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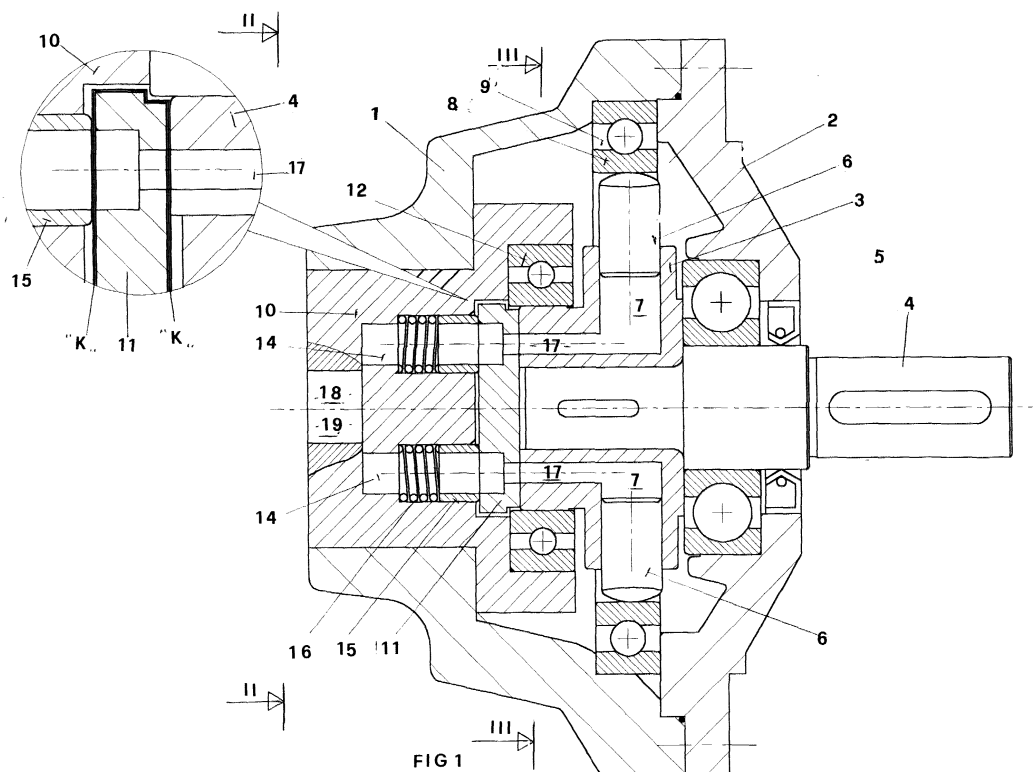
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(54) Radial piston hydraulic motor/pump

(57) Deals with a radial piston hydraulic motor/pump, where the alternating linear motion of the pistons takes place on a plane perpendicular to the shaft of the pump; such a dual-function machine (motor/pump) consists of a rotor containing a star of cylinders, a flow distributor and a reaction ring or stator, on which rest the

upper ends of the pistons which slide inside the cylinders mentioned above. The finding is characterised in that its fixed distributor plate is in hydrodynamic equilibrium, or hydrobalanced, being completely washed, under functioning conditions, with a film of pressurised fluid.



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Description

[0001] The finding regards a radial piston pump/motor, according to the introducing part of claim 1.

[0002] In the oleodynamic sector there is a vast range of dual-function machines, that is which offer the possibility of working as a motor or as a pump.

[0003] At the present state of the art such types of machine are subdivided into three distinct categories: those using vanes with an orbital rotor, those with axial pistons and those with radial pistons.

[0004] In detail, a radial piston hydraulic motor/pump, where the alternating linear motion of the pistons takes place on a plane perpendicular to the pump shaft, basically consists of a rotor containing a star of cylinders which is rotated by the motor shaft, a flow distributor which is fixed and coaxial to the rotor and a reaction ring (or stator), which is outside of the rotor and eccentric to it, upon which sit the ends of the pistons which slide inside the aforementioned cylinders.

[0005] The contact between the end of the piston and the stator is assured by the pushing of the pressurised liquid which fills the corresponding chamber of each cylinder.

[0006] Usually, the end of the star of cylinders leaning onto the stator is achieved by making the stator act as a rolling-contact bearing with the fixed external ring and the internal ring, onto which the ends of the pistons sit, which is rotated by these, thus reducing sliding to only compensatory movements, with a substantial reduction in wear.

[0007] The purpose of the present finding is to realise a dual-function hydraulic motor-pump of the type using radial pistons and with a rotating piston holder, which has a particularly simplified constructive form and which is able to provide a level of performance which can currently be obtained only with machines which use axial pistons, in such a way as to be highly innovative with respect to other similar machines of the known type, particularly in the operation as a motor.

[0008] This can be obtained, basically, through a hydraulic motor-pump where the fixed distributor plate is in hydrodynamic equilibrium (hydrobalanced), being completely washed, under functioning conditions, by a film of the pressurised fluid which, advantageously eliminates the friction between the respective moving parts.

[0009] Moreover, the grip between the distributor plate and the rotor is achieved through a thrust generated by small hollow pistons, equipped with a balancing coil, both contained in a seat formed on the distributor's body, connected firmly to the chassis of the machine.

[0010] The finding will now be described, in one of its particular embodiments, shown only as an illustrative and not limiting example, by means of the attached drawings, wherein:

- fig. 1 (Table I) shows the axial lengthways section of the machine according to the finding;

- figs. 2 and 3 (Table II) show, respectively, the frontal view of the machine according to direction II and the cross-section according to the line III-III of the machine according to fig. 1;

- fig. 4 (Table III) shows the exploded view in partial axial section of the machine according to fig. 1;

- figs. 5 and 6 show the frontal view according to direction V and direction VI, respectively, of the distributor plate according to fig. 4;

- figs. 7, 8 and 9 (Table IV) show the frontal view of the distributor body according to direction VII, the axial lengthways section according to line VIII-VIII of fig. 7 and the cross-section according to line IX-IX of fig. 8, respectively.

[0011] As can be seen in fig. 1, the machine according to the finding is basically made up of two coverings 1 and 2, forming the chassis, in the inner space between which is housed the rotor 3, fitted on the shaft 4, supported on one side by the bearing 5, whereas the radial pistons 6, sliding within the cylinders 7, formed on the aforementioned rotor, come into contact with the inner ring 8 of the bearing 9, mounted on the chassis eccentrically in respect to the axis of the rotor.

[0012] In the covering 1 is housed the element that characterises the machine, that is to say the distributor group, coaxial with the rotor, made up of a distributor body 10 integral with the chassis and the distributor plate 11.

[0013] On the distributor body 10 a further bearing 12, which assures the continued rotation of the whole rotating system is inserted.

[0014] On the distributor body 10 are fitted, inside the seats 13 formed on the pipes 14, four small hollow pistons 15 equipped with a balancing coil 16, which keep the distributor plate 11 in hydrodynamic equilibrium, as well as gripped to the upper wall of the rotor 3, equipped with pipes 17 (see fig. 3), connected on one side to the external pipe 18 and on the other side to the external pipe 19 (see fig. 2), respectively.

[0015] Depending on whether the machine operates as a pump or a motor the pipes 18 and 19 can be connected, where the machine operates as a pump, to the fluid tank and the feed pipe, respectively, whereas, where the machine operates as a motor, they are connected to the pressurised fluid and to the exhaust pipe respectively.

[0016] In the first case, while half of the pistons 6, positioned along the arc from "E" to "F" (see fig. 3) in the direction of the arrow "A" compress the fluid pushing it into the external feed pipe 18, the other half of the pistons 6 positioned from "F" to "E" expands, under the effects of centrifugal force, taking in the fluid through the external pipe 19.

[0017] In the second case, in which the machine op-

erates as a motor, the pressurised fluid acts, through the external pipe 19, upon the pistons 6, along the arc from "F" to "E", to be thus discharged in to the tank, through the external pipe 18, by the same pistons along the arc from "E" to "F".

[0018] The hydrodynamic equilibrium of the distributor plate 11, which constitutes the novelty of the finding, is due to the fact that it is completely covered with a film "K" of pressurised fluid, therefore it is self-balanced under all functioning conditions, which guarantees an optimal yield at all operating speeds.

[0019] Figs. 5-9 show the configuration of the two pipes 14 inside the distributor plate 11 (figs. 5, 6) and inside the distributor body 10 (figs. 7-9), respectively.

[0020] Obviously it is possible to have functional variations with respect to the illustrated machine, such as the use of two series of pistons, positioned on separate and sliding surfaces inside cylinders formed in a single rotating body, but where the operation is completely analogous to the one described with a single series of pistons, without as such going outside of the scope of the patent.

Claims

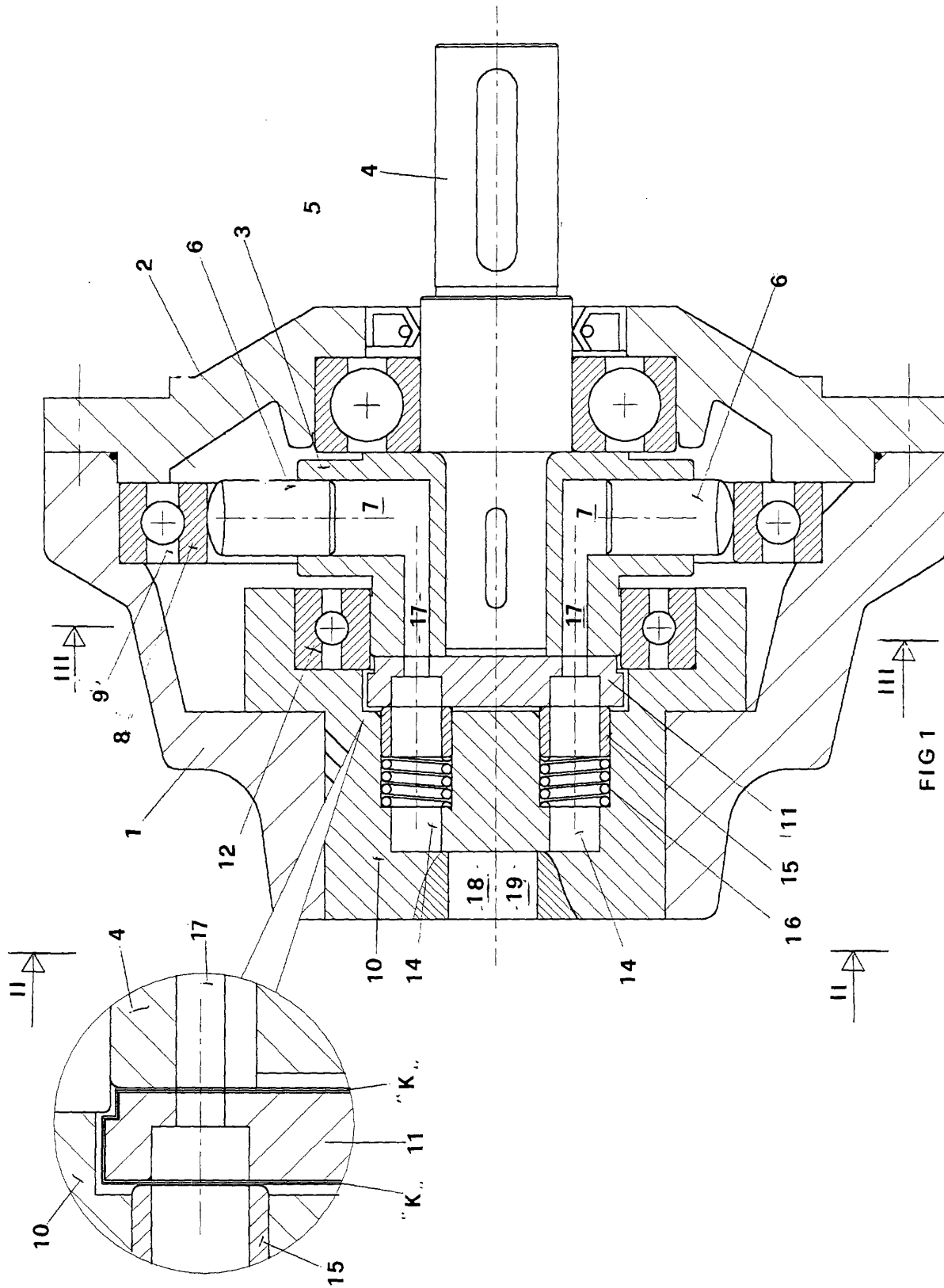
1. RADIAL PISTON HYDRAULIC MOTOR/PUMP, where the alternating linear motion of the pistons takes place on a plane perpendicular to the pump shaft, said motor/pump basically consisting of a rotor containing a star of cylinders and made to rotate by the motor shaft, a flow distributor, fixed and coaxial with the rotor and a reaction ring or stator, external to the rotor and eccentric in regard to it, on which rest the upper ends of the pistons which slide inside the aforementioned cylinders, the contact between the end of the piston and the stator being assured by the thrust of the pressurised liquid, which fills the corresponding chamber of each cylinder, the end of the star of cylinders leaning on the stator being achieved by making the stator act as a rolling-contact bearing with the fixed external ring and the internal ring, onto which the ends of the pistons sit, which is rotated by these, thus reducing sliding to only compensatory movements, with a substantial reduction in wear,

said motor-pump **characterised in that** the fixed distributor plate is in hydrodynamic equilibrium (hydrobalanced), being completely washed, under operating conditions, by a film of the pressurised fluid which, advantageously eliminates the friction between the respective moving parts, said equilibrium, as well as the gripping between said distributor plate and the rotor, being achieved through a thrust generated by a small hollow piston, equipped with a balancing coil, both contained within a seat formed on the distributor body, attached firmly to the chassis of the machine.

2. RADIAL PISTON HYDRAULIC MOTOR/PUMP, according to claim 1, basically consisting of two covers (1, 2), constituting the chassis, the space in between which contains the rotor (3), fitted on the shaft (4), supported on one side by the bearing (5), while the radial pistons (6), slidable inside the cylinders (7), formed on the aforementioned rotor, come into contact with the internal ring (8) of the bearing (9), mounted on the chassis, eccentrically in respect to the axis of the rotor, said motor-pump being **characterised in that** the distributor group, coaxial with the rotor, consists of a distributor body (10), attached firmly to the chassis and wherein is inserted a further bearing (12), which assures the continued rotation of the whole rotating system and a distributor plate (11), upon said distributor body (11) are mounted in the seats (13), formed on the pipes (14), four small hollow pistons (15), each equipped with a balancing coil (16), which keep the aforementioned distributor plate in hydrodynamic equilibrium as well as in a gripping relationship with the upper wall of the rotor (3), equipped with pipes (17) connected on one side to the external pipe (18) and on the other side to the external pipe (19), respectively.

3. RADIAL PISTON HYDRAULIC MOTOR/PUMP, according to claims 1 and 2, **characterised in that** the hydrodynamic equilibrium of the distributor plate (11) is due to the fact that it is completely covered with a film of pressurised fluid thus self-balancing in all operating conditions, which guarantees an optimal yield at all operating speeds.

4. RADIAL PISTON HYDRAULIC MOTOR/PUMP, according to one or more of the preceding claims, **characterised in that** it uses two or more series of pistons, positioned on separate planes and slidable inside the cylinders housed in a single rotating body.



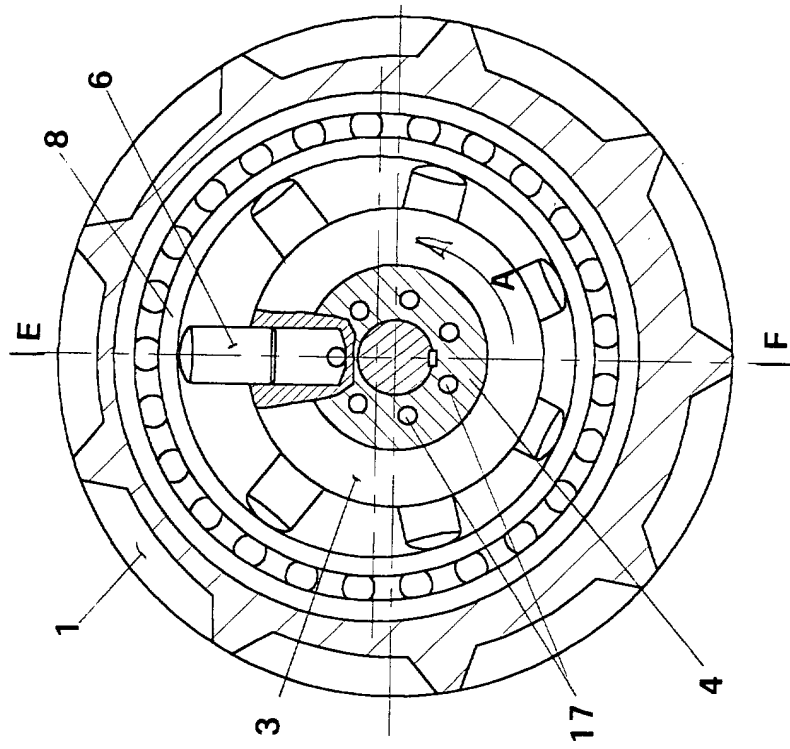


FIG 3

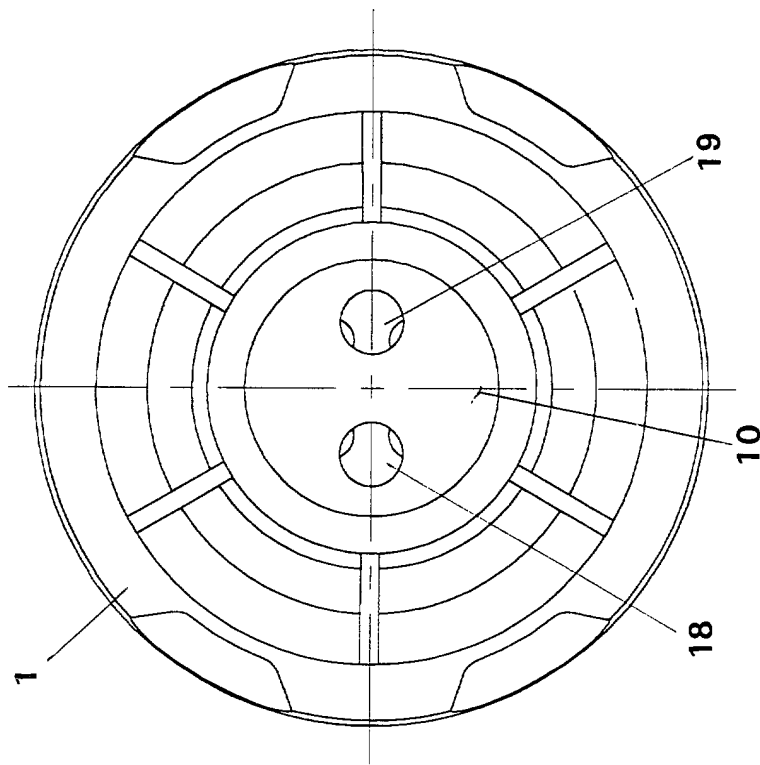


FIG 2

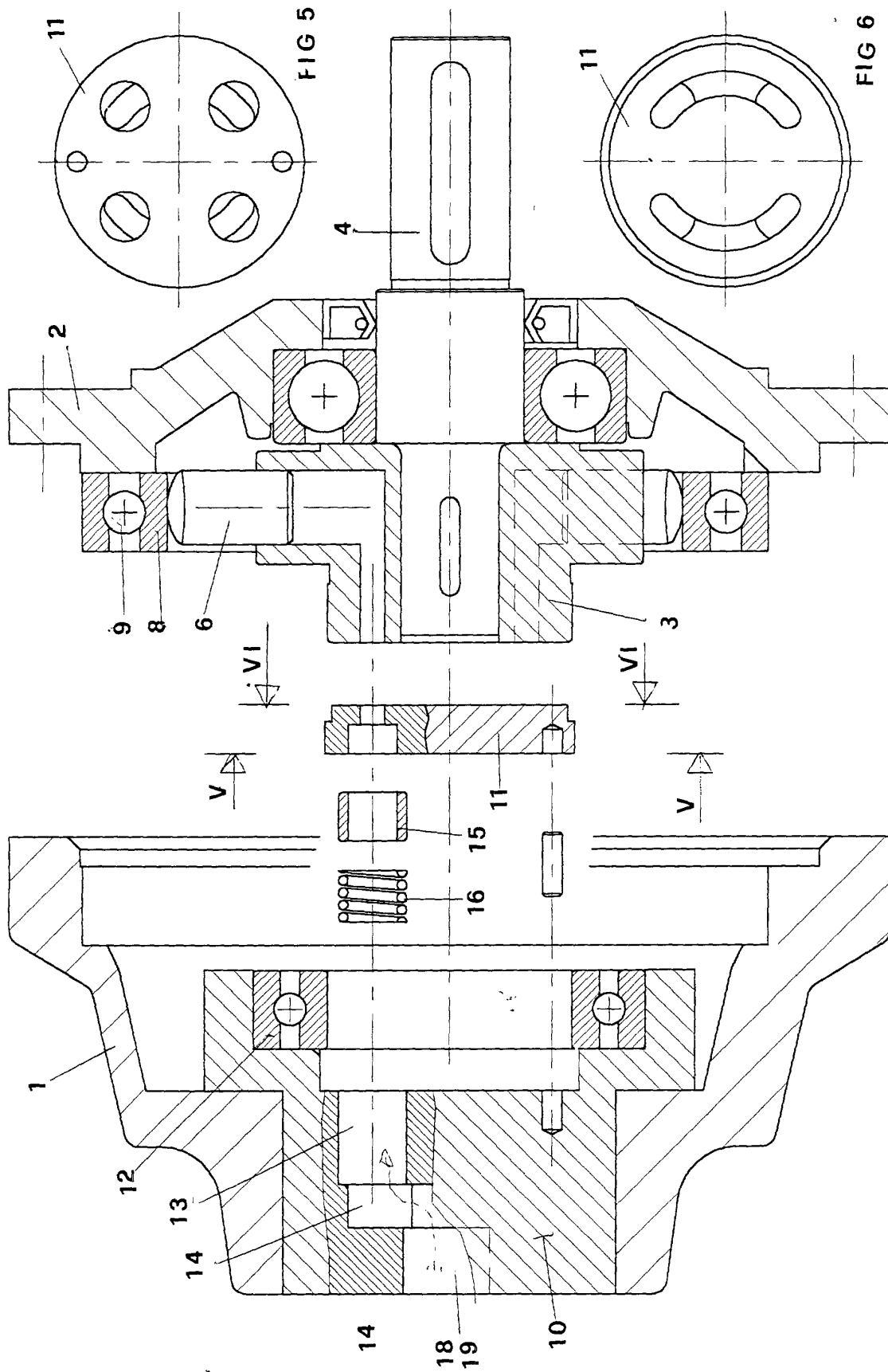


FIG 4

