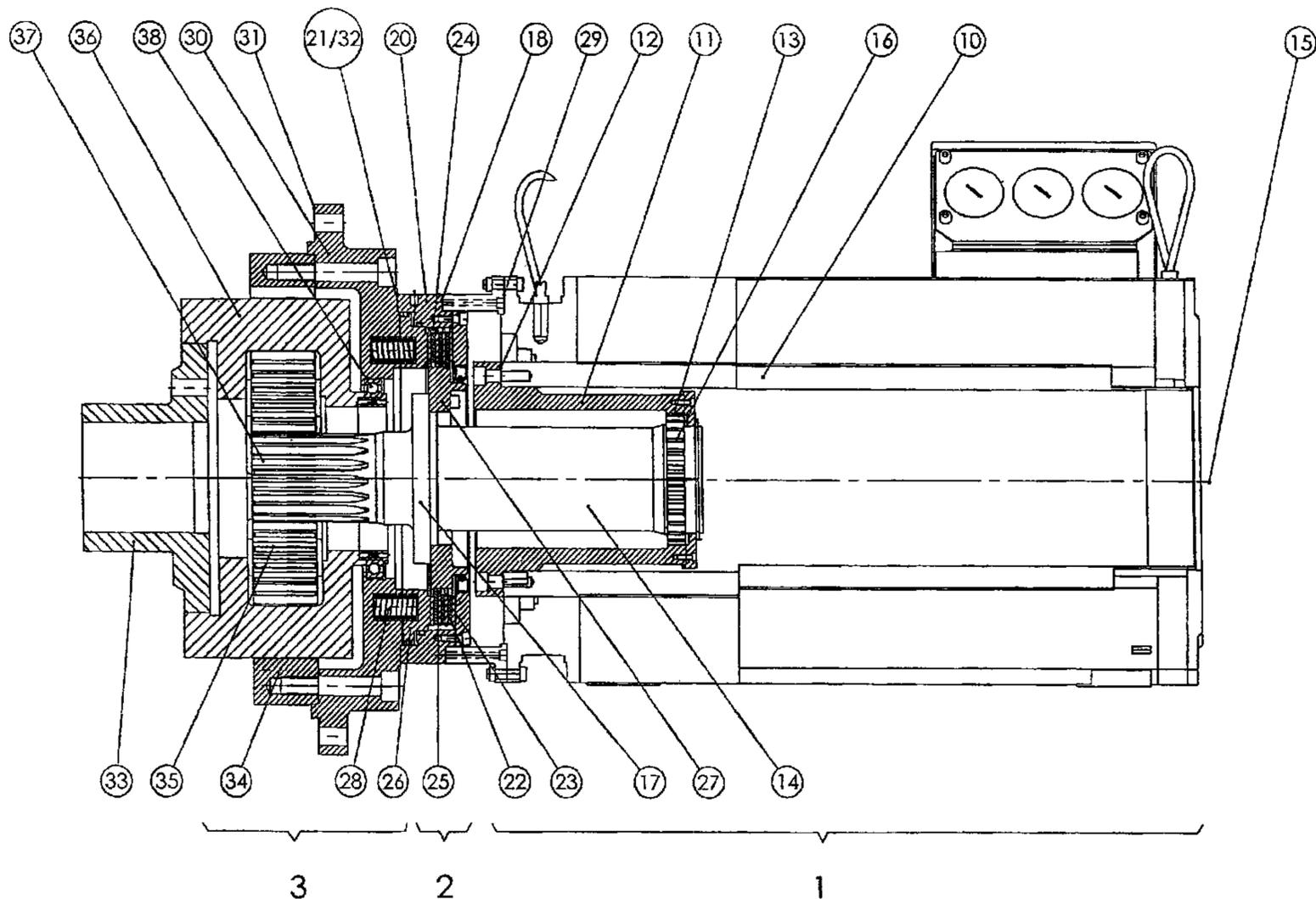




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 (72) Inventeurs/Inventors:
DESCH, ALEXANDER P., DE;
PLATTFAUT, BERNHARD, DE;
GEILKER, UWE, DE
 (73) Propriétaire/Owner:
DESCH ANTRIEBSTECHNIK GMBH & CO. KG, DE
 (74) Agent: NORTON ROSE OR S.E.N.C.R.L., S.R.L./LLP

(54) Titre : COMMANDE POUR MACHINE, EN PARTICULIER COMMANDE DE PRESSE, ET MACHINE, EN PARTICULIER PRESSE A FORMER
 (54) Title: DRIVE FOR A WORKING MACHINE, IN PARTICULAR A PRESS DRIVE, AND A WORKING MACHINE, IN PARTICULAR A FORMING PRESS



(57) **Abrégé/Abstract:**

A drive for a working machine, in particular a press drive, characterized in that the drive comprises an electric motor (1), a transmission (3) and a brake (2), whereas the brake (2) is arranged between the transmission (3) and the electric motor (1); and a forming means, in particular a forming press, comprising a press housing (4), a press shaft (5) and a drive for the press shaft (5), which is a drive (1, 2, 3) according to one of the claims 1 to 14.

Abstract (Fig. 2)

A drive for a working machine, in particular a press drive, characterized in that the drive comprises an electric motor (1), a transmission (3) and a brake (2), whereas the brake (2) is arranged between the transmission (3) and the
5 electric motor (1); and a forming means, in particular a forming press, comprising a press housing (4), a press shaft (5) and a drive for the press shaft (5), which is a drive (1, 2, 3) according to one of the claims 1 to 14.

Drive for a Working Machine, in Particular a Press Drive, and a Working Machine, in Particular a Forming Press

The present invention relates to a drive for a working machine, in particular a press drive, and a working machine, in particular a forming press.

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A drive according to the state of the art for a working machine, in particular a press drive, essentially comprises an electric motor, a transmission and a brake. Since a fly wheel is dispensed with, such a drive is also referred to as a "direct drive". Corresponding drives for working machines equipped with a fly wheel and/or driven via a belt drive are not referred to as direct drives.

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In an application as a press drive, the electric motor together with the transmission is arranged on the one side of the press housing and drives a press shaft. The brake is arranged on the other side of the press housing and brakes the motor via the press frame as needed.

15 Such an arrangement has drawbacks. For example, an extended press shaft is necessary to be able to flange the brake in a suitable manner. A complete braking unit is also necessary, which is bothersome to mount on the press housing. Furthermore, additional wiring is to be provided for driving the brake, which must be installed to extend as far as the side of the press housing facing away from the electric motor or the transmission. Further, a protective device for the brake must be provided.

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It is an object of the present invention to alleviate this drawback, in particular to suggest a drive for a working machine, which can be made cheaper than a drive known from the state of the art, with reduced wiring overhead and without an additional protective device for the brake.

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According to the present invention, it is suggested that the drive comprises an electric motor, a transmission and a brake arranged between the transmission and the electric motor. By these means it is possible for the brake to be incorporated into the drive, at least, however, it need no longer be arranged
5 as a separate part on the side of the press housing opposite the electric motor or the transmission. By now arranging the brake near the electric motor or the transmission, wiring overhead can also be substantially reduced, in particular, electric and other supply lines need no longer be installed on both sides of the press housing. The brake housing can also be made in a substantially more
10 material-saving manner, since, for example, a brake housing completely surrounding the brake is no longer needed. Portions of the transmission or the transmission housing and/or portions of the electric motor or the electric motor housing can also be used as a brake housing.

Further advantageous embodiments of the present invention can be derived
15 from the features of the dependent claims.

It can be advantageously provided, for example, that the drive is equipped with a drive shaft, wherein the drive shaft is provided at least between the electric motor and the transmission, wherein the drive shaft passes through the brake and can be braked by the brake.

20 It is advantageous that the brake between the transmission and the electric motor can be made smaller in relation to the transmission gear ratio with respect to the torque, than in a drive known from the state of the art. This results in considerable cost savings.

It can preferably be provided that the drive comprises a housing, wherein the
25 transmission at least partially, and the brake are accommodated together in the housing. This compact structure contributes to the effect that the drive has only little weight and only occupies little structural space, whereby the

suggested drive is extremely suitable to be mounted on one side of a working machine, in particular a forming press.

It can also be advantageously provided that the housing comprises a transmission housing and a brake housing, wherein the transmission housing is equipped with a press housing connecting flange and a brake housing connecting flange, wherein the brake housing is equipped with a transmission housing connecting flange and an electric motor connecting flange.

In particular, it can be advantageously provided that the transmission is a planetary transmission. A planetary transmission facilitates the necessary reduction of the rotary movement and only occupies little structural space. The entire drive can thus be made very compact and, in particular, light which is advantageous, especially, in the context of mounting the drive including the brake on only one side of the working machine, in particular the forming press. For example, little structural space is wasted adjacent the working machine, and the static weight load on the working machine is at least slightly reduced, since the drive can already be made lighter.

As an advantageous electric motor for the drive according to the present invention, a torque motor or a servo motor can be considered, which can create substantial torques while only occupying the smallest structural space.

To couple the hollow shaft of the torque motor to the drive shaft, it is preferably provided that the drive shaft is equipped with a second gear, wherein the drive shaft is equipped with an adapter, wherein the adapter is mounted on the hollow shaft, wherein the adapter, in particular, is equipped with a toothing which is in engagement with the second gear of the drive shaft. The adapter is for realizing a plug-and-socket connection between the electric motor and the drive shaft. By exchanging the adapter it is very simple to equip the drive with different electric motors. The adapter can also be formed with a clamping set. This embodiment can thus also contribute to

making the drive very cheap, since a great variety of electric motors can be used.

In this context it can also be advantageously provided that the adapter is a
5 hollow cylinder at least embracing a section of the drive shaft.

It is a further object of the present invention to suggest a working machine, in particular a forming press, comprising a press housing, a press shaft, and a drive for the press shaft, which can be made cheaply and wherein a portion of the cable material, the protective devices and the housing, which must be
10 provided in a working machine according to the state of the art, can be economized.

According to the present invention, this object is solved by providing a drive for a working machine, in particular a press drive, wherein the drive comprises an electric motor, a transmission and a brake, wherein the brake is arranged
15 between the transmission and the electric motor, wherein the transmission includes a planetary transmission comprising a sun gear, a hollow gear, and a planet carrier with a number of planet gears. By using the drive it can be omitted that a brake must be provided on the side of the press housing or the press shaft opposed to the electric motor or transmission. By these means, in
20 the working machine according to the present invention, part of the accessories, such as a separate protective device for the brake, can be dispensed with. Part of the housing material for the brake can also be economized, since portions of the transmission housing or the electric motor can also be used as a housing for the brake. A portion of the electric and
25 other supply lines for the brake can also be dispensed with, since the wiring or other supply lines can be directly installed to extend to the unit consisting of electric motor, brake and transmission, i.e. the drive according to the present invention.

4a

Further features and advantages of the present invention will become apparent from the following description of preferred exemplary embodiments with reference to the accompanying drawings, wherein:

- 5 Fig. 1 shows a drive for a working machine, in particular a press drive according to the state of the art;

- Fig. 2 shows a drive according to the present invention for a working machine, in particular a press drive, in a partial sectional side view;
- Fig. 2a shows a drive according to the present invention for a working machine, in particular a press drive, in a partial sectional side view
5 (extended partial view according to Fig. 2);
- Fig. 2b shows a drive according to the present invention for a working machine, in particular a press drive, in a partial sectional side view (extended partial view according to Fig. 2);
- Fig. 3 shows a drive according to the present invention for a working
10 machine, in particular a press drive, in a partial sectional perspective view;
- Fig. 4 shows a drive according to the present invention for a working machine, in particular a press drive, in a partial sectional perspective view, but without electric motor; and
- 15 Fig. 5 shows a drive according to the present invention for a working machine, in particular a press drive, mounted on a press or a press housing.

The following reference numerals will be used:

- 1 electric motor
- 20 2 brake
- 3 transmission
- 4 press housing (press)
- 5 press shaft
- 10 hollow shaft
- 25 11 adapter
- 12 hollow shaft connecting flange

- 13 tothing
- 14 drive shaft
- 15 rotary axis / longitudinal axis
- 16 second gear
- 5 17 brake connecting flange
- 18 brake housing connecting flange
- 20 brake housing
- 21 transmission housing connecting flange
- 10 22 first brake disc(s)
- 23 second brake disc(s)
- 24 sliding tothing
- 25 sliding tothing
- 26 brake piston
- 15 27 brake disc carrier
- 28 pressure spring
- 29 electric motor connecting flange
- 30 transmission housing
- 20 31 press housing connecting flange
- 32 brake housing connecting flange
- 33 press shaft connecting flange
- 34 hollow gear
- 35 planetary gear
- 25 36 planet carrier
- 37 sun gear / first gear
- 38 bearing

Fig. 1 schematically shows a press or a press drive according to the state of the art. The press comprises a press housing 4, on which both an electric motor 1 together with a transmission 3 and a brake 2 are mounted. The brake 2 and the electric motor 1 with the transmission 3 are arranged on opposing

sides of the press housing 4. Furthermore, a press shaft 5 is arranged between the brake 2 and the transmission 3 or the electric motor 1.

This arrangement has the above-mentioned drawbacks, in particular the press shaft 5 is forced to protrude out a distance from the press housing 4 so that the brake 2 can be connected to the press shaft 5. A complete brake 2 is also necessary, i.e. at least a complete brake housing is necessary, which protects the brake 2 against dirt etc. This brake 2 is correspondingly bothersome to mount on the press housing 4. Furthermore, an additional wiring is to be provided for controlling the brake 2, which must be installed to extend up to the side of the press housing 4 facing away from the electric motor 1 or the transmission 3. Further, a protective device for the brake 2, in particular a protective device for covering the rotating parts, is to be provided.

It is suggested according the present invention that the brake 2 should now be arranged between the electric motor 1 and the transmission 3, and in particular should not be separately provided on the end of the press shaft 5, which is opposed to the electric motor 1 or the transmission 3. The brake 2 can be incorporated in the drive for a working machine. A drive according to the present invention thus comprises, as seen in the direction of the longitudinal or rotary axis 15, a transmission 3, a brake 2 and an electric motor 1 in the order mentioned above.

The Figs. 2 to 5 illustrate a preferred embodiment of a drive according to the present invention for a working machine, in particular a press drive. In each case, the arrangement of electric motor 1, brake 2, transmission 3, brake housing 4 or press shaft 5 can be seen.

A drive according to the present invention comprises a drive shaft 14, which extends from the electric motor 1, via the brake 2 to the transmission 3. The drive shaft 14 is rotation symmetrical and has a longitudinal axis 15 coinciding with the rotary axis of the drive shaft 14. The drive shaft 14 transmits the

torque of the electric motor 1 to the transmission 3. On the one hand the drive shaft 14, on its end, has a first gear 37, and on the other hand, also on its end, a second gear 16. Furthermore, the drive shaft 14 is equipped with a brake connecting flange 17. The brake connecting flange 17 is formed as a circumferential collar with corresponding threaded bores. The connection
5 between the drive shaft 14 and the brake 2, in particular a brake disc carrier 27, can also be configured as a clamp ring connection. The electric motor further has a brake housing connecting flange 18 for connection to a brake housing 20.

10 The transmission 3 has essentially a transmission housing 30 and a planetary transmission. The planetary transmission comprises a hollow gear 34, a number of planetary wheels 35 in a planet carrier 36, and a sun gear 37. The sun gear is formed by the first gear 37 of the drive shaft 14. The hollow gear 34 is connected to the transmission housing 30. The planet carrier 36 is
15 equipped with a press shaft connecting flange 33. The transmission housing 30, in turn, comprises a press housing connecting flange 31 and a brake housing connecting flange 32. The press housing connecting flange 31 is essentially configured as a circumferential collar with a number of through bores. The brake housing connecting flange 32 essentially comprises a
20 number of threaded bores. The planet carrier 36 is rotatably received in the transmission housing 30 via a bearing 38, in particular a ball bearing.

The brake 2 preferably comprises a brake housing 20 with a transmission housing connecting flange 21 and an electric motor connecting flange 29. The brake 2 further comprises a cylindrical brake piston 26, a number of annular
25 first brake discs 22, a number of annular second brake discs 23, and the annular brake disc carrier 27.

The first brake discs 22 are connected to the brake housing via a connecting means. The connecting means comprises a sliding tothing 24 on the inner side wall of the brake housing 20, wherein the first brake discs 22 are

equipped with a corresponding sliding tothing 24 at their circumference. With this connecting means, the first brake discs 22 are axially slidably received in the brake housing 20. It is possible, however, to transmit a torque, a braking torque in the present case, from the first brake discs 22 to the brake housing
5 20.

The second brake discs 23 are connected to the brake disc carrier 27 via a connecting means. The connecting means comprises a sliding tothing 25 on the outer side wall of the brake disc carrier 27, wherein the second brake discs 23 are equipped with a corresponding sliding tothing 25 on their inside.
10 The second brake discs 23 are axially slidably received on brake disc carrier 27 by this connecting means. It is also possible, however, to transmit a torque, a braking torque in the present case from the second brake discs 23 to the brake disc carrier 27.

Pressure springs 28 are provided between the transmission housing 30 and
15 the brake piston 26 for activating the brake 2. The pressure springs 28 are configured to press the brake disc arrangement comprising the first brake discs 22 and the second brake discs 23 against one another, or against the brake housing 20 so that a braking torque is created by friction between the brake discs 22, 23.

20 The electric motor 1 is preferably a servo motor with a correspondingly driven hollow shaft 10. The hollow shaft 10 is connected with the drive shaft 14 by means of an adapter 11. It is provided that the adapter 11 is a hollow cylindrical sleeve, wherein the sleeve is equipped with a hollow shaft connecting flange 12, and with a tothing 13 for connection to the second
25 gear 16 of the drive shaft 14.

Fig. 5, finally, shows a working machine, also according to the present invention, in particular a forming press, comprising a press housing 4, a press shaft 5, and a drive 1, 2, 3. The forming press is preferably provided for

forming metal. The drive is a drive according to the present invention so that the working machine according to the present invention can dispense with a separate brake, in particular with a brake mounted on the side of the housing 4 of the forming press opposed to the electric motor 1 or the transmission 3.

- 5 Further features of the drive according to the present invention can be derived from the following functional description.

The servo motor 1 rotates the adapter 11 and therefore the drive shaft 14 in a corresponding fashion. The rotary movement is transmitted into the planetary transmission via the sun gear 37, whereby a press shaft connecting flange 33
10 is rotated, which in turn drives the press shaft 5. The press shaft could also be immediately coupled to the planet carrier 36. The gear reduction between the drive shaft 14 and the press shaft connecting flange 33 can be adjusted by corresponding design of the transmission 3, in particular the planetary transmission.

- 15 The drive shaft 14 can be braked as needed by the brake 2 interposed between the electric motor 1 and the transmission 3. For this purpose, the pressure springs 28 are provided. With these pressure springs the brake piston 26 can be displaced so that the first brake discs and the second brake discs are pressed together. A braking torque can thus be created for
20 decelerating the rotary movement of the drive shaft 14. To release the brake, the brake piston 26 is provided, with which the spring force of the pressure springs 28 is released by moving the brake piston.

Overall, the suggested drive is distinguished by its compact structure. This is achieved, among other things, by incorporating the brake in the transmission
25 housing. A fly wheel can also be dispensed with, which can further contribute to a compact structure. Furthermore, no coupling-brake combination is needed for the suggested drive, whereby the structural space can also be kept very small. This additionally serves to save weight.

Claims

1. A drive for a working machine, in particular a press drive, wherein the drive comprises an electric motor, a transmission and a brake, wherein the brake is arranged between the transmission and the electric motor,
5 wherein the transmission includes a planetary transmission comprising a sun gear, a hollow gear, and a planet carrier with a number of planet gears.
2. The drive according to claim 1, wherein the drive is equipped with a drive shaft, wherein the drive shaft is provided between the electric motor and
10 the transmission, wherein the drive shaft is passed through the brake and can be braked by the brake.
3. The drive according to any one of claims 1 to 2, wherein the drive comprises a housing, wherein the transmission, at least partially, and the brake are accommodated together in the housing.
- 15 4. The drive according to any one of claims 1 to 3, wherein the housing comprises a transmission housing and a brake housing, wherein the transmission housing is equipped with a press housing connecting flange and a brake housing connecting flange, wherein the brake housing is equipped with a transmission housing connecting flange and an electric
20 motor connecting flange.
5. The drive according to any one of claims 1 to 4, wherein the hollow gear is connected to the transmission housing.
6. The drive according to any one of claims 1 to 5, wherein the drive shaft is equipped with a first gear, which is the sun gear for the planetary
25 transmission.

7. The drive according to any one of claims 1 to 6, wherein the electric motor is a servo motor with a driven hollow shaft.
8. The drive according to any one of claims 1 to 7, wherein the drive shaft is equipped with a second gear, wherein the drive shaft is equipped with an adapter, wherein the adapter is mounted on the hollow shaft, wherein the adapter is equipped with a tothing, which is in engagement with the second gear of the drive shaft.
9. The drive according to any one of claims 1 to 8, wherein the adapter is a hollow cylinder embracing at least a section of the drive shaft.
10. The drive according to any one of claims 1 to 9, wherein the drive shaft comprises a brake connecting flange.
11. The drive according to any one of claims 1 to 10, wherein the brake comprises a brake disc arrangement with at least one first brake disc and at least one second brake disc, which can be brought in contact with each other to create a braking action.
12. The drive according to any one of claims 1 to 11, wherein the brake comprises a brake housing, wherein the at least one first brake disc is connected with the brake housing via a connecting means, wherein the connecting means comprises a sliding tothing on the interior side wall of the brake housing and a corresponding sliding tothing on the circumference of the at least one first brake disc, wherein the at least one second brake disc is connected with the brake disc carrier via a connecting means, wherein the connecting means comprises a sliding tothing on the exterior side wall of the brake disc carrier and a corresponding sliding tothing on the inside of the at least one second brake disc, wherein a brake piston, preferably a cylindrical brake piston,

is provided, which can be pressed via the pressure springs onto the brake disc arrangement for achieving a braking action.

- 5
13. The drive according to any one of claims 1 to 12, wherein the electric motor, the brake and the transmission are arranged along a longitudinal axis.
14. A working machine, in particular a forming press, comprising
- a press housing,
 - a press shaft, and
 - a drive according to any one of claims 1 to 13 for the press shaft.

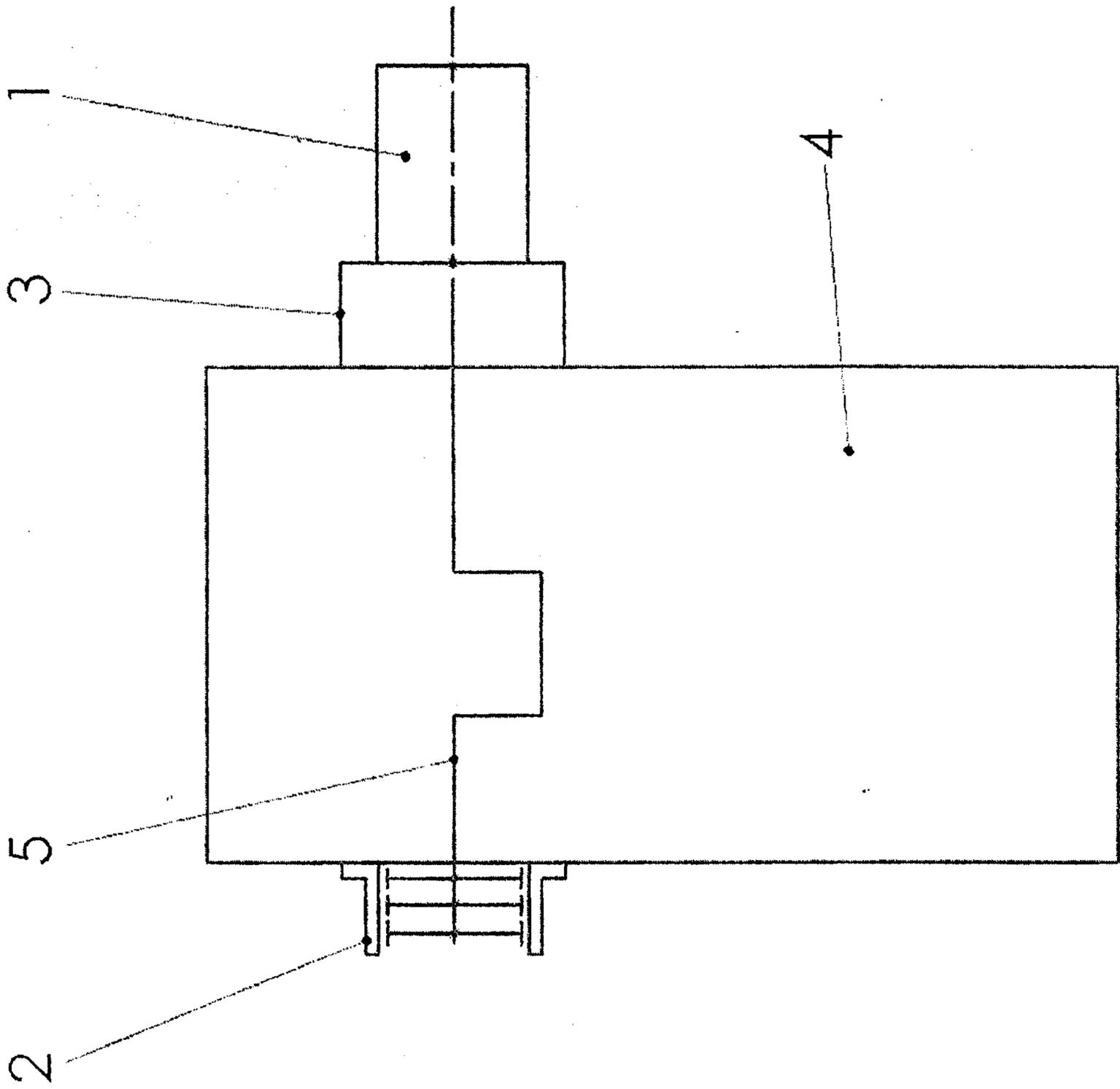


Fig. 1

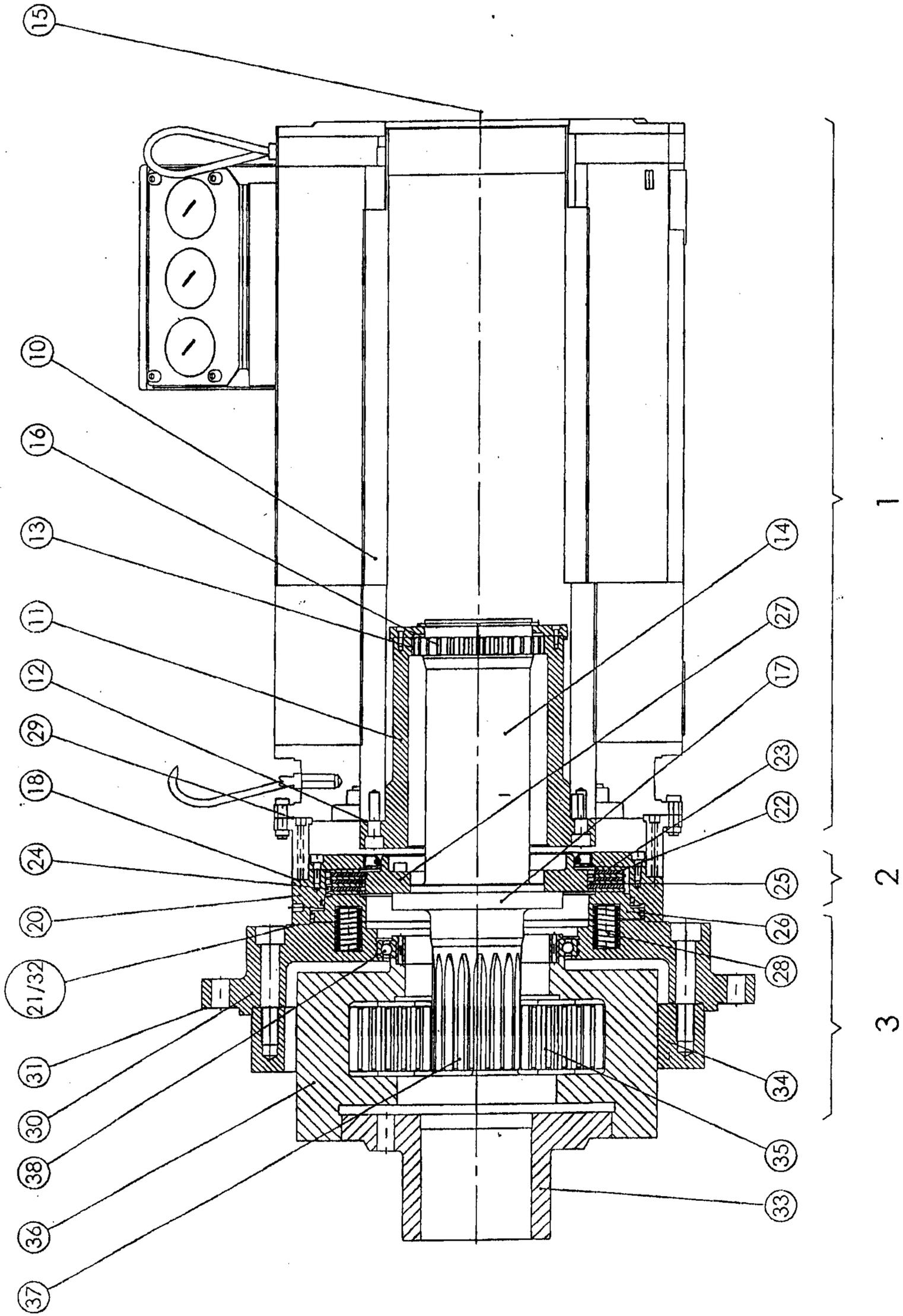


Fig. 2

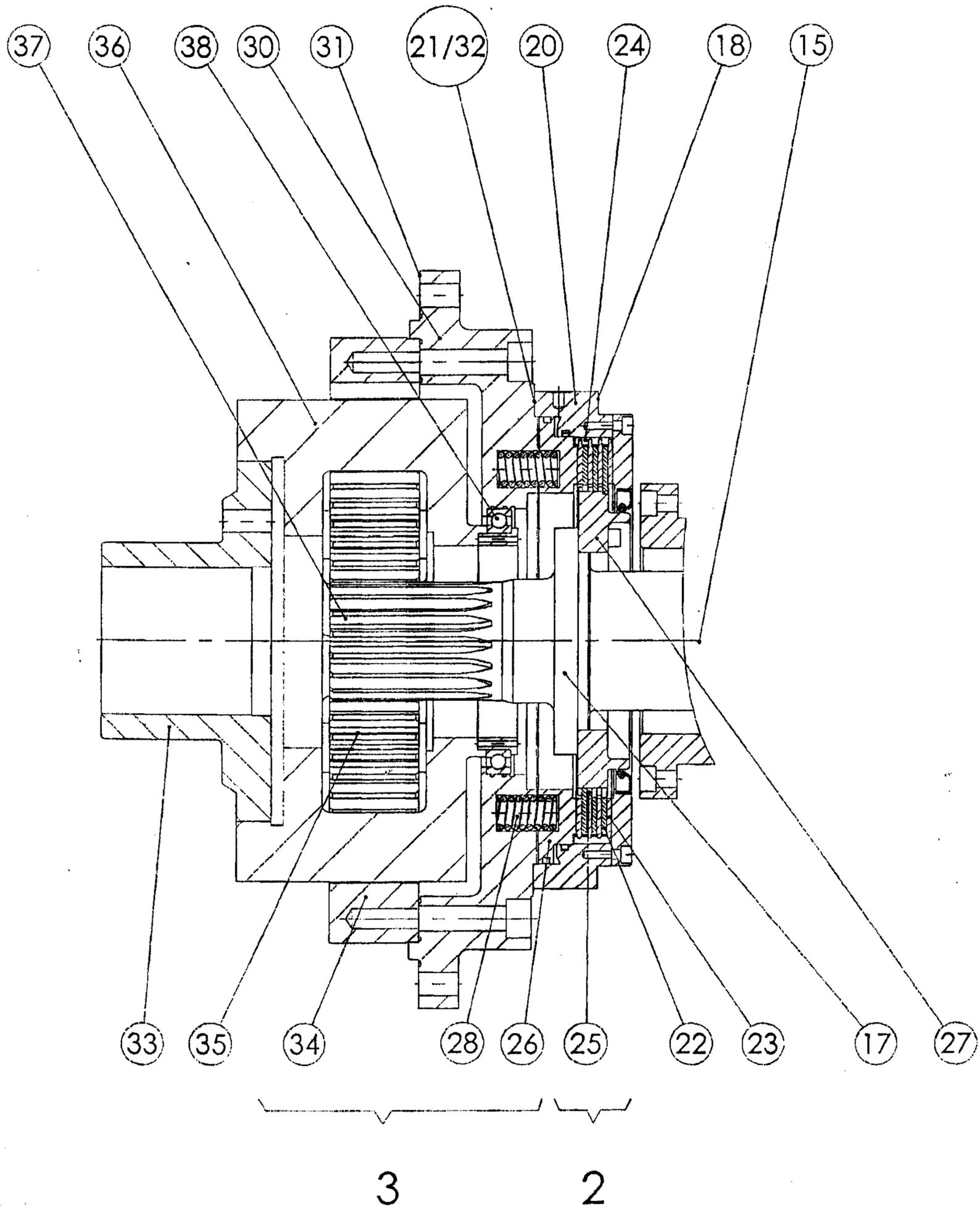


Fig. 2a

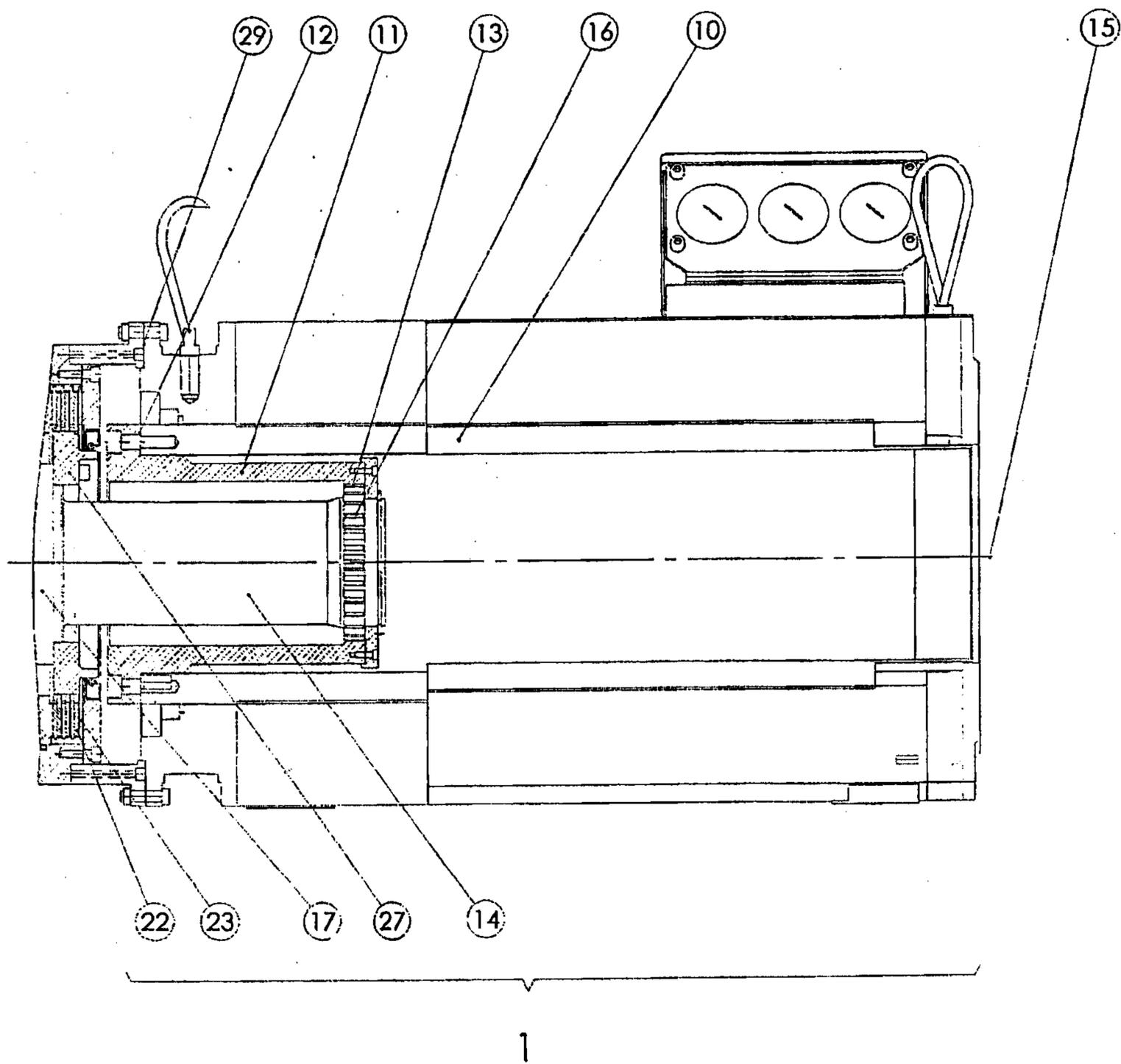


Fig. 2b

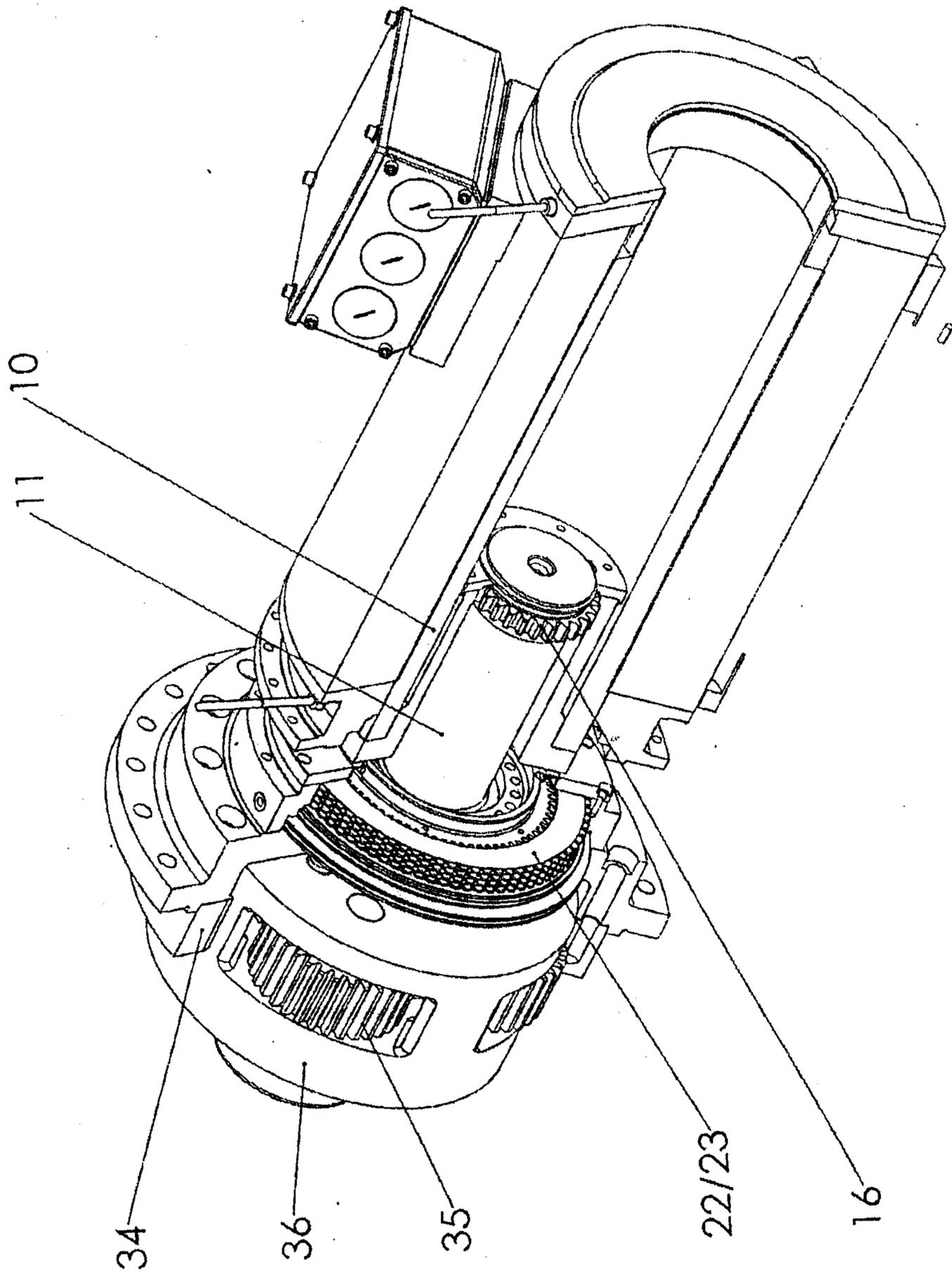


Fig. 3

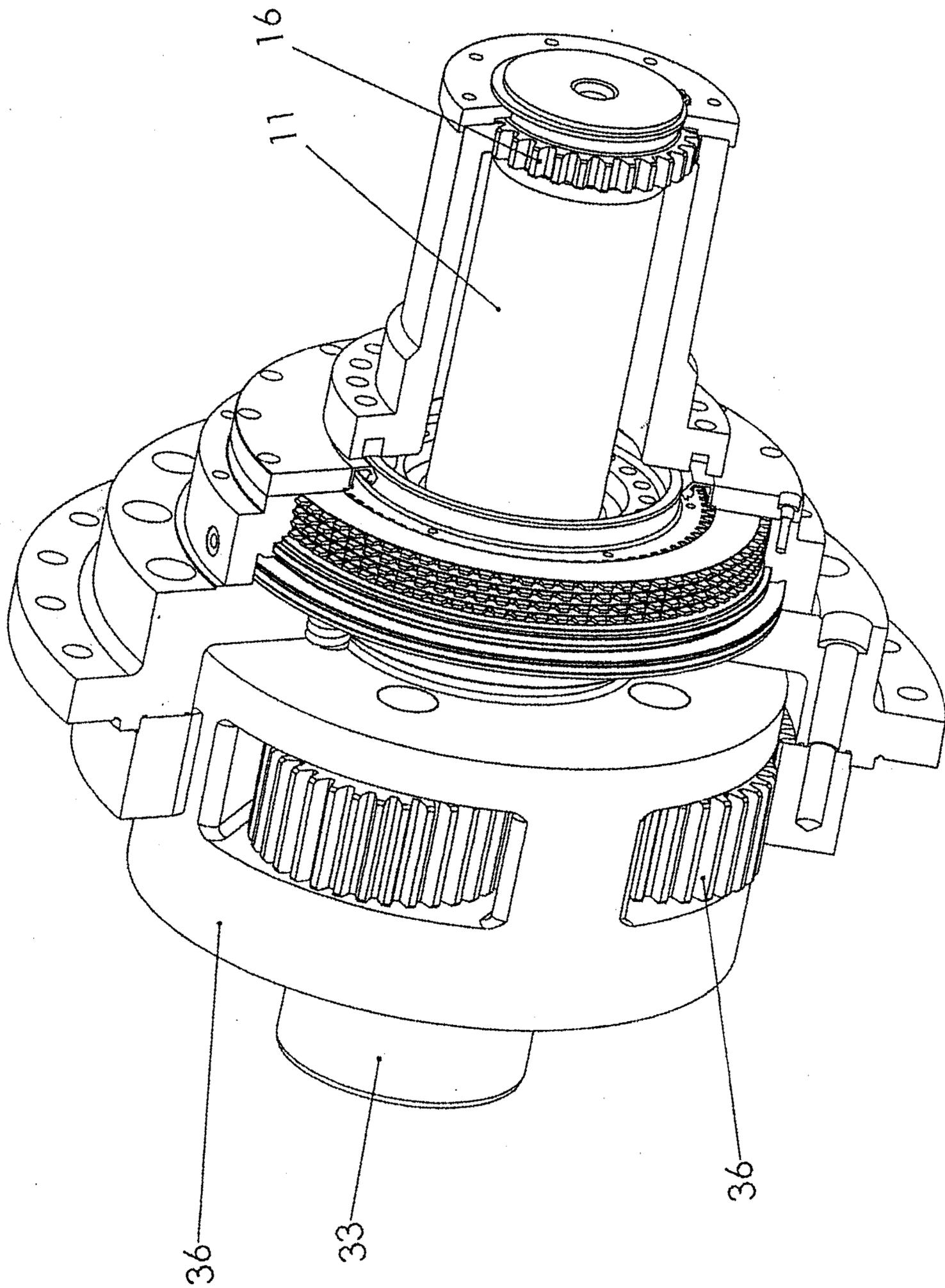


Fig. 4

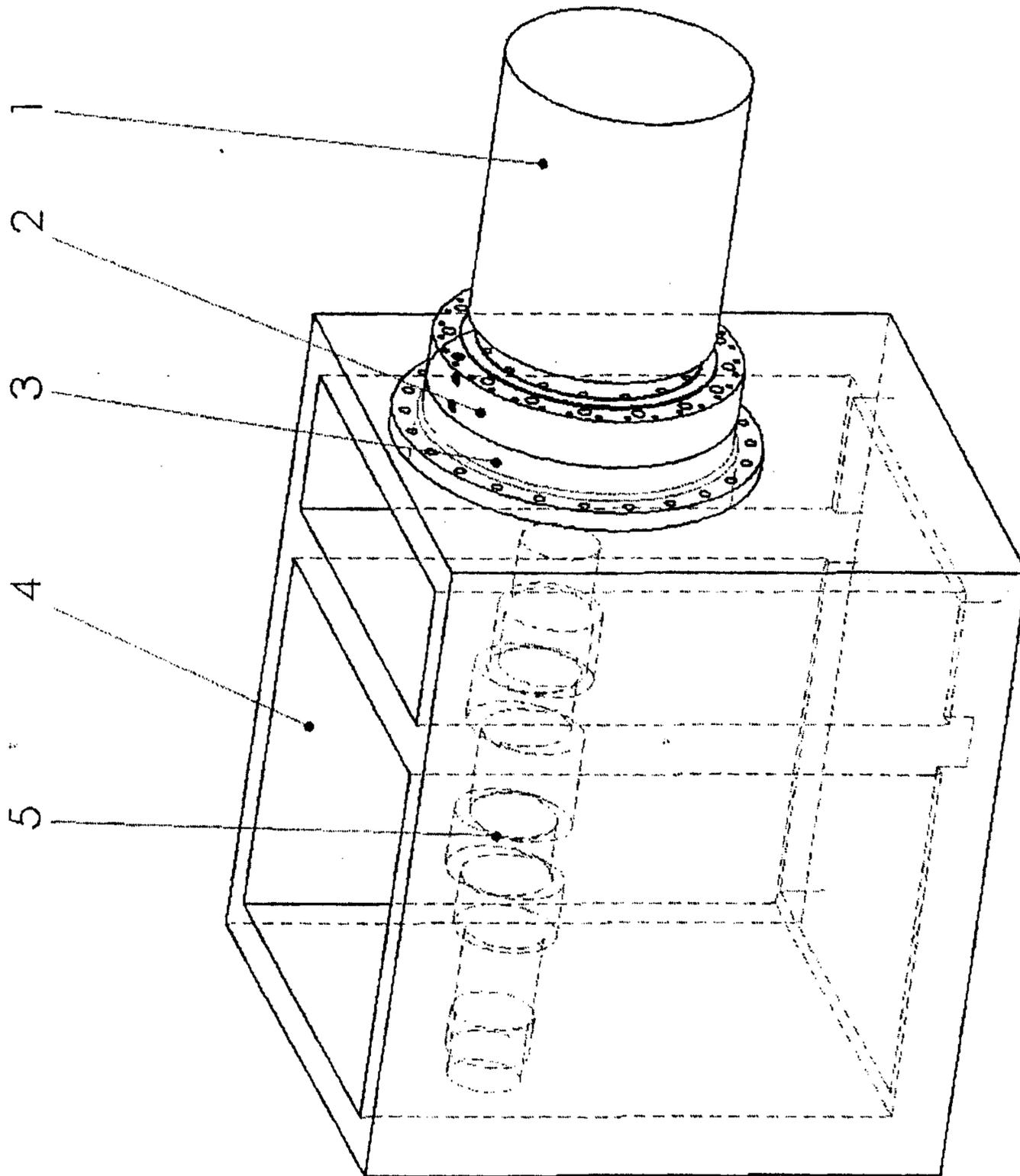


Fig. 5

