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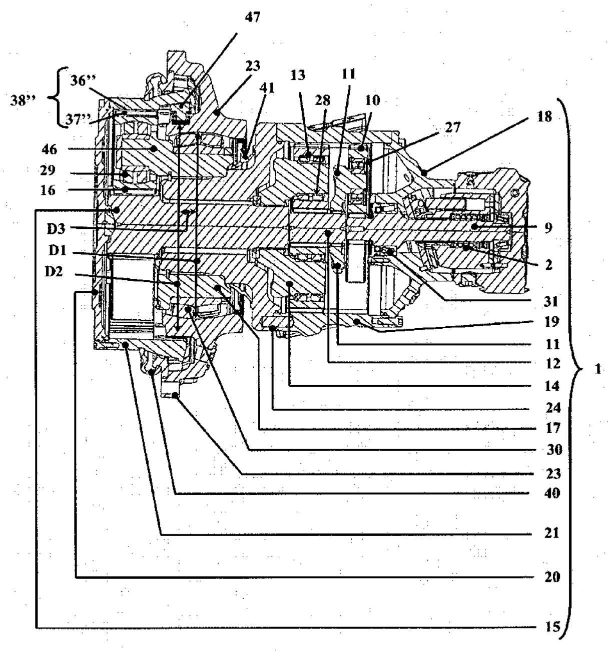

Fig. 10

(57) **Abstract**: Drive comprising a multistage epicyclic gear-reduction device in which the drive comprises a fixing flange 23 or flange for the final transmission of the motion, the drive being provided with coupling means which are configured and structured so as to allow a misalignment between an axis of the drive and an axis of the fixing flange or flange for the final transmission of the motion at the exit of the drive.

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DESCRIPTION

DRIVE

Technical field

The present invention relates to a drive according to the characteristics of the pre-characterizing part of claim 1.

The present invention also relates to a concrete mixer vehicle provided with a concrete mixing rotating drum which is provided with a drive, according to the characteristics of the pre-characterizing part of claim 28.

Prior art

In the field of the drives and in particular of driving systems for the rotation of a drum of a concrete mixer vehicle, it is known the combination of a drive system with a hydraulic motor for rotating the drum of the concrete mixer vehicle within which the continuous mixing occurs of the concrete which is contained into the drum itself. The rotation occurs in two directions, one direction being intended for mixing and one direction and being intended for discharging the concrete which is contained into the drum.

The drum must be operated with a maximum rotational speed of 14-20 rpm and a maximum torque ranging from 30000 Nm up to 60000 Nm and beyond, depending on the capacity of the mixing drum itself. The drum can be 3 to 4 m long, for example and without limitation to the application of the present invention, and it is secured at its ends on a frame with tractor for the road transportation of concrete. A key feature to be observed is that the rotation speed of the drum must be independent from the operating speed of the engine of the tractor vehicle. Due to the fact that on the tractor a power take-off is not available which is able to supply the speed and torque which are required for the operation of the drum, the usually adopted solution consists in interposing a system consisting of a hydraulic pump and a hydraulic motor between the engine of the tractor vehicle and the drum. The axial piston hydraulic motor is the most commonly used because it represents the best compromise between power output, size and costs. A hydraulic motor of this type is able to provide maximum power at speeds that are between 1800 and 2500 rpm. Due to the rotation speed of the drum and the rotation speed of the hydraulic motor it is necessary to interpose a mechanical reducer between them which ensures a minimum reduction ratio of about 1:100. For this kind of use a planetary gear reducer with multiple reduction stages is typically used, due to size and reliability reasons. The gear unit constituting the drive system is usually coaxially installed with respect to the drum and at an external position with respect to the inner compartment of the drum, while solutions are present in which the hydraulic motor is placed in an aligned condition with respect to the drive system as well as solutions in which the hydraulic motor is arranged in an axially offset position with respect to the drive system. The installation occurs in correspondence of the opposite side of the drum with respect to the introduction and extraction mouth of the concrete.

Patent SU 1364486 describes a drive for a mixing drum of a concrete mixer vehicle in which part of the gears is fixed internally to the body of the drum, wherein the first and the second stage of the gear unit are positioned in an outer shell, and the third stage is located within an shell which is located internally to the drum, the outer shell having a wall thickness greater than the thickness of the wall of the inner shell.

Patent US4006946 describes a roller bearing for the shaft of a cement-mixer drum, universally jointed on a shaft of a planetary-gear train driving the drum shaft through a gear coupling with arcuate teeth, in which the roller bearing is provided with an inner ring which is fixed to the shaft of the drum and with an outer ring which is fixed on a surrounding drive housing, such outer ring being axially split into two halves each accommodating a set of barrel-shaped rollers which are held in respective cages, peripherally offset from each other.

Patent DE8326270 discloses a planetary gear with power take-off which acts on a first stage consists of a central inner gear, planetary-gears and planetary-gear supports, in which the rotation movement of the planetary-gear support occurs through a curved teeth coupling using a spherical bearing for the output coupling, and further in which the shaft of the output joint protrudes towards the inside of the gear being supported on a spherical bearing with a convex radius of curvature and the planetary-gear support being axially supported through roller bearings.

Patent DE2948936 describes a planetary gear in which the rotation axis lies on the pins of the planetary-gear support of the last stage of the drive, and wherein in correspondence of such coupling a ring is present which has with an outer arcuated profile rotatably associated with a counter-shaped supporting profile.

Patent US4124304 describes a device for driving a drum of a concrete mixer vehicle comprising a casing fixedly mounted on the vehicle frame and a driving shaft connected to the drum by a universal coupling consisting of a driving member concentrically connected to the driving shaft and rotatably supported by the casing through a self-aligning roller bearing, and a driven member which is fixed to the driven drum which engages with the driving member with a spherical bearing disposed there between, the self-aligning roller bearing and spherical bushing being concentrically arranged to rotate about a common center of rotation, and the connecting means being arranged on a reference plane in which the center of rotation lies.

Patent US3788610 describes a lubricant system for the support unit of a concrete mixer vehicle comprising a lubricant chamber enclosing the drive connection between the drive shaft and drum.

Patent WO 2013/045070 describes a drive device for a drum of a concrete mixer vehicle which includes a multistage epicyclic gear-reduction device which comprises at least two reduction stages of which at least a first stage is housed within the volume of the drum of the concrete mixer vehicle while at least another stage is housed externally with respect to the volume of the drum of the concrete mixer vehicle.

Prior art solutions are known which are based on the use of a grooved coupling between a series of teeth and grooves in which the teeth themselves can slide by means of a rotation around a rotational center for the fixing flange of the drive. In this way a misalignment is allowed between the final transmission stage of the drive and the fixing flange of the drive on which the drum is fixed.

Problems of the prior art

Prior art solutions have many problems. One problem is relative to the overall size of the concrete mixer vehicle and to its weight. The size of the drive, while apparently looking negligible if compared to the overall size of the concrete mixer vehicle, are very important because it is necessary to provide enough space on the frame of the concrete mixer vehicle to house the drive and the corresponding hydraulic motor, in an intermediate position between the concrete containing drum and the operating cab. Prior art solutions involve a considerable space required for the installation of such devices, with the consequence that it is necessary to use greater drum supporting frames with further increasing of costs and increasing of weights and consumption. Some prior art solutions for solving this problem have adopted configurations with integrated gear-motors, transverse or inverted arrangement of the motor with respect to the drive with a conical coupling, but such solutions are often complex, heavy and expensive, and in addition they involve maintenance problems for the various interested members and devices.

Additionally it should be noted that the drum is mounted on roller supports which allow its rotation and which support the weight of the drum and the concrete contained in it. Part of the weight is also released on the drive system. A further drawback is due to the fact that, during the movement of the mixer on the road, the drum, the frame and the drive system are subject to high stresses with the consequence that torsion phenomena occurs involving the frame of the concrete mixer vehicle itself. As a consequence reciprocal movements are present between the rotating drum and the support frame on which also the drive system and hydraulic motor are fixed. To solve this problem, prior art solutions provide for the use of an assembly which is known as bell coupling joint, which allows the drive of the rotational motion and at the same time allows the reciprocal displacement between the drum and part of the drive system which is fixed to the frame. This solution is constructively complex and heavy because the bell coupling joint must also be able to support and release at least a part of the weight of the drum and of the concrete which is contained into it. In order to solve this problem, some prior art solutions provide the use of a drive system which is coupled to the vehicle frame by means of elastic means, such as rubber pads having a great thickness. By means of the elastic deformation of these bearing pads the reciprocal movements are allowed between the drum and the frame of the vehicle. These systems, although appearing as simple systems, are subject to many problems with reference to the limitation of the allowed movements by the elastic means to avoid that an excessive displacement could cause excessive stresses of the components with possible detachments of the same. Further such elastic means may be subject to premature aging resulting in the loss of their functionality, due to the fact that they are exposed to temperature change, sun, weather conditions, etc. In addition, the need to provide sizes of the pads suitable for the application and sizes of the mechanical components able to withstand the induced vibrations, at least in part compromises the economic benefits obtained by the adoption of such systems, so as to cause this solution to be more expensive than conventional systems, in addition to the fact that no reduction of the weights and of the overall dimensions is not provided for the group comprising the drive and the hydraulic motor.

Furthermore, since part of the weight of the drum is released by means of the roller bearings, the prior art solutions are subject to problems due to the wear of the rollers of the roller bearings which support the drum of the concrete mixer vehicle.

Prior art solutions which are based on the use of a grooved coupling between a series of teeth and grooves in which the teeth themselves can slide, are subject to various problems. Due to the fact that the contact between the ring gear and the splined shaft associated to titling flange usually is not aligned to the center of the roller bearing of the stage of the drive, each of the teeth engaging to the corresponding groove must have a tapered configuration providing a progressive decreasing of the thickness of the tooth in the longitudinal direction. This is a drawback for this type of solutions because due to the decreasing of the thickness of the tooth it undesiderable axial forces could be genérated. Moreover this represent a limit for these solutions because a tooth with an excessive low thickness could be subject to breaks or it could not be able to transmit the provided torque of the drive.

Aim of the invention

The aim of the present invention is to provide a drive for the drum of a concrete mixer vehicle which allows a reduction of the overall size of the drive itself and in particular of the portion of the drive which is inserted within the volume of the drum of the concrete mixer vehicle at the same time not increasing the size of the drive on the external side of the drum itself.

The aim of the present invention is to solve the above mentioned problems and disadvantages of the prior art systems, providing a drive for a drum of a concrete mixer vehicle which is compact and reliable allowing a reduction of the overall sizes.

A further aim of the present invention is to allow an effective releasing of the portion of the weight of the drum of the concrete mixer vehicle which weights down over the drive while ensuring a reduction of the drive itself while maintaining its reliability.

Concept of the invention

The aim is reached with the characteristics of the main claim of the compact drive for the drum of a concrete miser. The sub-claims represent advantageous solutions.

Advantageous effects of the invention

The solution according to the present invention, by the considerable creative contribution whose effect constitutes an immediate and not-negligible technical progress, presents various advantages.

First, a greater compactness of the concrete mixer vehicle can be obtained.

This allows, among other things, a reduction of its length and therefore a better exploitation of the space which is available for the arrangement of the components for the same total length of the vehicle, greater efficiency in the management of masses, greater maneuverability.

Furthermore a consistent reduction in weight of the drive is allowed with respect to prior art systems.

Furthermore a reduction of the length of the drive as a whole is allowed, reducing the axial size of the drum and drive assembly, this reduction being estimated as being about a 10 – 15 % reduction in overall dimensions if compared to prior art systems.

Further advantages concern the reduction of the number of components necessary for making the drive with benefits from the point of view of cost-effectiveness with a reduction of production costs, benefits from the point of view of reliability, benefits from the point of view of the simplicity of use and benefits from the point of view of maintenance.

Description of the drawings

It is hereinafter described an embodiment with reference to the included drawings to be considered as a non-limiting example of the present invention in which:

Fig. 1 schematically shows a concrete mixer vehicle comprising the drive according to the present invention.

Fig. 2 schematically shows a drum for a concrete mixer vehicle comprising the drive according to the present invention.

Fig. 3 shows the detail which is indicated with "A" in Fig 2.

Fig. 4 is a schematic exploded view of the drive according to the present invention.

Fig. 5, Fig. 6, Fig. 7, Fig. 8 are views showing a mounting sequence of one of the components of the drive according to the present invention.

Fig 9 schematically shows a sectional view of a prior art drive.

Fig 10 schematically shows a sectional view of the drive according to the present invention.

Fig. 11, Fig. 12, Fig. 13, Fig. 14, Fig. 15 schematically show the reciprocal movement which is allowed between the components of the drive according to the present invention.

Fig 16 shows the detail which is indicated with "B" in Fig 14.

Fig 17 shows the detail which is indicated with "C" in Fig 15.

Fig 18 shows the detail which is indicated with "D" in Fig 15.

Fig 19 shows a detail of the coupling system according to the invention.

Fig 20 shows one of the elements of the coupling system according to the invention.

Fig. 21, Fig. 22 show the mounting condition of the element of Fig. 20 inside the drive.

Fig. 23, Fig. 24 show the operation of the coupling system according to the invention.

Description of the invention

Referring to the figures (Fig. 1), the concrete mixer vehicle (8) consists of a tractor vehicle (6) which is operated by a respective motor (4) of the tractor vehicle and a frame (7) on which the rotating drum (3) is mounted resting on supports (5). The rotation of the drum (3) occurs (Fig. 2, Fig 3) by means of a drive system (1) driven by a respective hydraulic motor (2), which puts in rotation the drum (3) of the concrete mixer vehicle (8) within which the continuous mixing occurs of the concrete which is contained in the drum (3) itself. The rotation occurs in two directions, one direction being intended for mixing and one direction and being intended for discharging the concrete which is contained into the drum. Preferably, but not necessarily, the motor which puts in rotation the drum (3) is a hydraulic motor, even more preferably an axial piston hydraulic motor. Since the drum (3) must be operated with a rotation speed approximately but not limitatively comprised in the range of about 14 rpm to 20 rpm and with a maximum torque ranging from 30000 Nm up to 60000 Nm and since the hydraulic motor (2) is able to provide maximum power at speeds that are between 1800 rpm and 2500 rpm, it is necessary to interpose a mechanical reducer between them which ensures a minimum reduction ratio of about 1:100. The solution according to the present invention provides the interposition of a drive system (1) consisting of a planetary gear unit with multiple reduction stages. The gear unit constituting the drive system (1) is preferably installed according to a coaxial arrangement with respect to the drum (3) in correspondence of the opposite side of the drum (3) with respect to the introduction and extraction mouth of the concrete.

The drive (1) is constructed (Fig. 3, Fig 4, Fig 10) according to a configuration with planetary-gears and planetary-gears supports. Although in the illustrated embodiments the configuration includes 3 stages of planetary-gears and planetary-gears supports, the present invention should be intended as being also applicable in the case of solutions in which a lower or higher number of stages is present, as for example drive configuration with two stages of planetary-gears and planetary-gears supports, drive configuration with four stages of planetary-gears and planetary-gears supports, etc. In particular, in the illustrated embodiment, the configuration provides that the last stage of the drive, the third stage in the illustrated embodiment, is a stage which is configured with planetary-gears support (17) of the third stage of the fixed type and with a rotating ring-gear (21). In this way, it is the ring-gear (21) itself which transmits the motion to the fixing flange (23) of the drum (3).

In the prior art solutions (Fig. 9) this transmission of motion was obtained by means of a joint (22) provided with a specific grooved coupling (38') to allow a misalignment by some degrees between the axis of the drive (1) and the axis of the drum (3) of the concrete mixer vehicle (8). In the prior art solutions (Fig. 9), the grooved coupling (38') is made up of:

- a groove (37') obtained on the power stage (15, 16, 17, 21) in correspondence of the element (21) transmitting the rotational motion from the power stage (15, 16, 17, 21) to the fixing flange (23) of the drum (3);

- a guiding element (36') obtained on the flange (23).

The guiding element (36') guides the reciprocal misalignment movement between the flange (23) and an element (21) transmitting the rotational motion to the fixing flange (23) of the drum (3), the guiding element (36') sliding in the groove (37').

In the solution according to the invention said intermediate coupling element was advantageously eliminated by realizing a construction simplification aimed at improving reliability and reducing weight and overall dimensions.

In the solution according to the invention (Fig. 10, Fig. 14, Fig. 15, Fig. 16, Fig. 17, Fig. 18) the reciprocal misalignment between the ring-gear (21) and the fixing flange (23) of the drum (3) which allows for a reciprocal inclination between the drum (3) of the concrete mixer vehicle (8) and the frame (7) of the concrete mixer vehicle (8) occurs by means of misalignment coupling means (47) which will be dealt with in the following of the present description and which are advantageously integrated directly on the fixing flange (23) with no interposition of further elements such as the prior art joint (22).

The maximum allowed misalignment (Fig. 12, Fig. 13, Fig. 17, Fig. 18) is of at least +/-2 degrees, preferably of at least +/-4 degrees. This allows to take into account the bending of the frame (7) of the concrete mixer vehicle (8) which occur during transportation on the road, preventing the stresses transmitted to the drive (1) may lead to a blocking of the same or to its premature wearing, as well as preventing anomalous stresses on the supports of the rotating drum (3) to occur.

Advantageously the solution according to the present invention provides that at least the last stage of the epicyclic drive system, that is the power stage of the same, is housed (Fig. 3) within a chamber (26) obtained at the head of the drum (3), namely in correspondence of the side of the drum (3) which is the opposite side with respect to the side on which there is the intake for the introduction and the taking-out of the concrete. Positioning the epicyclic power stage inside the drum (3) it is allowed to free up space to place two more epicyclic stages at the head of the drive (1). In this way a drive (1) or reduction gear can be obtained with an extremely high reduction ratio, which makes it possible to use an input hydraulic motor (2) having a reduced size if compared to current standards. The sum of all these aspects results in a reduction of weight of the drive (1) by about 15-20%, if compared to current solutions. As a consequence of this, it is apparent the great economic advantage of this product. With the present invention, therefore, a drive (1) or reduction gear is provided which is particularly light in weight and compact with consequent benefits from the economic point of view, while maintaining or even improving the characteristics of reliability and duration. Furthermore also the axial size outside of the drum (3) of the assembly of drive (1) and hydraulic motor (2) is reduced (Fig. 10) by about 10 – 15 % if compared to current solutions, as for example the prior art solution of WO 2013/045070 (Fig. 9). As previously observed, the power stage is realized according to a configuration with fixed planetary-gears support and rotating ring-gear (21), so that it is the rotating ring-gear (21) itself which transmits the motion to the fixing flange (23) of the drum (3).

In details, the drive (1) for a concrete mixer vehicle according to the present invention comprises a three-stage epicyclic gear, although different embodiments can also be provided having two or four stages. The box (19) of the drive (1) only houses inside (Fig. 3, Fig 4, Fig 10) the first two gear stages of the reduction gear:

- the first stage with the respective planetary-gear support (11) of the first stage, planetary-gears (10) of the first stage and pinion (9) of the first stage;
- the second stage with the respective planetary-gear support (14) of the second stage, planetary-gears (13) of the second stage and pinion (12) of the second stage.

The third stage of the drive (1), instead, is advantageously positioned on the opposite side of the fixing flange (23) with respect to first and second stage of the drive (1) and it comprises planetary-gear support (17) of the third stage, planetary-gears (16) of the third stage and pinion (15) of the third stage. In this way, when the drive (1) is installed on the drum (3), the third stage (15, 16, 17, 21) is advantageously housed inside (Fig. 3) a chamber (26) which is obtained at the head of the drum (3). By means of the flange (23) the fixing or coupling on the drum (3) of the concrete mixer vehicle (8) occurs for the transmission of motion, while the drive (1) is fixed on the frame (7) of the concrete mixer vehicle (8) by means (Fig. 3 , Fig 4) of fastening means (25) obtained at the base of the box (19) of the drive (1) itself.

The hydraulic motor (2) is fixed on the box (19) of the drive (1) in correspondence of the cover (18) which closes the inside of the box (19) containing the first stage (9, 10, 11) and containing the second stage (12, 13, 14) of the drive (1). The shaft (32) of the motor (2) is advantageously (Fig. 3, Fig. 4, Fig. 10) structured so as to integrate in it also the function of the pinion (9) of the first stage and it is supported on the cover (18) by means of a second bearing (31). The integration of the pinion (9) of the first stage and of the shaft (32) of the motor into one single component by obtaining directly on the shaft (32) of the motor the gears of the pinion (9) of the first stage, allows to further reduce the overall dimensions of the drive according to the invention and to reduce the number of components necessary for making the drive with a consequent greater simplicity and simplification of the drive itself, a reduction of weight, an increase in reliability and, as a consequence, a reduction of construction and maintenance costs. The pinion (9) of the first stage, that is the shaft (32) of the motor (2) configured and structured as pinion (9) of the first stage, couples with corresponding planetary-gears (10) of the first stage which in turn transmit the motion to a planetary gear-support (11) of the first stage by means of sliding on third bearings (27). The planetary gear-support (11) of the first stage in turn transmits the motion to the pinion (12) of the second stage. The pinion (12) of the second stage couples with corresponding planetary-gears (13) of the second stage which in turn transmit the motion to a planetary gear-support (14) of the second stage by means of sliding on fourth bearings (28). The planetary gear-support (14) of the second stage in turn transmits the motion to the pinion (15) of the third stage. The pinion (15) of the third stage couples with corresponding planetary-gears (16) of the third stage which in turn transmit the motion to a ring-gear (21) by means of sliding on fifth bearings (29).

Finally, the ring-gear (21) puts in rotation the drum (3) of the concrete mixer vehicle (8) through misalignment coupling means (47) which couple to the fixing flange (23) of the drum (3). The planetary gear-support (17) of the third stage is therefore stationary and integral with or fixed to the central body (24) of the drive. A closing shell-guard (20) is fixed to the ring-gear (21) to close the head of the drive (1). Unlike the prior art solutions (Fig. 9), in which the fixing flange (23) of the drum (3) of the concrete mixer vehicle (8) was supported radially internally by the central body (24), in the solution according to the invention (Fig. 10) the fixing flange (23) of the drum (3) of the concrete mixer vehicle (8) is supported radially internally by the planetary gear-support of the third stage (17). In practice in the drive (1) for the drum (3) of the concrete mixer vehicle (8) according to the invention the fixing flange (23) of the drum (3) of the concrete mixer vehicle (8) is supported radially internally by a body (46) of the fixed planetary gear-support of the power stage (15, 16, 17, 21). The body (46) of the fixed planetary gear-support of the power stage (15, 16, 17, 21) is placed in a position at least partially interspersed between the flange (23) and a central body (24) of the drive wherein the central body (24) of the drive is integral with or fixed to the box (19) of the drive (1) and wherein the central body (24) develops from the box (19) developing in a direction directed towards the power stage (15, 16, 17, 21) and is inserted radially internally with respect to the fixed planetary gear-support, that is to say, below it supporting it and acting as a weight releasing element from the flange towards the frame by means of the first bearings. This solution allows to considerably retract the planetary gear-support of the third stage (17) which is thus at least partially interspersed between the flange (23) and the central body (24). In this way one obtains a more compact, solid and reliable structure, as well as a better release of the weight of the drum (3) and of its content through the first bearings (30). The pinion (15) of the third stage rotates within a passing-through housing situated within the central body (24), the central body (24) being interspersed between the pinion (15) of the third stage and the fixed planetary gear-support of the power stage (15, 16, 17, 21), consisting of the planetary gear-support of the third stage (17).

The new geometry of the central body with respect to the prior art solutions along with the new geometry and assembly of the planetary gear-support of the third stage contributes to reducing the overall dimensions of the part of gear-reduction device which is housed inside the drum of the concrete mixer vehicle, with advantages from the point of view of the reduction of the overall dimensions, reduction of weight and reduction of production costs.

Advantageously the need is prevented for complex solutions of the bell coupling joint type to allow the transmission of the rotational motion and at the same time to also allow the reciprocal displacement between the drum and the fixed portion of the drive which is integral with the frame of the concrete mixer vehicle. Indeed the releasing of the portion of the weight of the drum (3) which weights down on the drive (1) occurs by means of the flange (23), which releases the weight on the central body (24) of the drive by means of first bearings (30) with the interposition of the planetary gear-support (17) of the third stage, and, as a consequence, the weight is released through the central body (24) on the box (19) down to the support (5) which is installed on the frame (7) of the concrete mixer vehicle (8).

Advantageously the first bearings (30) are shaped to allow (Fig. 11, Fig. 12, Fig. 13, Fig. 14, Fig. 15, Fig. 16, Fig. 17, Fig. 18) a misalignment by some degrees between the axis of the drive (1) and the axis of the drum (3) of the concrete mixer vehicle (8) by means of a sliding movement with inclination of the base of the flange (23) with respect to the planetary gear-support (17) of the third stage and the central body (24), which are reciprocally integral elements. The maximum allowed misalignment (Fig. 12, Fig. 13, Fig. 17, Fig. 18) is of at least +/-2 degrees, preferably at least +/-4 degrees. The first bearings (30) are roller bearings.

With respect to the prior art solutions a configuration (Fig. 5, Fig. 6, Fig. 7, Fig. 8, Fig. 11, Fig. 12, Fig. 13, Fig. 14, Fig. 15, Fig. 16, Fig. 17, Fig. 18) of the flange (23) and of the first bearings (30) was advantageously designed, which allows to obtain a greater robustness and structural solidity of the rotating coupling between the flange (23) itself and the other components of the drive, in the solution shown, in particular, of the rotating coupling between the flange (23) and the planetary gear-support of the third stage (17). In fact, advantageously, the flange (23) also integrates the function of rolling ring of the first bearings (30). In fact (Fig. 10, Fig. 11) the flange (23), the external ring of the first bearings (30) and the joint (22) of the prior art (Fig. 9) are integrated in one single element consisting of the flange (23) itself. In this way the first bearings (30) are integrated in the fixing flange (23) of the drum (3). By "integrated" one means that in the flange (23) one obtains the external rolling path of the rollers of the first bearings (30), the term "external" being referred to a radial direction and to the axis of the drive (34). The advantages which can be obtained by this configuration are:

- the integration of the first bearings (30) in the flange (23) allows to obtain a greater space for housing the rollers (42, 43) of the first bearings (30) and in this way it allows to use rollers (42, 43) and first bearings (30) having a larger diameter with greater loading capacity, allowing to obtain a lower stress of the first bearings (30) themselves to the advantage of the reliability and duration of the drive;
- the integration of the first bearings (30) in the flange (23) allows to reduce the number of components of the gear-reduction device in its entirety;
- the integration of the first bearings (30) in the flange (23) allows to obtain smaller overall dimensions of the part of gear-reduction device which is housed in the drum (3) of the concrete mixer vehicle (8);
- the integration of the first bearings (30) in the flange (23) allows to obtain a lower overall weight of the gear-reduction device;
- the integration of the first bearings (30) in the flange (23) allows to obtain a lower production cost of the gear-reduction device.

The rolling surface (45) of the rollers (42, 43) of the first bearings (30) which is obtained and integrated in correspondence of the flange (23) is treated to provide said rolling surface (45) with a greater resistance to wear by means, for example, of hardening surface treatments, preferably hardening surface treatments in the form of induction hardening of the flange (23) in correspondence of the external rolling surface (45) of the rollers (42, 43) of the first bearings (30). With reference to the wear of the components, the integrated first bearings (30) have a diameter definitely larger with respect to the prior art solutions and larger rollers (42, 43) with respect to the bearing of the prior art solutions, said oversizing being translated into a lower specific pressure acting as load on all the components, both the components of the first bearings (30) and the flange (23), allowing to obtain a greater resistance to wear. In practice the solution of drive according to the invention, provided with a flange (23) with first bearings (30) integrated in the flange (23) itself has a longer duration with respect to the prior art solutions which use non-integrated components.

The main aim of said integration is to cope with the need to reduce as far as possible the overall dimensions of the part of gear-reduction device which is housed in the drum (3) of the concrete mixer vehicle (8). In this way, by the solution according to the invention one obtains a double advantage with respect to the prior art solutions:

- one reduces the overall dimensions of the drive (1) outside the drum (3) because part of the drive (1) is integrated within the volume of the drum (3) of the concrete mixer vehicle, thus allowing to use a more compact and lighter frame (7) of the concrete mixer vehicle (8);
- one reduces the overall dimensions of the drive (1) inside the drum (3) allowing a better exploitation of the internal volume of the drum (3) itself and in this way allowing to use a drum (3) having smaller external sizes because one has a better exploitation of its internal volume, thus allowing a further reduction of the overall weight of the concrete mixer vehicle (8).

In the preferred embodiment of the present invention (Fig. 5, Fig. 6, Fig. 7, Fig. 8), the first bearings (30) are roller bearings with two crowns of rolling bodies in the form of first rollers (42) and second rollers (43) housed in a blocking cage (44) wherein the first rollers (42) and the second rollers (43) are placed according to a reciprocally inclined condition with respect to one another within the blocking cage (44). However, it will be evident that other less preferred embodiments are also possible in which the first bearings (30) are provided with rollers having one single crown of rolling bodies. The misalignment can occur (Fig. 11, Fig. 12, Fig. 13) in both directions, that is to say, with deviation angles (33) between the axis (34) of the drive (1) and the axis (35) of the drum (3) preferably included in a range at least from 2 degrees to +2 degrees, even more preferably in a range at least from -4 degrees to +4 degrees. The flange (23) which is provided with specific coupling means (47) integrated in the flange (23) itself, allows to obtain the misalignment between the axis (34) of the drive (1) and the axis (35) of the drum (3) so that the misalignment affects the flange (23) but not the ring-gear (21). In this way the ring-gear (21) is free to rotate to transmit the motion to the flange (23), while the flange (23) although receiving the rotational motion from the ring-gear (21) is able to be subjected to the indicated misalignment. In fact, the ring-gear (21) is configured in a different way with respect to prior art solutions such as SU 1364486, in which the ring-gear is rigidly connected to the pinion of the third stage of reduction in such a way that the ring-gear can rotate but cannot undergo any other movement in any other direction because it is always kept in a coaxial condition of alignment with respect to the pinion of the third stage and, therefore, with respect to the body of the drive.

By way of summary the present invention relates to a drive (1) for the drum (3) of a concrete mixer vehicle (8) comprising a multistage epicyclic gear-reduction device which comprises at least two reduction stages of which:

- a first reduction stage (9, 10, 11) comprising various components;
- a power stage (15, 16, 17, 21).

The first reduction stage (9, 10, 11) comprises a power takeoff for the connection of a motor (2), the drive comprises a flange (23) for the fixing or for the final transmission of the motion at the exit of the drive (1) in which the coupling between the power stage (15, 16, 17, 21) and the fixing flange (23) occurs by means of coupling means (47) which are configured and structured in such a way as to allow a misalignment between one axis (34) of the drive (1) and one axis (35) of the flange (23) of fixing or final transmission of the output motion. Said misalignment involves the misalignment of the flange (23) with respect to the components of the power stage (15, 16, 17, 21), the power stage (15, 16, 17, 21) being configured and structured in such a way as to transmit the rotational motion to the flange (23) in a reciprocal misalignment condition between the first stage of reduction (9, 10, 11) and the power stage (15, 16, 17, 21).

The coupling means (47) are (Fig. 19) a series elements arranged circumferentially in which each of the coupling means (47) is provided with a coupling interface between the ring-gear (21) and the flange (23) and in which each coupling interface of each of the coupling means (47) is freely oscillating with respect to the other coupling interfaces of the other coupling means (47) of the series.

The coupling means (47) are fixed (Fig. 19, Fig. 22) on the flange (23), the coupling interface consisting of a tooth (49) protruding circumferentially externally with respect to the flange (23), each tooth (49) being inserted into a corresponding seat (52) obtained on the ring-gear (21) which is provided with a number of seats (52) at least corresponding to the number of the teeth (49).

In a different equivalent embodiment (not shown) it is provided that, on the other hand, the coupling means (47) are fixed on the ring-gear (21), the coupling interface consisting of a tooth (49) protruding circumferentially internally with respect to the ring-gear (21), each tooth (49) being inserted into a corresponding seat (52) obtained on the flange (23) which is provided with a number of seats (52) at least corresponding to the number of said teeth (49).

The coupling means (47) are provided with an articulation (50) of the spherical type which allows the oscillation of the coupling interface. The tooth (49) comprises an insert (48) which is inserted within the articulation (50) of the spherical type, the insert

(48) constituting an insertion foot of the tooth (49) within the articulation (50), said insertion foot being free to oscillate by means of the articulation (50) of the spherical type.

The coupling means (47) are provided with elastic means (51) in correspondence of a fixing interface of the coupling means (47) themselves and the elastic means (51) are preferably made in the form of coned disk springs with preloading. The provided coned disk springs are configured and structured in such a way as to allow the coupling interface to perform an axial movement of extension or penetration with respect to an indentation (53) within which the coupling means (47) are contained so that the coupling means (47) can essentially slide inside with the described axial movement of extension or penetration.

In the preferred embodiment of the present invention the drive (1) is the drive (1) of a drum (3) of a concrete mixer vehicle (8). As a consequence, the box (19) of the drive comprising fixing means (25) to the frame (7) of the concrete mixer vehicle (8). In that case the flange (23) constitutes a fixing interface between the drive (1) and the drum (3). The coupling means (47) are configured and structured in such a way as to allow a misalignment between the axis (34) of the drive (1) and the axis (35) of the flange (23) of final transmission of the output motion which coincides with the axis of the drum (3).

The fixing flange (23) of the drum (3) is rotationally supported by the first bearings (30) radially internally with respect to a radial direction developing with respect to the axis (34) of the drive (1), that is to say, the first bearings (30) which rotationally support the flange (23) are radially internally with respect to a direction corresponding to the radial direction developing from the central axis (34) of the drive (1). In other words starting from the axis (34) of the drive and moving ideally towards the outside of the drive along a radial direction with respect to said axis (34) one first finds the supporting first bearings (30) and then, that is to say, externally according to the previously defined radial direction, the flange (34) which is thus internally supported by the supporting first bearings (30). The fixing flange (23) of the drum (3) and the first bearings (30) are reciprocally integrated according to such a configuration and structuring that the fixing flange (23) comprises a rolling surface (45) which is intended for the rolling of rollers (42, 43) of the first bearings (30), said rollers (42, 43) being held in position:

- in correspondence of a first radially external side by the rolling surface (45) of the flange (23), radially external being referred to a radial direction developing with respect to the axis (34) of the drive (1);
- in correspondence of a second radially internal side by a blocking cage (44) which is suitable to be fixed on a first component of the components of the power stage (15, 16, 17) radially situated internally with respect to the flange (23), radially internal being referred to a radial direction developing with respect to the axis (34) of the drive (1).

The at least one first bearing is concentric to the flange (23) and is placed within a central hole of the flange which is a central hole which is intended to house at least one first part of the power stage (15, 16, 17) comprising the first component of the components of the power stage (15, 16, 17) which is situated radially internally with respect to the flange (23) and which supports the at least one first bearing (30).

The ring-gear (21) is provided (Fig. 10) with a circular perimetrical first sealing gasket (40) which seals the internal part of the drive, the perimetrical sealing gasket (40) constituting a sealing between the ring-gear (21) and the fixing flange (23) of the drum (3).

A circular perimetrical second sealing gasket (41) is provided (Fig. 10) between the fixing flange (23) of the drum (3) and the central body (24) of the drive, said circular perimetrical second sealing gasket (41) constituting a sealing element of the internal part of the drive with respect to the external environment.

In this way the fixing flange (23) also constitutes, in addition to the element of fixing of the drive to the drum (3), a sealing element of the drive both with respect to the inside the drum (3) by means of the first sealing gasket (40) and with respect to the external environment by means of the second sealing gasket (41), the first sealing gasket (40) and the second sealing gasket (41) being placed on essentially opposite sides of the fixing flange (23) for the sealing of the only two opening portions which may lead to the penetration of dirt in the drive (1), besides ensuring the sealing function of the lubricating oil. This solution is advantageous because the fixing flange is integral with or fixed to the drum (3) and as a consequence it is possible to stably protect the zone which could be more subject to stresses and infiltrations because of the oscillations or inclinations of the drum (3) which are allowed by the drive (1) according to the invention by means of the misalignment coupling means (47). The first sealing gasket (40) allows to avoid providing an additional housing of protection of the drive within the volume of the drum (3), with a consequent further simplification of the drive and saving of weight and space in terms of useful volume inside the drum (3). This solution is particularly advantageous due to the previously described reasons and it is also necessary to consider that the first sealing gasket (40) is configured and structured to be flexible and deformable within the gap left between the ring-gear (21) and the fixing flange (23) of the drum (3). In fact, as explained, the ring-gear (21) and the fixing flange (23) are mounted on the drive (1) according to a configuration in which the ring-gear (21) and the fixing flange (23) are reciprocally floating a with respect to each other, to allow the inclination of the drum (3). The first sealing gasket (40) is advantageously mounted between two components, that is to say, the ring-gear (21) and the fixing flange (23) which rotate at the same speed, being the ring-gear (21) itself to transmit the motion to the fixing flange (23) of the drum (3), as previously explained. In this way the first sealing gasket (40) is not subject to relative rotational movements with respect to the ring-gear (21) or to the fixing flange (23) and works, thanks to the flexible and deformable configuration and structuring, only in elongation (Fig. 18) and deflection (Fig. 17) with respect to a rest condition (Fig. 16) in the essentially radial direction of the drive allowing to obtain an effective sealing of the gap between the ring-gear (21) and the fixing flange (23) which is left to allow the inclination of the drum (3) with respect to the frame of the concrete mixer vehicle. Moreover, thanks to the presence of the first sealing gasket (40), it is possible to use a floating configuration because the first sealing gasket (40) is able to deform in an elastic way in order to adapt to the movements of the floating ring-gear or to the movements of the fixing flange (23) of the drum (3) at the same time providing an effective sealing function for the oil.

Therefore the power stage (15, 16, 17, 21) is made according to a configuration with fixed planetary gear-support and a floating flange (23), in which the ring-gear (21) transmits the rotational motion from the power stage (15, 16, 17, 21) to the fixing flange (23) of the drum (3). Advantageously the ring-gear (21) is located circumferentially outside with respect to the elements of the power stage (15, 16, 17, 21), in such a way that the ring-gear (21) constitutes the casing of the drive.

The misalignment coupling means (47) were designed in such a way as to allow the transmission of motion between the ring-gear (21) and the flange (23) at the same time allowing (Fig. 23, Fig. 24) offsetting and the possibility of inclination or misalignment of the ring-gear (21) with respect to the flange (23) in a range at least from 2 degrees to +2 degrees, even more preferably in a range at least from -4 degrees to +4 degrees.

The solution provides (Fig. 16, Fig. 17, Fig. 18, Fig. 19, Fig. 20, Fig. 21, Fig. 22) the use of a series of teeth (49) arranged circumferentially and inserted in an articulation (50) of the spherical type which in its turn is kept compressed on the ring-gear (21) by means of elastic means, preferably in the form of coned disk springs.

Each of the misalignment coupling means (47) is therefore made up of a tooth (49) which by means of an insert (48) is inserted within an articulation (50) which is inserted within an indentation (53) of the flange (23) by means of elastic means (51) in the form of coned disk springs.

The tooth (49) is coupled with the ring-gear (21) within a seat (52) obtained on the ring-gear (21) itself.

The result of this solution is that the ring-gear (21) transmits the rotational force to the flange (23) by means of the various teeth (49) of the misalignment coupling means (47) and simultaneously the relative misalignment motion is allowed between the ring-gear (21) and the flange (23) and simultaneously the torque transmission is allowed between the ring-gear (21) and the flange (23) also in conditions (Fig. 23, Fig. 24) of reciprocal misalignment.

The elastic means (51), preferably in the form of coned disks, serve both as preloading for reducing possible undesired movements during the motion of the concrete mixer vehicle and because the tooth (49) must be able to follow the movements of the ring-gear (21) going inwards and outwards following always the profile of the ring gear while the tilting flange is moving.

Furthermore in the solution shown (Fig. 10) there is a gear coupling (38") between the planetary-gear support of the third stage (17) and the ring-gear (21) or element transmitting the rotational motion to the fixing flange (23) of the drum (3) and which is part of the power stage (15, 16, 17, 21). The coupling gear (38") comprises recesses (37") obtained on the ring-gear (21) within which protrusions (36") are inserted of the planetary-gear of the third stage (16) thus realizing a reciprocal coupling gear.

Thanks to the presence of the coupling means (47) shown the flange (23) is completely floating with respect to the other components of the drive so that the flange (23) has three degrees of freedom, not being constrained in any other point to the elements of the drive itself if not by means of the described couplings (47, 38").

Preferably (Fig. 14, Fig. 15, Fig. 18) an end-stop element (39) is also provided which is obtained in correspondence of a central body (24) of the drive (1). The end-stop element (39) limits the misalignment of the flange (23) with respect to the components of the power stage (15, 16, 17, 21) in correspondence of a maximum misalignment position.

Advantageously, in the solution according to the present invention, at least the power stage (15, 16, 17, 21) is located at the opposite side of the first reduction stage (9, 10, 11) with respect to the longitudinal position of the fixing flange (23) of the drum (3), the power stage (15, 16, 17, 21) being placed internally to the drum (3) within a chamber (26) obtained at the head of the drum (3), namely in correspondence of the side of the drum (3) which is the opposite side with respect to the side on which there is the intake for the introduction and the taking-out of the content of the drum (3).

It will be apparent that while on the preferred embodiment of the present invention only the power stage (15, 16, 17, 21) is placed internally to the chamber (26) of the drum (3), in alternative solutions (not represented), also an additional stage of the drive can be provided to be housed inside the same chamber (26).

Advantageously, in the drive (1) for the drum (3) of a concrete mixer vehicle (8) according to the present invention, the coupling between the power stage (15, 16, 17, 21) and the fixing flange (23) of the drum (3) occurs by means of the misalignment coupling means (47) between the axis (34) of the drive (1) and the axis (35) of the drum (3), such misalignment involving the misalignment of the flange (23) with respect to the components of the power stage (15, 16, 17, 21), the power stage (15, 16, 17, 21) transmitting the rotational motion to the flange (23) in a reciprocal misalignment condition of one with respect to the other one in absence of misalignment conditions between the first reduction stage (9, 10, 11) and the power stage (15, 16, 17, 21). The misalignment between the axis (34) of said drive (1) and the axis (35) of said drum (3) is allowed in a bi-directional way, the misalignment being allowed to occur in both directions, with deviation angles (33) between the axis (34) of the drive (1) and the axis (35) of the drum (3) preferably included in a range at least from – 2 degrees to + 2 degrees, even more preferably in a range at least from - 4 degrees to + 4 degrees.

The radially internal rolling surface (45) is (Fig. 4, Fig. 10) an essentially ring shaped circular surface. The average diameter (D1) of the ring shaped configuration is distant by a distance (D3) from a development diameter (D2) along which said coupling means (47) develop one after the other forming said series of elements arranged in said circumferential way. The distance (D3) is defined (Fig. 10) with respect to the longitudinal development of the drive (1). The distance (D3) is between 0 e 30 mm, the distance (D3) preferably being 0 mm.

In this way, since the distance (D3) is advantageously kept as small as possible, various problems of prior art solutions are prevented as for example the generation of undesiderable axial forces. Moreover in this way the drive (1) is able to transmit a greater torque with respect to prior art solutions.

Advantageously, the solution according to the present invention allows to obtain an effective releasing of the portion of the weight of the drum of the concrete mixer which weights down on the drive, at the same time allowing a decreasing of the gear itself keeping its reliability unchanged. Indeed, in the solution according to the present invention, the function relative to the transmission of the motion from the motor to the drum and the function relative to the release of the weight of the drum of the concrete mixer and its content are reciprocally free. This allows to obtain a drive having reduced weight and size with all the advantages coming from a reduced price, greater reliability and saving of space.

Although in the figures explicit reference is made to a concrete mixer of the movable type on a vehicle, that is of the type which is commonly known as a concrete mixer vehicle, it will be apparent that the present invention can be applied to generic concrete mixers and, therefore, to concrete mixers of the fixed or semi-fixed type. Therefore, by means of the term cement mixer it is meant to include all the types of concrete mixers and in particular concrete mixer vehicles, without excluding of fixed or semi-fixed concrete mixers.

The description of the present invention has been made with reference to enclosed figures in a preferred form of execution of the same, but it is evident that many possible alterations, changes and variants will be immediately clear to those skilled in the art of the sector in view of the previous description. So, it should be stressed that the invention is not limited by the previous description, but contains all alterations, changes and variants in accordance with the appended claims.

Used nomenclature

With reference to the identification numbers reported in the enclosed figures, the following nomenclature was used:

1. Drive
2. Hydraulic motor
3. Drum
4. Tractor motor
5. Support
6. Tractor
7. Frame
8. Concrete mixer vehicle
9. Pinion of the first stage
10. Planetary-gear of the first stage
11. Planetary-gear support of the first stage
12. Pinion of the second stage
13. Planetary-gear of the second stage
14. Planetary-gear support of the second stage
15. Pinion of the third stage
16. Planetary-gear of the third stage
17. Planetary-gear support of the third stage
18. Cover
19. Box
20. Shell guard
21. Ring-gear
22. Joint
23. Fixing flange or flange for the final transmission of the motion

24. Central body

25. Fastening means

26. Chamber

27. Third bearings

28. Fourth bearings

29. Fifth bearings

30. First bearings

31. Second bearing

32. Shaft

33. Deviation angle

34. Drive axis

35. Drum axis

36’. Guiding element

37’. Groove

38’. Grooved coupling

36”. Protrusion

37”. Recess

38”. Gear coupling

39. End-stop element

40. First sealing gasket

41. Second sealing gasket

42. First roller

43. Second roller

44. Cage

45. Rolling surface

46. Body of the fixed planetary gear-support of the power stage

47. Coupling means

48. Insert

49. Tooth
50. Articulation or articulated joint
51. Elastic means
52. Seat
53. Indentation

Claims

Drive (1) comprising a multistage epicyclic gear-reduction device which comprises at least two reduction stages of which:

- a first reduction stage (9, 10, 11) housed inside a box (19) of the drive;
- a power stage (15, 16, 17, 21),

said first reduction stage (9, 10, 11) comprising a power takeoff for the connection of a motor (2), said drive comprising a fixing flange (23) or flange for the final transmission of the motion at the exit of the drive (1) in which the coupling between said power stage (15, 16, 17, 21) and said fixing flange (23) occurs by means of coupling means (47) which are configured and structured so as to allow a misalignment between an axis (34) of said drive (1) and an axis (35) of said fixing flange (23) or flange for the final transmission of the motion at the exit, said misalignment involving the misalignment of said flange (23) with respect to the components of said power stage (15, 16, 17, 21), said power stage (15, 16, 17, 21) being configured and structured so as to transmitting the rotational motion to said flange (23) in said misalignment condition; characterised in that

said coupling means (47) are a series of elements arranged circumferentially, wherein each of said coupling means (47) is provided with a coupling interface between said ring-gear (21) and said flange (23) and wherein each coupling interface of each of said coupling means (47) is freely oscillating with respect to the other coupling interfaces of the others of said coupling means (47) of said series.

2. Drive (1) according to the previous claim characterised in that

said coupling means (47) are fixed on the flange (23), said coupling interface consisting of a tooth (49) protruding circumferentially externally with respect to said flange (23), each tooth (49) being inserted into a corresponding seat (52) obtained on said ring-gear (21) which is provided with a number of seats (52) at least corresponding to the number of said teeth (49).

3. Drive (1) according to the previous claim 1 characterised in that

said coupling means (47) are fixed on the ring-gear (21), said coupling interface consisting of a tooth (49) protruding circumferentially internally with respect to said ring-gear (21), each tooth (49) being inserted into a corresponding seat (52) obtained on said flange (23) which is provided with a number of seats (52) at least corresponding to the number of said teeth (49).

4. Drive (1) according to any of the previous claims characterised in that said coupling means (47) are provided with an articulation (50) of the spherical type which allows the oscillation of said coupling interface.

5. Drive (1) according to the previous claim and according to any of the previous claims 2 to 3 characterised in that said tooth (49) of said coupling means (47) comprises an insert (48) which is inserted within the articulation (50) of the spherical type, the insert (48) constituting an insertion foot of the tooth (49) within the articulation (50), said insertion foot being free to oscillate by means of the articulation (50) of the spherical type.

6. Drive (1) according to any of the previous claims characterised in that said coupling means (47) are provided with elastic means (51) in correspondence of a fixing interface of the coupling means (47) themselves.

7. Drive (1) according to the previous claim characterised in that the elastic means (51) of said coupling means (47) are made in the form of coned disk springs with preloading.

8. Drive (1) according to the previous claim characterised in that the provided coned disk springs of said coupling means (47) are configured and structured in such a way as to allow said coupling interface to perform an axial movement of extension or penetration with respect to an indentation (53) within which the coupling means (47) are fixed.

9. Drive (1) comprising a multistage epicyclic gear-reduction device which comprises at least two reduction stages of which:

- a first reduction stage (9, 10, 11) housed inside a box (19) of the drive;

- a power stage (15, 16, 17, 21),

said first reduction stage (9, 10, 11) comprising a power takeoff for the connection of a motor (2), said drive comprising a fixing flange (23) or flange for the final transmission of the motion at the exit of the drive (1) in which the coupling between said power stage (15, 16, 17, 21) and said fixing flange (23) occurs by means of coupling means (47) which are configured and structured so as to allow a misalignment between an axis (34) of said drive (1) and an axis (35) of said fixing flange (23) or flange for the final transmission of the motion at the exit, said misalignment involving the misalignment of said flange (23) with respect to the components of said power stage (15, 16, 17, 21), said power stage (15, 16, 17, 21) being configured and structured so as to transmitting the rotational motion to said flange (23) in said misalignment condition, characterised in that

said flange (23) is rotatively supported by at least one first bearing (30) radially internally with respect to a radial direction developing with respect to said axis (34) of said drive (1), said fixing flange (23) and said at least one first bearing (30) being reciprocally integrated according to a configuration and structure such that said fixing flange (23) includes a radially internal rolling surface (45) intended for the rolling of rollers (42, 43) of said at least one first bearing (30), said rollers (42, 43) being held in position:

- in correspondence of a first radially external side by said rolling surface (45) of said flange (23), radially external being referred with respect to a radial direction developing with respect to said axis (34) of said drive (1);
- in correspondence of a second radially internal side by a blocking cage (44) which is intended to be fixed on a first component of said components of said power stage (15, 16, 17) which is located radially internally with respect to said flange (23), radially internally being referred with respect to a radial direction developing with respect to said axis (34) of said drive (1);

said at least one first bearing being concentric with respect to said flange (23) and being placed within a centre hole of said flange which is a centre hole intended to house inside of it at least a first part of said power stage (15, 16, 17) comprising said first component of said components of said power stage (15, 16, 17) which is located radially internally with respect to said flange (23) and which supports said at least one first bearing (30).

10. Drive (1) according to the previous claim characterised in that said coupling means (47) are configured and structured according to any of the previous claims 1 to 8.

11. Drive (1) according to any of the previous claims 9 to 10 characterised in that said radially internal rolling surface (45) is an essentially ring shaped circular surface in which an average diameter (D1) of said ring shaped configuration is distant by a distance (D3), with respect to the longitudinal development of the drive (1), from a development diameter (D2) along which said coupling means (47) develop one after the other forming said series of elements arranged in said circumferential way.

12. Drive (1) according to the previous claim characterised in that the distance (D3) is between 0 e 30 mm, the distance (D3) preferably being 0 mm.

13. Drive (1) according to any of the previous claims characterised in that said power stage (15, 16, 17, 21) is made according to a configuration with fixed planetary gear-support and a ring-gear (21) transmitting the rotational motion from said power stage (15, 16, 17, 21) to said fixing flange (23), in which said fixing flange (23) is a floating fixing flange (23) with three degrees of freedom.

14. Drive (1) according to the previous claim characterised in that said flange (23) is internally radially supported by a body (46) of said fixed planetary gear-support of said power stage (15, 16, 17, 21), said body (46) of said fixed planetary gear-support of said power stage (15, 16, 17, 21) being placed in a position at least partially interspersed between said flange (23) and a central body (24) of said drive which is integral with or fixed to said box (19) of the drive (1) in which said central body (24) develops from said box (19) developing in a direction directed towards said power stage (15, 16, 17, 21) and it is inserted radially internally with respect of said fixed

planetary gear-support.

15. Drive (1) according to any of the previous claims characterised in that

it is the drive (1) of a drum (3) of a concrete mixer vehicle (8), said box (19) of the drive comprising fastening means (25) to the frame (7) of said concrete mixer vehicle (8), said flange (23) constituting a fixing interface between the drive (1) and said drum (3), said coupling means (47) being configured and structured so as to allow a misalignment between said axis (34) of said drive (1) and said axis (35) of said fixing flange (23) or flange for the final transmission of the motion at the exit which coincides with the axis of said drum (3).

16. Drive (1) according to the previous claim characterised in that

at least said power stage (15, 16, 17, 21) is located at the opposite side of said first reduction stage (9, 10, 11) with respect to the longitudinal position of said fixing flange (23) of said drum (3), said power stage (15, 16, 17, 21) being placed internally to the drum (3) within a chamber (26) obtained at the head of said drum (3), namely in correspondence of the side of said drum (3) which is the opposite side with respect to the side on which there is the intake for the introduction and the taking-out of the content of said drum (3).

17. Drive (1) according to any of the previous claims characterised in that

said misalignment between the axis (34) of said drive (1) and the axis (35) of said flange (23) is allowed in a bi-directional way, said misalignment being allowed to occur in both directions, with deviation angles (33) between the axis (34) of the drive (1) and the axis (35) preferably included in a range at least from – 2 degrees to + 2 degrees, even more preferably in a range at least from - 4 degrees to + 4 degrees.

18. Drive (1) according to any of the previous claims 9 to 17 characterised in that

said first bearings (30) are shaped to allow said misalignment between the axis (34) of the drive (1) and the axis (35) of the drum (3) by means of a sliding movement with inclination of the base of said flange (23) with respect to said body (46) of said fixed planetary gear-support .

19. Drive (1) according to the previous claim characterised in that
said first bearings (30) are bearings provided with said rolling rollers constituting two crowns of rolling bodies comprising first rollers (42) and second rollers (43) which are placed according to a reciprocally inclined condition the one with respect to the other within said blocking cage (44).

20. Drive (1) according to any of the previous claims 9 to 19 characterised in that
said rolling surface (45) obtained and integrated in correspondence of said flange (23) is treated to confer to said rolling surface (45) a greater wear resistance, said rolling surface (45) being preferably treated by means of hardening surface treatments, even more preferably by means of hardening surface treatments in the form of induction hardening of the flange (23) in correspondence of said rolling surface (45).

21. Drive (1) according to any of the previous claims 14 to 20 characterised in that
it includes an end-stop element (39) obtained in correspondence of said central body (24) of said drive (1), said end-stop element (39) limiting said misalignment of said flange (23) with respect to the components of said power stage (15, 16, 17, 21) in correspondence of a maximum misalignment position.

22. Drive (1) according to any of the previous claims characterised in that
said motor (2) is fixed on said box (19) of the drive (1) in correspondence of a cover (18) which closes the inside of said box (19) containing said first stage (9, 10, 11) and containing a second stage (12, 13, 14) of said drive (1), the shaft (32) of said motor (2) coupling with said first stage which is supported on said cover (18) by means of a second bearing (31), said motor (2) transmitting the motion to corresponding planetary-gears (10) of said first stage which in turn transmit the motion to a planetary gear-support (11) of said first stage by means of sliding on third bearings (27), said planetary gear-support (11) of said first stage in turn transmitting the motion to a pinion (12) of said second stage, said pinion (12) of said second stage coupling with corresponding planetary-gears (13) of said second stage which in turn transmit the motion to a planetary gear-support (14) of said second stage by means of sliding on

fourth bearings (28), said planetary gear-support (14) of said second stage in turn transmitting the motion to a pinion (15) of a third stage, said pinion (15) of said third stage coupling with corresponding planetary-gears (16) of said third stage which are supported by a planetary gear-support (17) of said third stage, said planetary-gears (16) of the third stage in turn transmit the motion to said rim (21) by means of sliding on fifth bearings (29).

23. Drive (1) according to the previous claim characterised in that said pinion (15) of said third stage rotates within a passing-through housing situated within said central body (24), said central body (24) being interspersed between said pinion (15) of said third stage and said fixed planetary gear-support of said power stage (15, 16, 17, 21).

24. Drive (1) according to any of the previous claims 22 to 23 characterised in that it comprises a gear coupling (38") between the planetary-gear support of the third stage (17) and the ring-gear (21), said gear coupling (38") comprising recesses (37") obtained on the ring-gear (21) within which protrusions (36") are inserted of the planetary-gear of the third stage (16) thus realizing a reciprocal coupling gear.

25. Drive (1) according to claim 14 and according to any of the previous claims 22 to 24 characterised in that

said planetary gear-support (17) of said third stage constitutes said fixed planetary gear-support of said power stage power (15, 16, 17, 21).

26. Drive (1) according to any of the previous claims 22 to 25 characterised in that said shaft (32) of said motor (2) is configured and structured as pinion (9) of said first stage, said shaft (32) of said motor in the form of pinion (9) of said first stage directly coupling with said planetary-gears (10) of said first stage.

27. Drive (1) according to any of the previous claims characterised in that said motor (2) is a hydraulic motor, preferably a hydraulic motor with axial pistons.

28. Concrete mixer vehicle (8) comprising a mixing drum (3) characterised in that

it includes a drive (1) for drum (3) of concrete mixer vehicle (8) according to any of the previous claims.

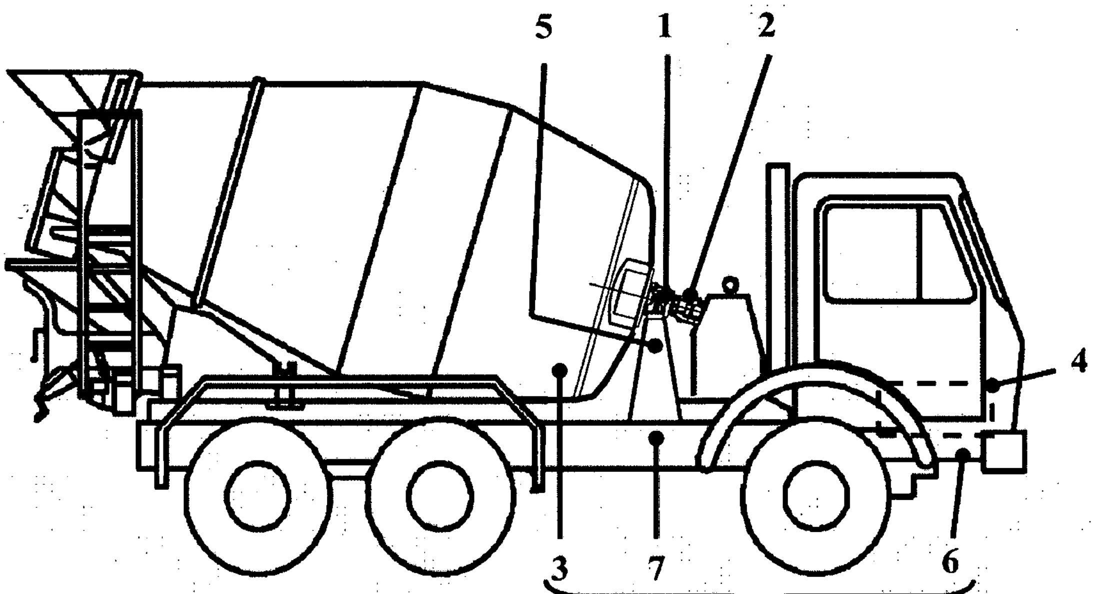


Fig. 1

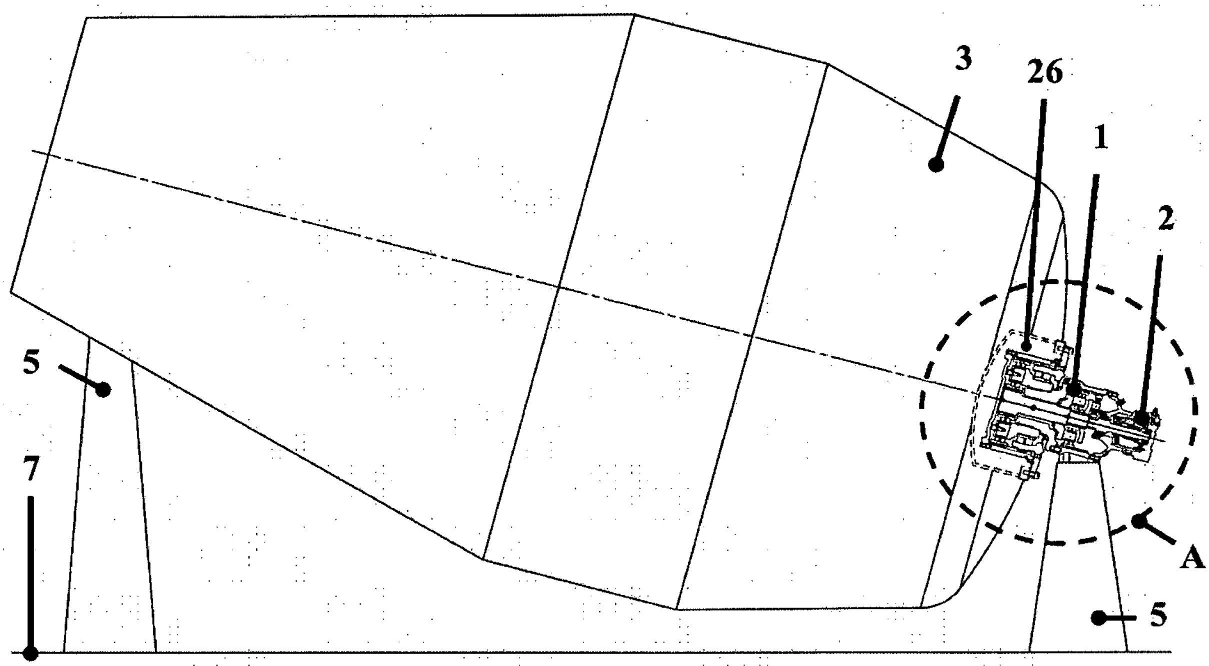


Fig. 2

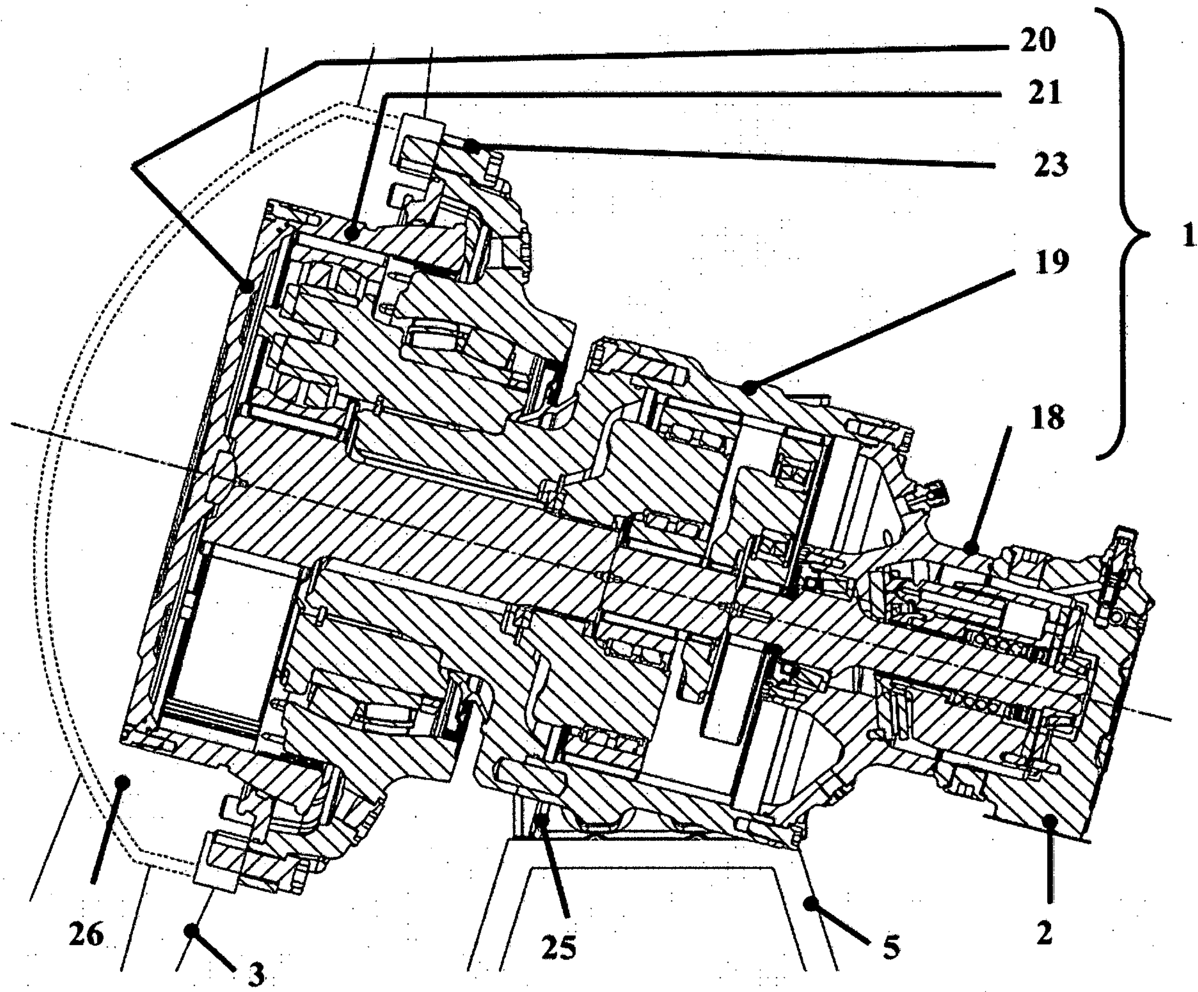


Fig. 3

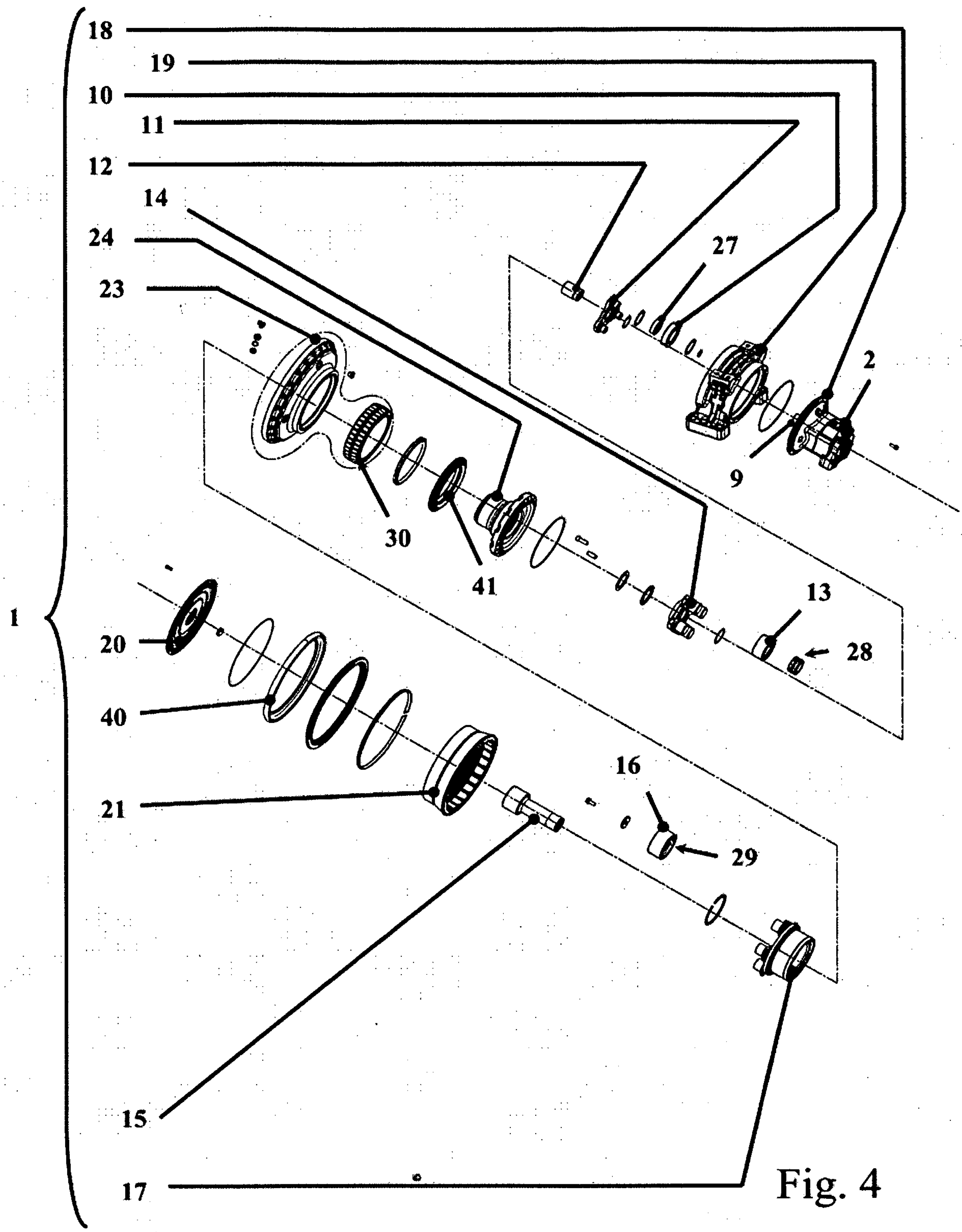


Fig. 4

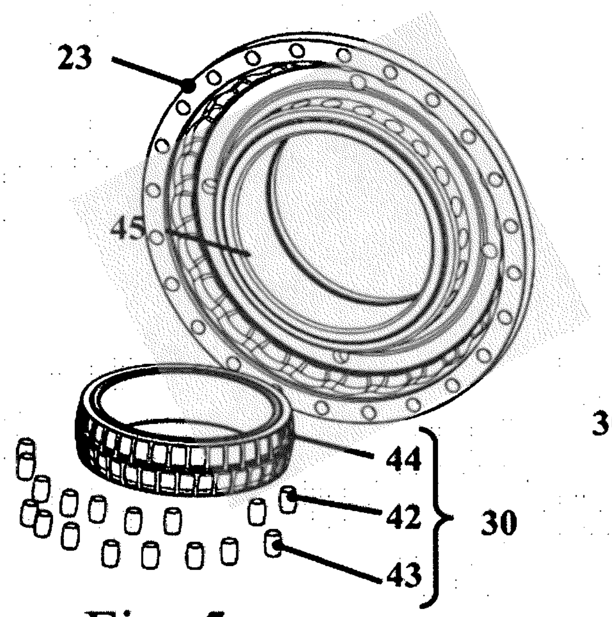


Fig. 5

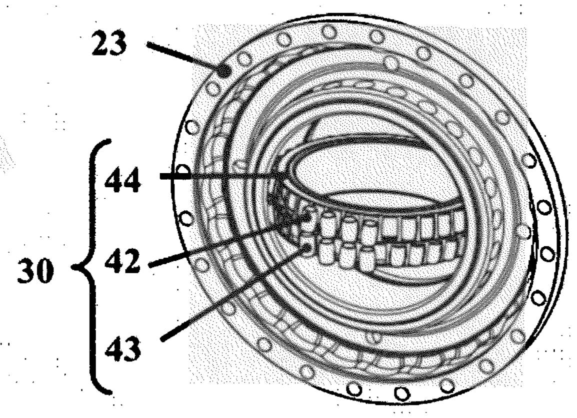


Fig. 6

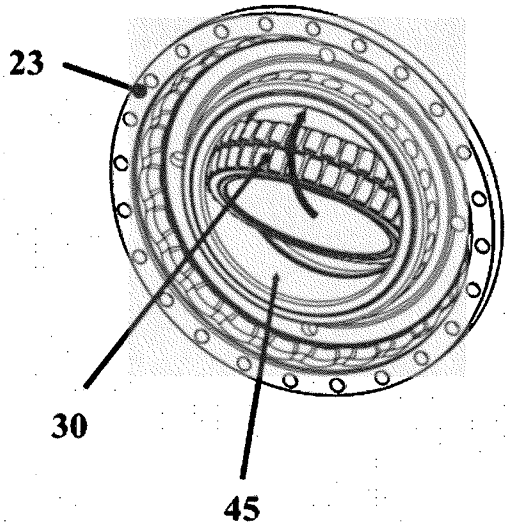


Fig. 7

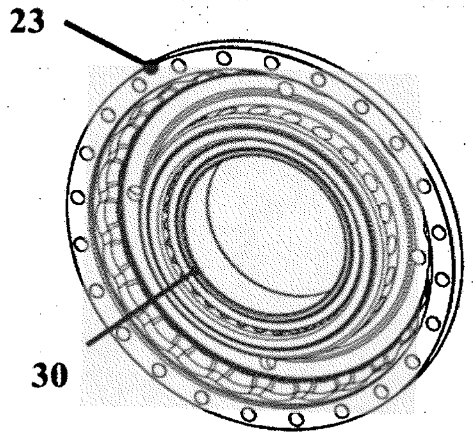
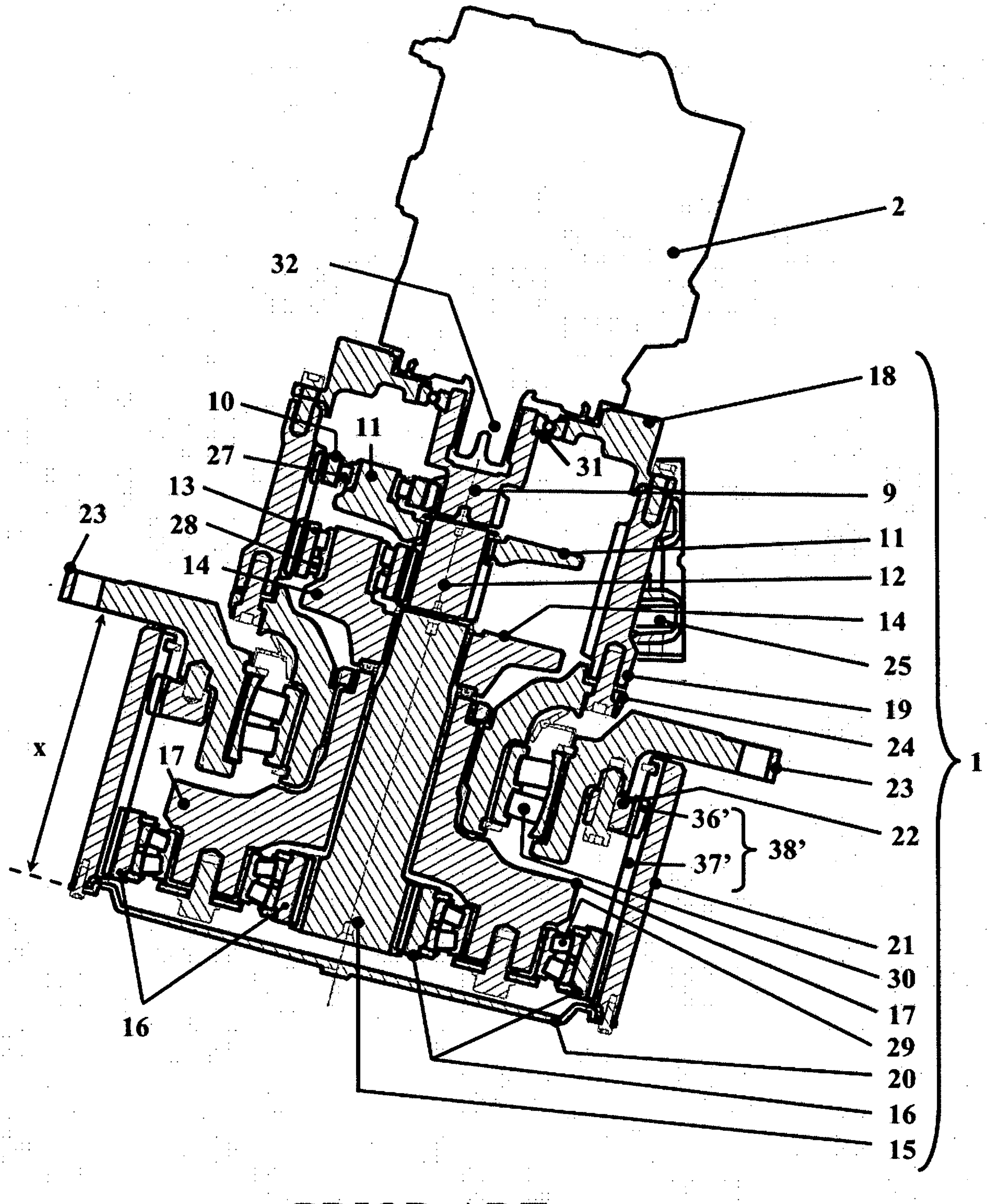


Fig. 8



PRIOR ART

Fig. 9

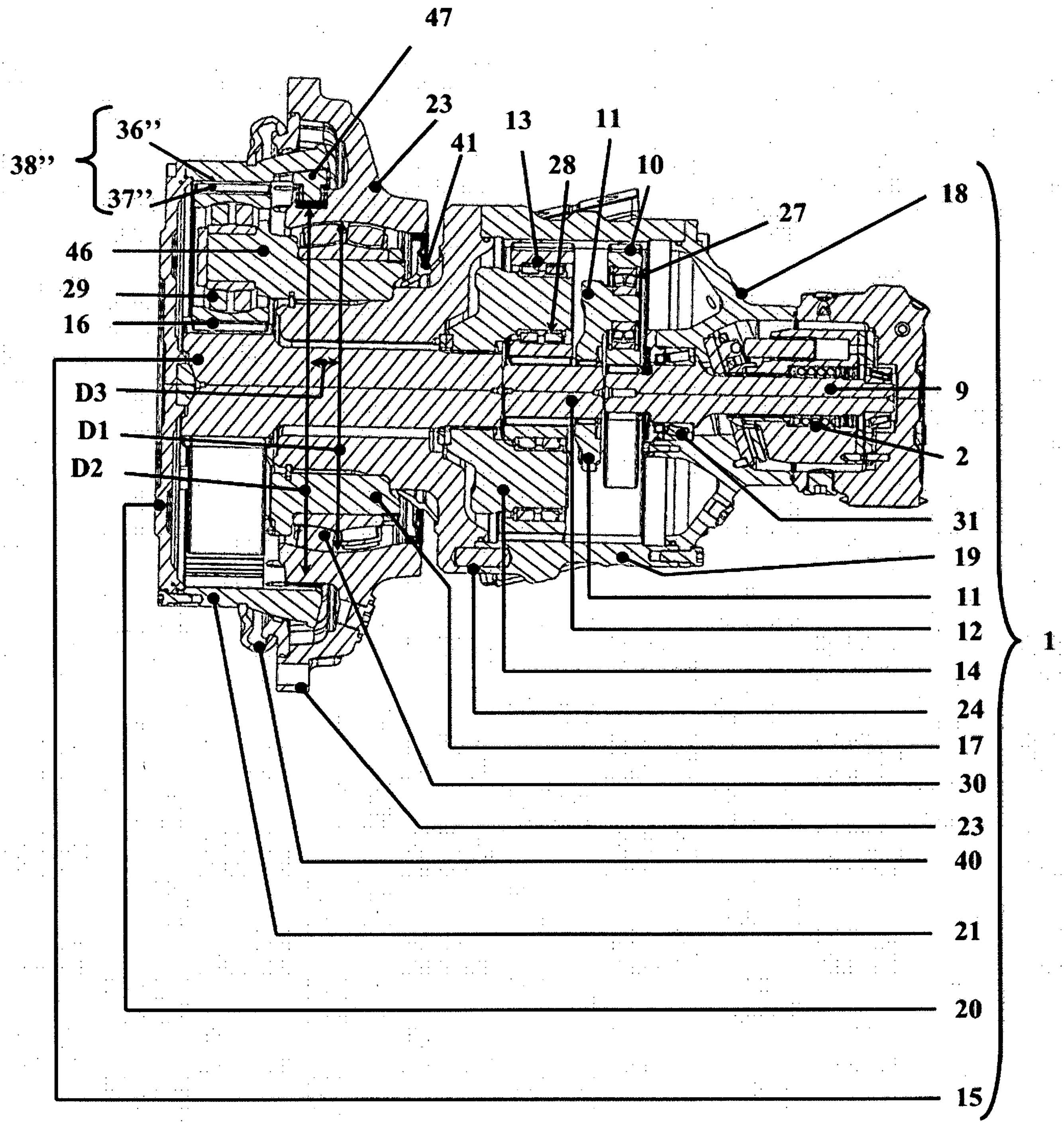

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Fig. 10

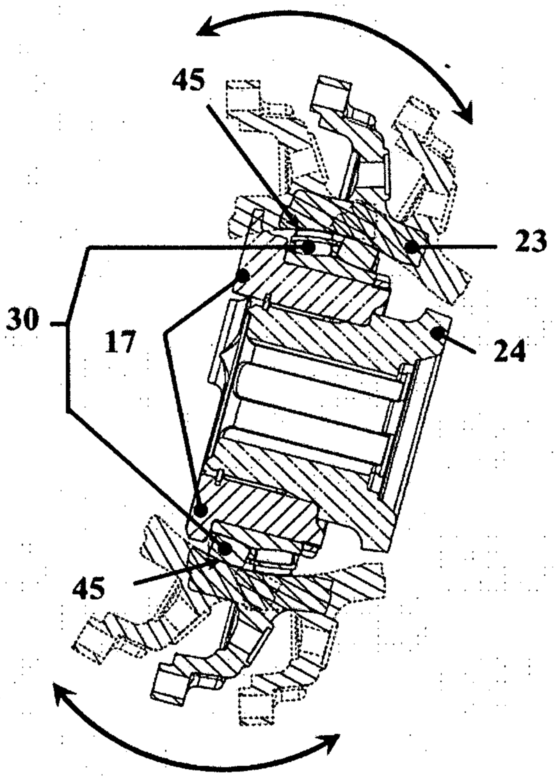

Fig. 11

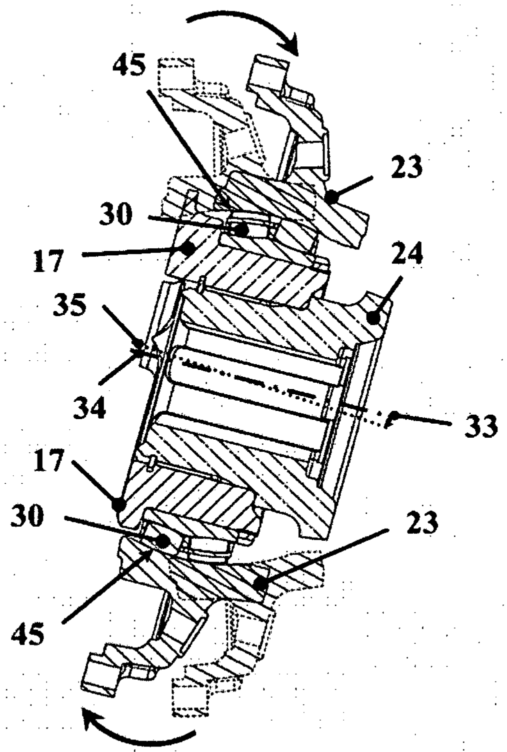

Fig. 12

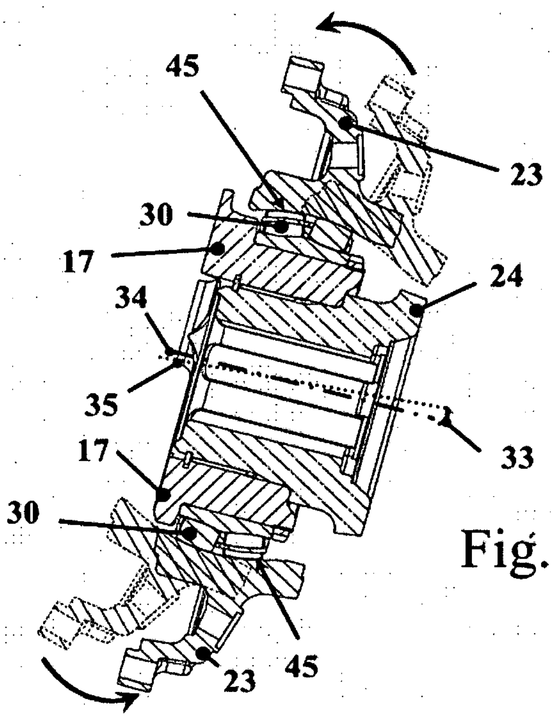

Fig. 13

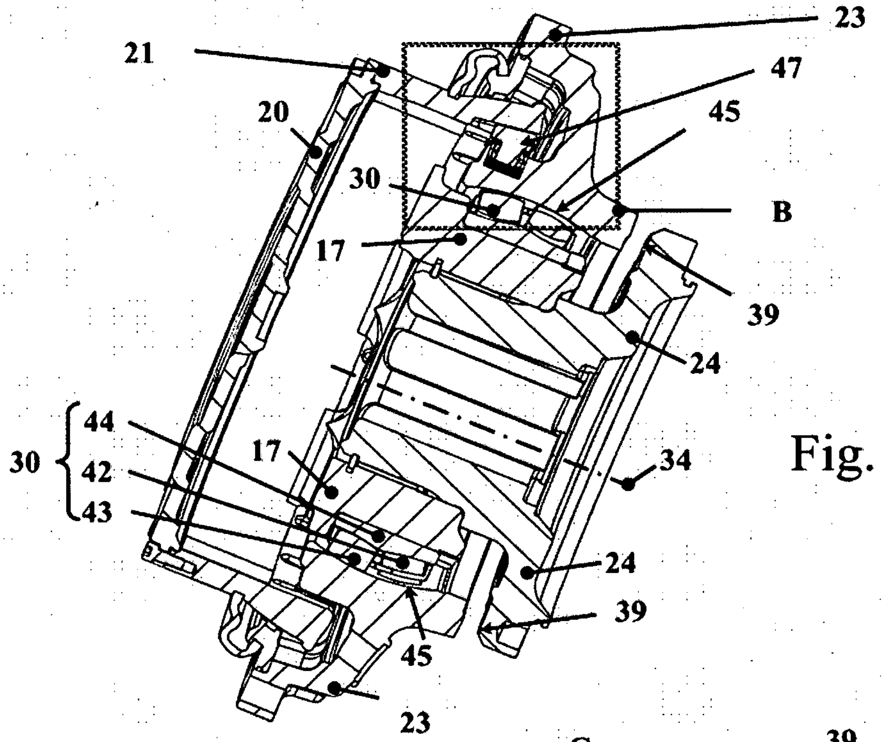
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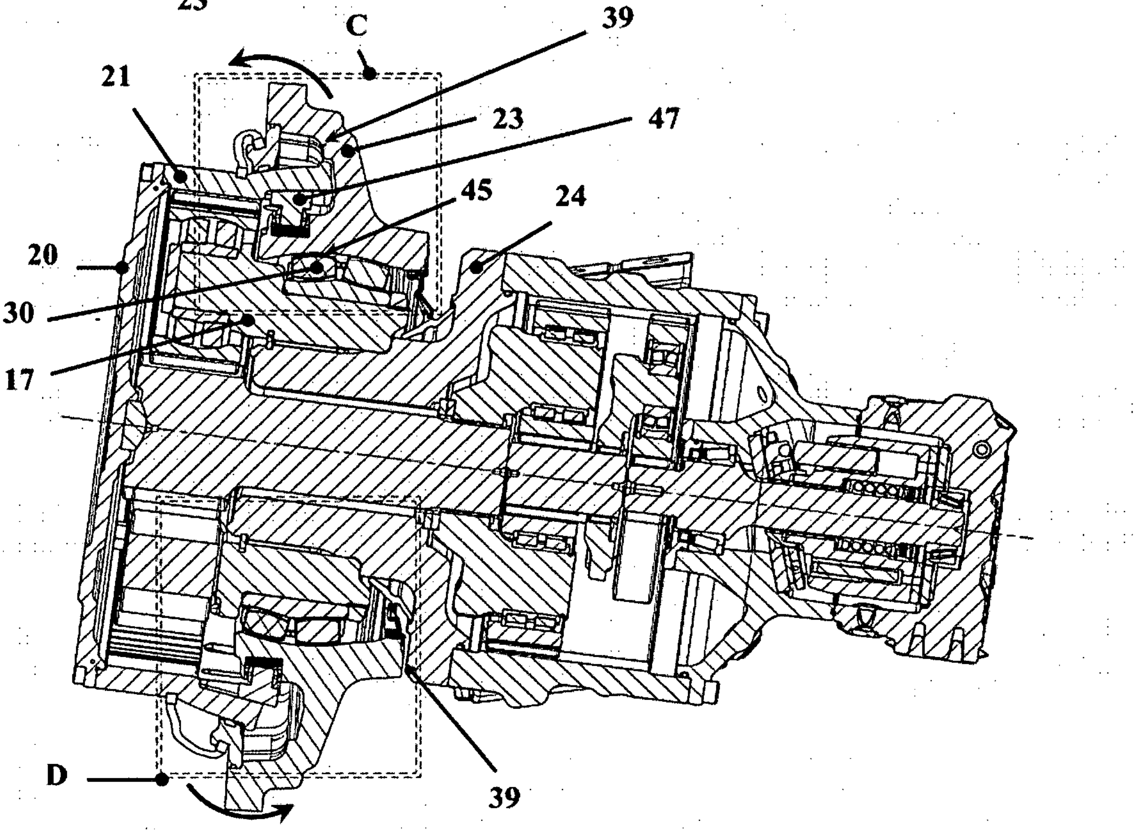
Fig. 14


C
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D
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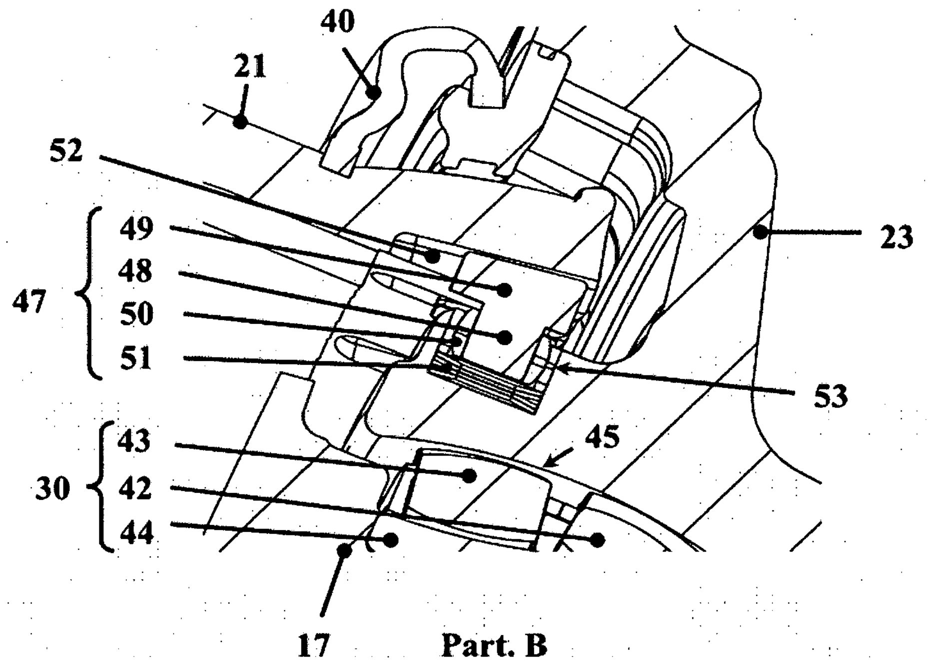
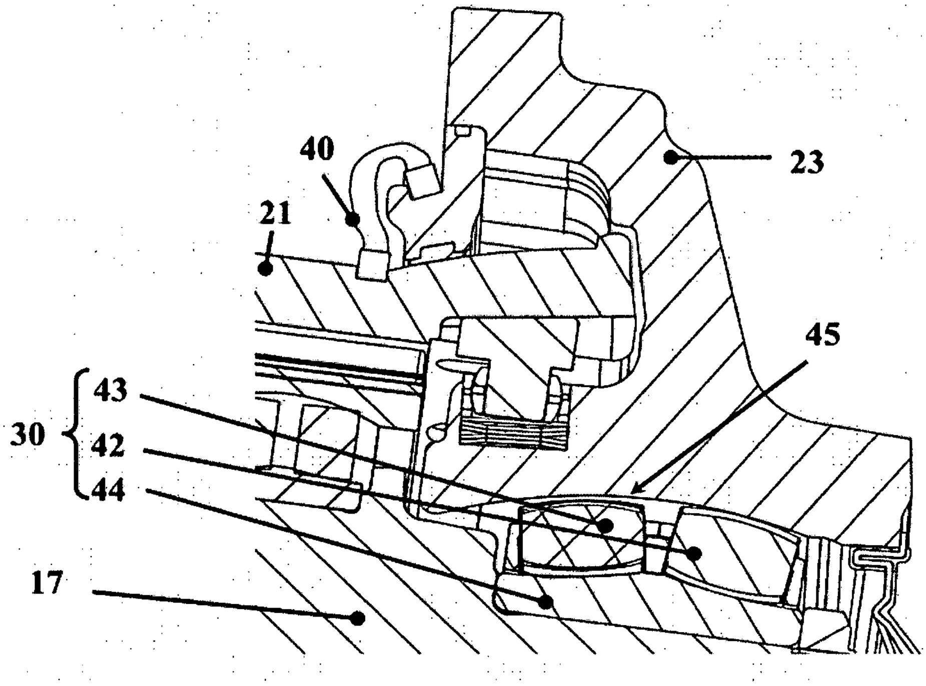
Fig. 15



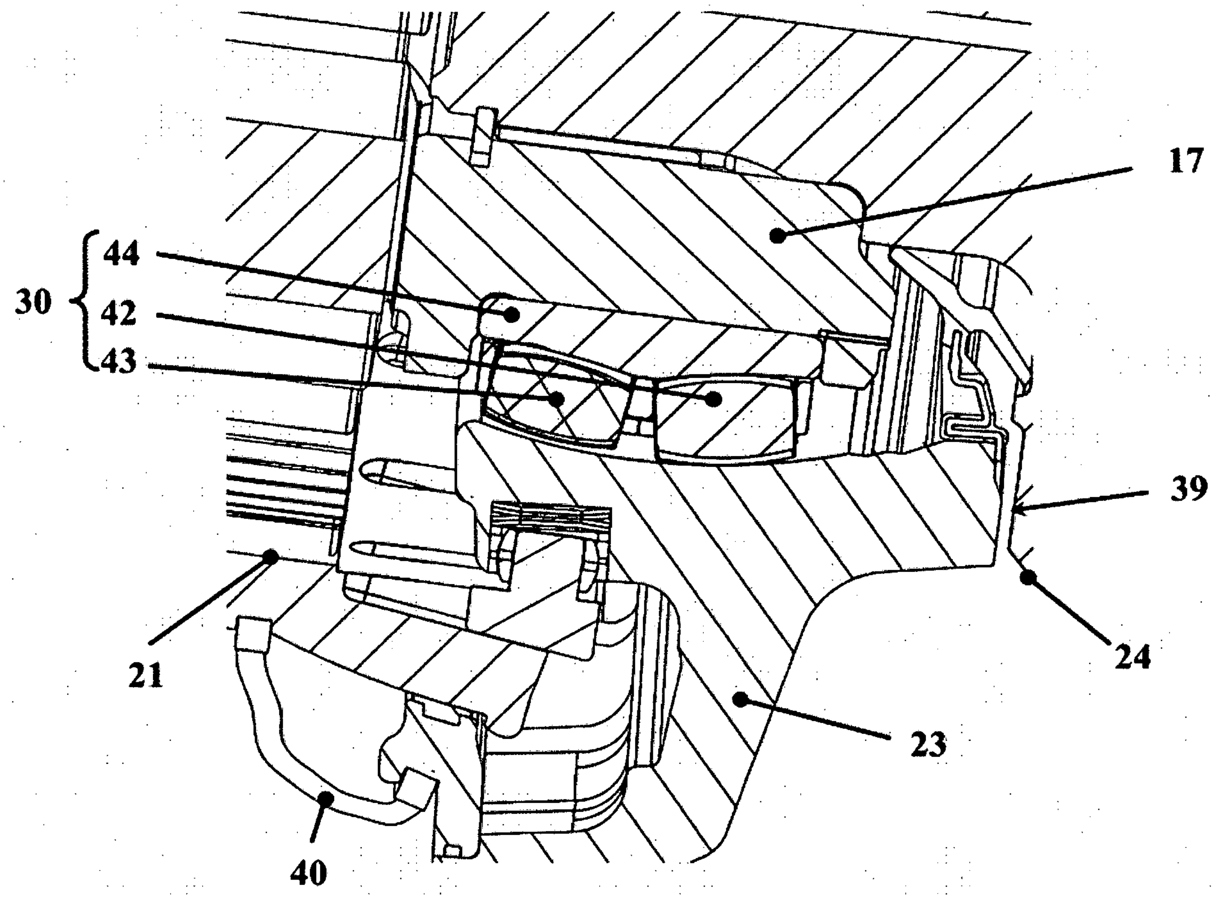
Part. B

Fig. 16



Part. C

Fig. 17



Part. D

Fig. 18

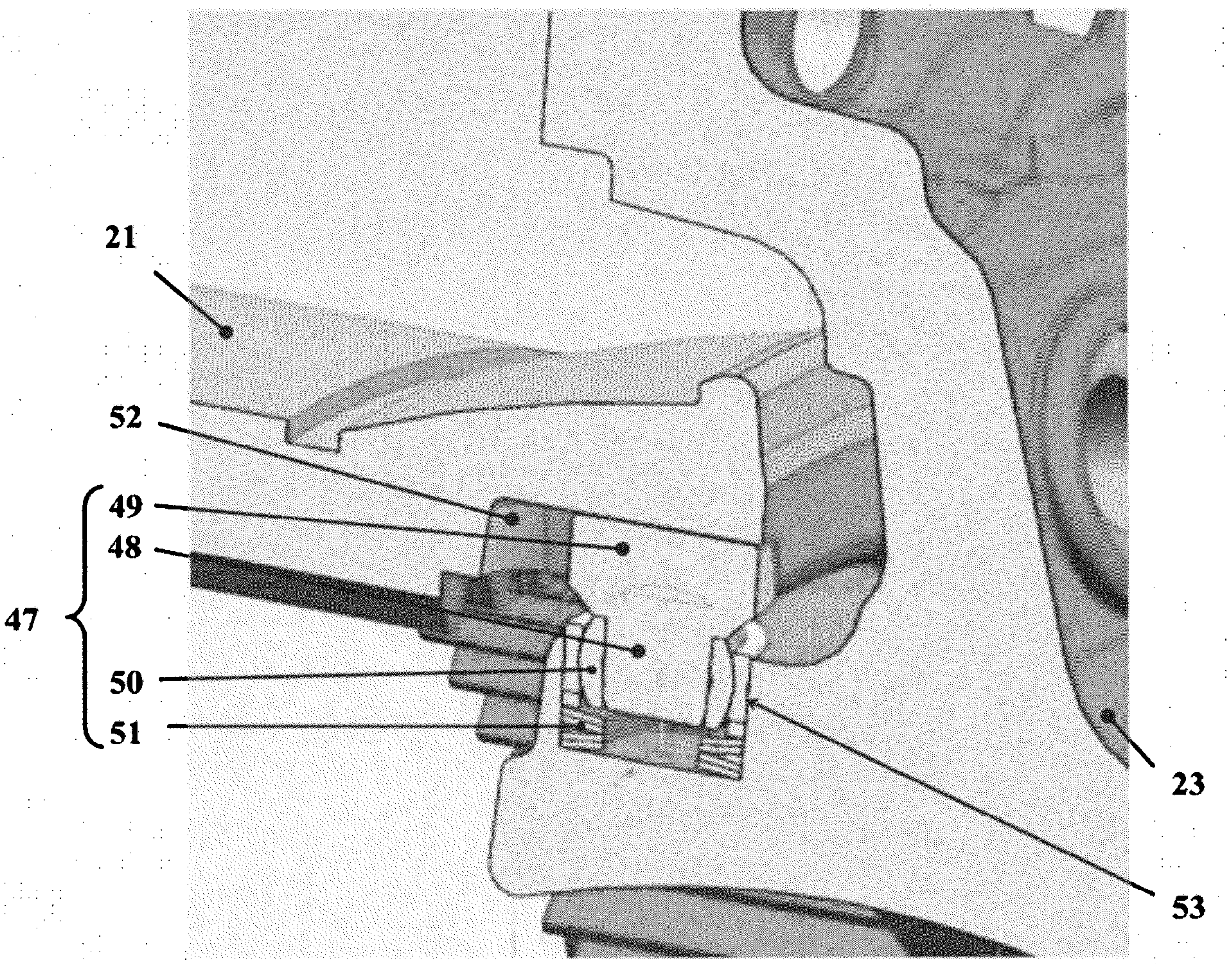


Fig. 19

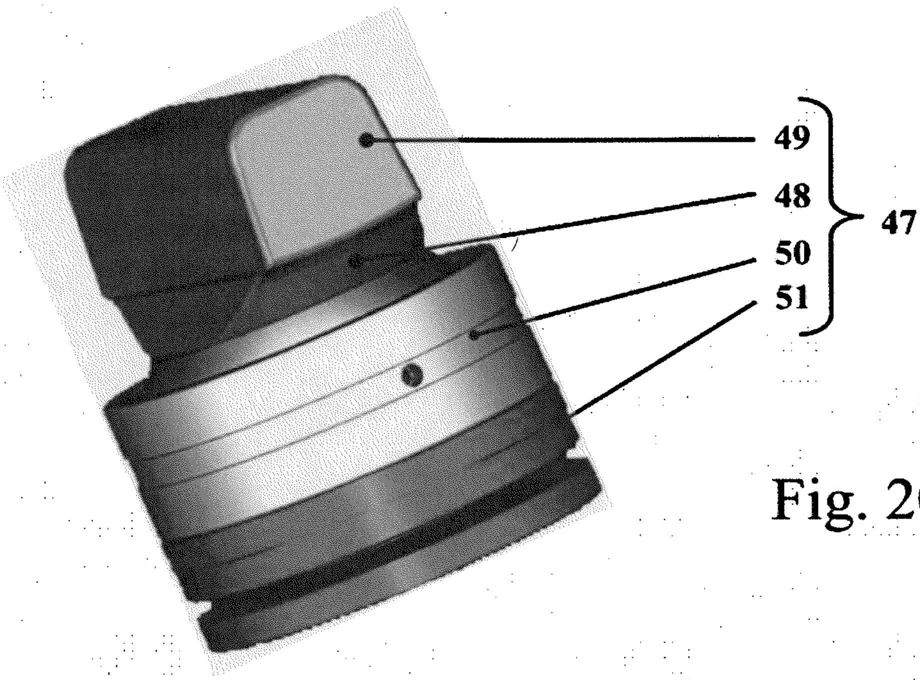


Fig. 20

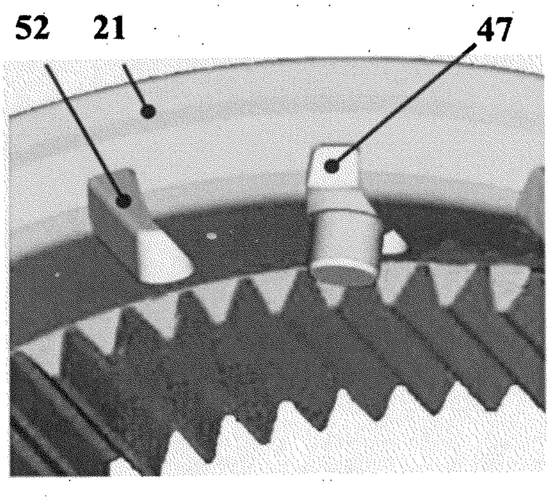


Fig. 21

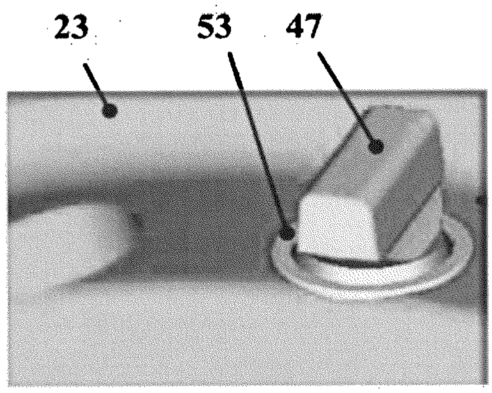


Fig. 22

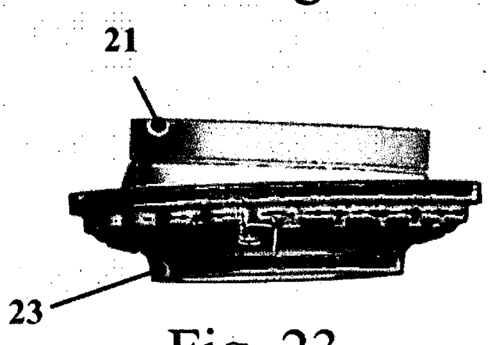


Fig. 23

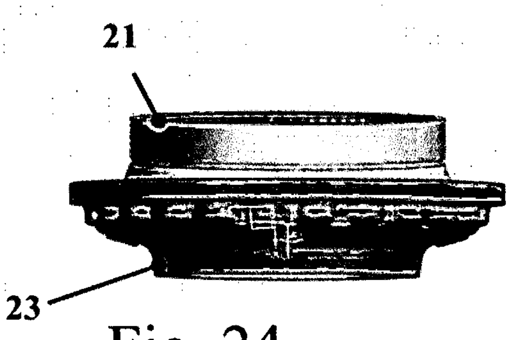


Fig. 24

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/001563

A. CLASSIFICATION OF SUBJECT MATTER
INV. B28C5/42 F16C35/067 F16H1/46 F16C23/08 F16C33/58
F16D3/56 F16D3/20
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B28C F16C F16H F16D B21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2008/291772 A1 (MOLLHAGEN KLAUS-PETER [DE]) 27 November 2008 (2008-11-27) paragraphs [0030], [0031]; figures 1,2	1-28
X	WO 2013/045070 A1 (PMP PRO MEC S P A [IT]; POZZO LUIGINO [IT]) 4 April 2013 (2013-04-04) cited in the application the whole document	1-28
A	US 3 393 584 A (HERBERT CLEFF PETER) 23 July 1968 (1968-07-23) figures	1-8
A	US 2009/180722 A1 (DOUGHERTY JOHN D [US] ET AL) 16 July 2009 (2009-07-16) paragraphs [0021], [0024]; figures 1,2	9
	-/--	

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 October 2015	02/11/2015

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Meritano, Luciano

1

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2015/001563

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