

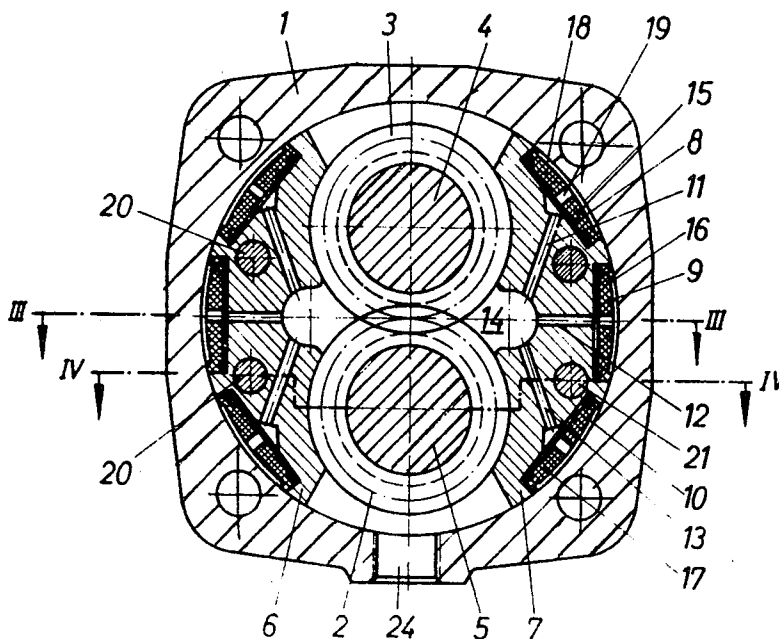
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[73] Assignee **said Eckerle, by said Jung**
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[33] **Germany**
[31] **P 17 28 050.1**

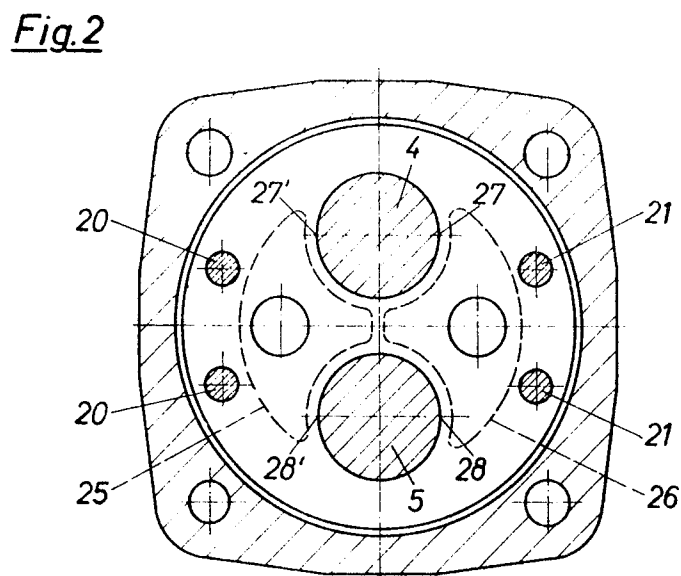
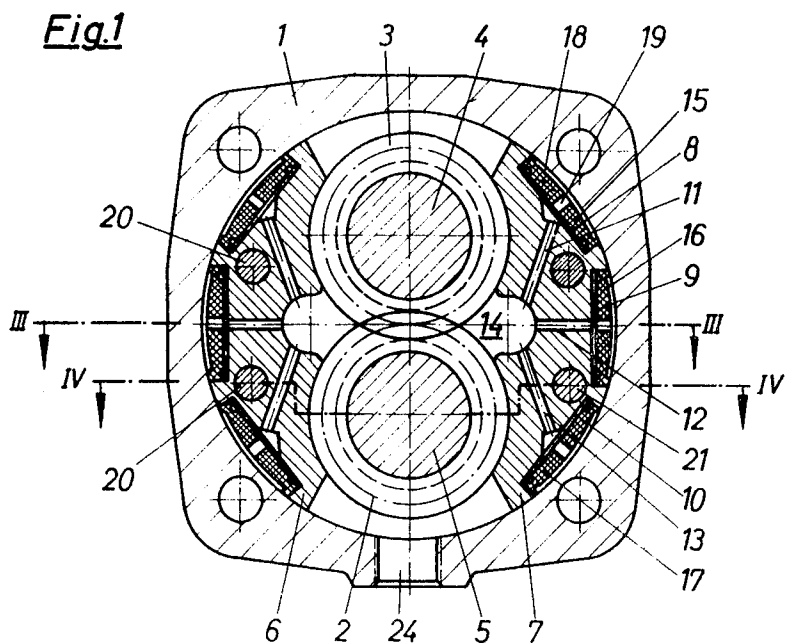
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[54] **HIGH-PRESSURE GEAR PUMP OR GEAR MOTOR WITH COMPENSATION FOR CLEARANCE AND WEAR**
5 Claims, 7 Drawing Figs.

[52] U.S. Cl. **418/126,**
418/133
[51] Int. Cl. **F01c 19/02,**
F04c 27/00, F01c 19/08
[50] Field of Search **418/126,**
131—133; 103/126 L; 230/141; 91/80, 87; 123/12

ABSTRACT: A high-pressure gear pump or gear motor with compensation for clearance and wear, where clearance takeup means enclose the pressure side of the gears both radially and axially and where they are connected by pins. While the pressure compensating means push the takeup means radially against the gears, this pressure is born simultaneously by the gear peripheries and by the gear shafts which are in contact with the face plates forming the lateral portions of the takeup means. Simultaneous contact is assured by providing a small initial clearance between the face plates and shafts which disappears during running in.





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Fig.3

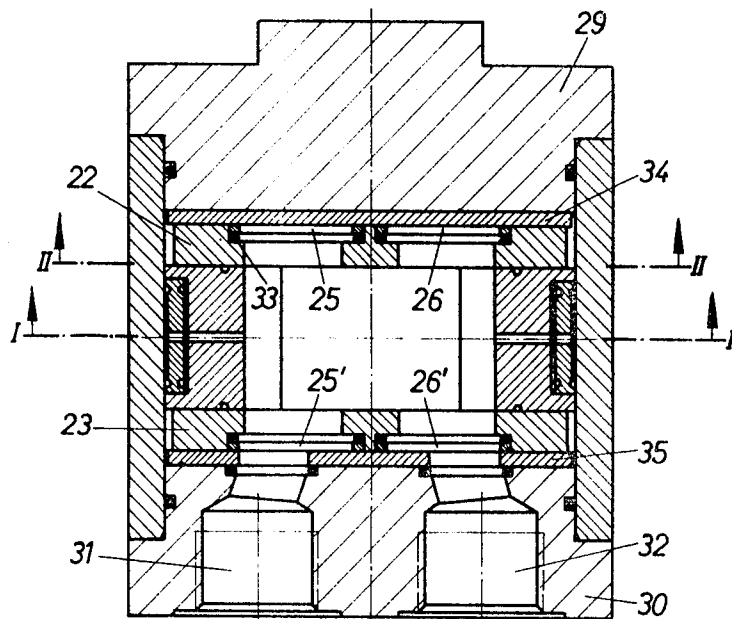
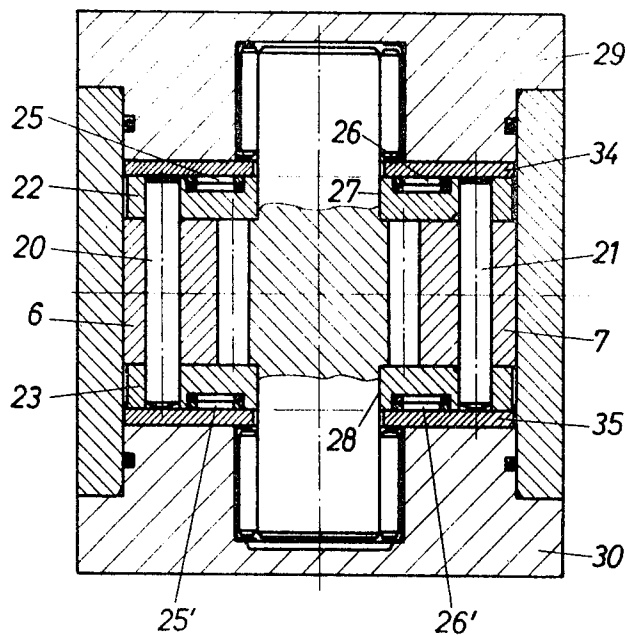


Fig.4



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Fig.5

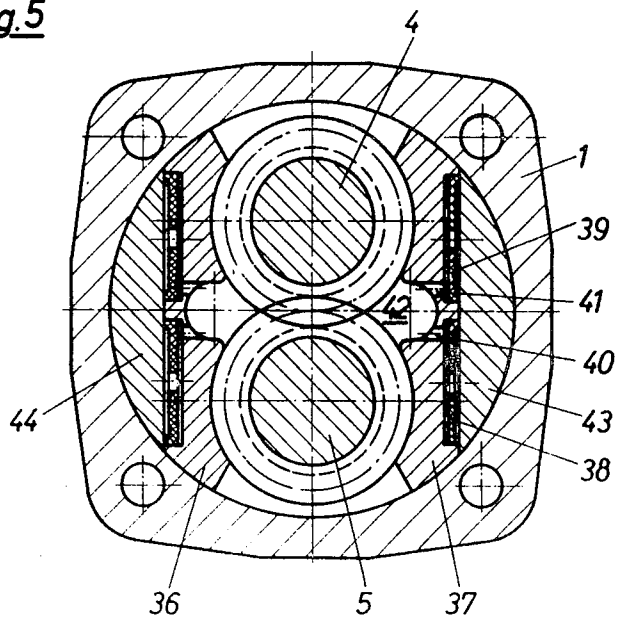
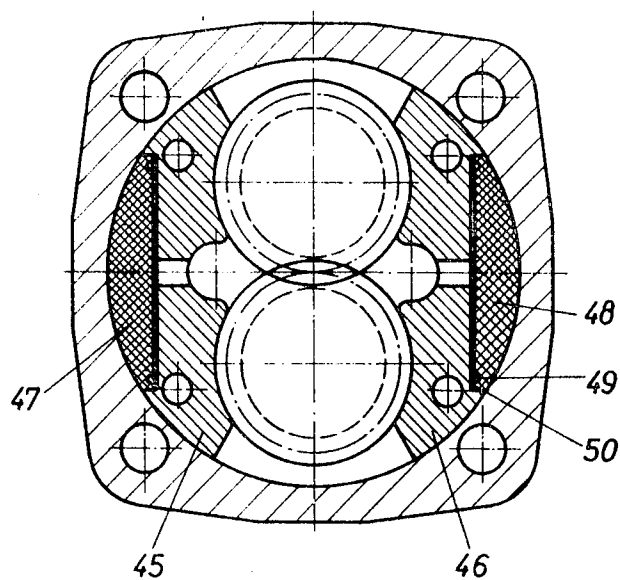


Fig.6



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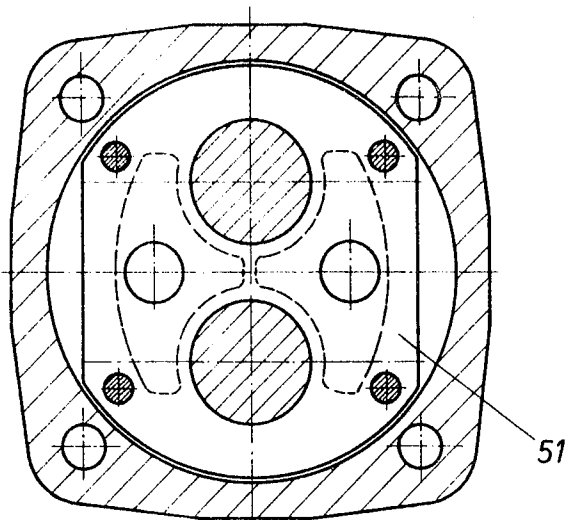
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Fig.7



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HIGH-PRESSURE GEAR PUMP OR GEAR MOTOR WITH COMPENSATION FOR CLEARANCE AND WEAR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to a high-pressure gear pump or gear motor with compensation for clearance and wear having a driven gear and one or more spur gears meshing with it and where the axial and radial boundary faces of the pressure zone are formed by a control piston which is displaceable against the gear meshing point and by two axial face plates which are movable axially against the gears, the control piston and the face plates being subjected to compensation pressure zones.

2. Description of the Prior Art

Machines of this kind have the shortcoming that the wear between the gear periphery and the control piston is very great. Above all it is difficult to choose the appropriate size of the pressure zones so that contact between the control piston and the gear peripheries is assured in all phases of operation. At the same time, wear conditions should be obtained which are justifiable in terms of longevity of the pump or motor. Because the pressure zone between the gears and the control piston is a function of the momentary position of the teeth, and the latter are in motion, this pressure zone is under continuous change. It is impossible, however, to arrange the compensation pressure zones to change in the same way. This means that, when the compensation pressure zones are too small, the control piston floats off cyclically, and when the compensation pressure zones are too large, wear becomes excessive. The reason for the high wear of the known devices is due to the fact that the bearing surface of the control piston which is determined by the peripheral faces of the teeth, is very small.

SUMMARY OF THE INVENTION

The present invention has as its object to provide a high-pressure gear pump or gear motor where the compensation pressure zones are of such dimensions that the prevention of the float-off condition is assured, while wear is kept within acceptable limits. The invention therefore suggests to combine the control piston with the axial face plates and to support the latter on the gear shaft.

For optimal adjustment of the tolerances, the parts are given such dimensions that in their new condition the control piston contacts the gears, while a small clearance of 0.5 to 0.1 mm. exists between the bores of the face plates and the gear shafts reaching through these bores. During running in of the device, the contact surface of the control piston wears very quickly until the bores of the face plates come into contact with the gear shafts. At this point, the force generated by over-compensation and acting through the pressure zones on the control piston is supported both over the bores of the face plates and over the gear peripheries. The total supporting surface thus obtained is a multiple of the original support surface, i.e. approximately its fourfold. Consequently, the wear is very small and can be neglected. Furthermore, this design shows more stability after running in, because the contact surfaces of the axial face plates exert a stabilizing effect on the control piston which, in known devices, is supported only on the moving contact faces of the gear teeth.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be explained on the basis of several embodiments illustrated in the drawings as follows:

- FIG. 1 shows a cross section through a gear motor along the line I-I of FIG. 3 illustrating an embodiment of the invention;
- FIG. 2 shows a cross section along the line II-II of FIG. 3;
- FIG. 3 shows a cross section along the line III-III of FIG. 1;
- FIG. 4 shows a cross section along the line IV-IV of FIG. 1;
- FIG. 5 shows a cross section, similar to that of FIG. 1, of an embodiment having modified radial pressure zones;

FIG. 6 shows another cross section, similar to that of FIG. 1, of an embodiment having further modified radial pressure zones;

FIG. 7 shows a cross section similar to that of FIG. 2 of the radial pressure zones of the embodiment of FIG. 6.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As can be seen from FIG. 1, inside a cylindrically bored housing 1 are arranged two gears 2 and 3, having gear shafts 4 and 5. When the device is used as a pump, one of the shafts is driven. On the sides of the gears are arranged the control pistons 6 and 7, each one having three circular compensation pressure zones 8, 9, and 10, which are connected with the pressure chamber 14 over bores 11, 12 and 13. They are sealed by means of pistons 15, 16 and 17 which are made of high-resistance plastic.

The pistons 15, 16 and 17 are hydrostatically load compensated on the side facing the inner diameter of the housing in order to assure proper adjustment of the pistons. This effect is obtained by providing a recess 18 in the piston 15, for example, and by connecting it with the pressure chamber 14 via bores 19 and 11. The hydrostatic load compensation is particularly necessary because the direction of motion of the control piston 6 or 7 is different from the motion of the pistons 15, 16 and 17. As can be seen from FIGS. 2 and 4, there are also provided pins 20 and 21, which connect the control pistons 6 and 7 with the axial face plates 22 and 23. A drain connection 24 is provided for the return of leaked-out oil to the reservoir.

The face plates 22 and 23 (FIG. 3) may also be made of two halves. The contours of the axial pressure compensation zones 25 and 26 are indicated in FIG. 2 by dotted lines. When they are new, the axial face plates have only a small clearance to the gear shafts 4 and 5. Only after running in will these clearances have been eliminated at the points 27 and 28, or 27' and 28', respectively, depending on which side of the motor is under pressure.

FIGS. 3 and 4 illustrate the housing 1 and the side covers 29 and 30. The cover 30 is provided with connections 31 and 32 for the fluid inlet and fluid outlet. The axial face plates 22 and 23 are provided with pressure zones 25 and 26, or 25' and 26', respectively, on their sides facing away from the gears. These zones are sealed by means of O-rings 33, or metal rings (for high pressures), in such a way that each of the face plates 22 and 23 take an independent position between the lateral faces of the gears and the discs 34 and 35 positioned between the face plates and the covers 29 and 30.

In FIG. 5 the radial compensation of the control pistons 36 and 37 is obtained by two circular pistons 38 and 39 whose pressure zones are connected to the pressure chamber 42 via the bores 40 and 41. The pistons 38 and 39 are supported by the segments 43 and 44 positioned inside the housing 1. This embodiment has the advantage that the motion of the pistons 38 and 39 has the same direction as the takeup motion of the control pistons 36 and 37, which motion is necessary to compensate for the deflection of the gear shafts 4 and 5.

FIG. 6 illustrates a further possibility of arranging the control pistons. In the control pistons 45 and 46 are arranged oblong rectangular recesses inside which are positioned plastic form pieces 47 and 48 serving as pistons. The use of plastic pistons for the radial pressure compensation zones makes it possible to take advantage of the plasticity, although small, of the material by providing a marginal groove 49 on the pressure side of the piston, thereby forming a sealing lip 50.

FIG. 7 shows an embodiment of an axial face plate 51 which could be used, for example, with a pump corresponding to FIG. 6.

What we claim is:

1. A high pressure gear pump and motor with compensation for play and wear comprising:
 - a housing having parallel intersecting bores therein;
 - a pair of intermeshing gears disposed in said bores and having gear shafts rotatably supported in said housing,

one of said gears being a driven gear for the transmission of power into the pump, or from the motor, respectively, and at least one other gear meshing with the driven gear; said housing having a high-pressure and a low-pressure passage at opposite sides of the mesh points of the gears; bearing trunnions being positioned on both sides of said gears; clearance takeup means enclosing the pressure side of said meshing gears both radially and axially, thereby forming a pressure chamber therewith; said clearance takeup means including a plurality of control pistons forming the radial enclosure for said pressure chamber by contacting portions of the gear peripheries to both sides of the gear-meshing point, the width of said control pistons corresponding substantially to that of the gears; a plurality of axial face plates, one on each side of said control pistons and gears, forming the axial enclosure for said pressure chamber; and means connecting each of said control pistons and face plates, respectively, to form a unit in the sense of radial movement; bearing portions for contacting said trunnions and being a part of said face plates; pressure-compensating means adapted to radially move and

maintain said takeup means against said gears and against said trunnions in opposition to the operating pressure present within said pressure chamber; said pressure-compensating means being arranged as pressure-compensating zones within said control pistons, said pressure-compensating zones communicating with said pressure chamber.

2. A high-pressure gear pump and motor as claimed in claim 1, wherein said connecting means between the control piston and face plates are axially aligned pins.

3. A high-pressure gear pump and motor as claimed in claim 1, wherein said axial face plates include means to compensate for the axial operating pressures, so that the face plates are hydrostatically balanced with respect to the lateral faces of said gears and said control pistons, as well as to the axial portions of said housing.

4. A high pressure gear pump and motor and claimed in claim 1, wherein each of said control pistons is provided with a marginal groove near its periphery, thereby determining a sealing lip on the periphery of each of said pistons.

5. A high pressure gear pump and motor as claimed in claim 4, wherein each of said pistons has an oblong rectangular configuration.

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