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(54) **Hydraulic motor.**

(57) A hydraulic motor (10), comprising a plurality of radially mounted hydraulic cylinders (14) pivoted at their outer ends at fixed locations (16), a drive shaft (26), a main crank pin (22) fixed eccentrically to the drive shaft, and a member (18) pivoted to the main crank pin on which member the inner ends of the hydraulic cylinders are pinned on a circle concentric to the main crank pin so that hydraulic fluid fed to the cylinders causes the shaft to rotate; characterised in that the motor further includes an extension portion of the member (18) pivoted to a second crank pin (28) mounted to rotate eccentrically about a fixed centre of rotation, and means (34,38,36) to link the rotary motion of the drive shaft (26) and the second crank pin (28) so that the rotary motions are in phase.

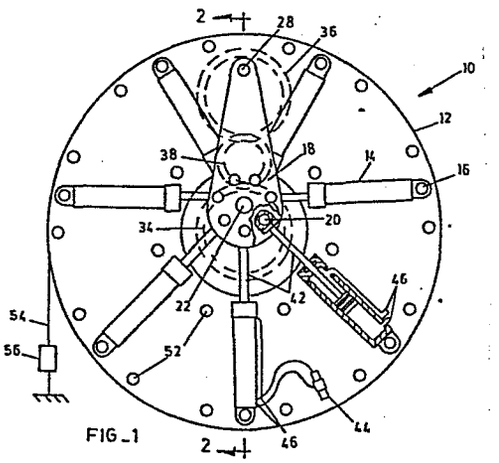

FIG_1

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Hydraulic Motor

This invention relates to hydraulic radial piston motors.

The most pertinent prior art known to the Applicant is Swiss Patent 249710 to Leo Widmer which describes a rotary motor which has single acting rams located radially about a plate, the outer ends of the rams being pivotally connected to the housing of the motor. The rams are arranged to rotate a shaft. In order to restrain the plate from rotating about the shaft, an extension piece is provided which includes a passive piston and cylinder assembly which is also pivotally connected to the housing. The outer ends of the rams describe elliptical orbits of different shapes.

It is desirable to provide a radial hydraulic motor which can operate with a higher torque and at slower speeds than prior art motors.

According to the invention a hydraulic motor, comprising a plurality of radially mounted hydraulic cylinders pivoted at their outer ends on a fixed outer circle, a drive shaft concentric with the outer circle, a main crank pin fixed eccentrically to the drive shaft, and a plate secured to the main crank and on which the inner ends of the hydraulic cylinders are pinned on a circle concentric to the main crank pin so that hydraulic fluid fed to the cylinders cause the shaft to rotate; has the improvement of a connecting rod having its big end pivoted to the main crank pin and its small end pivoted to a small crank pin mounted to rotate eccentrically about a fixed centre of rotation, and means to link the rotary motion of the drive shaft and the small crank pin so that their rotary motions are in phase, i.e. they rotate at the same rate and in the same direction and the crank pins pass through the same dead centre positions simultaneously.

The cylinders are preferably double acting and a cam surface rotating with the drive shaft may control the feed to the cylinders.

In one form of the invention a gear fast with the drive shaft and a gear fast with the small crank pin are in motion transmitting relationship with one another and preferably the two gears are linked by means of an intermediate gear meshing with them both.

The invention will be illustrated by the following description of a preferred embodiment with reference to the accompanying drawings in which:-

Figure 1 is a side view partly in section of a motor according to the invention; and

Figure 2 is a section along the line II - II of Figure 1.

Referring to the drawings a hydraulic motor 10 has a frame 12 composed of two parallel plates linked by a plurality of rods 52 on which are radially disposed seven double acting hydraulic cylinders 14. The cylinders 14 are fixed to the frame 12 at pivots 16 and to the big end of a connecting rod 18 at pivot pins 20 which are radially disposed around a main crank pin 22. The main crank pin 22 is eccentrically connected to two discs 24 which are spaced apart and mounted centrally to rotate on the frame 12. One of the discs 24 is connected to the input shaft 26 of the machine to be driven, i.e. the output or drive shaft of the hydraulic motor.

The connecting rod 18 is in the form of a yoke having two spaced apart plates which provide a working space for two of the hydraulic cylinders 14. The small end of the connecting rod 18 is connected to a crank pin 28 which is eccentrically connected to two discs 30 which are spaced apart and mounted to rotate

on the frame 12.

A central disc 24 carries a gear wheel 34 while a disc 30 carries a gear wheel 36. An idler gear wheel 38 connects the gear wheels 34, 36 to each other and maintains the same sense of rotation for these gear wheels at the same speed of rotation.

A cam 40 is attached to one of the discs 24 as seen in the drawings and a switch 42 is arranged to ride the surface of the cam 40. The switches 42 of which there are seven are connected to valves 44 which control the ports 46 of the cylinders 14 for extending or retracting the piston rods.

The discs 24 are mounted to rotate on main bearings 48 while the discs 30 rotate on bearings 50 all of which are fixed to the frame 12. Chains 54 anchor the motor 10 to restrain it from rotating in the direction of the output shaft 26. A load cell 56 may be fixed to the chain 54 for registering the output torque of the motor 10.

In use hydraulic fluid under pressure is fed through the hydraulic valves 46 to the cylinders 14 to either extend or retract the piston rods of the cylinders 14 depending on the position of the cam 40 and the switches 42. In the Figure 1 position with output shaft 26 rotating clockwise and the connecting rod 18 lying in a straight line with one of the cylinders 14, the switch 42 for this cylinder will change the direction of movement of the piston rods from the retracting to the extending mode. The cylinders 14 lying to the left hand side of the drawing are extending their piston rods while those to the right are retracting their rods. It will thus be seen that the modes of the piston rods change sequentially to enable all the cylinders 14 to exert forces in the direction of rotation.

The connecting rod 18 having its small and big ends linked by the gear train constrains the pins 20 to describe circular orbits. This is in contrast to prior art radial hydraulic motors in which the pins describe elliptical orbits of different shapes.

The result is that the motor of the invention has a relatively smooth power curve and can rotate large and heavy machinery at speeds as slow as 1 rpm or less. In a practical example a motor of the invention rotates a sugar crystalliser vessel with a total volume of 135 m^3 at a speed of 1 to 1,5 rpm and with a torque of up to 275 kNm. The hydraulic efficiency of the motor is also extremely high.

CLAIMS

1. A hydraulic motor (10), comprising a plurality of radially mounted hydraulic cylinders (14) pivoted at their outer ends at fixed locations (16), a drive shaft (26), a main crank pin (22) fixed eccentrically to the drive shaft, and a member (18) pivoted to the main crank pin on which member the inner ends of the hydraulic cylinders are pinned on a circle concentric to the main crank pin so that hydraulic fluid fed to the cylinders causes the shaft to rotate; characterised in that the motor further includes an extension portion of the member (18) pivoted to a second crank pin (28) mounted to rotate eccentrically about a fixed centre of rotation, and means (34,38,36) to link the rotary motion of the drive shaft (26) and the second crank pin (28) so that the rotary motions are in phase.

2. A hydraulic motor as claimed in claim 1 further characterised in that the cylinders (14) are double acting.

3. A hydraulic motor as claimed in claim 1 or claim 2 further characterised in that a cam surface (40) rotating with the drive shaft (26) controls the hydraulic feed to the cylinders (14).

4. A hydraulic motor as claimed in any one of the above claims further characterised in that a gear (34)

fast with the drive shaft (26) and a gear (36) about the centre of which the second crank pin (28) is constrained to orbit are in motion transmitting relationship with one another.

5. A hydraulic motor as claimed in claim 4 further characterised in that the gears (34) (36) are linked by means of an intermediate gear (38) meshing with them both.

6. A hydraulic motor as claimed in any preceding claim further characterised in that the second crank pin (28) is of small diameter compared to the main crank pin (22).

7. A hydraulic motor as claimed in any preceding claim further characterised in that the outer ends of the cylinder (14) are pivoted at locations (16) on a circle.

8. A hydraulic motor as claimed in any preceding claim further characterised in that the member (18) comprises a plate.

9. A hydraulic motor, comprising a plurality of radially mounted hydraulic cylinders pivoted at their outer ends on a fixed outer circle, a drive shaft concentric with the outer circle, a main crank pin fixed eccentrically to the drive shaft, and a plate secured to the main crank pin and on which the inner ends of the hydraulic cylinders are pinned on a circle

concentric to the main crank pin so that hydraulic fluid fed to the cylinders cause the shaft to rotate; with the improvement of a connecting rod having its big end pivoted to the main crank and its small end pivoted to a small crank pin mounted to rotate eccentrically about a fixed centre of rotation, and means to link the rotary motion of the drive shaft and the small crank pin so that the rotary motions are in phase.

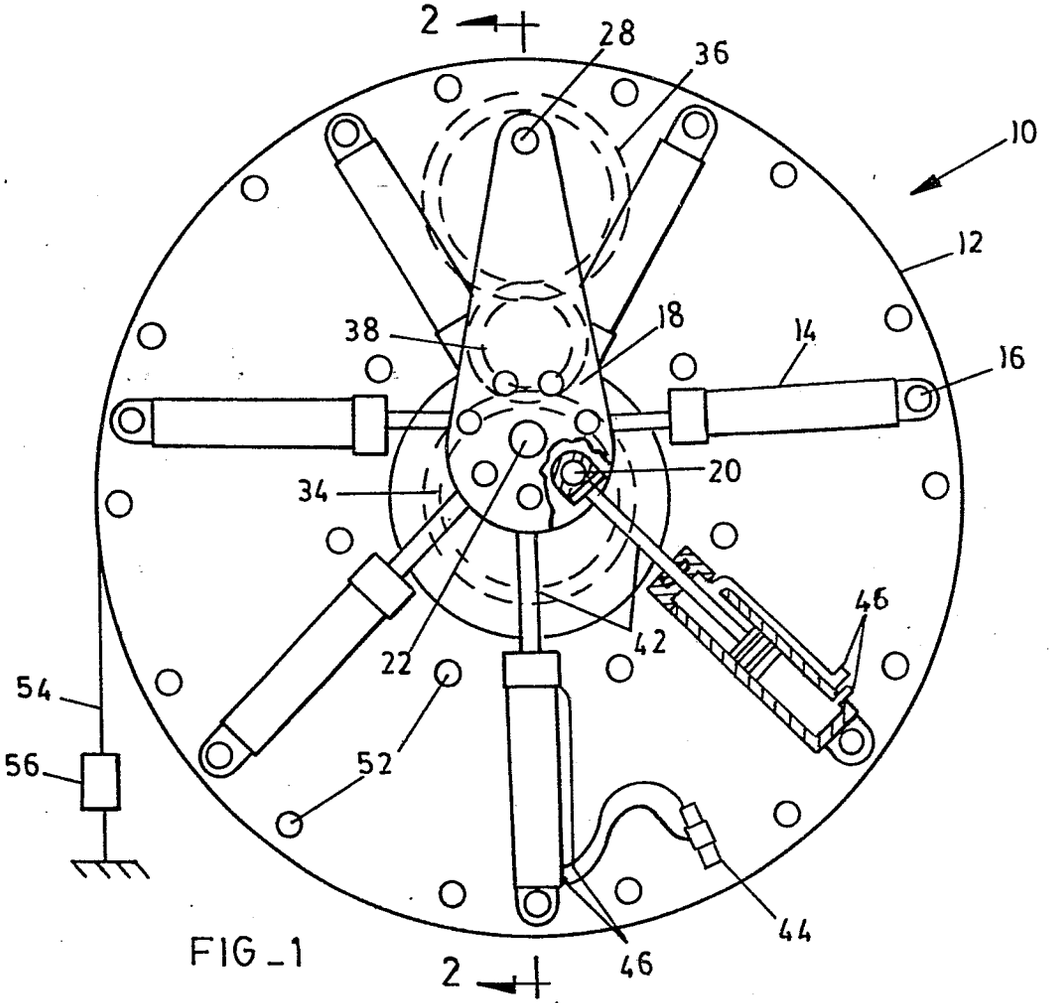
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FIG_1

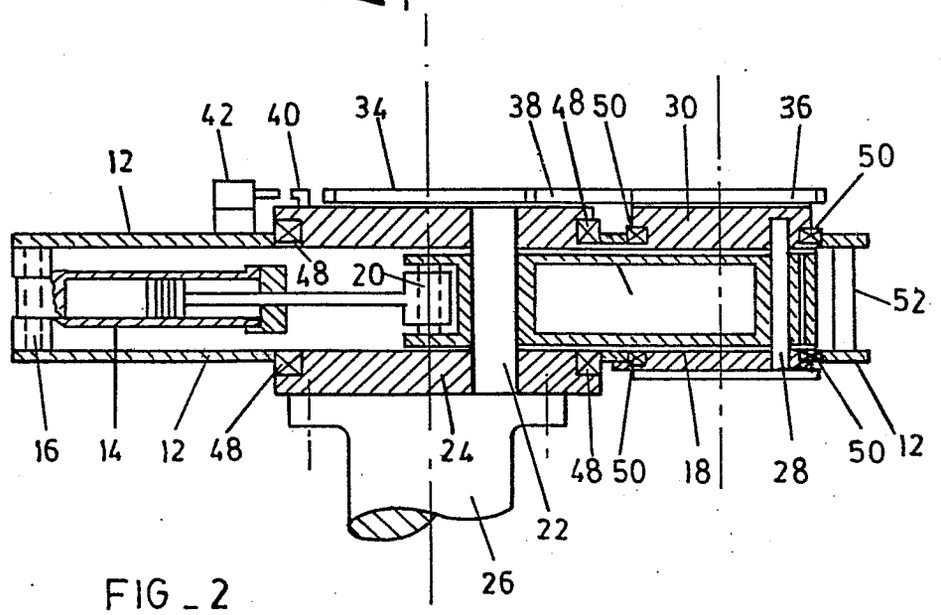
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FIG_2

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EUROPEAN SEARCH REPORT

0117152
Application number

EP 84 30 1108

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
Y	GB-A- 650 810 (S.L.M.) * Figures 1,2; page 1, line 10 - page 2, line 40 *	1,9	F 03 C 1/22 F 03 C 1/04
A		6-8	

Y	US-A-2 235 486 (LAWRANCE) * Figures 1,2; page 1, left-hand column, line 44 - page 2, left-hand column, line 7 *	1,9	
A		4,5,6, 8	

A	GB-A- 914 373 (RICHIER) * Figure 1; page 1, lines 56-69 *	2,3	
	-----		TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			F 03 C 1/22 F 03 C 1/04

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	09-05-1984	VON ARX H.P.

CATEGORY OF CITED DOCUMENTS

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