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HYDRAULIC MOTORS

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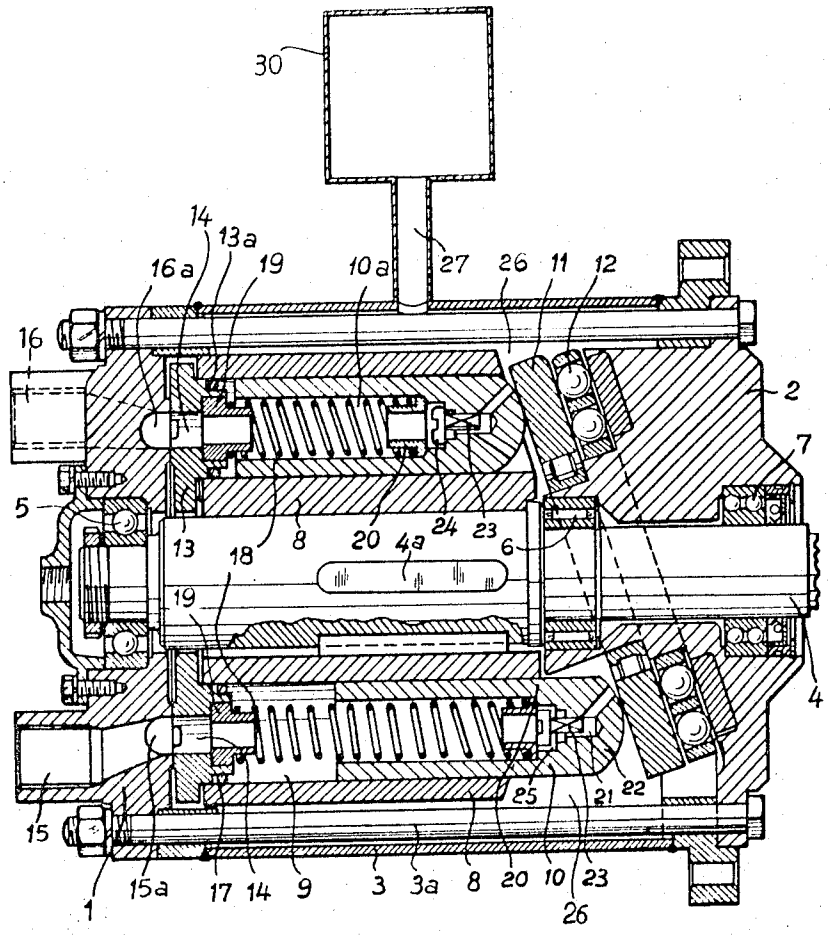

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HYDRAULIC MOTORS

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This invention relates to hydraulic motors having axial free pistons, of the type comprising a rotary block formed with cylindrical recesses extending parallel with the rotational axis of the block. The recesses have pistons slidably mounted therein, which are operated by fluid pressure from a pump and act against a surface inclined to the rotational axis of the block of a swash plate mounted on the stationary motor frame, in order to rotate the latter. Control valves alternately connect each cylinder with the pressure fluid supply pump and exhaust, respectively, dependently upon the angular position cyclically taken by the piston on rotation of the block.

Known hydraulic motors of the abovementioned type afford a limited braking effect when the motor is rotated by effect of the inertia of the driven parts coupled with the rotating motor part. Under these circumstances the pistons are removed from the swash plate against which they normally bear, which results in objectionable hammering and prevents the motor from effectively braking the rotating parts. This process is due to the vacuum set up in the cylinder liners on account of the phase displacement of the piston expansion stroke and pressure fluid supply or of the absence of supply during the said piston stroke.

This necessitates the use of complex brake devices, for the machine parts driven by the motors of the above referred type.

The object of this invention is to provide a hydraulic motor having axial free pistons, wherein the setting up of a subatmospheric pressure in the cylinders is prevented, when an external force raises the number of revolutions to a higher value than that due to the supply of pressure fluid by the pump driving the motor.

According to this invention the axial bore in each piston in which the fluid pressure acts, is connected with a chamber surrounding the rotor and connecting in turn with the fluid reservoir, the communication being established through conduits formed in the piston bottoms, each controlled by a unidirectional valve adapted to automatically close by effect of the fluid acting in the loaded cylinders and open by effect of the vacuum set up in the cylinders when the motor starts being rotated to allow of the fluid at atmospheric pressure to flow from the reservoir to the axial bore in the pistons and cause the resilient return means acting on the pistons to constantly hold the latter in contact with the swash plate.

Further characteristic features and advantages will be understood from the appended detailed description given by way of a non-limiting example, the single figure being an axial sectional view of a motor according to this invention.

Reference numerals **1** and **2** denoted the head portions of the motor frame, which are connected by rods **3***a* to a cylindrical housing **3** and are provided with ball or roller bearings **5**, **6** and **7** for guiding a shaft **4** arranged on the motor axis. The shaft **4** carries, such as by means of keys **4***a* a cylindrical block **8** formed with cylindrical recesses **9** extending parallel with the axis, having slidable therein pistons **10** having their outwardly facing end convex and bearing on a ring **11** guided by means of a ball or roller bearing **12** with respect to an internal surface on the head portion **2**, which is inclined to the rotational axis of the block **8**.

A ring **13** is arranged in contact with the flat inner wall of the head portion **1** and is formed with cylindrical projections **13***a* sealingly engaging through seals **17** the cylindrical recesses **9** in the rotary block. The ring **13** has conduits **14** bored therethrough for supply of fluid pressure to the cylindrical recesses **9** in the rotary block. The fluid pressure is supplied through an inlet conduit **15** bored in the stationary head portion **1**, connecting through a groove **15***a* in the form of a circular segment cut in the inner face of the head portion **1** with half the cylindrical recesses **9**.

The fluid is discharged through a conduit **16** likewise bored in the head portion **1** connecting through a groove **16***a* cut in the inner face of the head portion with the other half of the cylindrical recesses **9**.

The pistons **10** in the recesses connecting with the fluid supply conduit **15** are pressed against the swash plate **11** and act on the rotary block and distributor ring **13** by a tangential thrust which rotates the motor.

According to this invention the pistons **10** are formed with an axial bore **10***a* opening on the side turned towards the forward head portion **1**, accommodating a helical compression spring **18**, the opposite ends of which engage two tubular sleeves **19**, **20** secured on the cylindrical projection **13***a* on the ring **13** forming the head portion of the cylinder **9** and to the bottom of the bore **10***a* in the piston **10**, respectively.

A chamber **26** formed by the clearance between the rotor **8** and housing **3** surrounds the rotor **8** and connects through a conduit **27** with a reservoir **30** for the fluid at atmospheric pressure.

The chamber **26** connects with the bore **10***a* in each piston through an axial opening **21** in the piston bottom and a plurality of holes **22** extending obliquely to the piston axis. The opening **21** connects with the bore **10***a* in the piston through a larger diameter cylindrical recess **25**.

The opening **21** accommodates a unidirectional valve provided with a mushroom head **24** adapted to abut the wall of the recess **25** and with a shank **23** of a size such as to admit of fluid flow through the opening **21** when the head **24** is removed from the recess **25**.

During normal operation of the motor, the high pressure acting in each piston effects closure of the valve **(23, 24)**, which intercepts communication between the bore **10***a* in the piston and drain chamber **26**.

When the engine is set in rotation a subatmospheric pressure is set up in the bore **10***a* in each piston and opens the valve, whereby the fluid in the drain chamber **26** reaches into the bore and releases the subatmospheric pressure. Consequently, the return spring **18** acting on the piston is in a condition to cause the piston to perform its expansion strokes while it is constantly held in contact with the swash plate **11**.

Consequently, even when the motor is rotated while the cylinders are not supplied with fluid through the conduit **15**, **15***a*, the fluid fills just the same the bore **10***a* through the holes **22** in the pistons, and is subsequently expelled, through the conduits **16***a*, **16**. Consequently, the running motor can be braked by throttling the flow of fluid issuing from the conduit **16** by means of a valve the opening of which is adjustable by the operator.

The device is advantageous in use in connection with motors structurally combined with vehicle wheels for braking on down-hill drive; in control of rotation of towers for cranes, excavators and the like, in which the masses of the rotary parts are considerable and are liable to give rise to undesired movements by inertia.

What I claim is:

A hydraulic motor of the type comprising a tubular body, a rotor rotatably mounted within said body so that a clearance is formed between said body and said rotor,

and a swash plate situated on one side of the rotor supported by the body, a plurality of cylindrical recesses parallel to the rotational axis in said rotor, fluid inlet and outlet means disposed adjacent the side of said rotor opposite said swash plate, a piston freely slidably mounted in each recess, a compression spring mounted in each recess and urging the piston so that its head abuts said swash plate, a valve housing remote from said fluid inlet and outlet means, a conduit in continuous communication with said valve housing and with the clearance between the rotor and the body, a one-way valve opening towards the inside of the recess mounted in each valve housing and a conduit connecting the clearance between the body and

the rotor with a reservoir containing fluid at atmospheric pressure.

References Cited by the Examiner

UNITED STATES PATENTS

2,667,862	2/1954	Muller	91—199
2,980,077	4/1961	Magill	91—198
3,183,847	5/1965	Raymond	103—173
3,221,660	12/1965	D'Amato	103—162

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