

Description

The present invention relates to an axial variable capacity pump or motor. A known axial variable capacity gear pump (GB-A-1 539 515) comprising the features of the first part of claim one discloses a rather complicated structure of a housing, which carries the axial movable gear and a sealing member for sealing a part of the periphery of the axially fixed gear.

In a known axial variable capacity vane pump of the type described in JP-A-59/54 719 having the features of the first part of claim 6 the sealing effectiveness of the sealing between the vanes and the axially fixed rota-table member is not satisfying so that fluid-leakage may occur and as a consequence a desired working-pressure can not be build up in the working chamber of the vane pump.

The problem underlying the invention is to provide an axial variable capacity pump or motor of simple structure, improved sealing characteristics and a wide range of capacity change. Such pump or motor should be particularly adapted for use in a hydrostatic transmitting system especially for vehicles.

This problem is accomplished by an axial variable capacity gear pump or motor according to claim 1 or 4 and by an axial variable capacity rotary vane pump or motor according to claim 6.

Preferred embodiments of the invention are claimed in the subclaims.

Preferred embodiments of the inventions are described in the following with reference to the accompanying drawings, in which

Fig. 1 (a) is a longitudinal section view showing an axial variable capacity external gear pump of the present invention;

Fig. 1 (b) is a cross section view along line A-A in Fig. 1 (a);

Fig. 1 (c) is a cross section view along line B-B in Fig. 1 (a);

Fig. 1 (d) is a partly enlarged view of location I in fig. 1 (a);

Fig. 1 (e) is a partly enlarged view of location II in Fig. 1 (b);

Fig. 2 (a) is a longitudinal section view showing an axial variable capacity internal gear pump of the present invention;

Fig. 2 (b) is a sketch showing the cross section within the interval L in Fig. 2 (a);

Fig. 2 (c) is a sketch showing the cross section within the interval F in Fig. 2 (a);

Fig. 3 (a) is a revolved section view showing an axial variable capacity double action vane pump of the present invention;

Fig. 3 (b) is a sketch showing the cross section within the interval L in Fig. 3 (a);

Fig. 4 is a cross section view showing an effect-

changeable external gear motor of the present invention;

Fig. 5 is a cross section view showing an effect-changeable internal gear motor of the present invention;

Fig. 6 is a sketch showing a reversing device of the present invention which utilizes the effect-changeable gear motor to make a vehicle move backward;

Fig. 7 is a sketch showing a directional valve which is utilized in an system having an effect-changeable motor to carry out the reverse gear operation.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The operation principle of axial variable capacity gear pumps and one of their embodiments may refer to Fig. 1.

Input shaft 1 rotates together with driving gear 3 which drives the mating gear 11, the rotating direction being shown in Fig. 1 (c). Under the sealing action of radial seal blocks 7 and 12, fixed end plate 8 (assembled together with the casing), sliding end plate 5 and capacity change members 10 and 4, the oil is pumped from low pressure area 1 to high pressure area h, by flowing into the casing through a wide inlet opening 9 and flowing out of the casing through a wide outlet opening 23. The capacity change member 10 is an internal ring gear sleeved onto gear 11 and rotatable with gear 11. In the radial clearance between gear 11 and the ring gear 10 is inserted a ring gear-shaped elastic gasket 24, which functions as the radial seal in the tooth clearance (see also enlarged views Fig. 1(d) Fig. 1 (e)). The capacity change member 10 is rigidly contacted with the gear along most axial length in order to provide a good positioning and supporting. It may be seen from enlarged view Fig. 1 (d) that capacity change member 10 has a flange which is used to withstand oil pressure and functions as a seal. Capacity change member 4 has the same structure, which is sleeved onto gear 3 and rotatable in sliding end plate 5. In Fig. 1 (a), reference numbers 2, 14 and 15 indicate needle bearings. Sliding end plate 5 may axially slide together with gear 11 and radial seal block 7, and forms the axial sealing on the right side together with capacity change member 4, radial seal blocks 7 and 12 and gaskets 6 and 13. When sliding end plate 5 is pushed leftward, gear 11 and capacity change member 4 are also pushed leftward, while capacity change member 10 will have a rightward movement relative to gear 11, thus shortening the meshing length of mating gears, namely the working length L of the pump. The delivery capacity per revolution of the pump is then linearly reduced,

while maintaining the efficiency unchanged. If the sliding end plate moves to the leftmost position to contact the fixed end plate, then $L=0$, the delivery capacity of the pump will be zero, the pump in the system is now equivalent to a closed valve and the input shaft will run idle. On the contrary, when sliding end plate 5 moves to the rightmost position, the working length L will reach its maximum value, and so does the delivery capacity per revolution. Hence the axial motion of sliding end plate 5 makes the delivery capacity of the pump steplessly vary from zero to maximum value. Every position of the sliding end plate corresponds to a gear pump with gear width L , maintaining the efficiency basically unchanged.

Radial seal blocks 7 and 12 have slots alternating with flanges on their outer surface, which fit with the slots and flanges on the inner circumference of the casing in order to prevent radial seal blocks from sliding towards low pressure area under the load of oil pressure in high pressure area. Some slots connecting the high pressure area are formed also on the outer surface of radial seal blocks in order to introduce some pressurized oil into these slots to balance the radial pressure of the high pressurized oil in tooth clearance, thus making the sliding end plate easier to move. Under the action of the pressurized oil and the elasticity of gaskets 6 and 13, the radial clearance between radial seal blocks and gears is compensated (the aforementioned slots and flanges are not shown in Fig. 1). The clearances between radial seal blocks and fixed or sliding end plate are also sealed by gaskets.

Referring to Fig. 1(b), partition plate 8 integrated with the casing is provided to separate the higher and lower pressure area. The compensation of axial clearance between gears and end plates can easily be realized using well known technique. It is worth special notice that when the pump in Fig. 1 (a) is used as a torque converter for vehicles, its input shaft should be connected with transmitting shaft 21. Making use of the splined sleeve which can move forward and backward along the transmitting shaft and inserting a small spring 22, the axial clearance of gear 3 may be compensated.

In cylinder 16 connected to casing 8 is installed a piston 19 to which control rod 18 is connected. The other end of the control rod is fixed onto the pressure center of sliding end plate. A hole 20 is drilled on cylinder 16 in order to lead high pressurized oil into the cylinder to form a pressure on piston 19. The area of the piston is so designed as to use most of the pressure to balance the high pressure acting on the left side of sliding end plate, and use small part of the pressure to compress spring 17. Imagining that the pump

drives hydraulic motor and then drives a load, if the loading torque increases by K -times, the pressure acting on piston 19 and the force P of piston 19 acting on spring 17 also increase by K -times. So long as the product of P and spring length X remains constant, force P will push sliding end plate leftward to shorten working length L to $1/K$ of its original length, thus maintaining the input torque namely the engine torque unchanged. This is right the self-controlled torque characteristic required for vehicle travelling. A hyperbolic spring is then required for spring 17 rather than a linear one. When compressed, the product of spring length and compressing force remains constant. Various methods may be used to manufacture this kind of spring, and do not need more explanation here. This is an example of self-controlled torque mechanism using axial variable capacity pump.

With the same principle as mentioned above, an embodiment of axial variable capacity internal gear pumps is shown in Fig. 2. The operation principle of internal gear pumps is well known. Referring to sketch 2 (b), gear 5d internally meshes with ring gear 6d. When the pump is rotating in the direction as shown in the figure under the sealing action of radial seal block 11d, the oil will be pumped from low pressure area 1 into high pressure area h. If, in Fig. 2 (a), radial seal block 11d and gear 5d move leftward with sliding end plates 4d and 7d, the meshing length of gear 5d and internal ring gear 6d namely the working length L will then be lengthened, or shortened otherwise. Capacity change member 8d is an external ring gear closely sleeved into internal ring gear 6d, rotatable around left sliding end plate 7d, and movable together with 7d, thereby forming the axial sealing on left side. Gear 5d is supported on needle bearing 9d at the left end and rotatable in unrotatable end plate 7d. Sliding end plate 4d forms the axial sealing on right side. The interval denoted by length F is the area of "idle running", the cross section of which is shown in Fig. 2(c). In the fixed cylinder 2d, gear 5d rotates within two radial seal blocks 3d and 11d, pumping oil from area 1 into area h, meanwhile pumping the same amount of oil from area h back to area 1. Therefore, no pumping effect exists within interval F , hence ensuring an effective variation of capacity when working length L is changed. Denoted in this figure, 1d is the input shaft driving gear 5d, 9d and 12d are needle bearings and 10d the casing.

An axial variable capacity vane pump can also be formed according to the same principle aforementioned. An embodiment of axial variable capacity double action vane pumps is shown in Fig. 3. The operation principle of double action vane pumps is well known and can be briefly described using the sketch Fig. 3 (b) which is a cross section

view within working length L. When rotor 10f rotates, vanes 5f and 13f radially movable outward and inward in the rotor contact with the inner surface of stator 3f and pump oil from low pressure area 1 into high pressure area h. Only one set of vanes are shown in the figure. In order to make it easier to describe, capacity change member 6f located on left side is shown using a revolved sectional view. It may be seen from the figure that capacity change member 6f may rotate with rotor 10f. Inside capacity change member 6f is a chamber for rotor 10f and vanes 5f and 13f to slide inward and outward as shown in Fig. 3 (a). Under the slight pressure of small springs 8f and 11f, sealing blades 7f and 12f respectively contact with the edges of vanes 5f and 13f, thus improving the sealing among capacity change member, stator and vanes. Sliding end plate 4f is unrotatable, it forms the right side axial sealing in the chamber of stator 3f. When end plate 4f is pushed leftward, rotor 10f and vanes 5f and 13f are pushed into capacity change member 6f, thereby to shorten length L and reduce delivery capacity per revolution. When end plate 4f moves rightward, the rotor and vanes also move rightward to increase the delivery capacity. The rightward motion may be realized by the pressure of an axial spring (not known) in capacity change member 6f. This spring can also be used to compensate the axial clearance. In this figure, notation 1f is the input shaft driving rotor 10f, 2f and 9f are needle or ball bearings, 14f is the shaft of capacity change member 6f, which can be integrated with input shaft.

An axial variable capacity single action vane pump may be formed with the similar structure as mentioned above. The only difference is that the capacity change member is coaxial with rotor but eccentric to stator since rotor is eccentric. An axial variable capacity motor can be formed using the same principle and structure aforementioned.

The capacity change member in Fig. 3 is designed relatively larger with the consideration that it can be used as a flywheel for the engine, otherwise, it may be shortened as an end plate. Those parts aforementioned which form the axial sealing (e.g. sliding end plate, fixed end plate and capacity change member, etc.) may be termed as axial seal member, and those forming the radial sealing (e.g. radial seal blocks, stator, etc.) may be termed as radial seal members.

An embodiment of effect-changeable gear motors is shown in Fig. 4. Meshing gears 1k and 2k are installed in casing 5k. The shadowed area denoted by 3k is the axial inlet of high pressure oil, and the area denoted by 6k is the axial outlet of the oil. Effect change member is denoted by 4k, the position of which shown in the figure is the "zero effect" position. At this position, the effect

change member stands apart from the gears, oil running idly from 3k to 6k, unable to drive the gears. When effect change member 4k moves in the direction as shown by the arrow to approach the gears, motor effect gradually increases. When it is pushed to a position closely contacting the gears (this position is shown by dot dash line), a "full effect" position is reached, the motor will then work with full effect and the high pressurized oil will drive gears to rotate in the directions as shown with its full potential. The axial seal plate (not shown) of the motor is floatingly assembled and may function as an axial clearance compensator. Since the effect change member is radially movable, it may also be used as a radial clearance compensator. This is an advantage over ordinary gear motor.

When the effect change member is pushed from zero effect position towards full effect position, the motor effect gradually increases. This is favorable to starting a vehicle. When the distance between effect change member and gears increases, the input and output power, the output torque and output speed of the motor will decrease accordingly. The maximum distance— "zero effect" position will make gears and vehicle wheels run idle. This is equivalent to "out of gear". If the effect change member is pushed to "full effect" position and inlet 3k and/or outlet 6k are closed, the gears will then be unrotatable. This is equivalent to "brake".

Effect-changeable motor (or pump) has some advantages over fluid couplings: the efficiency does not decrease with the reduction of input speed; the load variation at output end in full effect position does not lead to speed variation caused by motor; vehicle may be started at any constant engine speed (if engine torque is sufficient); stepless regulation of output power, torque and speed may be realized with little variation of efficiency; vehicle may be fully braked; power may be transmitted inversely; the power shaft and working shaft do not have to be aligned with each other.

An embodiment of effect-changeable internal gear motors is shown in Fig. 5. Notations 1p and 2p respectively represent the internal ring gear and external gear meshing with the former. The shadowed areas denoted by 5p and 6p are the inlet and outlet for the oil respectively. The rotating directions of gears 1p and 2p are shown by arrows. Effect change member is denoted by 4p, which is mounted on a rotatable axle 3p. The position of effect change member shown in the figure is "full effect" position. When effect change member 4p driven by axle 3p rotates counterclockwise, it will lose contact with the gear and the motor effect will gradually vanish. Clockwise rotation of effect change member 4p will increase motor effect. At full effect position, the clockwise torque around the

center of axle 3p caused by the high pressure acting on the left upper part of effect change member 4p may be slightly greater than the counterclockwise torque at the lower part so as to compensate the radial clearance. This can be done by properly designing the center position of axle 3p. The compensation of axial clearance is achieved by an axial floating end plate (not shown in the figure).

The aforementioned principle of changing effect applies to any kind of positive displacement pumps (or motors). For instance, if part of the cylinder wall is used as the effect change member for a plunger pump, an effect-changeable plunger pump is obtained.

The mechanism formed by using an effect-changeable pump of the present invention as a drive means of a hydraulic motor may be utilized to replace current fluid couplings. Its transmitting efficiency will be higher than that of fluid couplings at low speed, and may rotate and transmit power inversely.

A reverse gear is needed in gear box for a vehicle to travel reversely. This function also may be realized by an effect-changeable motor. Referring to Fig. 6, three meshing gears 1q, 4q and 5q are mounted in case 8q (two pairs of gears may be used). The shadowed areas denoted by 3q and 6q are respectively the inlet and outlet for the oil. If the rotating direction of gear 1q is positive when effect change member 2q is at full effect position and effect change member 7q is at zero effect position, then gear 1q will rotate in negative direction when effect change member 2q is back to zero effect position and effect change member 7q moves forward to its full effect position.

The function of reverse gear may also be achieved by reversing the oil flow, namely by exchanging the inlet and outlet of variable capacity pump so as to make the motor rotate reversely. To avoid additional resistance, the section area of directional valve should be as large as possible. An example is shown in Fig. 7. Throttle 2r may rotate in valve housing 1r. At the position shown in the figure, oil flows into opening h and outside opening l, the returning oil then flows through openings o and i. If the throttle 2r rotates by an angle of 45° , the flow direction will then be reversed, and the motor rotates in a reverse direction.

When hydrostatic transmission is employed in a vehicle, two effect-changeable motors for driving two driving wheels may be integrated with axial variable capacity pump. These three can be assembled in a common casing with a common high pressure area and low pressure area in order to save some pipe and lessen pipe resistance. The transmitting shaft connecting to engine for driving the variable capacity pump and the output shaft of

motor together form a "T" shape. The top dash of letter T represents the driving axle of the vehicle. In this case, two motors are connected in parallel, therefore they have an automatic differential function. When the vehicle makes a turn, the motor for inner side wheel will rotate slower since the resistant torque is larger and the oil flowing into the motor is less, while the motor for outer side wheel will rotate faster since the resistant torque is smaller and the motor can get more oil. The "differential interlocking function" can be easily obtained. If the wheel at one side is trapped in the mud and can only slip, the oil pipe leading to the motor on this side is then cut-off, the motor at the unslipping side will obtain sufficient torque. If the motor shown in Fig. 6 is employed, the effect change member for reverse rotation of the motor at the slipping side (e.g. effect change member 7q) may be pushed to its full effect position, so that very great resistant torque will be produced, functioning as a differential interlocking mechanism.

If the aforementioned T-shaped hydrostatic transmitting system is utilized in a vehicle, the operating system of the vehicle may be simplified by removing clutch pedal, brake pedal, gear lever and hand brake lever and replacing the acceleration pedal by a pedal operating certain devices. If the pedal is stepped down into the "driving area" the throttle will open wider.

Within the "driving area", the hydrostatic transmitting system adjusts the working length L of axial variable capacity pump (or motor) according to the travelling resistance of the vehicle so as to allow the vehicle to have a full self-adaptability under different working conditions, such as starting, travelling, accelerating, climbing up a slope, etc. In the case of constant engine torque. When releasing the pedal, it will rotate back under the action of a return spring. After the pedal moves into the "decelerating area" the effect-changeable motor is at "full effect" position and becomes a pump, the engine being idling or at rest, the pedal mechanism pushing sliding end plate of axial variable capacity pump to make its working length L shorter than working length L_E given by automatic torque converter. This means that the effect-changeable motor (now becoming a pump) will drive variable capacity pump and engine to rotate at a higher speed. The resistant torque caused by pumping action of the engine and friction will decelerate the vehicle.

An independent hand-operating lever may be utilized to manually adjust working length L of the axial variable capacity pump. When starting, this lever is set at a position to make L very small. Stepping down the operating pedal and releasing the lever simultaneously will very smoothly start the vehicle under the control of automatic torque

converter system. At normal operating condition, this lever itself sways forward and backward with the adjusting of automatic torque converter system. If this lever is manually pushed to a deviate position from that given by automatic torque converter system, the loading torque of the engine will vary accordingly. For instance, if L is greater than L_E , the loading torque of the engine will then increase. When the engine is started by pushing or pulling the vehicle, this lever may be pushed to the position of maximum L , then gradually reducing L after the vehicle starting moving. Starting the engine in this way will become much easier. This lever may be manually operated also for decelerating or braking the vehicle in case of emergency. Usually this lever is not often used.

Compared with current variable capacity plunging pumps, the axial variable capacity rotary positive displacement pump herewith presented has the advantages of simpler structure, lower cost and better ability to withstand dirty oils.

Compared with current vortex type hydraulic torque converter, the basic hydrostatic transmitting system (i.e. axial variable capacity torque converter) presented has advantages in the following aspects: Although their highest efficiencies are close to each other, the axial variable capacity torque converter may keep its high efficiency in an almost infinite range of speed ratio (L may approach zero), while an vortex type torque converter can keep its high efficiency only in a very narrow range of speed ratio. The average efficiency of the former is therefore higher than that of the latter herewith. Furthermore, the axial variable capacity torque converter can reversely transmit power, can rotate in reverse direction (reverse gear), can allow input and output shafts to run idle, can stably operate at very low input speed, and can also be utilized as a brake, etc.

The present invention has advantages over current hydro-mechanical transmission in all aspects of main performances:

1. The highest efficiency of vortex type torque converter is about 0.8-0.9 (equivalent to the efficiency of axial variable capacity pump of the present invention), and the highest efficiency of the mechanical portion in hydro-mechanical transmission is about 0.85-0.9 (equivalent to the efficiency of effect-changeable motor of the present invention), but the present invention can keep its high efficiency in a very wide range of speed ratio, its average efficiency is therefore higher than that of hydro-mechanical transmission in practical application.

2. The axial variable capacity torque converter may automatically change the transmitting torque in a very wide range of speed ratio, much wider than that of hydro-mechanical trans-

mission.

3. Simple operation, low labor intensity and little probability of mistaken operation.

4. Excellent brake performance:

- (1) There is no mechanical friction in the brake system. Therefore it may properly work in hard environments with high humidity, water, oil, combustible gas, etc. and is adaptable widely and reliable. Moreover, maintenance is much easier since "friction pair" is eliminated.

- (2) Production cost is very low since very few brake parts are needed. The main brake structure utilizes driving motor and so on, eliminating all mechanisms used in current brake systems.

- (3) Operation is easy and, no booster is needed. Hence brake performance is reliable.

- (4) Brake time delay is very short because the responding time for the driver just to release the same pedal is shorter than that to step down another pedal and the responding time of the hydraulic pump is also very short because of the simplified load transmitting mechanism. Shortening the brake time is of great significance for high speed vehicles to shorten their stopping distance.

- (5) The requirements of preventing "deadlocked" wheels during brake can be easily met, the optimum brake performance may be easily obtained by adjusting the minimum value of L .

- (6) The present brake system may automatically balance the brake torques for left and right side wheels to prevent the vehicle from brake steer during brake. The two driving motors on two sides are connected in parallel. If one motor temporarily produces a larger brake torque because of improper adjustment or different road drags acting on two sides, this motor will then attempt to drive another motor of smaller brake torque to rotate in a reverse direction, thus increasing the latter's brake torque. Furthermore, the motor with smaller torque will have smaller pumping power (motors become pumps during brake period), hence have a tendency to decrease the oil pressure and reduce another motor's brake torque. The automatic balance of brake torques is therefore achieved.

- (7) The kinetic energy of the vehicle during brake period can be stored in an accumulator for other uses.

- (8) The front wheels can also be braked, the vehicle can be parked on a steep slope.

5. Front driving can be easily realized, the passibility of the vehicle can be improved.

6. Power can be transmitted reversely. There-

fore, the engine may be started by pushing or pulling the vehicle, and may be used to decelerate the vehicle.

7. The vehicle may travel reversely at any speed. This is of importance for vehicles with internal combustion engines.

8. This system has differential interlocking function.

On the other hand, when compared with current mechanical transmitting systems, the hydrostatic transmitting system of the present invention also has advantages:

1. The clutch, gear box, reductor and differential of rear axle for the vehicle are all eliminated. Added to the vehicle is only an axial variable capacity torque converter which is composed of a pump and two motors assembled in a common casing (altogether, there are six gears and a few auxiliaries). Weight and volume of the system are considerably reduced, production costs are largely lowered.

2. Only engine torque is transmitted through transmitting shaft (i.e. drive shaft), the cross section of the shaft can be reduced.

3. Two effect-changeable motors and relevant pipes are added for front driving, but the cost is still lower than that in mechanical transmission for transfer case, transmitting shaft, and front driving axle with constant-velocity joint.

4. Engine flywheel is eliminated, starting system is replaced by accumulator, battery may have smaller capacity.

5. The reserve power of engine may be reduced, thus lowering the production costs.

Regarding to efficiency, the hydrostatic transmitting system of the present invention has the following features when compared with current mechanical transmission:

1. The efficiency of mechanical transmission at different gears or speeds is usually lower than its highest efficiency, while the efficiency of the present invention is basically unchanged.

2. The engine employed in the present invention may have constant output torque which therefore can be fixed to a level with the lowest specific fuel consumption.

3. Based on the same reason as above, a diesel engine which has low specific fuel consumption but poor adaptability is adoptable.

4. The air pump in current brake systems for medium and large trucks can be eliminated.

5. The energy stored in accumulator during brake period may be used to compress the inlet air for the engine so as to lower the specific fuel consumption.

6. More trailers may be trailed (truck train) to obtain more economic transportation. This is equivalent to considerably increasing the trans-

mitting efficiency.

7. The performance of automatic torque converting in the hydrostatic transmitting system of the present invention makes the vehicle possess fully self-adaptability and always travel with optimum economy. This is equivalent to increasing the average transmitting efficiency.

It can be seen therefrom that when judged from a point of view transportation economy, the hydrostatic transmitting system of the present invention is of high efficiency.

In addition to applying the present invention to vehicles, it may also be utilized for other machines and other purposes.

Claims

1. An axial variable capacity gear pump or motor comprising a casing (8) with an inlet (9) and an outlet (23); an axially movable gear (11) and an axially fixed gear (3) mounted in said casing in a meshing relationship for rotation about their respective axes, said axially movable gear (11) being movable along the axial direction relatively to said axially fixed gear (3); radial sealing means (7, 12) arranged between an inner surface of said casing and tooth-tops of said gears (3, 11) for providing radial seals therebetween, and axial sealing means for providing seals at either axial side of said gear (3, 11) and having an axially fixed member (8) and an axially movable member (5) so as to change a length of a sealed working chamber defined between said gears and thereby to change a delivery capacity per revolution of said pump or motor, characterized in that said radial sealing means comprises an axially fixed sealing member (12) and an axially movable sealing member (7); said axially movable member of said axial sealing means comprises a slidable end plate (5), a ring gear (4) rotatably supported in said slidable end plate and slidably sleeved on said axially fixed gear (3) so as to move axially together with said slidable end plate (5); and a ring gear-shaped elastic gasket arranged between said axially fixed gear (3) and said axially movable ring gear (4) for providing a seal therebetween; and said axially fixed member of said axial sealing means comprises a fixed end plate (8) and an axially fixed ring gear (10) rotatably supported in said fixed end plate (8) and sleeved on said axially movable gear (11), and a ring gear-shaped elastic gasket (24) arranged between said axially movable gear (11) and said axially fixed ring gear (10).



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2. Only engine torque is transmitted through transmitting shaft (i.e. drive shaft), the cross section of the shaft can be reduced.

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1. An axial variable capacity gear pump or motor comprising a casing (8) with an inlet (9) and an outlet (23); an axially movable gear (11) and an axially fixed gear (3) mounted in said casing in a meshing relationship for rotation about their respective axes, said axially movable gear (11) being movable along the axial direction relatively to said axially fixed gear (3); radial sealing means (7, 12) arranged between an inner surface of said casing and tooth-tops of said gears (3, 11) for providing radial seals therebetween, and axial sealing means for providing seals at either axial side of said gear (3, 11) and having an axially fixed member (8) and an axially movable member (5) so as to change a length of a sealed working chamber defined between said gears and thereby to change a delivery capacity per revolution of said pump or motor, characterized in that said radial sealing means comprises an axially fixed sealing member (12) and an axially movable sealing member (7); said axially movable member of said axial sealing means comprises a slidable end plate (5), a ring gear (4) rotatably supported in said slidable end plate and slidably sleeved on said axially fixed gear (3) so as to move axially together with said slidable end plate (5), and a ring gear-shaped elastic gasket arranged between said axially fixed gear (3) and said axially movable ring gear (4) for providing a seal therebetween; and said axially fixed member of said axial sealing means comprises a fixed end plate (8) and an axially fixed ring gear (10) rotatably supported in said fixed end plate (8) and sleeved on said axially movable gear (11), and a ring gear-shaped elastic gasket (24) arranged between said axially movable gear (11) and said axially fixed ring gear (10).



2. A pump or motor as claimed in claim 1, wherein said radial sealing members include radial seal blocks (7, 12) engaging with said tooth-tops of one of said gears (3, 11), means for compensating for any radial clearance which may occur between said teeth of said one gear and said radial seal block due to wear, said compensating means including an elastic gasket between said radial seal block and said inner surface of said casing.
3. A pump or motor as claimed in claim 2, wherein a plurality of slots are formed in a back surface of said radial seal blocks (7, 12) which engages with said elastic gasket for receiving high pressure liquid of said pump or motor to balance the liquid pressure exerting on a surface opposite of said back surface of said radial seal block.
4. An axial variable capacity gear pump or motor comprising:
a casing (10d) with an inlet and an outlet, an axially movable gear (5d) and an axially fixed ring gear (6d) mounted in said casing in a internal meshing relationship for rotation about their respective axes, said axially movable gear (5d) being movable along an axial direction relative to said axially fixed ring gear (6d);
radial sealing means (11d) arranged between said gears for providing radial seal, and being movable axially; and axial sealing means for providing seals at either axial side of said gears, and having two axially movable members (4d, 7d) which are movable together with said axially movable gear and said radial sealing means so as to change a length of a sealed working chamber defined between said gears and thereby to change the delivery capacity per revolution of said pump or motor, characterized in that
one of said axially movable members is movable inside of said ring gear (6d) and has an end plate (7d) mounted on one axial side of said axially movable gear (5d) and an external ring gear (8d) rotatably supported on said end plate and meshing with said axially fixed, internally toothed ring gear (6d) around its whole circumference and that the other one of said axially movable members consists of a slidable end plate (4d) mounted on another axial side of said axially movable gear (5d) and being movable outside of said axially fixed ring gear.
5. A pump or motor as claimed in claim 4, wherein a ring gear shaped elastic gasket is arranged between said axially fixed ring gear and said external ring gear.
6. An axial variable capacity rotary vane pump or motor comprising:
a casing with an inlet and an outlet;
a stator (3f) mounted in said casing;
a rotor (10f) mounted in said stator and being able to rotate about an axis, said rotor having a plurality of radially movable vanes (5f, 13f) which are meshing with an inner surface of said stator (3f), said rotor (10f) being movable axially relative to said stator (3f) to change the meshing length between said vanes (5f, 13f) of said rotor (10f) and said inner surface of said stator (3f);
sealing means for providing seals at either axial side of said rotor, which comprises an axially fixed rotatable member (6f) having a center bore accomodating said rotor (10f) and a plurality of radial slots for accomodating said vanes (5f, 13) passing through, and an axially movable member (4f) which is movable axially together with said rotor (10f) to change a length (L) of a working chamber defined between said rotor (10f) and said stator (3f) thereby to change a delivery capacity per revolution of said pump or motor, characterized in that
each of said slots in said axially fixed rotatable member (6f) contains a sealing blade (7f, 12f) which is constantly biased against each of said vanes (5f, 13f) of said rotor (10f) by a small spring (8f, 11f) to allow said vanes (5f, 13f) of said rotor (10f) to fluidtightly pass through said axially fixed rotatable member (6f).
7. A pump or motor as claimed in claim 6, wherein said axially movable member consists of a slidable end plate (4f) fluidtightly engaging with said inner surface of said stator (3f).
8. A pump or motor as claimed in claim 6 or 7, wherein said axially fixed rotatable member (6f) is formed in the shape of a disk.
9. A pump or motor as claimed in any one of claims 1 to 8, further comprising and automatic control device responsive to variation of load of said pump or motor for controlling an axial movement of said axially movable gear or rotor.
10. A pump or motor as claimed in claim 9, wherein said automatic control device comprises an axially extended cylinder (16), a piston (19) arranged within said cylinder, a control rod (18) with opposite ends connected respectively to said axially slidable end plate (5) of



said axial sealing means and one end face of said piston (19), and a compression spring (17) mounted around said controlling rod, opposite ends of said compression spring (17) being respectively engaged with one end wall of said cylinder (16) and said one end face of said piston (19), the other end wall of said cylinder and the other end face of said piston defining a chamber communicating with the high-pressure chamber of said pump or motor for introducing high-pressure liquid from said pump or motor into said chamber of said cylinder (16) so as to axially move said piston (19) in response to pressure exerted by said high-pressure liquid on said other end face of said piston together with the spring force exerted on said one end face of said piston by said compression spring and a force exerted on said one end face of said piston (19) by said control rod (18).

11. A pump or motor as claimed in claim 10, wherein said compression spring is formed as a hyperbolic spring so that a product of the force acting on said spring and the length of said spring remains constant.
12. A pump or motor as claimed in claim 10 or 11, wherein said control rod (18) is connected to a position of said slidable end plate such that an action line of resultant of pressure forces exerted by the liquid within said pump or motor on said slidable end plate coincides with an action line of the force exerted by said controlling rod on said slidable end plate.
13. A hydrostatic transmitting system comprising at least a pump and at least a motor driven by said pump, characterized in that at least one of said pump and said motor is an axial variable capacity pump or motor as claimed in any one of claims 1 to 12.
14. A hydrostatic transmitting system as claimed in claim 13, wherein one pump drives two motors connected in parallel, said pump and motors being integrated as a single unit with a common high pressure area and a common low pressure area.

Revendications

1. Pompe ou moteur à engrenage de capacité variable, axial comprenant un carter (8) avec une entrée (9) et une sortie (23), une roue dentée axialement mobile (11) et une roue dentée axialement fixe (3) montée dans le carter en une relation d'engrènement pour la rota-

tion autour de leurs axes respectifs, la roue dentée axialement mobile (11) pouvant se déplacer le long de la direction axiale par rapport à la roue dentée axialement fixe (3), un moyen de scellage radial (7, 12) agencé entre une surface intérieure du carter et des têtes de dents des roues dentées (3, 11) pour former entre ceux-ci des joints radiaux, et un moyen de scellage axial pour former des joints de chaque côté axial de la roue dentée (3, 11) et comportant un organe axialement fixe (8) et un organe axialement mobile (5) de manière à modifier une longueur d'une chambre de travail scellée définie entre les roues dentées et pour modifier ainsi une capacité de débit au tour de la pompe ou du moteur précitée, caractérisé en ce que le moyen de scellage radial comprend un organe de scellage axialement fixe (12) et un organe de scellage axialement mobile (7), l'organe axialement mobile du moyen de scellage axial comprend une plaque d'extrémité coulissante (5), une couronne d'entraînement (4) supportée à rotation dans la plaque d'extrémité coulissante et agencée à la manière d'un manchon coulissant sur la roue dentée axialement fixe (3) de manière à se déplacer axialement en même temps que la plaque d'extrémité coulissante (5) et une garniture élastique en forme de couronne d'entraînement agencée entre la roue dentée axialement fixe (3) et la couronne d'entraînement axialement mobile (4) pour former un joint entre celles-ci, et l'organe axialement fixe du moyen de scellage axial comprend une plaque d'extrémité fixe (8) et une couronne d'entraînement axialement fixe (10) supportée à rotation dans la plaque d'extrémité fixe (8) et agencée à la manière d'un manchon sur la roue dentée axialement mobile (11) ainsi qu'une garniture élastique en forme de couronne d'entraînement (24) agencée entre la roue dentée axialement mobile (11) et la couronne d'entraînement axialement fixe (10).

2. Pompe ou moteur suivant la revendication 1, caractérisée en ce en ce que les organes de scellage radiaux comprennent des blocs de scellage radiaux (7, 12) s'engageant avec les têtes de dents d'une des roues dentées (3, 11), un moyen pour compenser tout intervalle radial qui peut se produire entre les dents de la roue dentée précitée et le bloc de scellage radial dû à l'usure, ce moyen de compensation comprenant une garniture élastique entre le bloc de scellage radial et la surface intérieure du carter.

3. Pompe ou moteur suivant la revendication 2,



caractérisé en ce qu'une série de fentes sont formées dans une surface arrière des blocs de scellage radiaux (7, 12) qui s'engage avec la garniture élastique pour recevoir du liquide à haute pression de la pompe ou du moteur de manière à équilibrer la pression de liquide s'exerçant sur une surface opposée de la surface arrière du bloc de scellage radial précité.

4. Pompe ou moteur à engrenage de capacité variable, axial comprenant : un carter (10d) avec une entrée et une sortie, une roue dentée axialement mobile (5d) et une couronne d'entraînement axialement fixe (6d) montée dans le carter en une relation d'engrènement interne pour la rotation autour de leurs axes respectifs, la roue dentée axialement mobile (5d) pouvant se déplacer le long d'une direction axiale par rapport à la couronne d'entraînement axialement fixe (6d), un moyen de scellage radial (11d) agencé entre les roues dentées pour former un joint radial, et pouvant se déplacer axialement, ainsi qu'un moyen de scellage axial pour former des joints de chaque côté axial des roues dentées et comportant deux organes axialement mobiles (4d, 7d) qui peuvent se déplacer en même temps que la roue dentée axialement mobile et que le moyen de scellage radial de manière à modifier une longueur d'une chambre de travail scellée définie entre les roues dentées et pour modifier ainsi la capacité de débit autour de la pompe ou du moteur, caractérisé en ce que l'un des organes axialement mobiles peut se déplacer à l'intérieur de la couronne d'entraînement (6d) et comporte une plaque d'extrémité (7d) montée d'un côté axial de la roue dentée axialement mobile (5d) et une couronne d'entraînement externe (8d) supportée à rotation sur la plaque d'extrémité et s'engrénant avec la couronne d'entraînement intérieurement dentée, axialement fixe (6d) autour de la totalité de sa circonférence et en ce que l'autre des organes axialement mobiles se compose d'une plaque d'extrémité coulissable (4d) montée d'un autre côté axial de la roue dentée axialement mobile (5d) et pouvant se déplacer à l'extérieur de la couronne d'entraînement axialement fixe.
5. Pompe ou moteur suivant la revendication 4, caractérisé en ce qu'une garniture élastique sous la forme d'une couronne d'entraînement est agencée entre la couronne d'entraînement axialement fixe et la couronne d'entraînement externe.
6. Pompe ou moteur à vannes rotatives de capacité variable, axial comprenant : un carter avec

une entrée et une sortie, un stator (3f) monté dans le carter, un rotor (10f) monté dans le stator et pouvant tourner autour d'un axe, ce rotor comportant une série de vannes radialement mobiles (5f, 13f) qui s'engrènent avec une surface intérieure du stator (3f), ce rotor (10f) pouvant se déplacer axialement par rapport au stator (3f) pour modifier la longueur d'engrènement entre les vannes (5f, 13f) du rotor (10f) et la surface intérieure du stator (3f), un moyen de scellage pour former des joints de chaque côté axial du rotor, qui comprend un organe rotatif axialement fixe (6f) comportant un trou central recevant le rotor (10f) et une série de fentes radiales pour recevoir les vannes (5f, 13) les traversant, ainsi qu'un organe axialement mobile (4f) qui peut se déplacer axialement en même temps que le rotor (10f) pour modifier une longueur (L) d'une chambre de travail définie entre le rotor (10f) et le stator (3f) pour modifier ainsi une capacité de débit autour de la pompe ou du moteur, caractérisé en ce que chacune des fentes de l'organe rotatif axialement fixe (6f) contient une lame de scellage (7f, 12f) qui est constamment appelée contre chacune des vannes (5f, 13f) du rotor (10f) par un petit ressort (8f, 11f) pour permettre aux vannes (5f, 13f) du rotor (10f) de traverser d'une manière étanche aux fluides l'organe rotatif axialement fixe (6f).

7. Pompe ou moteur suivant la revendication 6, caractérisé en ce que l'organe axialement mobile se compose d'une plaque d'extrémité coulissable (4f) s'engageant d'une manière étanche aux fluides avec la surface intérieure du stator (3f).
8. Pompe ou moteur suivant l'une ou l'autre des revendications 6 et 7, caractérisé en ce que l'organe rotatif axialement fixe (6f) est sous la forme d'un disque.
9. Pompe ou moteur suivant l'une quelconque des revendications 1 à 8, caractérisé en ce qu'il comprend en outre un dispositif de commande automatique sensible à une variation de charge de la pompe ou du moteur pour commander un déplacement axial de la roue dentée axialement mobile ou du rotor.
10. Pompe ou moteur suivant la revendication 9, caractérisé en ce que le dispositif de commande automatique comprend un cylindre allongé axialement (16), un piston (19) agencé à l'intérieur du cylindre, une tige de commande (18) avec des extrémités opposées connectées respectivement à la plaque d'extrémité coulissa-



ble axialement (5) du moyen de scellage axial et à une face d'extrémité du piston (19) ainsi qu'un ressort de compression (17) monté autour de la tige de commande, des extrémités opposées du ressort de compression (17) étant respectivement engagées avec une paroi d'extrémité du cylindre (16) et la face d'extrémité précitée du piston (19), l'autre paroi d'extrémité du cylindre et l'autre face d'extrémité du piston définissant une chambre communiquant avec la chambre à haute pression de la pompe ou du moteur pour l'introduction de liquide à haute pression provenant de la pompe ou du moteur dans ladite chambre du cylindre (16) de manière à déplacer axialement le piston (19) en réponse à la pression exercée par le liquide à haute pression sur l'autre face d'extrémité du piston en même temps qu'à la force de ressort exercée sur la face d'extrémité précitée du piston par le ressort de compression et une force exercée sur cette face d'extrémité du piston (19) par la tige de commande (18).

11. Pompe ou moteur suivant la revendication 10, caractérisé en ce que le ressort de compression est sous la forme d'un ressort hyperbolique de telle sorte qu'un produit de la force agissant sur le ressort et de la longueur du ressort reste constant.

12. Pompe ou moteur suivant l'une ou l'autre des revendications 10 et 11, caractérisé en ce que la tige de commande (18) est connectée en une position de la plaque d'extrémité coulissante précitée de telle sorte qu'une ligne d'action de la résultante des forces de pression exercées par le liquide à l'intérieur de la pompe ou du moteur sur cette plaque d'extrémité coulissante coïncide avec une ligne d'action de la force exercée par la tige de commande sur cette plaque d'extrémité coulissante.

13. Système de transmission hydrostatique comprenant au moins une pompe et au moins un moteur commandé par ladite pompe, caractérisé en ce qu'au moins la pompe ou le moteur est une pompe ou un moteur de capacité variable axial suivant l'une quelconque des revendications 1 à 12.

14. Système de transmission hydrostatique suivant la revendication 13, caractérisé en ce qu'une pompe commande deux moteurs connectés en parallèle, la pompe et les moteurs étant assemblés sous la forme d'une seule unité avec une aire de haute pression commune et une aire de basse pression commune.

Patentansprüche

1. Zahnradpumpe oder -motor mit axial veränderbarer Fördermenge mit einem Gehäuse (8) mit einem Einlaß (9) und einem Auslaß (23); einem axial beweglichen Zahnrad (11) und einem axial feststehenden Zahnrad, die miteinander zu einer Drehbewegung um ihre entsprechenden Achsen kämmend im Gehäuse angeordnet sind, wobei das axial bewegliche Zahnrad (11) in axialer Richtung bezüglich dem axial feststehenden Zahnrad (3) verlagerbar ist; mit radialen Dichtmitteln (7, 12), welche zwischen einer Innenfläche des Gehäuses und Zahnköpfen der Zahnräder (3, 11) zum Schaffen einer radialen Abdichtung dazwischen angeordnet sind, sowie axialen Dichtmitteln zum Schaffen von Abdichtungen auf jeder axialen Seite des Zahnrades (3, 11) mit einem axial feststehenden Teil (8) und einem axial beweglichen Teil (5), um die Länge der abgedichteten Arbeitskammer zwischen den Zahnrädern und damit die Fördermenge je Umdrehung der Pumpe oder des Motors zu verändern, dadurch gekennzeichnet, daß die radialen Dichtmittel ein axial feststehendes Dichtglied (12) und ein axial bewegliches Dichtglied (7) aufweisen; daß das axial bewegliche Teil der axialen Dichtmittel eine gleitbare Stirnplatte (5), ein Ringzahnrad (4), welches drehbar in der gleitbaren Stirnplatte gelagert und gleitbar auf das axial feststehende Zahnrad (3) aufgeschoben ist, um sich axial zusammen mit der gleitbaren Stirnplatte (5) zu bewegen, sowie eine ringzahnradförmig gestaltete elastische Dichtung umfaßt, welche zwischen dem axial feststehenden Zahnrad (3) und dem axial beweglichen Ringzahnrad (4) zum Schaffen einer Dichtung dazwischen angeordnet ist; und daß das axial feststehende Teil der axialen Dichtmittel eine feststehende Stirnplatte (8) und ein axial feststehendes Ringzahnrad (10), das drehbar in der feststehenden Stirnplatte (8) gelagert und auf das axial bewegliche Ringzahnrad (11) aufgeschoben ist, sowie eine ringzahnradförmige elastische Dichtung (24) aufweist, die zwischen dem axial beweglichen Zahnrad (11) und dem axial feststehenden Ringzahnrad (10) angeordnet ist.

2. Pumpe oder Motor nach Anspruch 1, dadurch gekennzeichnet, daß die radialen Dichtglieder radiale Dichtblöcke (7, 12) aufweist, welche an den Zahnköpfen eines der Zahnräder (3, 11) angreifen, sowie Mittel zum Kompensieren jeglichen radialen Spieles, welches zwischen den Zähnen des einen Zahnrades und dem radialen Dichtblock aufgrund von Verschleiß auftre-



ten kann, wobei die Mittel zum Kompensieren eine elastische Dichtung zwischen dem radialen Dichtblock und der Innenfläche des Gehäuses umfassen.

3. Pumpe oder Motor nach Anspruch 2, dadurch gekennzeichnet, daß mehrere Schlitze in einer Rückseite der radialen Dichtblöcke (7, 12) eingeformt sind, die mit der elastischen Dichtung zum Aufnehmen von Hochdruckflüssigkeit der Pumpe oder des Motors zusammenwirken, um den Flüssigkeitsdruck auszugleichen, der auf eine Fläche entgegengesetzt der Rückseite der radialen Dichtblöcke wirkt.
4. Zahnradpumpe oder -motor mit axial veränderbarer Fördermenge mit:
einem Gehäuse (10d) mit einem Einlaß und einem Auslaß, einem axial beweglichen Zahnrad (5d) und einem axial feststehenden Ringzahnrad (6d), die im Gehäuse zu einer Drehung um ihre entsprechenden Achsen miteinander kämmend angeordnet sind, wobei das axial bewegliche Zahnrad (5d) in axialer Richtung relativ zum dem axial feststehenden Ringzahnrad (6d) beweglich ist;
radialen Dichtmitteln (11d), die zwischen den Zahnrädern zum Schaffen einer radialen Dichtung angeordnet und axial beweglich sind; und
axialen Dichtmitteln zum Schaffen einer Dichtung auf jeder axialen Seite der Zahnräder mit zwei axial beweglichen Teilen (4d, 7d), die gemeinsam mit dem axial beweglichen Zahnrad und den radialen Dichtmitteln beweglich sind, um die Länge einer abgedichteten Arbeitskammer zwischen den Zahnrädern und damit die Fördermenge je Umdrehung von Pumpe oder Motor zu verändern, dadurch gekennzeichnet, daß eines der axial beweglichen Teile im Inneren des Ringzahnrades (6d) beweglich ist und eine Stirnplatte (7d) aufweist, welche auf einer axialen Seite des axial beweglichen Zahnrades (5d) angeordnet ist, und ein äußeres Ringzahnrad (8d) drehbar an dieser Stirnplatte gelagert ist und mit dem axial feststehenden, innen verzahnten Ringzahnrad (6d) um seinen gesamten Umfang kämmt, und daß das andere axial bewegliche Teil aus einer gleitbaren Stirnplatte (4d) besteht, die auf der anderen axialen Seite des axial beweglichen Zahnrades (5d) außerhalb des axial feststehenden Ringzahnrades beweglich angeordnet ist.
5. Pumpe oder Motor nach Anspruch 4, dadurch gekennzeichnet, daß eine ringzahnradförmig gestaltete elastische Dichtung zwischen dem axial feststehenden Ringzahnrad und dem äußeren Ringzahnrad angeordnet ist.

6. Zahnradpumpe oder -motor mit axial veränderbarer Fördermenge mit:
einem Gehäuse mit einem Einlaß und einem Auslaß; einem Stator (3f) in dem Gehäuse; einem im Stator angeordneten Rotor (10f), der um eine Achse drehbar ist und mehrere radial verschiebbliche Flügel (5f, 13f) aufweist, die mit einer Innenfläche des Stators (3f) in Kontakt stehen, wobei der Rotor (10f) axial relativ zum Stator (3f) beweglich ist, um die Kontaktlänge zwischen den Flügeln (5f, 13f) des Rotors (10f) und der Innenfläche des Stators (3f) zu verändern; Dichtmitteln zum Schaffen von Dichtungen auf jeder axialen Seite des Rotors, die ein axial feststehendes drehbares Teil (6f) mit einer Mittelbohrung zur Aufnahme des Rotors (10f) und mehrere radiale Schlitze zum Aufnehmen und Führen der Flügel (5f, 13f), sowie ein axial bewegliches Teil (4f) umfassen, daß axial zusammen mit dem Rotor (10f) beweglich ist, um die Länge (L) einer Arbeitskammer zwischen dem Rotor (10f) und dem Stator (3f) und damit die Fördermenge je Umdrehung von Pumpe oder Motor zu verändern, dadurch gekennzeichnet, daß jeder Schlitz in dem axial feststehenden drehbaren Teil (6f) ein Dichtblatt (7f, 12f) aufweist, daß konstant gegen jeden Flügel (5f, 13f) des Rotors mittels einer Feder (8f, 11f) gedrückt ist, um die Flügel (5f, 13f) des Rotors (10f) dicht in dem axial feststehenden drehbaren Bauteil (6f) zu führen.
7. Pumpe oder Motor nach Anspruch 6, dadurch gekennzeichnet, daß das axial bewegliche Teil eine gleitbare Stirnplatte (4f) ist, die fluidicht mit der Innenfläche des Stators (3f) zusammenwirkt.
8. Pumpe oder Motor nach Anspruch 6 oder 7, dadurch gekennzeichnet, daß das axial feststehende drehbare Teil (6f) in Gestalt einer Scheibe ausgebildet ist.
9. Pumpe oder Motor nach einem der Ansprüche 1 bis 8 mit einer automatischen Regelvorrichtung, welches auf Laständerungen von Pumpe oder Motor reagiert, um die axiale Bewegung des axial beweglichen Zahnrades oder des Rotors zu regeln.
10. Pumpe oder Motor nach Anspruch 9, dadurch gekennzeichnet, daß die automatische Regelvorrichtung einen axial sich erstreckenden Zylinder (16), einen im Zylinder angeordneten Kolben (19), eine Steuerstange (18), deren entgegengesetzte Enden mit der axial gleitbaren Stirnplatte (5) der axialen Dichtmittel einerseits und einer Stirnfläche des Kolbens (19) verbunden



den ist, und einer Druckfeder (17), die um die Steuerstange und mit ihren entgegengesetzten Enden zwischen einer Stirnwand des Zylinders (16) und der einen Stirnfläche des Kolbens (19) angeordnet ist, wobei die andere Stirnwand des Zylinders und die andere Stirnfläche des Kolbens eine mit einer Hochdruckkammer der Pumpe oder des Motors kommunizierende Kammer zum Einführen von Hochdruckflüssigkeit aus der Pumpe oder dem Motor in die Zylinderkammer (16) definieren, um so den Kolben (19) axial in Abhängigkeit vom durch die Hochdruckflüssigkeit auf die andere Stirnfläche des Kolbens ausgeübten Druck zusammen mit der auf die eine Stirnfläche des Kolbens durch die Druckfeder aufgebrauchten Federkraft und einer auf die eine Stirnfläche des Kolbens (19) durch die Steuerstange (18) ausgeübten Kraft axial zu bewegen.

11. Pumpe oder Motor nach Anspruch 10, dadurch gekennzeichnet, daß die Druckfeder als hyperbolisch wirkende Feder ausgebildet ist, derart, daß das Produkt der auf die Feder wirkenden Kraft und der Länge der Feder konstant bleibt.

12. Pumpe oder Motor nach Anspruch 10 oder 11, dadurch gekennzeichnet, daß die Steuerstange (18) in einer solchen Position der gleitbaren Stirnplatte angeschlossen ist, daß die Wirkungslinie der Resultierenden der Druckkräfte, welche durch die Flüssigkeit in der Pumpe oder dem Motor auf die gleitbare Stirnplatte ausgeübt werden, mit der Wirkungslinie der Kraft zusammenfällt, welche durch die Steuerstange auf die gleitbare Stirnplatte ausgeübt wird

13. Hydrostatisches Übertragungssystem mit mindestens einer Pumpe und mindestens einem von der Pumpe angetriebenen Motor, dadurch gekennzeichnet, daß mindestens die Pumpe oder der Motor eine Pumpe oder ein Motor mit axial veränderbarer Fördermenge nach einem der Ansprüche 1 bis 12 ist.

14. Hydrostatisches Übertragungssystem nach Anspruch 13, dadurch gekennzeichnet, daß eine Pumpe zwei parallel geschaltete Motoren antreibt, wobei die Pumpe und die Motoren zu einer einzigen Baueinheit mit einem gemeinsamen Hochdruckbereich und einem gemeinsamen Niederdruckbereich zusammengefaßt sind.

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