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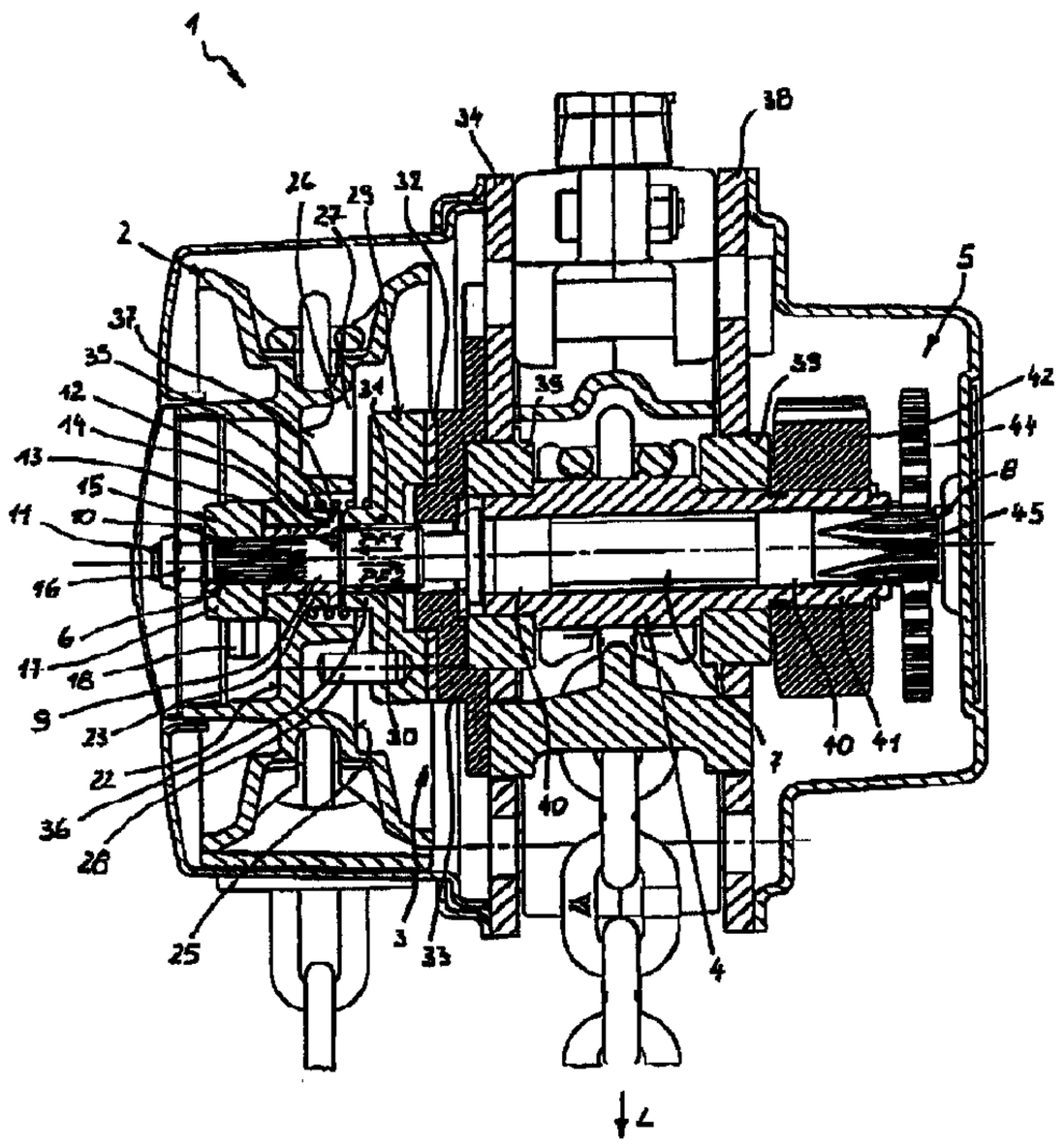

(57) Abrégé/Abstract:
The invention relates to a lifting jack (1) that is provided with a driving wheel (2), an automatic mechanical brake (3), a load wheel (4) and a gearbox (5) which are axially arranged in tandem in a housing. The driving wheel (2) which is provided on one end (6) of a drive shaft (7) can be coupled to the gearbox (5) in a torque-transmitting manner and by means of the drive shaft (7) which intersperses the automatic mechanical brake (3) and the load wheel (4), whereby said gearbox (5) is situated on the remaining end (8) of the drive shaft (7) and drives the load wheel (4). The driving wheel (2) cannot be axially displaced on the drive shaft (7) but is mounted in such a way that said wheel can be relatively rotated in a limited manner. The driving wheel can be coupled to a brake disc (29) in a limited and relatively rotatable manner. Said brake disc can be axially displaced on a thread section (31) of the drive shaft (7) and can be pressed against a pressure disc (33) by integrating a friction disc (32). Said pressure disc is fixed to the housing. The driving wheel (2) is a component of the automatic mechanical brake (3).

ABSTRACT

The invention relates to a lifting device which includes a drive wheel (2), a friction disc brake (3), a load wheel (4) and a gear (5), which are arranged sequentially in an axial direction inside a housing. The drive wheel (2) provided on one end (6) of a drive shaft (7) can be coupled by way of the drive shaft (7) which extends through the friction disc brake (3) and the load wheel (4), with the gear (5) which is located on the other end (8) of the drive shaft (7) and drives the load wheel (4) for transmitting a torque. The drive wheel (2) is prevented from moving on the drive shaft (7) in an axial direction, but is supported for a limited relative rotation. The drive wheel (2) can rotate in a limited fashion relative to a brake disc (29), which and is axially moveable on a threaded section (31) of the drive shaft (7) and can be pressed with the help of a friction disc (32) against a pressure disc (33) that is attached to the housing. The drive wheel (2) forms a component of the friction disc brake (3).

LIFTING DEVICE

The invention relates to a lifting device according to the features recited in the preamble of claim 1.

Lifting devices of this type are used particularly for loads to be moved vertically. Such lifting devices include a drive wheel, which is frequently implemented as a chain wheel and can be rotate in both directions using a manually operated round link chain. However, instead of the chain wheel, a toothed wheel can also be used. Moreover, the drive wheel can be implemented as a coupling wheel for coupling to a motor shaft.

The load wheel which is typically also implemented as a chain wheel, is coupled through a round link chain with a load receiving means, for example a crane hook.

The housing of the lifting device is typically provided with a hook for suspending the housing from suitable support bearings.

The drive wheel, a friction disc brake, the load wheel and a gear are arranged sequentially in an axial direction inside the housing, with the gear frequently having the form of a planetary gear. The drive wheel sits on one end of a drive shaft which extends through the friction disc brake and the load wheel. The gear

is located on the other end of the drive shaft which is connected to the load wheel in order to transmit torque.

In a known design of a lifting device of the aforedescribed type (brochure from Yale industrial products GmbH, 5620 Velbert 1 "Yale Flaschenzug/Hoist/Palan à bras Mod. VS"), the friction disc brake is comprised of a ratchet disc, of friction discs disposed on both sides of the ratchet disc, as well as of two detents which are pivotally supported on the housing and urged by leg springs against the ratchet disc. The two friction disks are frictionally coupled, on one hand, with the ratchet disc and, on the other hand, with a pressure disc affixed to the shaft or the drive wheel, respectively. The drive wheel is axially moveable on a thread disposed on one end of the drive shaft. The other end of the drive shaft is coupled with two toothed wheels which are operatively connected with a toothed wheel by toothed pinions having a smaller diameter. The toothed wheel has inside teeth in which a pinion engages which in turn is coupled with the load wheel.

The friction disc brake is provided to hold the load carried by the lifting device at a respective height when the drive wheel is stopped. In this case, the drive wheel is pressed via the friction disks and the ratchet disc against the pressure disc. The detents rest in the peripheral recesses disposed on the ratchet disc.

When the drive wheel is rotated in the direction for raising the load, the detents

slide across the teeth of the ratchet disc until the drive wheel stops. The detents then engage again with the recesses of the ratchet disc. When the load is lowered, the drive wheel rotates in the opposite direction, thereby axially sliding on the motion thread of the drive shaft, so that the frictional contact with the friction disks, the ratchet disc and the pressure disc is eliminated. The load can then descend until the coasting shaft once more compensates the axial play.

It would be desirable to improve the conventional design because the friction disc brake can fail when foreign particles enter the brake or the coil springs break. In addition, the noise originating from the detents are objectionable in many applications, in particular where this noise produces a noxious noise level. Moreover, the friction disc brake, in particular the ratchet disc, is expensive to manufacture.

Starting from the present state-of-the-art, it is therefore an object of the invention to provide a lifting device of a simpler design, which is less susceptive to malfunction and produces less noise.

The object is solved by the present invention by the features recited in the characterizing portion of claim 1.

Accordingly, the drive wheel can rotate relative to the drive shaft within certain limits, but is arranged so as to be axially immovable. In addition, the drive wheel

is coupled to a brake disc for limited relative rotation thereto, with the brake disc movable in the axial direction on a threaded section of the drive shaft. A friction disc is located between the brake disc, and a pressure disc attached to the housing of the lifting device.

When the load is to be raised, the drive wheel is rotated clockwise. After a predetermined rotation angle over which the drive wheel can rotate freely relative to the drive shaft, the free rotation ends and the drive shaft is driven directly by the hand wheel, without loading the brake. Since the threaded sections have a right-handed thread, the brake disc is released from the friction disc for clockwise rotation, thereby canceling the braking action.

When the rotation of the drive wheel is stopped, the drive shaft which rotates under the influence of the load, pulls the brake disc against the friction disc and thereby against the pressure disc. The load is arrested.

For lowering the load, the drive wheel has to be turned counterclockwise. After a predetermined rotation angle, the drive wheel is coupled with the brake disc. The brake disc is axially displaced on the threaded section towards the drive wheel due to the right-handed thread section, so that brake disc does no longer contact the pressure disc via the friction disc. The load can then coast according to the predetermined rotation angle between the drive wheel and the brake disc. The load is braked in that the drive shaft, which rotates under the load, pulls the brake

disc against the friction disc and the friction disc against the pressure disc. Advantageously, the design of the invention is significantly more accurate than conventional designs and operates more quietly. The lifting device according to the invention is also less complex due to the reduced number of components.

It should also be emphasized that the drive shaft and accordingly also the load wheel are driven directly by the drive wheel, without loading the friction disc brake.

The drive wheel can be driven using a chain, a rope, a crank or a motor, as is known in the art.

Rotation of the drive wheel on the drive shaft is preferably implemented by way of a bushing affixed to the drive shaft, as recited in claim 2. The bushing can be pressed onto the drive shaft.

According to the features recited in claim 3, for transmitting torque, the drive wheel cooperates with a wing disc that is non-rotatably secured on the drive shaft. One end face of the drive shaft has a projection which, after the drive wheel has rotated by a predetermined rotation angle, contacts a limit stop disposed on the drive wheel and hence rotatably locks both the wing disc and the drive shaft.

The position of the bushing of the drive shaft is fixed by the wing disc that pushed onto the drive shaft and prevented from rotating thereto.

The wing disc is preferably pushed onto a serration located on the end of the drive shaft and pressed against the bushing by a nut, with a radial collar of the bushing being pressed against a shoulder of the drive shaft. The drive wheel is thereby precisely guided between the radial collar and the end face of the wing disc facing the radial collar. The wing disc includes at least one radially projecting wing which cooperates with at least one projection provided on the end face of the drive wheel. The free rotation of the drive wheel on the drive shaft is limited by the cooperating projection and wing. The load can then be raised by the drive wheel. Preferably, the wing disc has two radial wings that are mutually offset by 180°. Two corresponding projections, which cooperate with the wings are then also provided on the end face of the drive wheel; in particular, the projections cast as one piece with the drive wheel.

The drive wheel is coupled for limited rotation with respect to the brake disc using the features recited in claim 4. Accordingly, a driven pin which is oriented in the axial direction and has a radial spacing to the drive shaft, is provided on the brake disc. The driven pin catches a segmented, preferably arcuate, recess located on one side of the drive wheel facing the load wheel. The ends of the recess in which the driven pin engages, are formed by radially oriented ribs. The brake disc is entrained by the drive wheel in order to lift the brake disc from the

pressure disc when the load is lowered, so that the friction disc brake is released.

In a modification of the basic concept of the invention, the brake disc is pressed against the pressure disc by a spring supported by the drive wheel, as recited in claim 5. This spring is provided for producing an initial braking torque, thereby reducing the response time of the friction disc brake.

The invention will be described hereinafter in more detail with reference to an embodiment illustrated in the drawings.

It is shown in:

FIG. 1 a top view of a lifting device;

FIG. 2 a vertical longitudinal section along the line II-II of FIG. 1;

FIG. 3 a vertical cross-section along the line III-III of FIG. 1; and

FIG. 4 a front view in the direction of the arrow IV of FIG. 1 without a cover.

FIGS. 1 to 4 illustrate a lifting device, designated with the reference numeral 1, which is used for raising and lowering loads L.

The lifting device 1 includes a drive wheel 2, a friction disc brake 3, a load wheel 4, and a gear 5, which are sequentially arranged in an axial direction inside a housing G which is not described in detail. The drive wheel 2 is disposed on one end 6 of a drive shaft 7, with the drive shaft 7 which extends through the friction

disc brake 3 and the load wheel 4, capable of coupling the drive wheel 2 to the gear 5, which is located on the other end 8 of the drive shaft 7 and drives the load wheel 4 for transmitting a torque.

The end 6 of the drive shaft 7 that carries the drive wheel 2, which has the form of a chain wheel 4 supporting a round link chain (not shown), is provided with a cylindrical longitudinal section 9 (FIG. 2), which transitions at the end face into a serration 10 and from the serration 10 into a threaded section 11. A bushing 13 having a radial collar 12 is placed on the cylindrical longitudinal section 9 and pushed towards a shoulder 14 of the drive shaft 7. The bushing 13 is then pressed against the shoulder 14 by a wing disc 15, wherein a nut 16 is turned on the threaded section, with the nut capable of pressing the wing disc 15 against the bushing 13 and the bushing 13 against the shoulder 14 (FIG. 1, 2 and 4).

The wing disc 15 is seen clearly in FIG. 4. The wing disc 15 has a central ring-shaped body 17 with two radially projecting wings 18 which are mutually offset by 180° and connected to the ring-shaped body 17. Each of the wings 18 has an arcuate rear section 19 and a limit stop face 20 extending in a radial plane. The limit stop faces 20 of the wings 18 make contact with projections 21 which are formed as a single piece with the free side 22 of the drive wheel 2.

The drive wheel 2 has an inner hub 23, which slidingly guides the drive wheel 2 between the radial collar 12 of the bushing 13 and the opposite end face 24 of

the wing disc 15 (FIG. 2).

On the side 25 facing away from the projections 21, the drive wheel 2 has three arcuate segmented recesses 26 (FIG. 2 and 3) which are delimited by three radial ribs 27. A driven pin 28, which is secured on a brake disc 29 with a radial distance to the drive shaft 7, engages with one of the recesses 26. The brake disc 29 has an inside thread 30, allowing it to move in the axial direction on an outside thread 31 of the drive shaft 7 located next to the cylindrical longitudinal section 9. The inside thread 30 and the outside thread 31 are formed as right hand-handed motion threads.

The brake disc 29 has a circular cross-section on the side facing away from the drive wheel 2 and contacts a friction disc 32, which is in turn pressed against a pressure disc 33. The pressure disc 33 is secured on a cross plate 34 which is part of the housing (FIG. 2). A coil pressure spring 35 that overlaps with an axial nipple 36 of the brake disc 29 and engages with a ring-shaped recess 37 of the drive wheel 2, assists in bringing the brake disc 29 in contact with the friction disc 32, and the friction disc in contact with the pressure disc 33.

The cross plate 34 of the housing G that supports the pressure disc 33 in conjunction with an additional parallel spaced-apart cross plate 38 provides a rotatable support for the load wheel 4 which forms a chain wheel for a round link chain (FIG. 1 and 2). The bearings for the load wheel 4 in the cross plates 34

and 38 are designated by the reference numeral 39. The load wheel is supported for relative rotation on two axially spaced-apart cylindrical sliding planes 40 of the drive shaft 7. An axial nipple 41 of the load wheel 4 engages with a toothed wheel 42 which is non-rotatably disposed on this nipple 41 next to the cross plate 38.

As depicted in both FIGS. 1 and 2, the toothed wheel 42 meshes with two pinions 43 which are part of two toothed wheels 44, which in turn mesh with an end section 45 of a toothed wheel disposed on the drive shaft 7.

Assuming that a load L is to be raised, the drive wheel 2 rotates clockwise in the direction of arrow PF, as indicated in Figs. 1, 3 and 4. Since the drive wheel 2 can initially rotate freely on the bushing 13 relative to the drive shaft 7, the drive wheel 2 rotates relative to the drive shaft until the projections 21 make contact with the wings 18 of the wing disc 15. Because the wing disc 15 prevented from rotating on the drive shaft 7 by the serration 10, the drive shaft 7 then also rotates clockwise in the direction of arrow PF. Accordingly, a torque is directly transmitted from the drive wheel 2 to the load wheel 4 via the drive shaft 7 and the gear 5. Because the motion threads 30,31 of the brake disc 29 and the drive shaft 7 are right-handed threads, the brake disc 29 is lifted from the friction disc 32 in the direction of the arrow PF1 of FIG. 2, and the friction disc 32 is lifted from the pressure disc 33, when the drive wheel 2 is rotated clockwise in the direction of the arrow PF. The load can be raised without a breaking action.

When the drive wheel 2 is stopped, the suspended load L causes the load wheel 4 to rotate in the direction of arrow PF3, i.e., counterclockwise, and also causes rotation of the drive shaft 7. Accordingly, the brake disc 29 is pulled against the friction disc 32 in the direction of the arrow PF2, and the friction disc 32 is pulled against the pressure disc 33. The position of the load is fixed at that height (FIGS. 1-4).

When the load L is to be lowered, the drive wheel 2 rotates counterclockwise in the direction of the arrow PF3, as shown in FIGS. 1-4. After a predetermined rotation angle, the driving pin 28 makes contact with a rib 27 of the drive wheel 2. As a result, the brake disc 29 is also displaced on the motion threads 31 of the drive shaft 7 and is lifted from the friction disc 32, while the friction disc 32 is lifted from the pressure disc 33. The load L then causes the drive shaft 7 to rotate relative to the drive wheel 2, so that the brake disc 29 is pulled again in the direction of the arrow PF2 against the friction disc 32, and the friction disc 32 in turn is pulled against the pressure disc 33, braking the load L.

List of reference numerals

1 lifting device

2 drive wheel

3 friction disc brake

4 load wheel

5 gear

6 end of 7

7 drive shaft

8 end of 7

9 cylindrical longitudinal section of 7

10 serration in 6

11 thread segment in 6

12 radial collar of 13

13 bushing

14 shoulder on 7

15 wing disc

16 nut

17 ring body of 15

18 wing of 15

19 rear section of 18

20 limit stop face

21 projections on 2

22 side of 2

23 hub of 2

24 end face of 15

25 side of 2

26 recesses in 25

27 ribs between 26

28 driven pin on 29

29 brake disc

30 inside thread of 29

31 outside thread of 7

32 friction disc

33 pressure disc

34 cross plate

35 coil compression spring

36 nipple of 29

37 annular recess in 2

38 cross plate

39 bearing for 4

40 sliding surfaces on 7

41 nipple on 4

42 toothed wheel

43 pinion

44 toothed wheels

45 end section of toothed wheel of 7

G housing of 1

L load

PF arrow

5 PF1 arrow

PF2 arrow

PF3 arrow

CLAIMS

1. Lifting device comprising a drive wheel (2), a friction disc brake (3), a load wheel (4) and a gear (5), which are arranged sequentially in an axial direction inside a housing, wherein the drive wheel (2) provided on one end (6) of a drive shaft (7) can be coupled by way of the drive shaft (7) which extends through the friction disc brake (3) and the load wheel (4), with the gear (5) which is located on the other end (8) of the drive shaft (7) and drives the load wheel (4) for transmitting a torque, characterized in that the drive wheel (2) is prevented from moving on the drive shaft (7) in an axial direction, but is supported for a limited relative rotation, and that the drive wheel (2) which forms a component of the friction disc brake (3), can rotate in a limited fashion relative to a brake disc (29), which is axially moveable on a threaded section (31) of the drive shaft (7) and can be pressed with the help of a friction disc (32) against a pressure disc (33) that is attached to the housing.

2. Lifting device according to claim 1, characterized in that the drive wheel (2) is rotatably supported on a bushing (13) which is secured on the drive shaft (7).

3. Lifting device according to claim 1 or 2, characterized in that the drive

wheel (2) has a projection (21) on an end face, which projection cooperates with a wing disc (15) which is non-rotatably connected with the drive shaft (7), for transmitting a torque.

4. Lifting the device according to one of the claims 1 to 3, characterized in that the brake disc (29) has a driven pin (28) which is oriented in the axial direction and can move relative to and engage with a segmented recess (26) of the drive wheel (2) located on a side (25) facing the load wheel (4).

5. Lifting device according to one of the claims 1 to 4, characterized in that the brake disc (29) is pressed against the pressure disc (33) by a spring (35) supported by the drive wheel (2).

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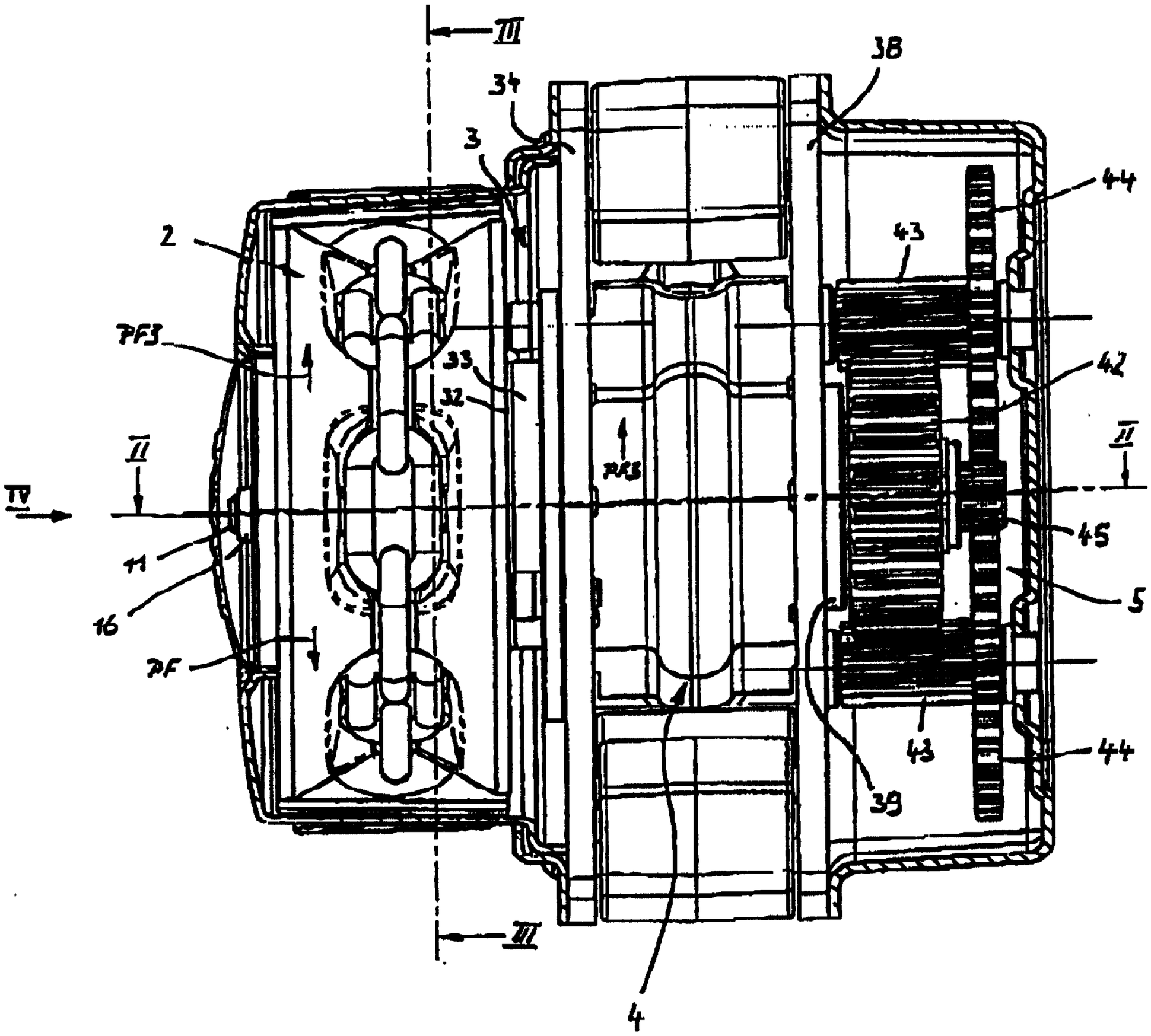

Fig. 1

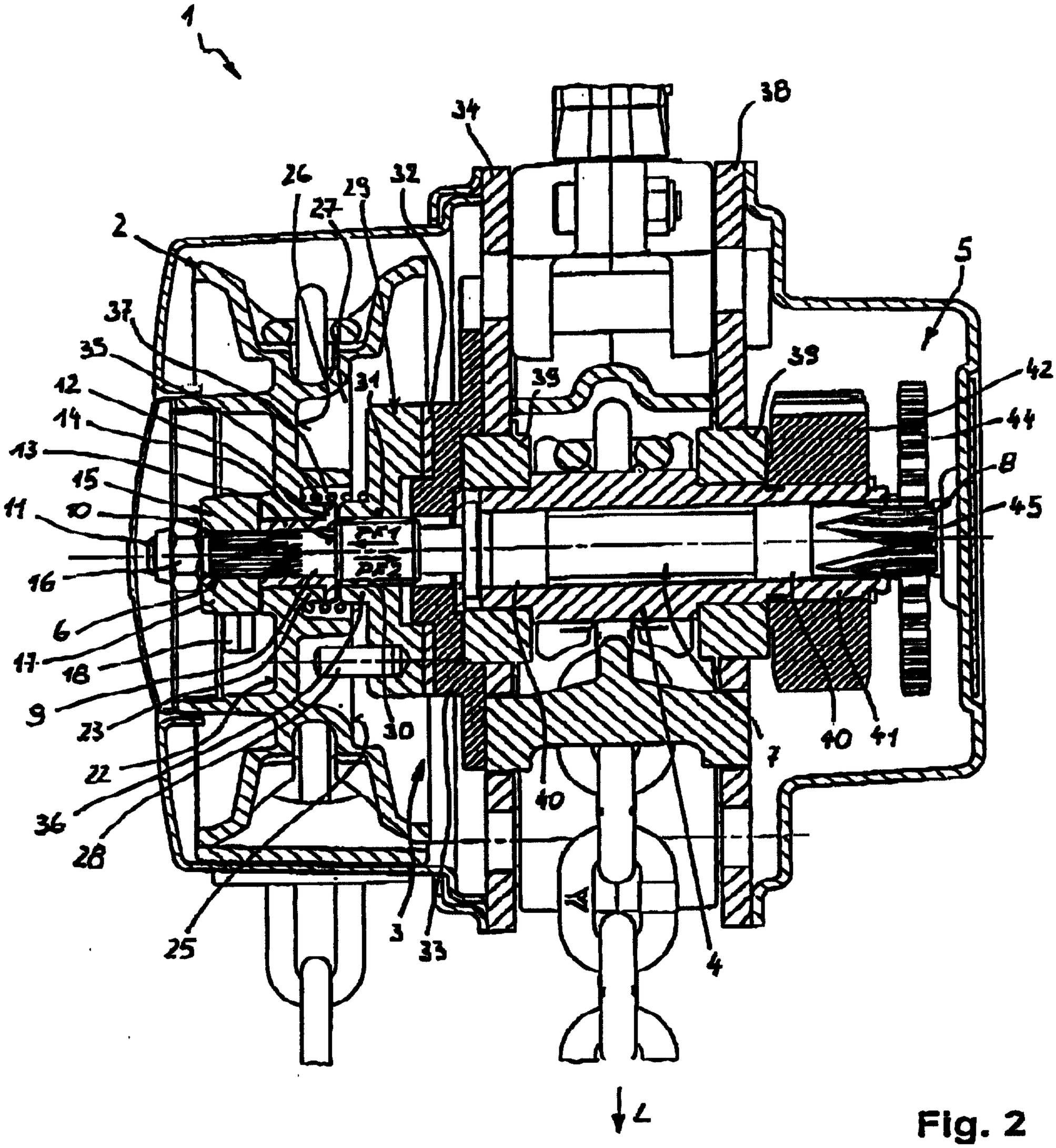
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Fig. 2

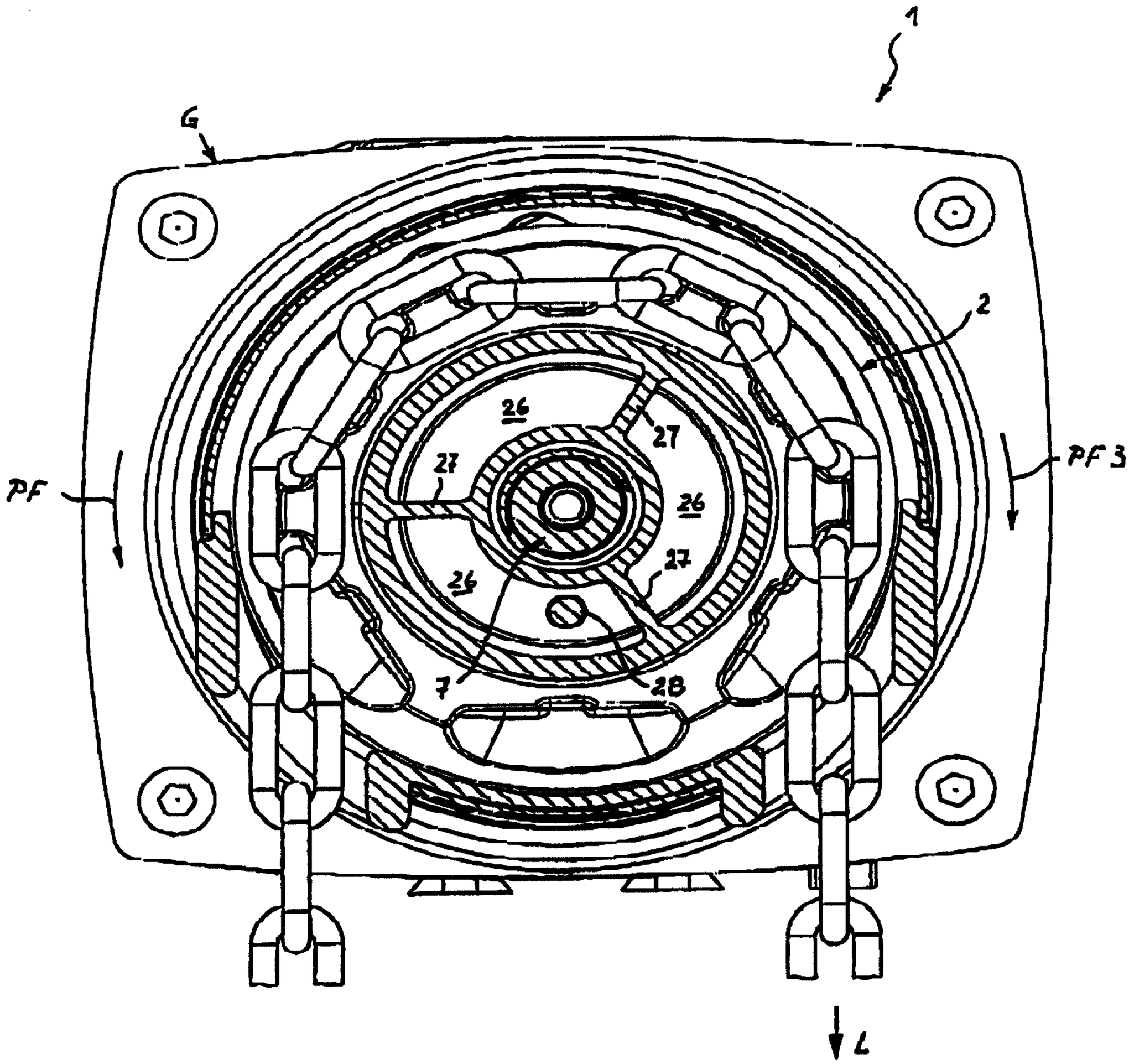


Fig. 3

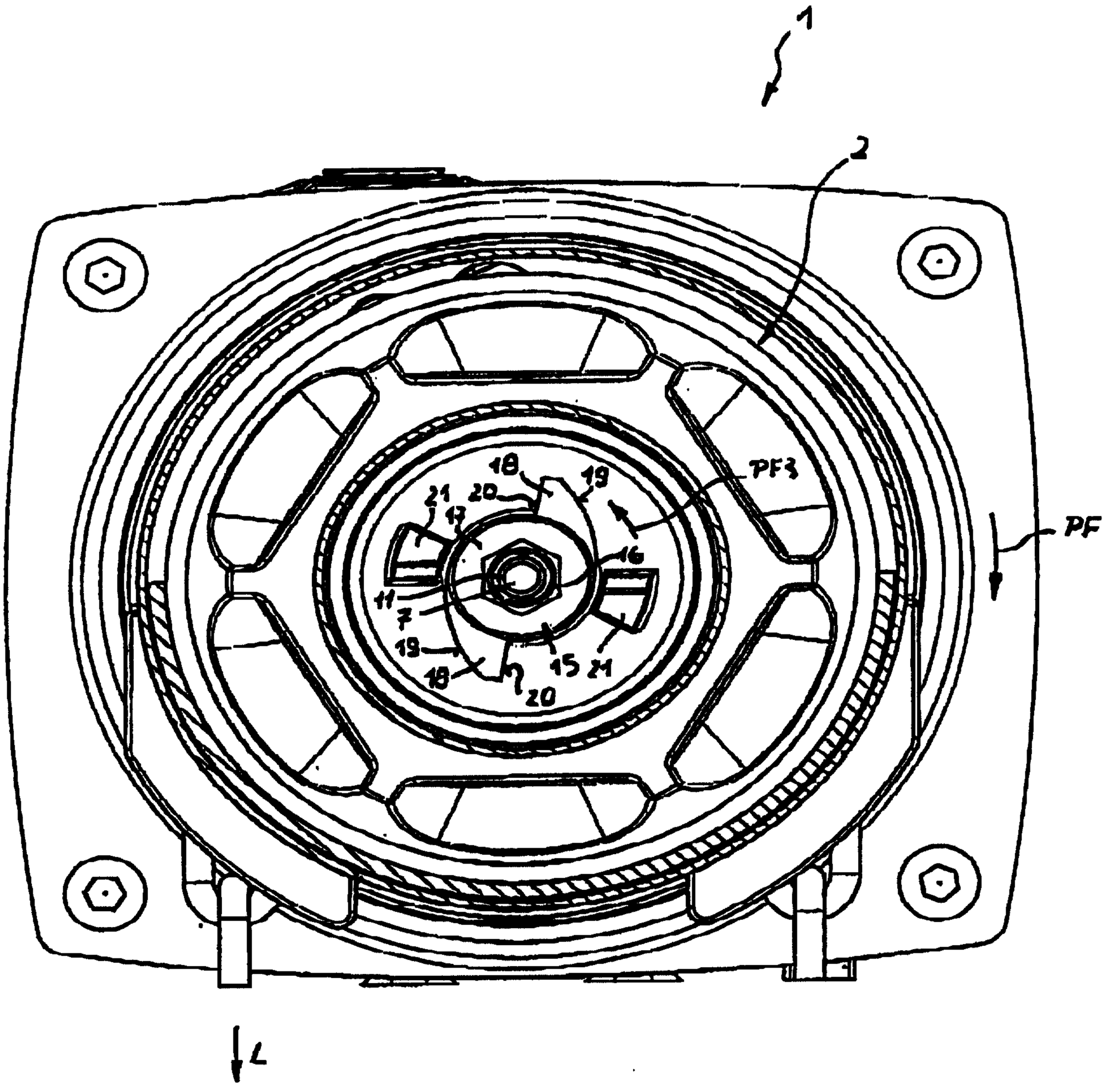
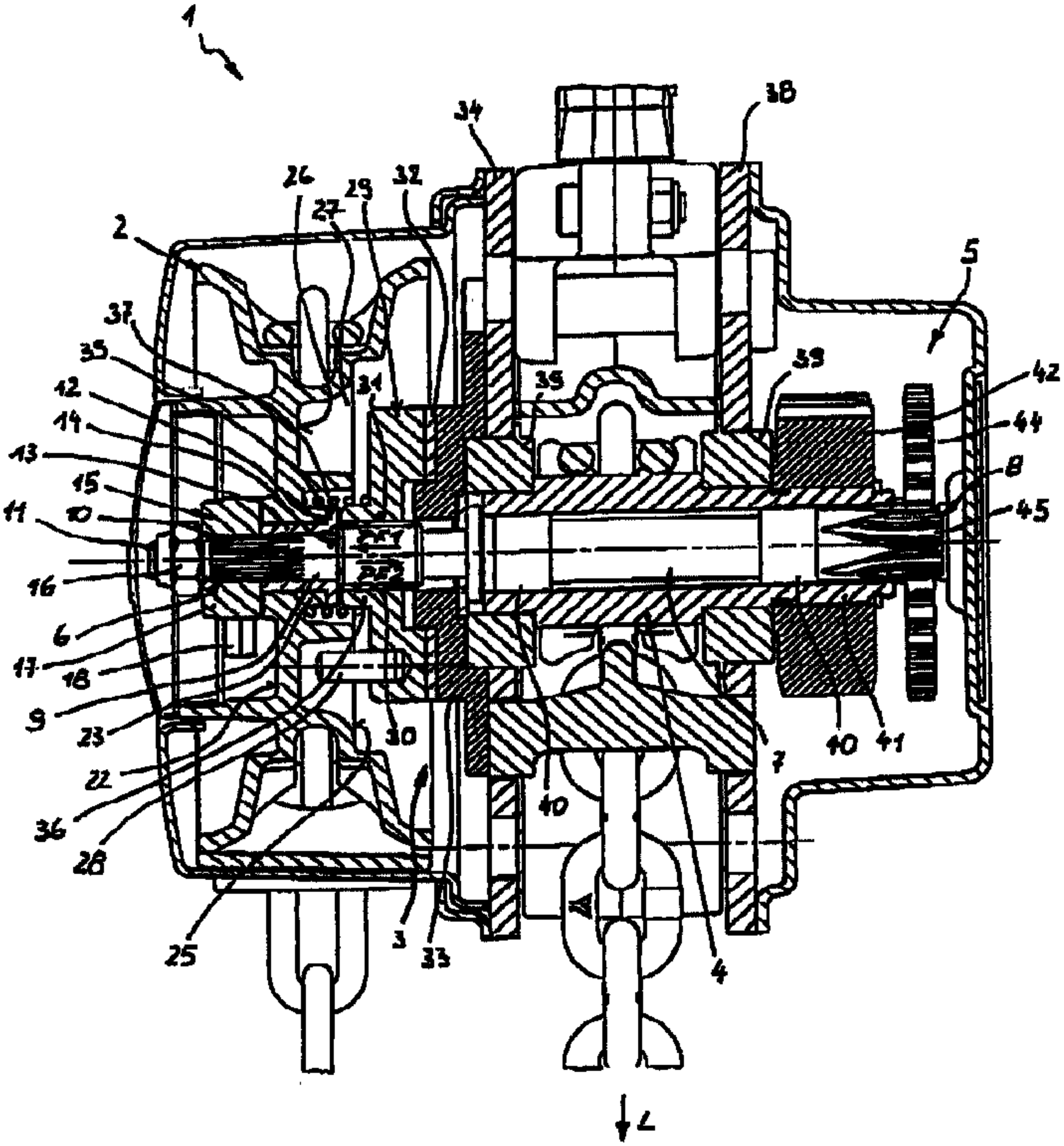


Fig. 4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