.

In another tool as well, known from DE 39 41 453 A1 the feeding of water under pressure to the cutting nozzles and to the drill nozzles proceeds initially in a central piston and from there, depending on the position of the piston in the casing of the tool, through apertures traversing the wall of the piston into one or two annular cavities of which one is connected to the cutting nozzles and the other is connected to the drill nozzles. The pressurized water flow is subjected in the piston to vortex formation and, only after having suffered corresponding pressure and flow losses, passes by way of the apertures in the wall of the piston into radial ducts in which the water is conducted to the nozzles.

In the tool known from U.S. Pat. No. 5,816,505 as well, two annular cavities of this type are provided to each of which the pressurized water is conducted, as a function of a control bringing about either the drilling mode of operation or the cutting mode, with considerable flow losses and forwarded from the respective annular cavity by way of ducts connected there to the nozzles.

The invention has as an object to provide a tool for crushing coke which has a particularly simple design as well as permitting reliable insertion and maintenance.

The invention attains this object by means of a tool where within the casing at least two flow passages are formed, each respectively forming closed-off regions and each of which is associated individually with a feed aperture and which each extend respectively between the associated feed aperture and the cutting nozzle or the drill nozzle, the valve for closing and opening the feed apertures being provided in the region of the feed apertures.

Characteristic features of the tool according to the invention are at least two flow passages formed inside the casing, which respectively extend between individual feed apertures associated with the respective drill passage and the respective cutting and drilling nozzles. The valve for controlling the direction of flow of the water to the cutting nozzles or the drilling nozzles respectively, is, in this context, accommodated in the region of the feed apertures, and, depending on the prevailing operating conditions, generally cutting or drilling, closes the corresponding feed apertures of the individual flow passages.

The flow passages which, within the scope of the invention, represent individually separated regions, extending between the feed apertures and the outlet apertures provided in the region of the associated nozzles, permit the feeding of the water with only very low flow losses in a directed manner to the 5 respective nozzles. As a result of the thereby achieved reduction of the disturbing effects acting on the nozzles, the life expectancy of the individual nozzles, as compared with conventional tools, can be increased substantially.

This minimizing of the flow losses as well as the optimizing of the flow within 10 the tool, in addition, permits feeding the water through the tool with a supply pressure, which is lower than with known tools whilst maintaining the same discharge pressures from the valves.

Accordingly, the design according to the invention also permits increasing the 15 life expectancy of the components which act in conjunction with the tool such as, e.g., a supply pump, due to the reduction of the pumping output.

A further advantage of the tools according to the invention results from the circumstance that the feed apertures which are closable for regulating the 20 direction of flow of the water, can be combined at an optional, constructionally advantageous locality of the tool, so that even a plurality of mutually independently arranged nozzles can be controlled using a single valve.

Accordingly, the employment of a multitude of valves, as are particularly 25 required when using a plurality of nozzles, which preferably have to be arranged in a single plane, can therefore be dispensed with so that the tool in accordance with the invention can be manufactured in a very compact form and at low cost, and, moreover, has a particularly simple construction.

30 Depending on the design of the valve and the arrangement of the feed apertures it is possible, in principle, to control the direction of flow of the water by the tool in an optional manner.

By being adapted to the predominating purpose of using the tool, this is in an advantageous manner designed for the two operational states of cutting and drilling, in the operational state of cutting, the feed apertures to the drilling nozzle and in the operational state of drilling, the feed apertures to the cutting 5 nozzle being closed by the valve.

This further development of the invention permits reducing the number of valve bodies in the valve required for the closing of the feed apertures, such that the valve can be designed particularly simply, this resulting, in particular, 10 in a further reduction of the manufacturing costs and an increase of the functional reliability of the tool, additionally to the afore going .

The arrangement of the flow passages as well as of the feed apertures in the tool can be freely selected subject to constructional and hydro-dynamic 15 preconditions.

According to a further development of the invention, the feed apertures are, however, arranged essentially normal to the direction of flow of the water flowing through the drill rod and the casing. In this context the direction of flow 20 will, as a rule, correspond to the longitudinal axis of the tool and of the drill rod, so that the flow apertures then extend transversely to the longitudinal axis of the tool.

This further development of the invention permits a particularly compact 25 design of the tool. More particularly, the constructional space requirements of the tool transversely to its longitudinal axis are reduced, because the valve bodies, in contrast to known tools, need no longer be arranged immediately adjoining the nozzle and, therefore, between the nozzle and the interior of the tool. Moreover, the twisting forces arising when readjusting the valves is 30 reduced considerably as compared with known tools.

If constructional considerations permit, the flow passages may be formed in one piece with the casing. However, a simplification of the manufacture is attained according to an advantageous embodiment of the invention in that

the flow passages are formed as an installation module to be installed in the casing.

The arrangement of this module is preferably so brought about that no water

5 will bypass between the module and the inner wall of the casing, which might otherwise have adverse effects on the main flow. This is preferably brought about by a non-positive or positive connection of between the module and the casing of the tool with the aid of screws or the like.

10 In that respect it is unnecessary in designing the flow passages to take the configuration of the casing of the tool into consideration, so that the flow passages which, according to a further development of the invention, has a hydro dynamically optimized configuration, preferably follow a rounded-off pattern, the cross section of the flow passages according to a particularly

15 advantageous further development, being optionally designed in the desired manner such that it changes from the feed aperture to the cutting and/or drilling nozzles.

The use of a separate installation module moreover makes it possible to

20 employ therefore a material which differs from the material for the casing and which is particularly suitable for the construction of the flow passages but, because of possibly higher cost, is only used to a limited extent for the manufacture of the casing.

25 An additional improvement of the flow through the casing may be attained in that at the end of the flow passages facing the nozzles, flow unifiers are provided which improve the flow performance of the water through the nozzles in a supplementary manner.

30 The valve for controlling the flow through the feed apertures may, in principle, comprise optionally designed valve bodies. According to an advantageous further development of the invention, however, the valve comprises valve bodies which, at least in sections, are of spherical configuration which close the feed apertures according to the particularly elected operational state.

The spherical configuration of the surface sections ensures that the entry to the respective feed apertures to be closed, are securely sealed against the passage of liquid. A circularly shaped disc, one side of which is spherically 5 convex would, for example, entirely satisfy the requirements of closing the feed apertures.

Accordingly to a particularly advantageous further development of the invention the valve bodies, however, include at least two spherical surface 10 sections and are preferably of symmetrical design. As a rule, these spherical surface sections are, in this context, provided on opposite sides, e.g. as spherical caps which are mutually adjoining along their maximum circumferences. The symmetrical design of the valve bodies offers the advantage that, because of their symmetrical design, they can be easily 15 guided in the valve. On the other hand, they offer the advantage that, in the event of a first spherical surface section having suffered some wear, the symmetrical valve body can simply be turned around. Whenever that happens, another spherical cap with a second spherical surface section can now be used for sealing the feed apertures.

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As compared with spheres serving as valve bodies which, according to a further advantageous embodiment of the invention, may likewise be used, and in which, because of the complete symmetry, any positional securing of the valve body can be dispensed with, the symmetrical valve bodies are to be 25 given preference whenever the diameter of the valve body directly affects the dimensions of the tool, because such valve bodies have a lesser thickness than spherical valve bodies.

According to a first embodiment the valve is accommodated in the interior of 30 the casing and comprises means for guiding, in particular half shells which embrace the valve body when these are in engagement with the feed apertures.

The means for guiding these valve bodies are accommodated in the valve where the latter, however, as a rule, does not fill the casing entirely. Accordingly, clearances are present between the valve and the casing. According to an advantageous further development of the invention these 5 clearances communicate with the interior of the tool so that the liquid which, in operation flows through the tool may also flow through these clearances. The advantage of this arrangement is that no pressure drop prevails in the tool between the interior and the clearances between the casing and the valve. Accordingly, the valve can be designed in a material-saving manner, because 10 no pressure differences leading to corresponding compressive and tensile forces need to be accommodated. In addition to this, the avoidance of pressure differences ensures the smooth performance of the valve.

The arrangement of the valve may, in a preferred manner, be such that the 15 valve bodies are automatically pressed by the internal pressure prevailing in the casing on to the feed apertures to be closed. According to an advantageous further development of the invention, the valve bodies, however, are biased by a spring element in the direction towards the feed aperture. This further development of the invention improves in a 20 supplementary manner the functional reliability of the valve and ensures in a particularly reliable manner that the valve bodies will enter into engagement with the particular selected feed apertures and close in a liquid-tight manner.

The switch-over from the operational state "drilling" to the other operational 25 state "cutting" takes place manually in most prior art tools. After the first processing step the tool is withdrawn from the drum and a device fitted inside the tool is actuated which, after conclusion of the drilling step process, closes the downwardly directed drilling nozzles and opens the cutting nozzles.

30 This device for the closing of individual or a plurality of nozzles, on the one hand, is in engagement with the valve, and on the other hand provides an aperture for accommodating an operating element which is to be actuated from the outside of the tool. In order to avoid accidents when operating the de-coking tool, the device for operating the valve, in accordance with an

advantageous further development of the invention, is provided in that region which faces towards the drilling rod, that is to say above the nozzles, so that even in the event of failure of any control- and warning devices, the operating personnel can approach the tool without the risk of serious injuries arising.

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In the following a working example of the invention will be described with reference to the drawings. Dependent claims relate to an advantageous embodiment of the invention. In the drawings there is shown in

10 Fig. 1 a first sectional view in longitudinal direction of an embodiment of the tool according to the invention in the operating condition "drilling";

Fig. 2 a second sectional view in longitudinal direction of the tool according to Fig. 1 in the same section plane in the operative condition

15 "cutting";

Fig. 3 a sectional view of the tool according to Fig. 1 along the section line A-B of Fig. 1;

Fig. 4 a plan view on to an assembly module of the tool according to Fig. 1 for the accommodation of flow passages;

20 Fig. 5 an elevation, half of which is in section of the module according to Fig. 4 along the section line A-B of Fig. 4;

Fig. 6 a sectional view of the module according to Fig. 4 along the section line C-D according to Fig. 5;

Fig. 7 a sectional view of the module according of Fig. 4 along the section

25 line E-F of Fig. 4;

Fig. 8 a perspective view of a valve of the tool according to Fig. 1;

Fig. 9 a front elevation of the valve according to Fig. 8;

Fig. 10 a reversed plan view of Fig. 8;

Fig. 11 a sectional view of the valve according to Fig. 8 along the section

30 line A-B of Fig. 9 and

Fig. 12 a sectional view of the valve according to Fig. 8 along the section line C-D of Fig. 10.

Fig. 1 shows a tool 2 including a casing 4, four nozzles 34, 41 – two nozzles 41 for the drilling of coke, two nozzles 34 for the cutting of coke – of which only two have been illustrated, an assembly module 30 comprising four flow passages 31, 47, as well as a valve 20 for opening and closing of feed apertures 32, 37 (see Fig. 4) provided in the module 30.

In its operational state the tool 2 is suspended from a drill rod which is not shown in detail and is introduced into a drum filled with coke. References such as "top" or "bottom" relate to the longitudinal axis A which is aligned with the 10 drill rod (top) and a bore (bottom; not illustrated) generated by the tool 2, in the context of the tool 2 illustrated in Figs. 1 and 3, as well as the components illustrated in Fig. 2 and 4 to 12.

The casing 4 is constructed in two parts and is composed of the upper casing 15 half 4a and the lower casing half 4b which are interconnected with the use of screws 7 extending through the lower casing half 4b and engaging threaded bores in the upper casing half 4a.

A cavity 50 in the lower casing half 4b ensures the unimpeded liquid flow 20 through the flow passages 31 to the drilling nozzles 41, which are accommodated in corresponding bores 48 in the lower casing half 4b and are secured in their position by screws 42. An annular gasket 43 provided in the region of the contact areas of the drilling nozzles 41 against the bore 48 serve to seal the interior of the tool 2 against the environment.

25 The upper casing half 4a is fitted by way of a flange 5 with inter-insertion of an annular gasket 6 in a liquid-tight manner to the drill rod. The upper casing half 4a from there extends as an essentially cylindrical hollow body to the lower casing half 4b. At the end of the upper casing half 4a which faces the lower 30 casing half 4b, a circular shoulder 51 is formed. At this shoulder 51 a module 30 provided in the lower region of the upper casing half 4a adjoins the upper casing half 4a by way of a flange 27.

Annular gaskets 36 for sealing the interior and for sealing the connection of the lower casing half 4b and the upper casing half 4a are accommodated in correspondingly configured grooves 29 (see Fig. 5) against the upper and lower side of the flange 27. A gasket 35 is inserted into an annular groove 28 provided in the upper region of the module 30 and seals the installation of the module 30 in the upper casing half 4a in its upper region.

On the upper side of the flange 27 a bore 39 for accommodating a positioning pin 38 is furthermore provided which, in the installed position of the module 30 in the upper casing half 4a, is partly accommodated in a corresponding bore in the upper casing half 4a.

The module 30 illustrated in Figs. 4 – 7, as a separate component, includes at its end directed towards the drill rod, four feed apertures 32, 37, each provided staggered by 90° on the circular end of the module 30. Two mutually opposite feed apertures 32, 37 respectively lead to the cutting nozzles 34, or to the cavity 50 preceding the drill nozzles 41.

Viewed in the direction of flow, the feed apertures 32 constitute the beginning of two flow passages 47 which follow an arcuate course and which terminate at outlet apertures 33 provided ahead of the cutting nozzles 34 provided diametrically on the tool 2. For fitting the cutting nozzles 34 to the outlet apertures 33, the module 30 in the region behind the outlet apertures 33 - likewise viewed in the direction of flow - shows a correspondingly configured receiving aperture 49. The cutting nozzles 34 as such are fitted in corresponding bores 45 in the upper casing 4a and are secured by screws 46.

The feed apertures 37 – viewed in the direction of flow – constitute the commencement of two further flow passages 31 which extend separately and mutually opposite towards the cavity 50. The flow passages 31 in this context have a rounded cross-section which, from the feed apertures 37 to the cavity 50, first constricts and then extends again. The sectional view illustrated in Figs. 3 and 6 in the plane of the cutting nozzles 34 shows the locality of the approximately smallest cross-section of flow passages 31.

Above the module 30 the valve 20 is accommodated rotatably in the upper portion of the casing 4a. The valve 20 in this context abuts with an annular shoulder 54 on its peripheral surface against a correspondingly configured 5 contact area 52 in the upper portion of the casing 4a and is thereby fixed in the direction towards the drill rod (see Figs. 8 – 12).

At its end, facing towards the module 30, the valve casing 21 takes the form of 10 a cylindrical hollow body into which is formed a half shell support 8 extending essentially at right angles to the longitudinal axis of the tool 2. The half shell support 8 includes two oppositely positioned half shells 25 for accommodating valve bodies 26, the half shells 25 embracing the valve bodies 26 in the upper region in order to secure the positions of the valve bodies 26 in the radial direction of the tool 2.

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The valve bodies 26 are of disc-shaped configuration and have mutually opposite spherical surface segments which match the configuration of the feed apertures 32, 37.

20 The half shell support 8 itself is of such configuration that, in a plane transverse to the longitudinal axis of the casing 4, two mutually opposite regions adjoining the half shells 25 are each opened up in an angular region of about 90° for the flow through the valve 20.

25 Starting from the half shell support 8 the valve casing 21 includes a circular section of upwardly constricting configuration which is followed by an annular flange 19 of cylindrical configuration, comprising for its connection to a conical gear 22 eight bores 9 designed for accommodating screws 24 extending through the bores 9 into correspondingly formed threads in the conical gear 30 22, whereby the latter is firmly connected to the valve casing 21.

The tool 2 illustrated in Fig. 1 is shown in the operational state “drilling” (drilling situation). In the drilling situation the valve bodies 26 of the valve 20 block the feed apertures 32 of the module 30. The diameter of the valve body

26 is, in this context, so dimensioned that feed apertures 32 are covered reliably and completely.

At the same time, the feed apertures 37 of the module 30 are freely accessible. Water which rushes under high pressure from the drill rod into the tool 2 flows through the interior in the tool 2 above the valve 20 through the latter and through the feed apertures 37 as well as the flow passages 31 following thereon, thereafter passing through the cavity 50 in the lower casing half 4b in order to eventually emerge through the bore nozzles 41 into a drum filled with coke, which is not actually illustrated.

In order to permit switching from the drilling situation to the operational condition "cutting", an operating device 10 is provided for operating the valve 20 in the tool 2. The operating device 10 includes, normal to the axis A extending through the upper casing half 4a, a shaft 12 at the end of which, positioned inside the tool 2, a conical gear 11 is provided, which engages the conical gear 22 on the upper side of the valve 20. At the end opposite to the gear 11 the shaft 12 comprises a tool receiving aperture 13 designed for accommodating a manual lever by means of which the shaft 12 and the conical gear 11 can be turned. The shaft 12 itself is pivotally mounted in a fitting 18, which is fixed in a bore 17 in the upper casing half 4a by means of an annular seal 15 and by screws 14 extending through the fitting 18 into the upper casing half 4a. Moreover, a further seal 16 seals the shaft 13 in the fitting 18.

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For changing from the drilling state to the operational state of "cutting", the conical gear 11 is actuated by turning the shaft 12 and with the aid of the manual lever fitting the tool receiving aperture 13. The valve 20 engaging the gear 11 by way of the gear 22 is turned by the gear 11 in the upper casing half 4a about the axis A. Jointly with the valve casing 21 the conical gear 22 is rotated and thereby also the valve body 26 of the valve 20.

By turning the valve 20 on the upper end of the module 30, the valve bodies 26 which previously closed the feed apertures 32 to the flow passages 47

leading to the cutting nozzles 34, are opened up. When operating the tool receiving aperture 13, the valve bodies 26 are moved along a circular trajectory by 90° until the feed apertures 37 are totally closed.

- 5 Fig. 2 shows the tool 2 in the operational state of cutting. Water under high pressure rushes from the drilling rod into the interior of the upper casing half 4a and now emerges through the feed apertures 32 into the flow passages 47 and thereafter, through the cutting nozzles 34. The feed apertures 37 are securely and completely closed by the valve bodies 26 provided there above.
- 10 The closing action of the valve bodies 26, in this position as well as during closing the feed apertures 32, is secured in that the extremely high water pressure which is well in excess of 100 bar, forces the valve bodies 26 into the feed apertures 32, 37.

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## CLAIMS:

1. A tool for crushing coke, including:  
a casing which, in an operational state, is connected to a drilling rod, the casing having on or in it:  
at least one cutting nozzle for cutting coke and at least one drilling nozzle for drilling coke; and  
at least one valve for controlling a direction of flow of water through the at least one cutting nozzle and the at least one drilling nozzle;  
characterized in that there are at least two flow passages that are independent from one another within the casing, each flow passage being associated individually with a feed aperture and each extending between the associated feed aperture and one of the cutting nozzle or the drilling nozzle; and wherein the at least one valve functions to close and open the feed apertures and is in the vicinity of the feed apertures.
2. The tool according to claim 1, wherein when operational for cutting, the feed aperture of the flow passage extending to the drilling nozzle is closed by the valve and when operational for drilling, the feed aperture of the flow passage extending to the cutting nozzle is closed by the valve.
3. The tool according to claim 1, wherein the feed apertures are essentially in an orientation normal to the direction of flow of water through the drilling rod and the casing.
4. The tool according to claim 1 wherein the flow passages are formed in a module installable in the casing.
5. The tool according to claim 1 wherein the flow passages are provided with a hydrodynamically optimized configuration.
6. The tool according to claim 1 wherein the flow passages vary in cross section from the

feed aperture to one or both of the cutting nozzle and the drilling nozzle.

7. The tool according to claim 1 wherein flow unifying means are provided at an end of the flow passages directed towards the cutting nozzle and the drilling nozzle.
8. The tool according to claim 1 wherein the valve includes segmentary spherically configured valve bodies which function to close the feed apertures.
9. The tool according to claim 8, wherein the valve bodies include at least two spherical surface segments.
10. The tool according to claim 1, wherein each said valve is a ball valve, such that the feed apertures are each closable by a respective ball of the ball valve.
11. The tool according to claim 9, wherein the valve bodies are biased by a spring element in the direction of the feed apertures.
12. The tool according to claim 9, wherein the valve bodies are in engagement with guide means.
13. The tool according to claim 2, wherein each said valve is in engagement with a device for operating the valve.
14. The tool according to claim 1, further comprising at least two nozzles for cutting and at least two nozzles for drilling, each of the cutting and drilling nozzles being fitted in bores of the casing and being respectively connected by way of the flow passage to the respective feed apertures arranged normal to the drilling rod, the feed apertures to the cutting nozzles being closed whenever the tool is operational for drilling and the feed apertures to the drilling nozzles being closed whenever the tool is operational for cutting.
15. The tool according to claim 5 wherein the flow passages have a rounded contour.

16. The tool according to claim 9 wherein the valve bodies are symmetrical.
17. The tool according to claim 12 wherein the valve bodies are in engagement with half shells that embrace the valve bodies.

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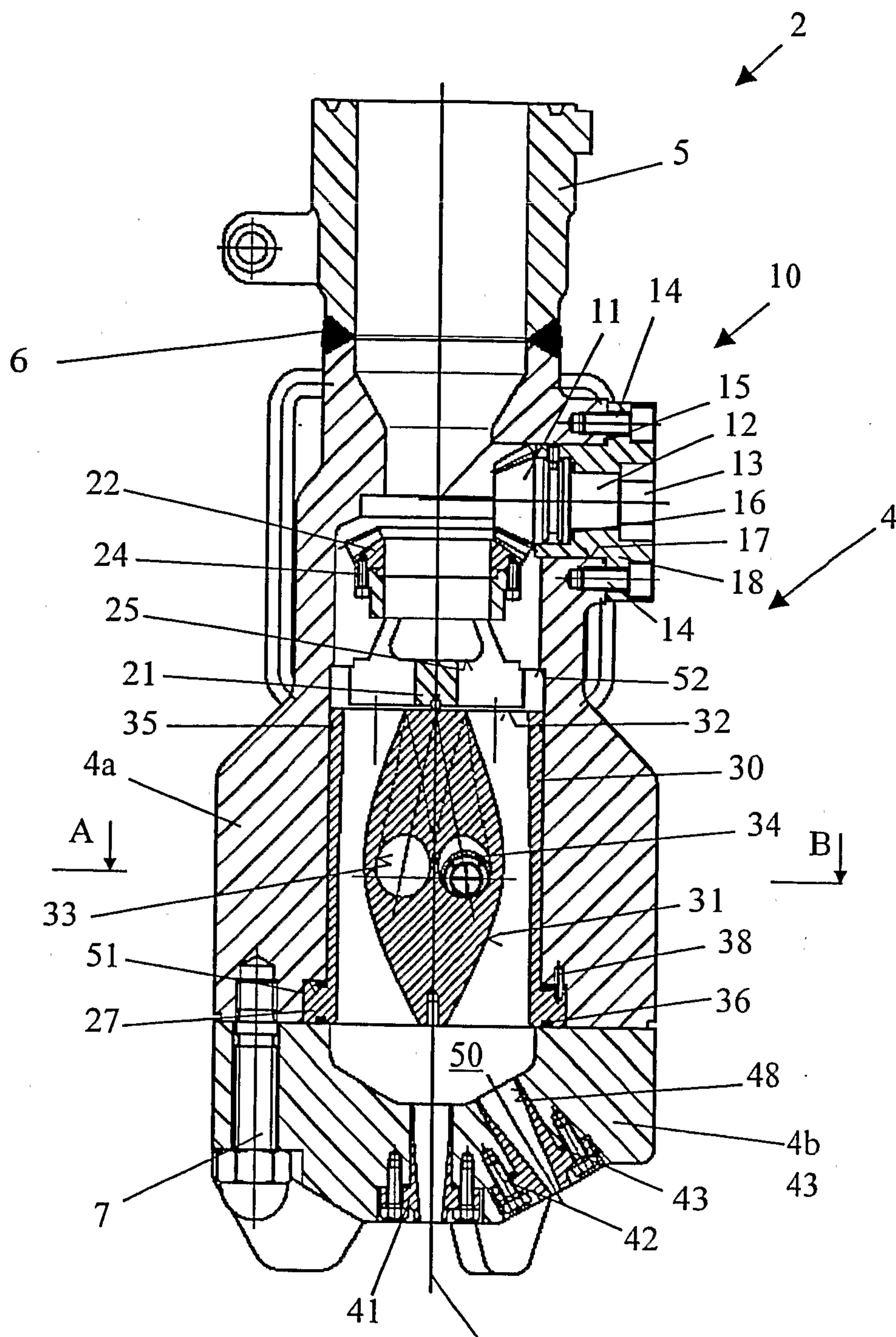


Fig. 1

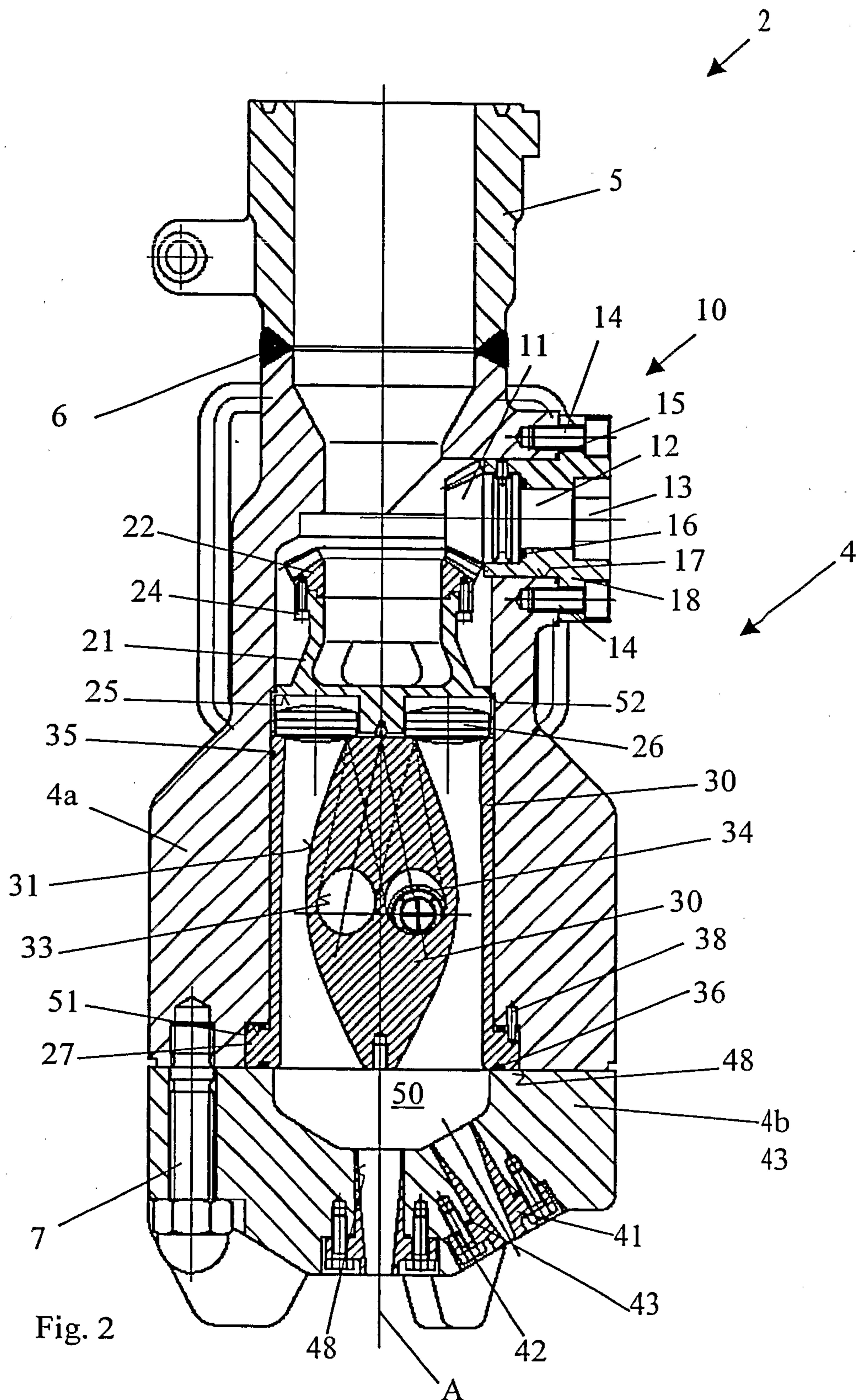


Fig. 2

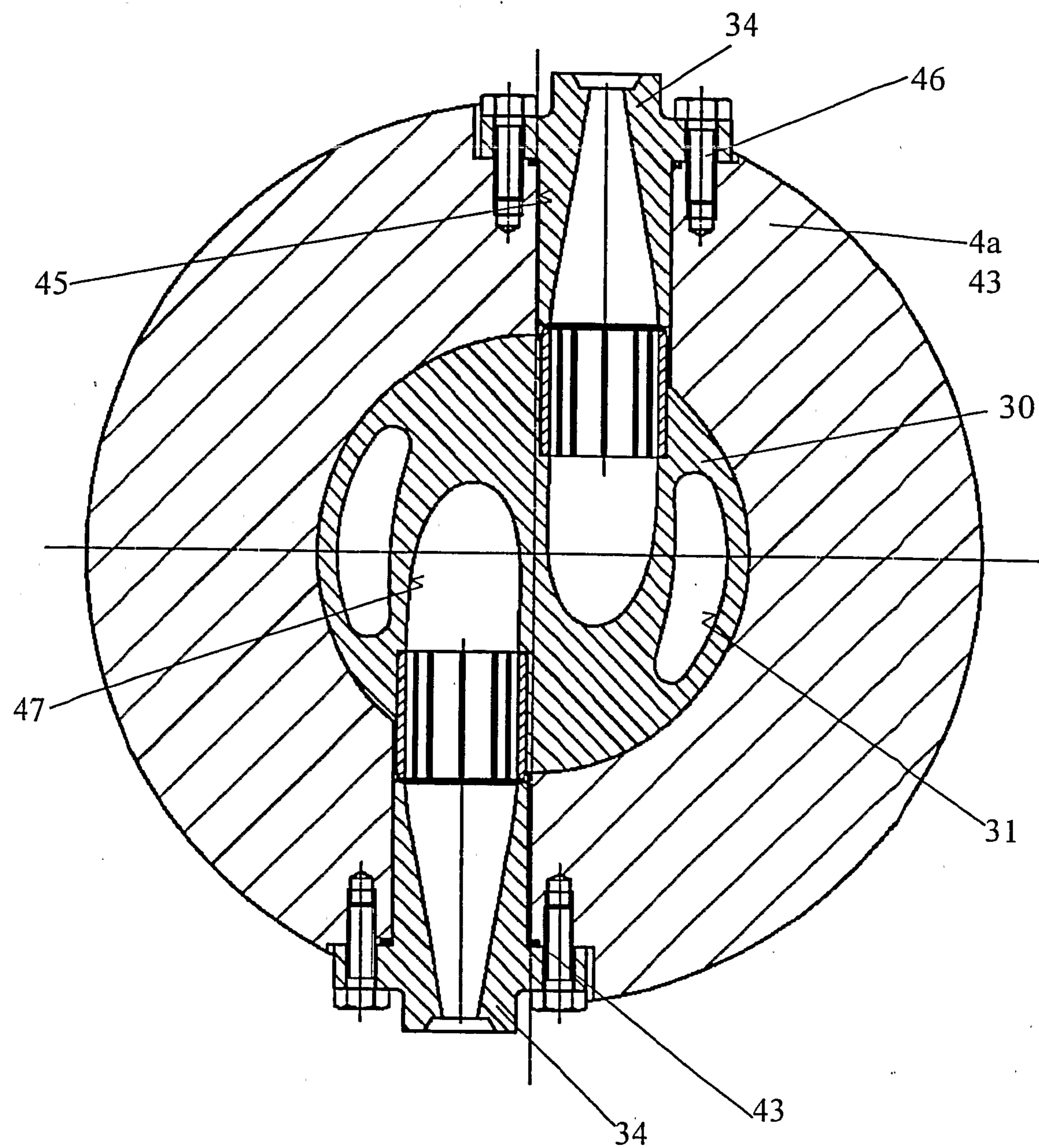


Fig. 3

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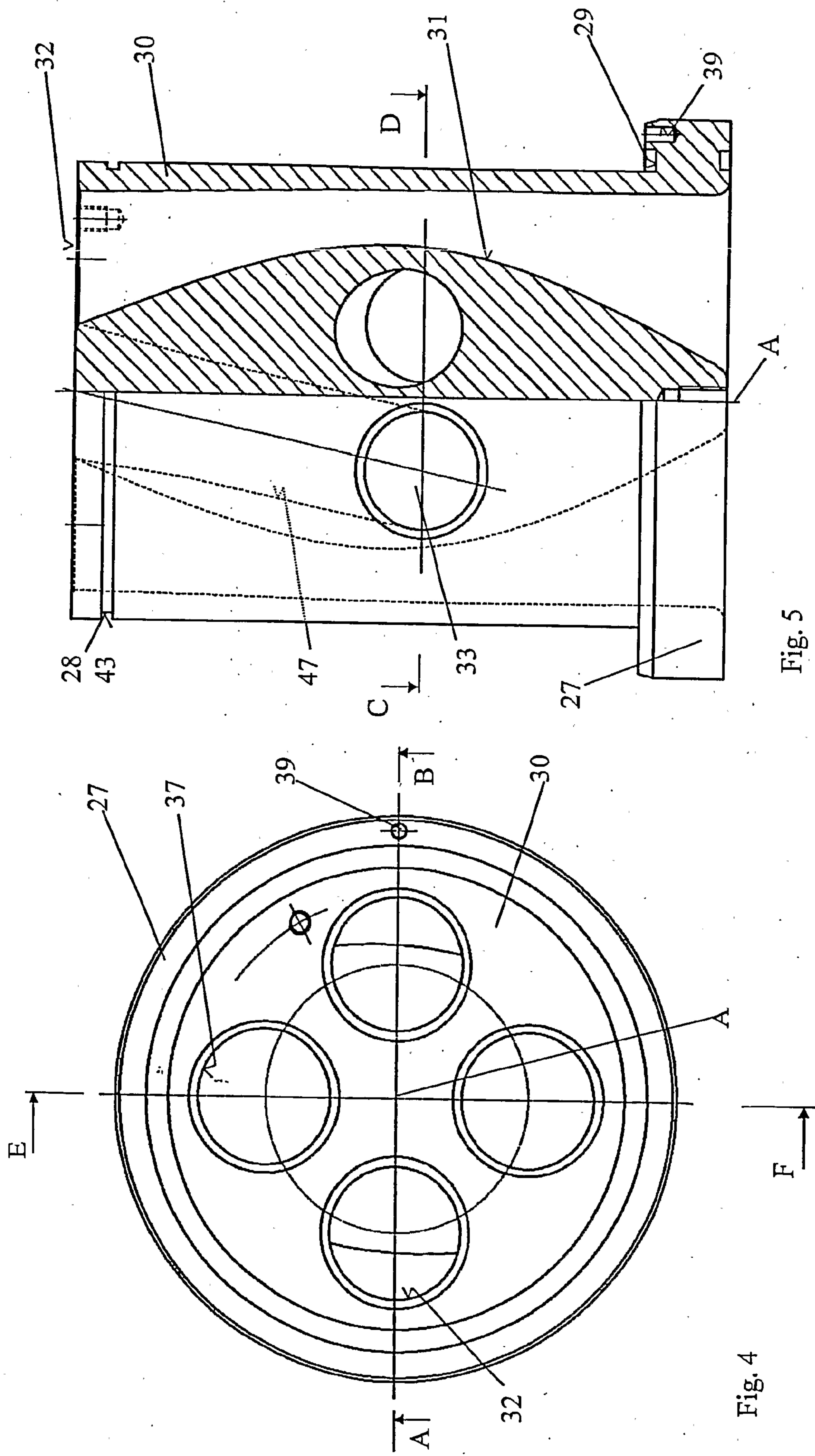


Fig. 4

Fig. 5

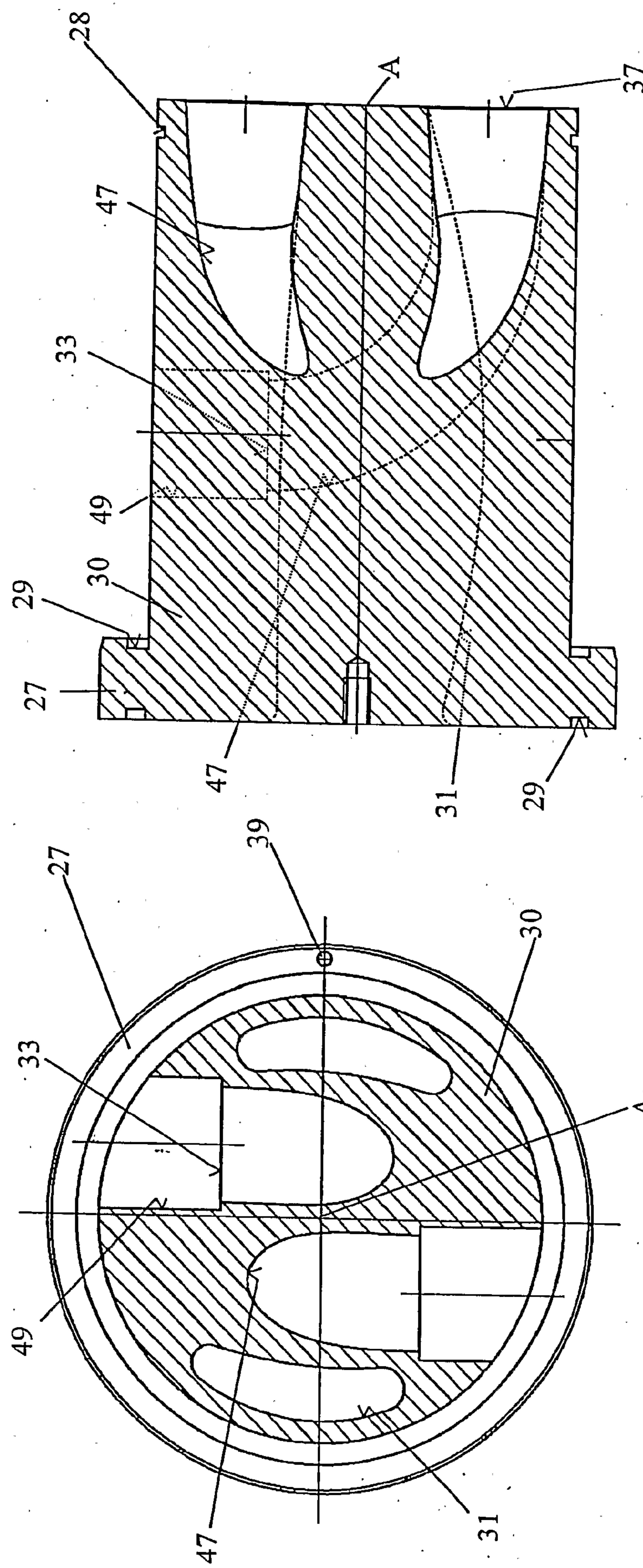


Fig. 6

Fig. 7

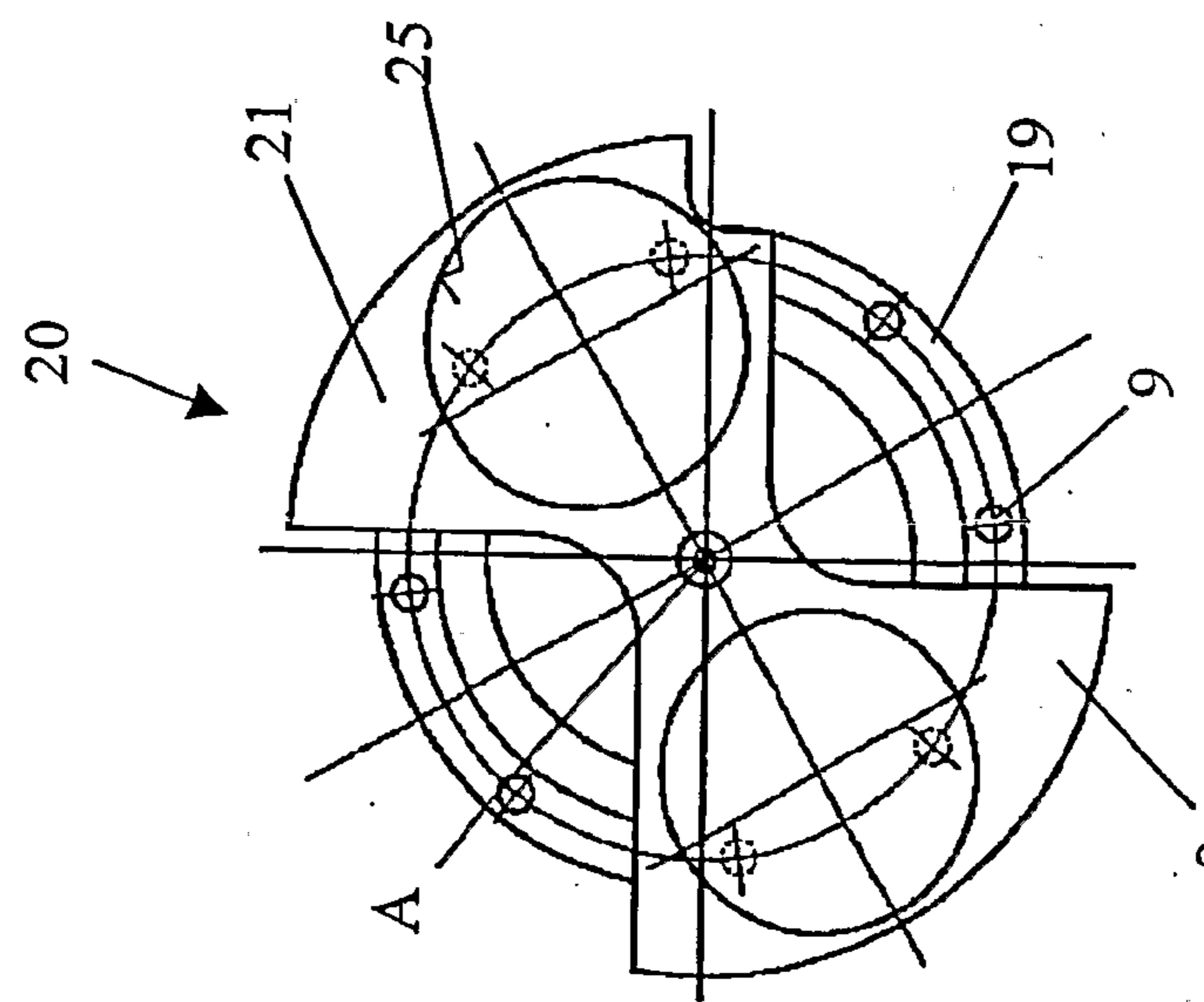


Fig. 10

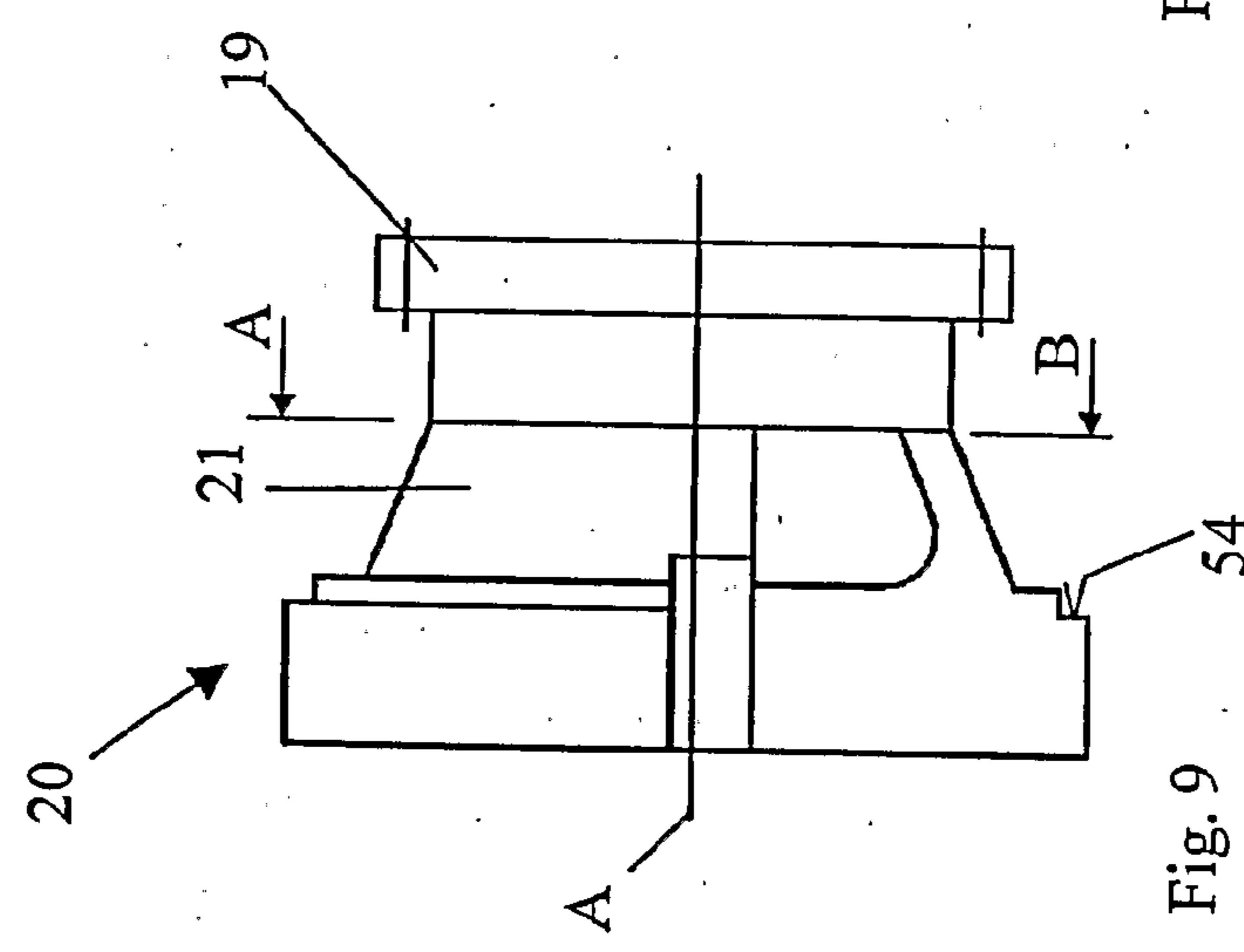


Fig. 9

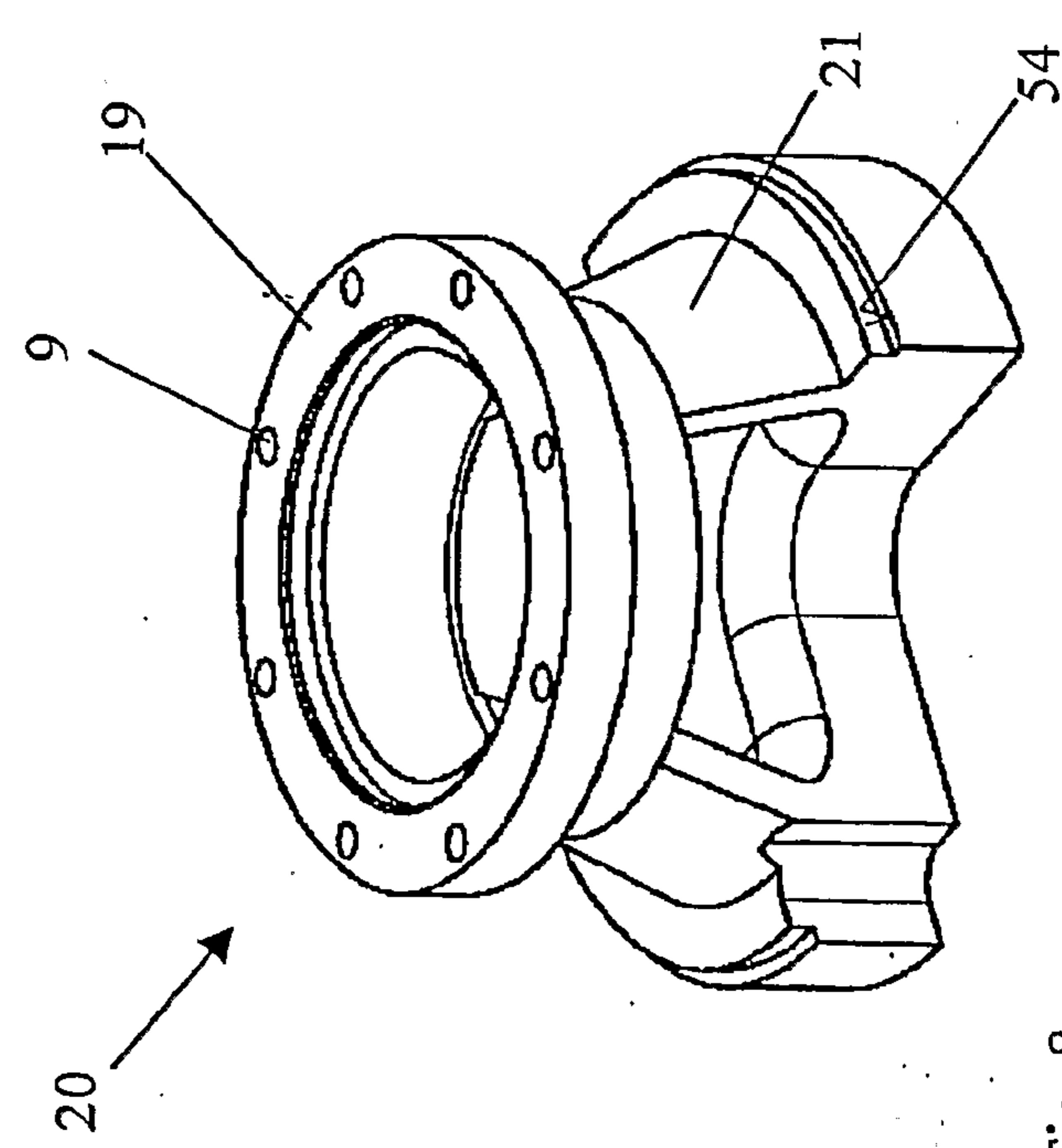


Fig. 8

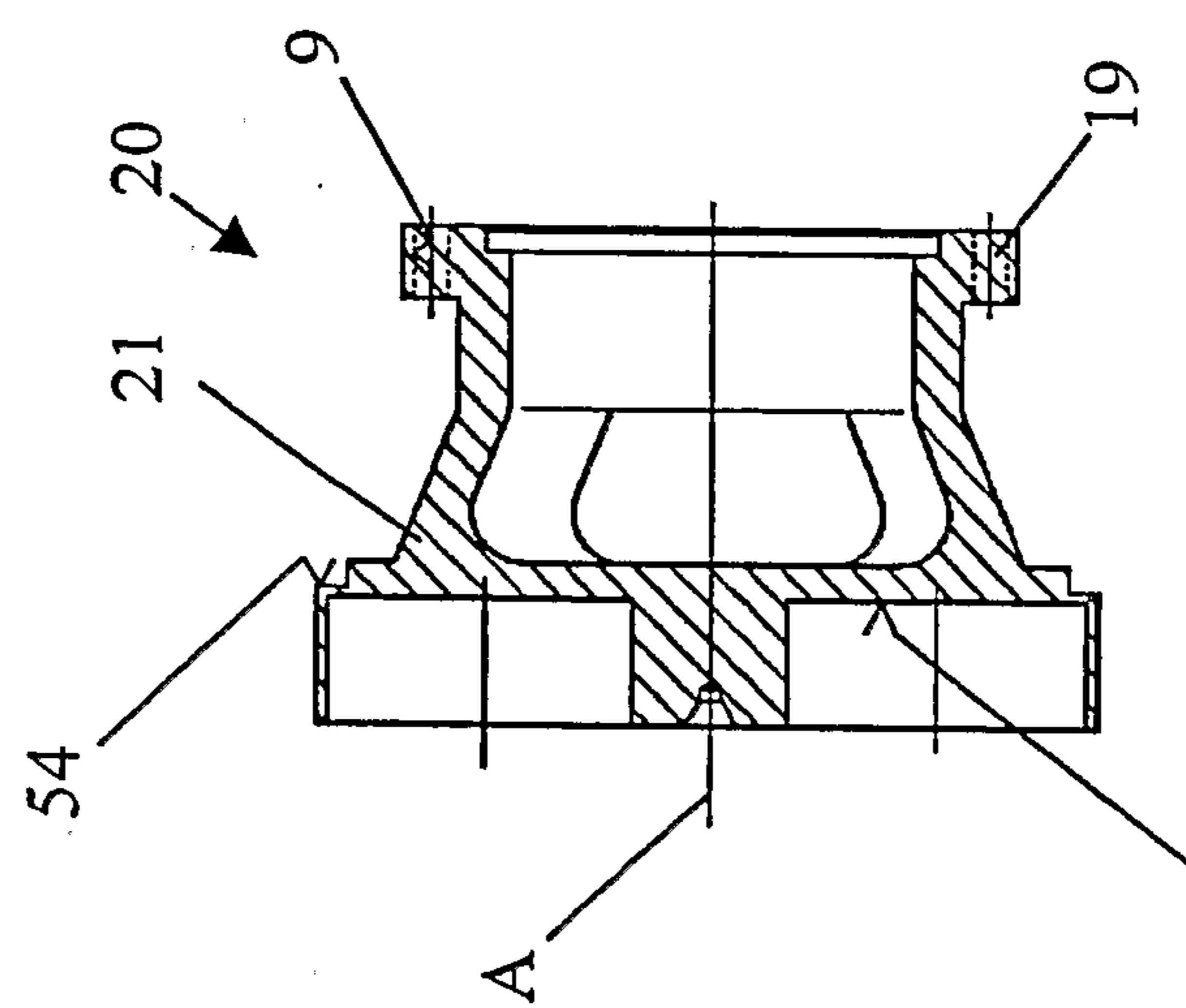


Fig. 12

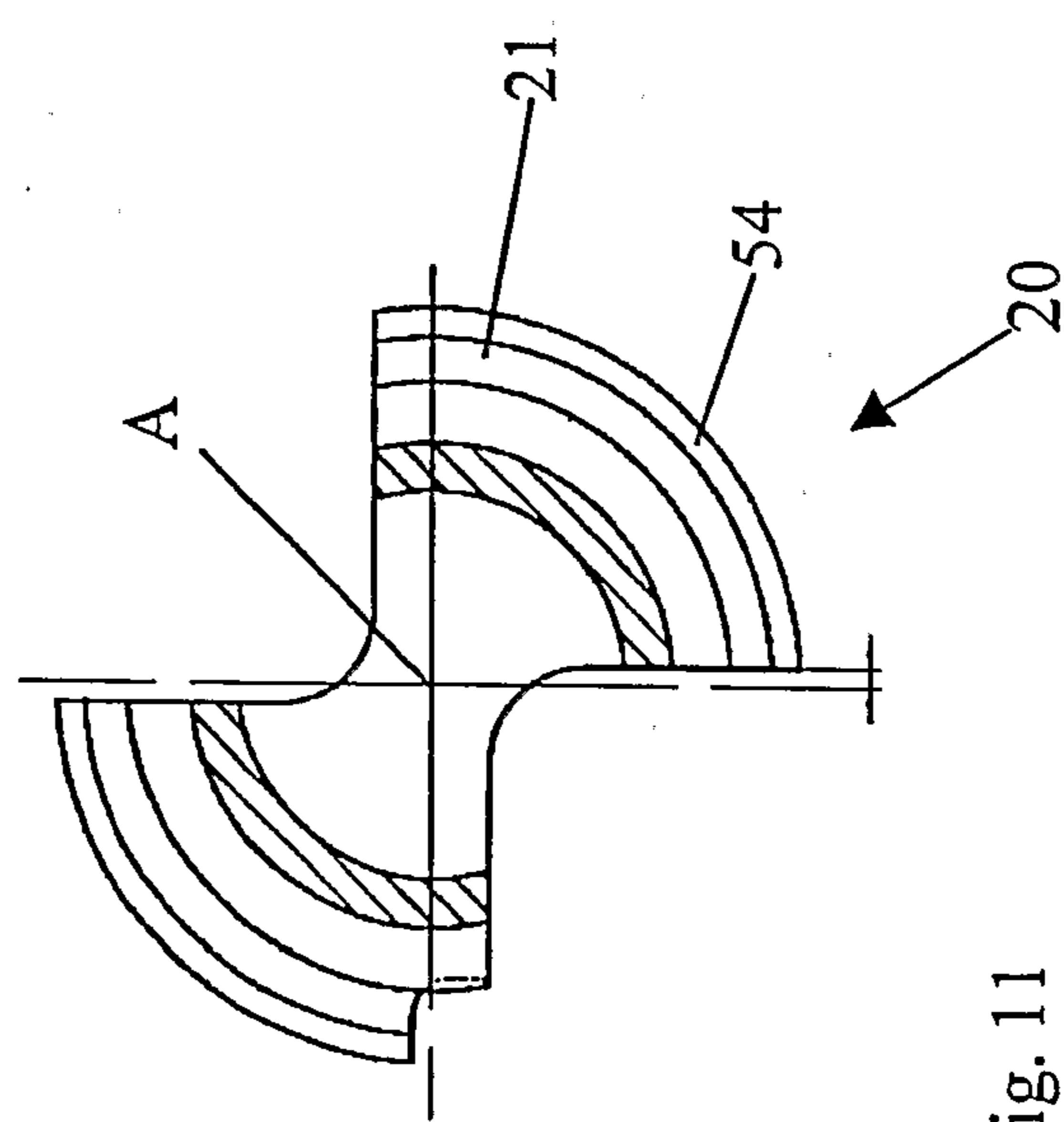


Fig. 11

