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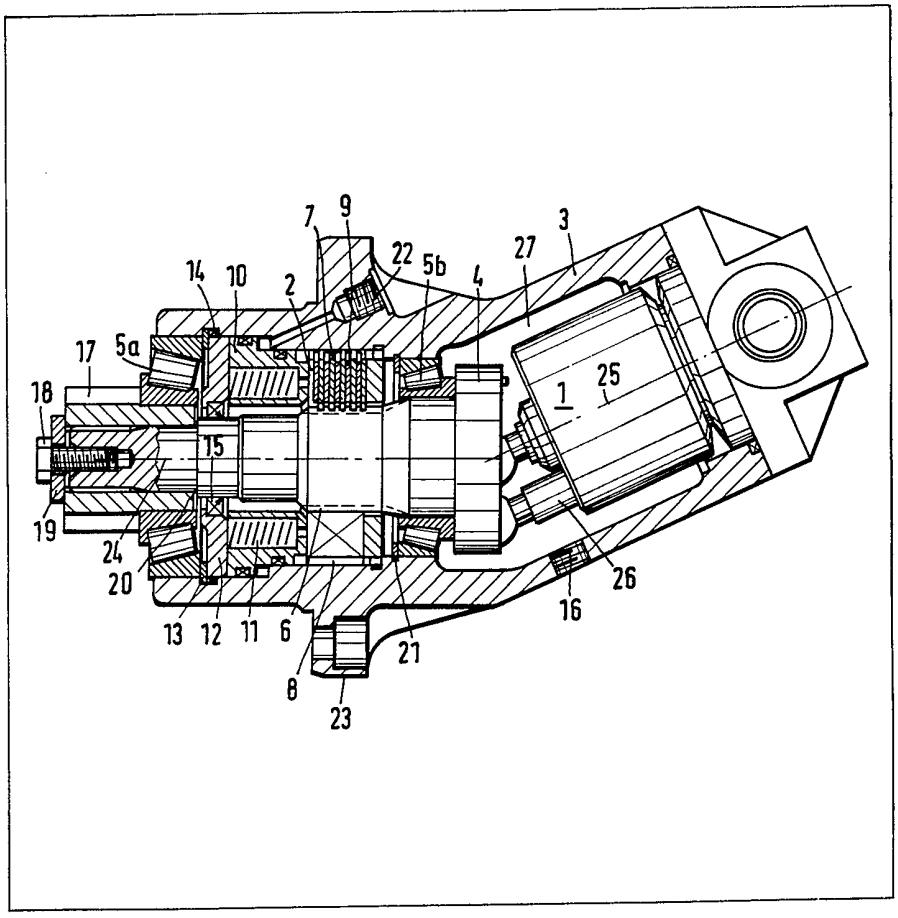
(54) **Inclined hydrostatic piston engines**

(57) An inclined hydrostatic axial piston engine has a spring-loaded multiple-disc brake (2) mounted in the engine housing (3) between two spaced bearings (5*a*,5*b*) on the drive shaft (4). The inner discs (7) of the brake (2) are coupled to rotate with the drive shaft (4) and the outer discs (9) are coupled to the housing (3). Spring means (11) continuously bias the discs (7,9) into braking engagement, and a piston/cylinder mechanism (10) is provided for overcoming the bias to selectively release the brake (2).



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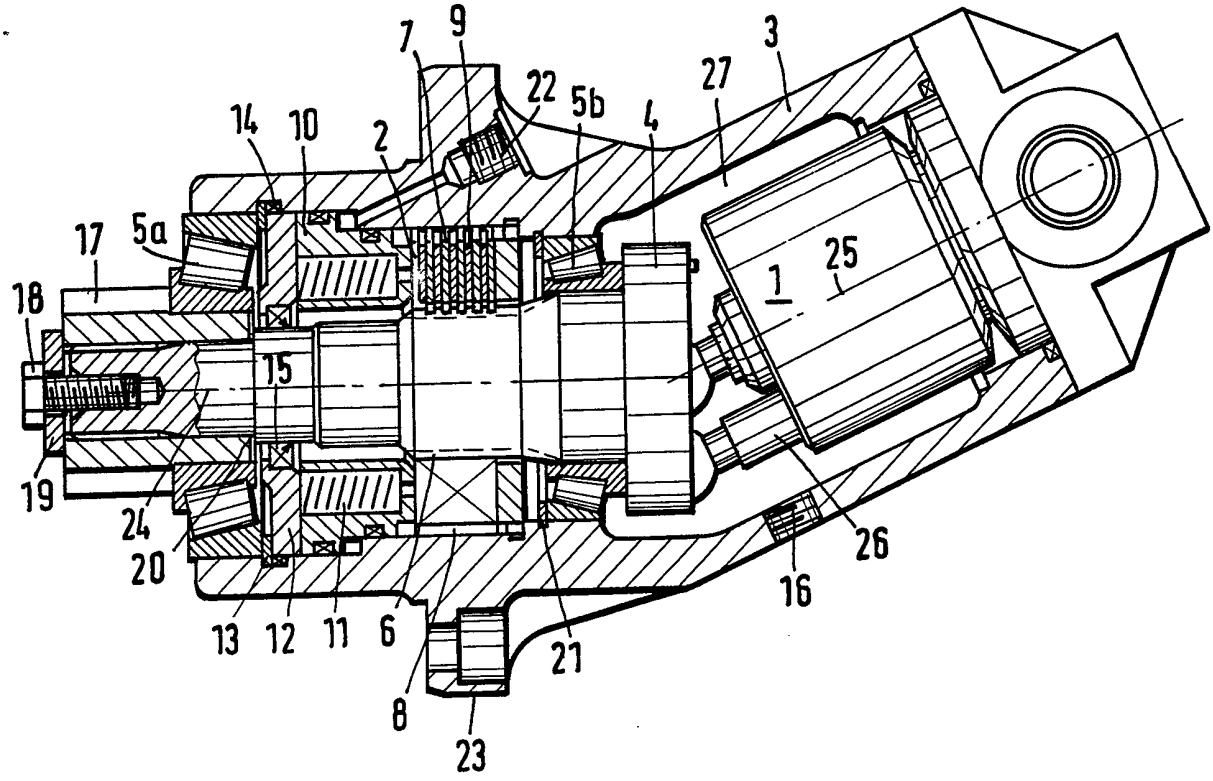

SPECIFICATION

Inclined hydrostatic piston engines

The invention relates to a hydrostatic axial piston engine of inclined construction, particularly for drive gears, the drive shaft of which is mounted at several points in the engine housing.

Basically, for drives of all kinds, there are two operating states, 'operational', with a constant or varying speed, and 'standstill'. During the transition from operation to standstill a brake is generally used to decelerate the moving masses. In hydrostatic drives for vehicles, a brake is also provided in the region of the drive gears, or incorporated therein, so as to keep the vehicle safely at a standstill. Spring-loaded multiple-disc brakes are generally provided for this purpose (Antriebstechnik 11 (1972) No. 7, page 255).

The aim of the invention is to provide a hydrostatic axial piston engine with an inclined axis construction, with which the system driven by said engine can be braked and/or kept at a standstill.

According to the invention, an hydrostatic axial piston engine of inclined axis construction has a drive shaft mounted in a housing by means of two spaced bearings; a multiple-disc brake mounted in the housing between the bearings and comprising inner discs coupled to rotation of the drive shaft and outer discs coupled to the housing; spring means acting axially of the drive shaft continuously biasing the discs into braking engagement; and a piston/cylinder mechanism selectively operable in response to fluidic pressure to overcome the bias of the spring means and release the brake. Preferably the inner discs of the brake has teeth meshing with teeth on the drive shaft, and wherein the outer discs have teeth meshing with teeth on the housing.

Normally the piston/cylinder mechanism comprises a ring piston which defines with the housing an annular cylinder, means being provided for delivering fluid under pressure to the annular cylinder and, to define the cylinder, the ring piston has a stepped skirt which complements a shoulder in the housing.

According to one embodiment of the invention, the multiple-disc brake is mounted beside a first internal bearing, and adjacent thereto, i.e. toward the free end of the drive shaft, a plurality of compression springs are distributed over the periphery, with the second, external bearing adjacent thereto.

It is also advantageous if the external bearing is lubricated with transmission lubricant, whilst the internal bearing and the multiple-disc brake run in hydraulic oil. The seal and separation between the two oil chambers is located between the external bearing and the multiple-disc brake.

The invention provides an inexpensive solution for a drive system which is also to include the braking means. Expensive maintenance and repair work at the construction site are also avoided by the fact that, in the case of damage, the hydrostatic axial piston engine provided with the brake can rapidly be taken out and replaced by a new one. The repair work itself can be carried out in the workshop. In known hydrostatic drives, the brake is mounted in the kinematic connection between the engine and the wheel which is to be driven, for example, the dredger drum of a caterpillar-type excavator, so that repairs to the brake always require complicated operations.

The invention will now be described by way of example and with reference to the accompanying drawing which schematically shows a section through a hydrostatic axial pistion engine according to the invention.

The hydrostatic axial piston engine, the inclined axis construction of which is indicated by the angle between the axes 24 and 25, contains a cylinder drum 1 with pistons, the piston rods 26 of which are connected to a drive shaft 4. The drive shaft 4 is mounted in the engine housing 3 at two points, namely via an external bearing 5*a* and an internal bearing 5*b*. Between the external bearing 5*a* and the internal bearing 5 there is mounted a multiple-disc brake 2, the brake 2 being constructed as a wet-running brake in the example shown.

In the region of the multiple disc brake 2, the drive shaft 4 comprises external teeth 6 for internal discs 7 and the one-part engine housing 3 comprises internal teeth 8 for external discs 9 of the multiple disc brake 2. The latter also includes a piston 10 subjected to loading from a plurality of compression springs 11 distributed over the periphery, whilst the piston chamber of said piston 10 can be acted upon by pressure medium via a pressure medium inlet 22. Actuation of the multiple-disc brake 2 is therefore effected by means of the spring-loaded piston 10 which is hydraulically lifted.

The springs 11 are supported, via a plate 12, on a securing ring 13, whilst the plate 12 has an 0-ring seal 14 and receives a shaft packing ring 15 which separates an oil chamber 27 from the external bearing 5. When the hydrostatic engine is installed, the external bearing is located inside a gear housing (not shown), namely the gear housing of the drive gears and thus in the oil chamber thereof.

The oil chamber 27 into which the waste oil of the hydrostatic engine passes contains a waste oil outlet 16.

A toothed wheel 17 is fitted on the drive shaft 4 and is held in the place by a screw 18 and a washer 19. Here, the toothed wheel 17 carries the external bearing 5*a*.

The axial force is borne in the housing by a securing ring 13. The bearings are arranged in an '0' configuration, whilst the axial prestressing is produced by means of shims 20 between the toothed wheel 17 and the drive shaft 4. The internal bearing 5*b*, also a conical-roller bearing, is fixed in the engine housing 3 by means of a securing ring 21 and determines the position of the drive shaft 4.

CLAIMS

1. An hydrostatic axial piston engine of inclined axis construction having a drive shaft mounted in a housing by means of two spaced bearings; a multiple-disc brake mounted in the housing between the bearings and comprising inner discs coupled to

rotation of the drive shaft and outer discs coupled to the housing; spring means acting axially of the drive shaft continuously biasing the discs into braking engagement; and a piston/cylinder mechanism selectively operable in response to fluidic pressure to overcome the bias of the spring means and release the brake.

2. An engine according to Claim 1 wherein the inner discs of the brake has teeth meshing with teeth on the drive shaft, and wherein the outer discs have teeth meshing with teeth on the housing.

3. An engine according to Claim 1 or Claim 2 wherein the piston/cylinder mechanism comprises a ring piston which defines with the housing an annular cylinder, means being provided for delivering fluid under pressure to the annular cylinder.

4. An engine according to Claim 3 wherein the ring piston has a stepped skirt which complements a shoulder in the housing to define said annular cylinder.

5. An engine according to any preceding claim wherein the bearings comprise an internal bearing and an external bearing, the multiple disc brake being mounted adjacent the internal bearing and the spring means being mounted adjacent the external bearing.

6. An engine according to Claim 5 wherein the housing defines an oil chamber enclosing the internal bearing and the multiple-disc brake, one boundary of the chamber being between the multiple-disc brake and the external bearing.

7. An engine according to Claim 6 wherein the external bearing is adapted to be lubricated with transmission lubricant.

8. An hydraulic axial piston engine substantially as described herein with reference to and as illustrated by the accompanying drawing.

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