

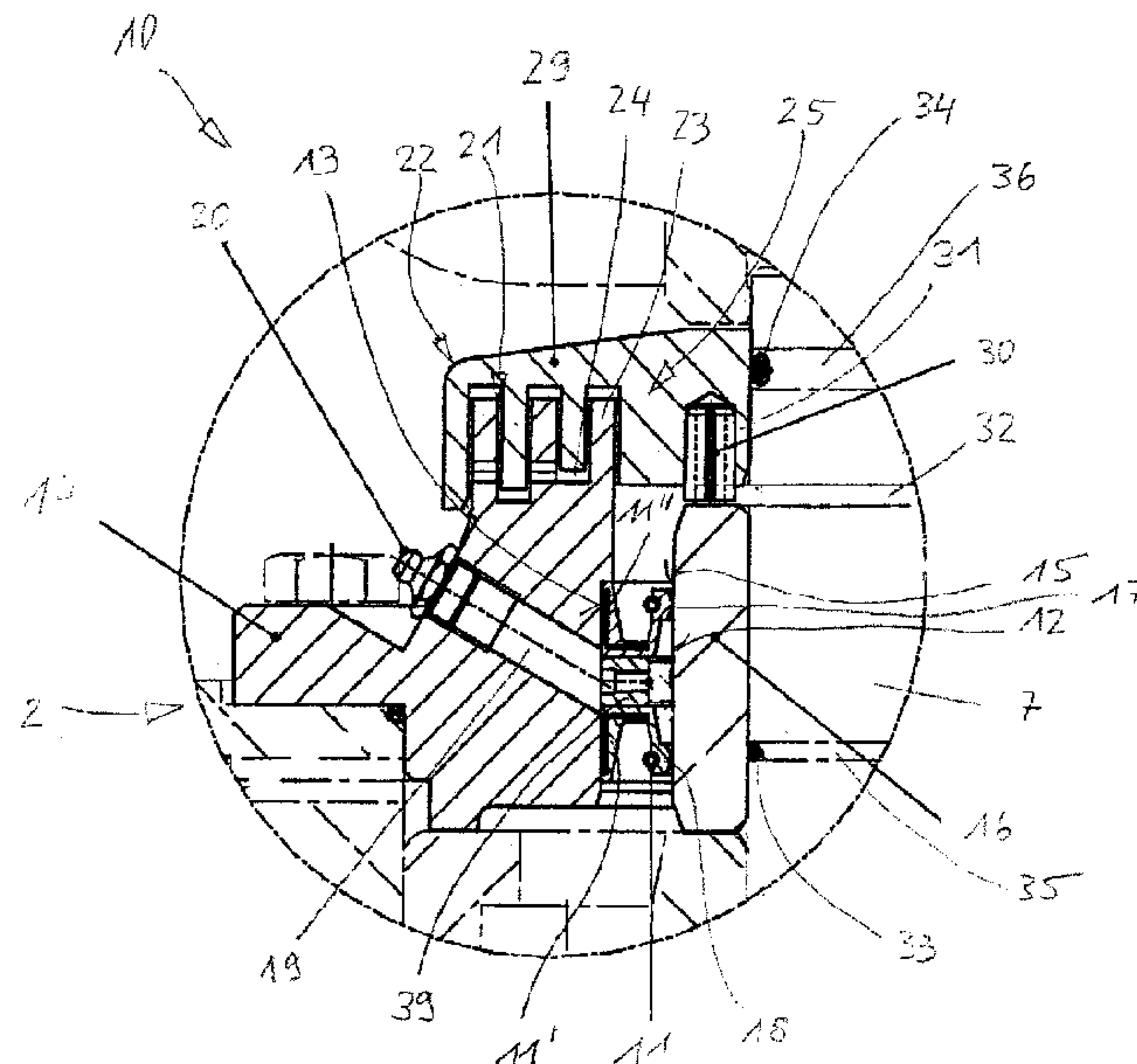


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(54) Title: DEVICE FOR PRODUCING A BORE IN THE GROUND, ROTARY DRIVE DEVICE AND ROTARY SEAL
ARRANGEMENT



(57) Abrégé/Abstract:

Device (100) for producing a bore in the ground, with a spindle (7) which is led rotatably through a housing (2), and with a rotary seal arrangement (10) with which a rotary lead-through of the spindle (7) through the housing (2) can be sealed, which arrangement comprises a shaft seal (11) which acts between a cylindrical, first sealing face (12) of the spindle (7) and, concentrically thereto, a second sealing face (13) of the housing (2), wherein a labyrinth seal arrangement (25) is provided upstream of which the shaft seal (11) is situated as viewed from the outer side of the housing.



Abstract

Device (100) for producing a bore in the ground, with a spindle (7) which is led rotatably through a housing (2), and with a rotary seal arrangement (10) with which a rotary lead-through of the spindle (7) through the housing (2) can be sealed, which arrangement comprises a shaft seal (11) which acts between a cylindrical, first sealing face (12) of the spindle (7) and, concentrically thereto, a second sealing face (13) of the housing (2), wherein a labyrinth seal arrangement (25) is provided upstream of which the shaft seal (11) is situated as viewed from the outer side of the housing.

**Device for producing a bore in the ground, rotary drive device
and rotary seal arrangement**

The invention relates to a device for producing a bore in the ground, with a spindle which is led rotatably through a housing, and with a rotary seal arrangement with which a rotary lead-through of the spindle through the housing can be sealed, which seal arrangement comprises a shaft seal which acts between a cylindrical first sealing face of the spindle and, concentrically thereto, a second sealing face of the housing. The invention also relates to the rotary seal arrangement of such a device.

Such devices are known from the prior art. The housing can be part of a flushing head. The device normally comprises a rotary table for rotatably driving the spindle. In particular, the housing can also be part of a power rotary head (in technical language also referred to as "top drive"). The power rotary heads normally are arranged on a drilling rig to be displaceable in the direction of advance of the bore and comprise a driven spindle to which - optionally in segments - the drill pipe can be connected. When displacing the drill pipe during advancing or when extracting the drill pipe, the power rotary heads are also displaced at the same time. In contrast, in the direction of advance, the rotary table is arranged stationarily in the drilling mast. The drill pipe is movable in the longitudinal direction, but is led through in a rotationally fixed manner. The flushing heads, which serve for rotatably connecting the drill pipe to the non-rotatable flushing pipe arrangement, are displaced together with the drill pipe.

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Such devices normally comprise a housing with rotary lead-throughs through which the spindles are led through to the outside. In order to avoid that contaminants from the outside can get into the interior of the housing and that lubricant
5 that optionally is contained in the housing can escape to the outside, the devices comprise rotary seal arrangements by means of which the rotary lead-throughs of the spindle through the housing can be sealed. These rotary seal arrangements consist substantially of an elastic shaft seal which acts between a
10 first cylindrical sealing face of the spindle and, concentrically thereto, a second sealing face of the housing.

In particular due to the impact of contaminants from the outside, the shaft seals are subjected to high mechanical load during the operation, resulting in high wear.

15 It is therefore an object of the invention to provide a device of the aforementioned type and a rotary seal arrangement thereof, the wear of which rotary seal arrangement is reduced.

In some embodiments of the invention, there is provided a device for producing a bore in the ground, with a spindle which
20 is led rotatably through a housing, the housing being part of a top drive, and with a rotary seal arrangement with which a rotary lead-through of the spindle through the housing can be sealed, which seal arrangement comprises a shaft seal that acts between a cylindrical first sealing face of the spindle and,
25 concentrically thereto, a second sealing face of the housing, wherein a labyrinth seal arrangement is provided that is located upstream of the shaft seal as viewed from the outside of the housing.

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In some embodiments of the invention, there is provided a rotary drive device of a device as described herein.

In some embodiments of the invention, there is provided a rotary seal arrangement of a device as described herein.

- 5 According to the invention, a labyrinth seal arrangement is provided upstream of the shaft seal, as viewed from the outside of the housing.

By "labyrinth seal arrangement" all contactless shaft seals are meant, the sealing effect of which is based on an extension of
10 the sealing path.

Due to this measure, the amount of contaminants that acts on the shaft seal located between the cylindrical first sealing face of

the spindle and, concentrically thereto, the second sealing face of the housing is significantly reduced. Thus, this shaft seal is subjected to considerably less wear than the seal used in devices according to the prior art. Downtimes of the device according to the invention due to failure of the seal are significantly reduced by the invention.

In order to facilitate assembly and disassembly of the shaft seal, it is provided in a preferred embodiment of the device according to the invention that the second sealing face, upon which the shaft seal acts, is formed on a housing cover through which the spindles passes. Moreover, a first sequence of rings and grooves, which form a portion of the labyrinth seal on the housing, is provided on this housing cover.

This first sequence of rings and grooves is - particularly preferred - provided on a front side of the housing cover.

Preferably, in the device according to the invention, a rotary cover is provided which is connected to the spindle in a rotationally fixed manner, and which has a second sequence of rings and grooves that form the second portion of the labyrinth seal.

In case that the first sequence of rings and grooves is provided on a front side of the housing cover, the second sequence of rings and grooves is provided on a front side of the rotary cover, which front side is located opposite to the front side of the housing cover. Due to this measure, assembling the rotary seal arrangement of the device according to the invention is particularly made easier since for engaging the first and second sequences of rings and grooves with each other, the rotary cover

has only to be shifted in the longitudinal direction of the spindle towards the cover.

Assembling the seal arrangement is facilitated again if the second sealing face, with which the shaft seal interacts, is provided on a sealing sleeve that is connected to the spindle in a rotationally fixed manner, and if the rotary cover is connected to the sealing sleeve in a rotationally fixed manner. For example, that front side of the sealing sleeve that is oriented towards the rotary cover can be formed for the purpose of providing the rotationally fixed mounting of the rotary cover on the spindle. Moreover, due to this configuration it is not required to rework the spindle in the event of wear on the second sealing face; rather, only the sealing sleeve has to be reworked or replaced.

Particularly preferred is a refinement of the device according to the invention in which the housing cover comprises a first lubricant feed channel by means of which lubricant can be fed to the shaft seal, and a second lubricant feed channel by means of which lubricant can be fed to the labyrinth seal. Due to this measure, on the one hand, a lubricant having a material composition and viscosity suitable for generating the best possible sealing effect and a minimum of wear can be fed to the shaft seal, and, on the other, the labyrinth seal can be provided with a lubricant that, where applicable, has a different material composition and viscosity and which optimizes the sealing effect of the labyrinth seal and accordingly prevents in the best possible way that dirt particles can reach the shaft seal.

The device can in particular be a device for producing a substantially vertical bore in the ground, wherein the rotary seal arrangement is in particular the upper rotary seal arrangement of a flushing head or a rotary drive device that is designed as a power rotary head.

Devices known from the prior art, for example, rotary drive devices, in particular if they are designed as power rotary heads, already have housing covers and rotary covers. Thus, the invention achieves the significant advantage that devices according to the prior art can be retrofitted so as to form a device according to the invention by exchanging the housing cover and the rotary cover, so that the rotary seal arrangement in itself and a rotary drive device provided therewith and a flushing head provided therewith are also of independent inventive importance.

The invention is now to be further explained by means of the drawing in which an exemplary embodiment of the device according to the invention schematically and partially illustrates a power rotary head as an example. In the figures:

Fig. 1 shows a section along the rotational axis of this exemplary embodiment;

Fig. 2 shows the detail II in Fig. 1 in an enlarged illustration, and

Fig. 3 shows the detail III in Fig. 1, likewise enlarged.

The device illustrated in Fig. 1 and designated as a whole by 100 comprises a power rotary head 1 for driving on the head side

a drill pipe, said power rotary head comprising a housing 2 which accommodates a reduction gear and to which drive motors are flange-mounted via couplings 3, 4 that act on said reduction gear. Such a power rotary head is known, for example, under the designation DDM 1000 2M from the company Aker Solutions. Attached to the housing 2 is a fastening device which, as a whole, is designated by 5, and by means of which the power rotary head can be connected to a lifting device which is not illustrated in the drawing and by means of which the power rotary head can be lifted and lowered according to the arrow P. The power rotary head 1 forms a rotary drive device 6 of the device 100 by means of which a spindle 7 can be set in rotation, to which spindle a drill pipe, which is not visible in the drawing, can be coupled in a manner known per se.

The spindle 7 is led through the housing 2. At the upper exit side of the housing 2, a housing cap 8 is provided through which the spindle 7 is led in a rotatable manner by means of a roller bearing 9.

For sealing the rotary lead-through, a seal arrangement 10 is provided, the construction and operating principle of which is described in greater detail below with reference to the Figures 2 and 3.

The seal arrangement 10 comprises a shaft seal 11 that acts between a cylindrical first sealing face 12 of the spindle 7 and, concentrically thereto, a second sealing face 13 of a housing cover 14 that forms a portion of the housing 2. The first sealing face 12 is not formed directly by the lateral surface of the spindle 7, but by the outer lateral surface 15 of a sealing sleeve 16 that is connected to the spindle 7 in a rotationally

fixed manner. The shaft seal 11 comprises two conventional elastic shaft sealing rings 11', 11'' that are spaced apart from each other by means of a spacer ring 39 and are mounted on the housing cover 14 in a rotationally fixed manner. The shaft seal has two sealing lips 17, 18 which, supported by a tension spring, rest slidably against the first sealing face 12.

In the housing cover 14, a first lubricant feed channel 19 is incorporated through which lubricant can be fed to the shaft seal region between the two sealing lips 17, 18. Said feed channel is closed from the outside by a lubricating nipple 20, to which optionally a device for feeding lubricant can be connected.

On that front side 21 of the housing cover 14 that faces upwards in the drawing, a first sequence 22 of rings 23 and grooves 24 is provided which form the housing portion of a labyrinth seal 25 that is arranged upstream of the shaft seal 11.

The second portion of the labyrinth seal 25 is formed by a second sequence 26 of rings 27 and grooves 28 which are engaging with the rings 23 and grooves 24 of the first sequence 22. The second sequence 26 is provided on a rotary cover 29 which is connected to the spindle 7 in a rotationally fixed manner. For this purpose, a pin 30 is provided which is located in a blind hole 31 of the rotary cover 29 and interacts with a clamping ring 32 that rests on the spindle 7.

O-rings 33, 34 that rest in the receiving grooves 35, 36 serve for sealing, on the hand, between the spindle 7 and the sealing sleeve 16 and, on the other, between the spindle and the rotary cover 29.

As can be seen in Fig. 3, the housing cover 14 has a second lubricant feed channel 37 which ends in a groove 24 of the rotary cover 29, and through which lubricant can be fed for lubricating and for improving the sealing effect of the labyrinth seal 25. The lubricant feed channel 37, in turn, is provided with a lubricating nipple 38.

Reference list

100	Device
1	Power rotary head
2	Housing
3	Coupling
4	Coupling
5	Fastening device
6	Rotary drive device
7	Spindle
8	Housing cap
9	Roller bearing
10	Rotary seal arrangement
11	Shaft seal
11', 11''	Shaft sealing rings
12	First sealing face
13	Second sealing face
14	Housing cover
15	Lateral surface
16	Sealing sleeve
17	Sealing lip
18	Sealing lip
19	Lubricant feed channel
20	Lubricating nipple
21	Front side
22	First sequence
23	Rings
24	Grooves
25	Labyrinth seal
26	Second sequence
27	Rings
28	Grooves

29	Rotary cover
30	Dowel pin
31	Blind hole
32	Clamping ring
33	O-ring
34	O-ring
35	Receiving groove
36	Receiving groove
37	Lubricant feed channel
38	Lubricant nipple
39	Spacer ring
P	Arrow

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CLAIMS:

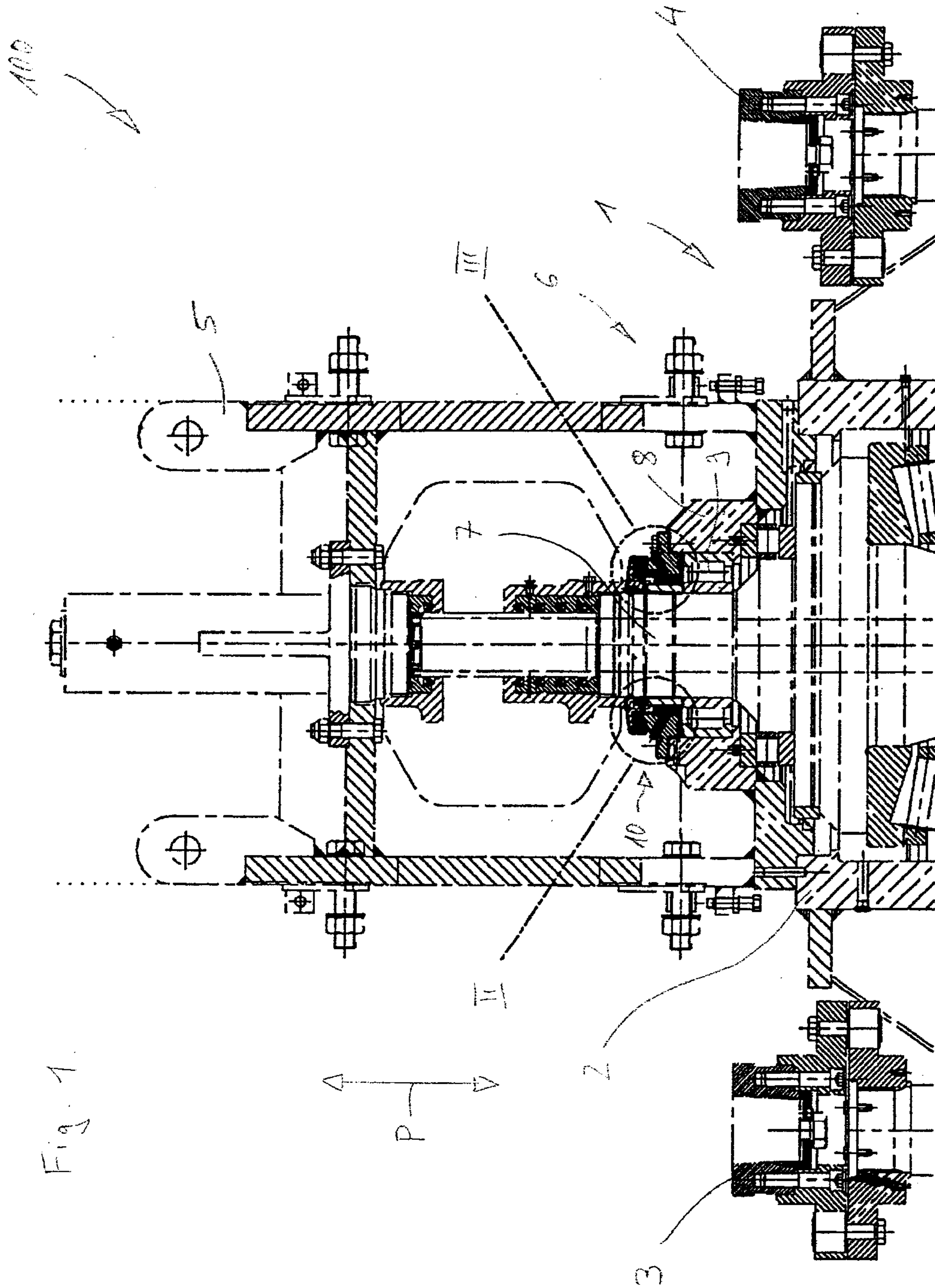
1. A device for producing a bore in the ground, with a spindle which is led rotatably through a housing, the housing being part of a top drive, and with a rotary seal arrangement
5 with which a rotary lead-through of the spindle through the housing can be sealed, which seal arrangement comprises a shaft seal that acts between a cylindrical first sealing face of the spindle and, concentrically thereto, a second sealing face of the housing, wherein a labyrinth seal arrangement is provided
10 that is located upstream of the shaft seal as viewed from the outside of the housing.
2. The device according to claim 1, wherein the second sealing face is formed on a housing cover through which the spindle passes and on which a first sequence of rings and
15 grooves is provided which form a portion of the labyrinth seal on the housing side.
3. The device according to claim 2, wherein the first sequence of rings and grooves is provided on a front side of the housing cover.
- 20 4. The device according to any one of claims 1 to 3, wherein a rotary cover is provided which is connected to the spindle in a rotationally fixed manner and which has a second sequence of rings and grooves which form the second portion of the labyrinth seal.
- 25 5. The device according to claim 4, wherein the second sequence of rings and grooves is provided on a front side of the rotary cover that is located opposite to the front side of the housing cover.

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6. The device according to any one of claims 1 to 5,
wherein the second sealing face is provided on a sealing sleeve
that is connected to the spindle in a rotationally fixed
manner, and wherein the rotary cover is connected to the
5 sealing sleeve in a rotationally fixed manner.

7. The device according to any one of claims 1 to 6,
wherein the housing cover comprises a first lubricant feed
channel by means of which lubricant can be fed to the shaft
seal, and a second lubricant feed channel by means of which
10 lubricant can be fed to the labyrinth seal.

8. The device according to any one of claims 1 to 7,
wherein it is a device for producing a substantially vertical
bore in the ground, and wherein the rotary seal arrangement is
the upper rotary seal arrangement of a rotary drive device that
15 is designed as a power rotary head.



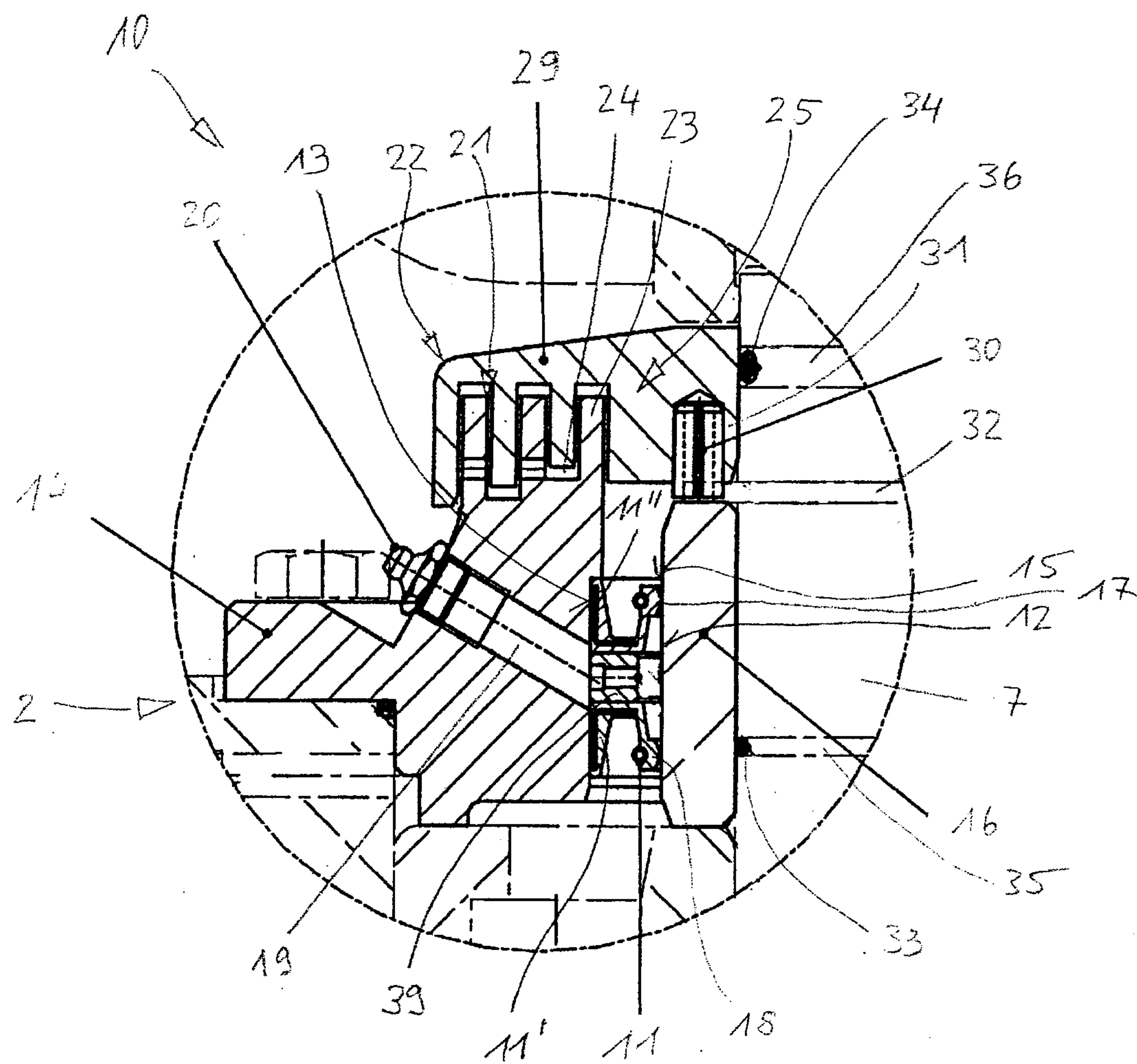


Fig. 2

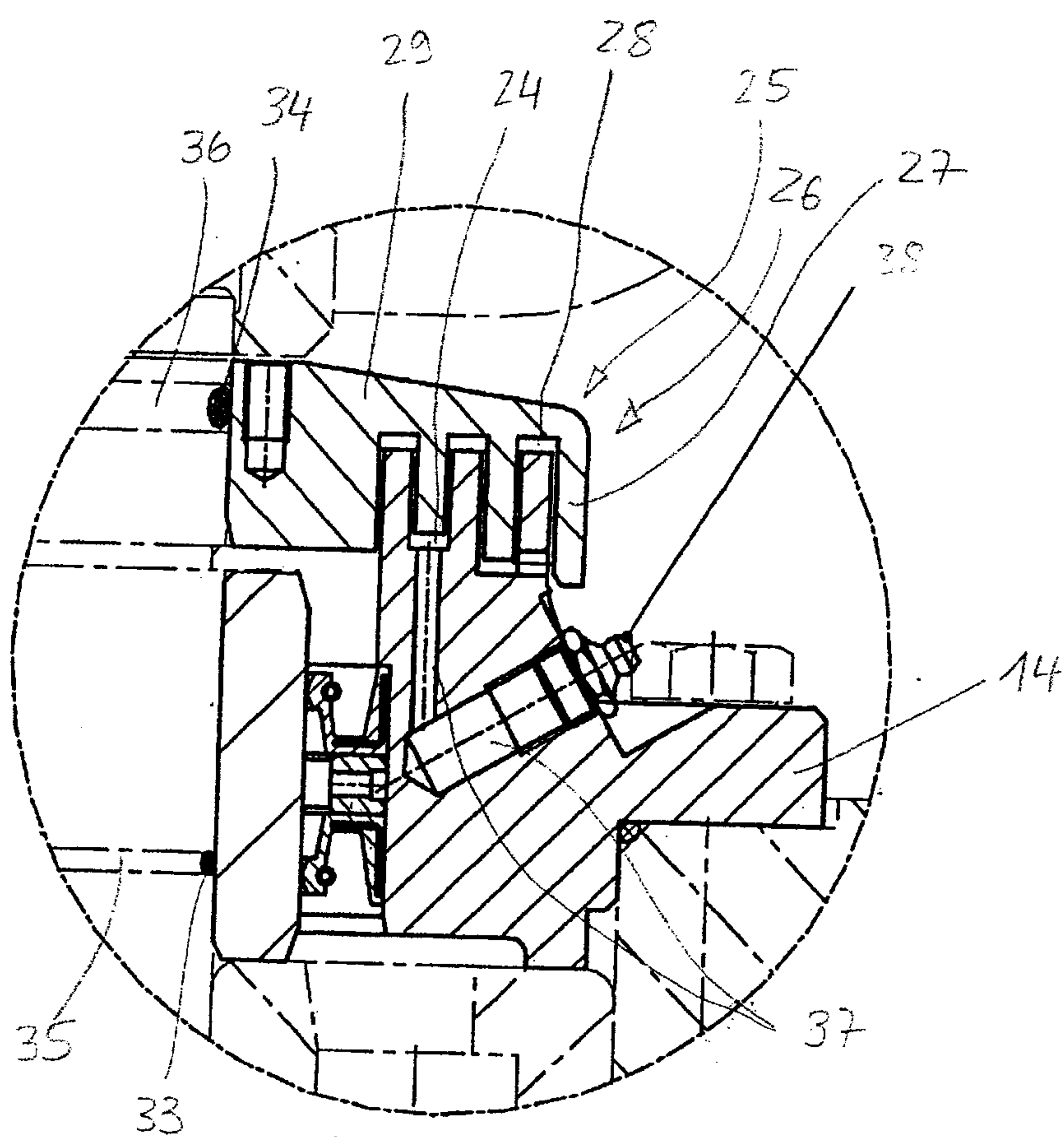


Fig. 3

