

ROTARY FLUID MOTOR

FIELD OF THE INVENTION

The present invention relates generally to fluid machinery and, more specifically, to a rotary fluid motor of the type including reciprocating pistons, which rotate around its axis of rotation.

DESCRIPTION OF THE PRIOR ART

Refer to my prior inventions ;

Patent No.: 16130 (Thailand) INTERNAL COMBUSTION
ROTARY ENGINE,

Patent No.: US 6,536,383 B2 INTERNAL COMBUSTION
ROTARY ENGINE,

Patent No.: US 6,813,989 B2 ROTARY COMPRESSOR OR
PUMP,

Patent No.: EP 1 085 182 B1 INTERNAL COMBUSTION
ROTARY ENGINE,

Patent No.: 3377968 (Japan) INTERNAL COMBUSTION
ROTARY ENGINE,

Application No. 095096 (Thailand) ROTARY FLUID
MOTOR

Alternative embodiments envision the use of the invention as a fluid motor. A fluid motor has the same structure as that of the rotary internal combustion engine, including cylindrical casing, a rotor with an output shaft as its axis in the cylindrical casing and crankshafts, pistons, piston chambers within the rotor. Each piston chamber undergoes downward movement by pressured-fluid through inlet-port and is discharged through outlet-port.

SUMMARY OF THE INVENTION

A fluid motor comprising: a casing defining a cylindrical chamber; a rotor with input shaft as the axis is in the said cylindrical chamber, crankshaft with pinion gear at the rear end in the rotor; piston chamber and piston in the rotor exists; drive train is provided to synchronize the rotation of the input shaft and the crankshaft.

BRIEF DESCRIPTION OF THE DRAWING

The above and other objects and advantages of the present invention will be understood with reference to the following detail description of embodiment thereof which is illustrated, by way of example, in the accompanying graphics; in which:

FIG. 1 is a diagrammatically illustrate inlet-port and outlet-port position of first block of rotary fluid motor,

FIG. 2 is a diagram of inlet-port and outlet-port position of second block of rotary fluid motor,

FIG. 3 is a perspective assembly view of the rotary fluid motor,

FIG. 3A is a perspective exploded view of the rotary fluid motor

FIG. 4 is a sectional view of front end plate of casing, screw gear chamber, and crankshaft front mounting plate and its' exploded view,

FIG. 5 is a sectional view of rear end plate of casing, drive train chamber and crankshaft rear mounting plate and its' exploded view,

FIG. 6 is an exploded perspective view of piston chamber base and cylindrical shape valve and detail of a connection spring stem and coil spring of cylindrical valve,

FIG. 7 is a perspective view showing interior details of the cylindrical shape valve and side view of FIG. 6,

FIG. 8 is rear view of fluid motor,

FIG. 9 is front view of fluid motor,

FIG. 10 is a perspective view of an annular body of the rotor,

FIG. 11 is a perspective view of a crankshaft middle mounting plate,

FIG. 12 is a perspective view of a crankshaft front mounting plate,

FIG. 13 is a perspective view of a crankshaft rear mounting plate,

FIG. 14 is a perspective view of output shaft and crankshaft mounting arm,

FIG. 15 diagrammatically illustrate inlet-stroke of the first rotary motor block and the concurrent outlet-stroke of the second rotary motor block,

FIG. 16 illustrate the outlet-stroke of the first rotary motor block and the concurrent inlet-stroke of the second rotary pressurizing motor block,

DETAILED DESCRIPTION

The illustrated fluid motor comprises a casing formed of a pair of end plate 11, 13 and outer cylinder 15 securely assembled as shown to enclose a cylindrical rotor. Outlet-port 2 and inlet-port 1 extend through the outer cylinder 15 to provide communication with the piston chamber.

The cylindrical rotor includes two annular bodies 8 having a cylindrical outer surface matching the cylindrical inner surface formed by outer cylinder 15 and has output shaft 3 as axis. The rotor includes front-

mounting plate of crankshaft 9 (with it's cover), and rear-mounting plate of crankshaft 10 secured against the annular bodies 8. Between two annular bodies 8 of the rotor is crankshaft middle mounting plate that comprises output shaft arm mounting plate 43 and its cover 44 (detail of plate 43 and its cover 44 are shown in FIG.11). The output shaft 3 is rotably mounted and extend through the casing by sleeve bearing mounted in the end plates 11, 13 of the casing.

The axis of output shaft 3 and the axis of rotor are the same axis (or concentric) and rotate together.

As shown in FIG.14, a crankshaft-mounting arm 56 is fixedly secured on the output shaft 3 for bodily rotation with it. A crankshaft-mounting arm 56 includes bearing housing 53, 55 and bearing 54. Piston chambers are fixedly secured with piston chamber bases 27 inside annular body of rotor 8. Each piston chamber axially extends to the outer surface of annular bodies of rotor 8, and wrapped by its cylindrical shape valve 7. In FIG.10, seal 42 is inserted in rotor annular bodies 8 to protect lube oil leak from cylindrical shape valve 7. Axis of each piston chamber is preferably uniformly spaced from output shaft axis in the direction of rotor rotation. The cylindrical shape valve 7 is slightly movable along the axis of its piston chamber. The curved end of the valve is pressed with inner cylindrical surface of outer cylinder of casing 15 by coil springs 31 to fluid tight. As shown in FIG.6, the coil springs 31 is seated in spring stem 32 that mounted on piston chamber bases 27 and lower end of cylindrical shape valve 7 to prevent cylindrical valve from moving. At the outer surface of piston chamber base 27 has ring-seal 28 covered to prevent lube oil leak from cylindrical valve 7. Key 29 with spring is mounted in keyway 30, 34 on

outside of each piston chamber and inside of its cylindrical shape valve 7 respectively. As shown in FIG.7, opening valve 35 and closing valve 36 are formed at the curve end of cylindrical shape valve 7, opening valve 35 to locate the start opening position of outlet-port and inlet-port, and closing valve 36 to locate the start closing position of outlet-port and inlet-port. A piston 6, normally of cylindrical shape similar to conventional construction, is reciprocating in each piston chamber. A piston rod is pivotally connected to each piston 6 and rotatively connected to its corresponding crank of crankshaft 5 by bearing 54. The fluid motor has two motor blocks, the first and the second block, and each block has two pistons. The first motor block, piston chamber bases 27 are fixedly secured on crankshaft front mounting plate 9 and cover of output shaft arm mounting plate 44. The second motor block, piston chamber bases 27 are fixedly secured on crankshaft rear mounting plate 10 and output shaft arm mounting plate 43.

FIG.4, between front end plate of casing 13 and crankshaft front mounting plate cover 9 is screw gear chamber 14, which enclose screw gear 4. The screw gear 4 is formed on the front end of output shaft 3 for driving lube oil pump.

A drive train is provided to synchronize the rotation of the output shaft 3 and both of the crankshafts 5. As shown in FIG.5, the drive train includes an annular gear-carrying cap 22 in drive train chamber 12. The drive train chamber 12 is between rear end plate of casing 11 and crankshaft rear mounting plate 10. A sleeve carry the output shaft is formed at the center of annular gear-carrying cap 22 with one end of this sleeve fixedly secured to rear end plate of casing

11. An annular gear 23 is fixed to the annular gear-carrying cap 22. The annular gear 23 mesh with pinion gears formed on the rear end of both crankshafts 5. The drive train shall specify the gear teeth ratio of annular gear to pinion gear to be appropriate to rotary fluid motor efficiency preferably twice the number of pistons in each motor block. For example, in a typical two-piston rotary pressurizing motor the gear teeth ration of annular gear to pinion gear shall be 4:1 so that when the output shaft rotates one round clockwise, the crankshafts will rotate four rounds. Similarly, the gear teeth ration of 3, 4, 6, 8 pistons rotary pressurizing motor shall be 6:1, 8:1, 12:1 and 16:1 respectively.

As output shaft 3 and crankshafts 5 concurrently rotate, the pistons 6 reciprocate in their piston chamber due to the rotation of crankshaft 5. The reciprocation of the pistons is synchronized to receive pressured-fluid through inlet-port 1 (inlet-stroke) and discharge from outlet-port 2 (outlet-stroke).

As an example, operation sequence of the rotary pressurizing motor as shown in FIG. 15 and FIG. 16 illustrates two sets piston of motor block. Each block comprises two-pistons.

During inlet-stroke of the first motor block (Fig. 15 position 57, 58, 59), piston chamber No. 1 & 2 passes through the inlet-port while the piston moves down by the pressured-fluid into its piston chamber. When the piston complete it downward-stroke, the inlet-stroke is also complete. At the same time the second motor block is operated in outlet-stroke (Fig.15 position 60, 61, 62).

Outlet-stroke of the first motor block (Fig.16 position 63, 64) occurs when piston chamber No.1 & 2 continues moving around the output shaft while the crankshaft drives piston No.1 & 2 move up to discharge

fluid. At the same time the second motor block is operating in inlet-stroke (Fig.16 position 65, 66).

Piston chamber No.1 and No.2 make the first motor block while piston chamber No.3 and No.4 make the second piston chamber set. The movement of each pair of piston must be balanced in order to maximize the output-power. However, this does not limit variation of the invention. Depending on the capacity required, the rotary pressurizing motor might comprise a plurality of motor block preferably. Again, one motor block may comprise a plurality of pistons and piston chambers preferably at least two for the same requirement for balancing. Moreover, the inlet stroke of each piston will substantially twice to no. of piston in each motor block that are six, eight, twelve and sixteen for 3, 4, 6, 8 pistons motor block.

Claims

1. A rotary fluid motor comprising:

a fixed cylindrical casing (11, 13, 15),

a rotor (8) in the casing, the rotor having a rotatable output shaft (3) extending co-axially within the casing, the rotor including a plurality of piston chambers, a respective piston being reciprocally mounted in each of the piston chambers for radial movement relative to the axis of rotation of the output shaft, and each piston having a piston rod connected to a crankshaft connected to the rotor for rotation therewith,

the casing having a respective fluid inlet port and a respective fluid outlet port communicating with each of the piston chambers, whereby rotation of the rotor admits pressurised fluid through the inlet ports and discharges pressurised fluid from the outlet ports in a two-stroke cycle,

a respective valve member surrounding each piston chamber to provide fluid communication between that piston chamber and the associated inlet and outlet ports, each valve member being cylindrically shaped, and having a curved end complementing the inner surface of the cylindrical casing to close said ports when that valve member is closed,

a drive train synchronising rotation of the crankshaft and the output shaft, the drive train having an annular gear and a piston gear with a gear teeth ratio appropriate to engine efficiency, and the arrangement is such that the pistons undergo reciprocal movement in the piston chambers in synchronism so that the pistons all have the same stroke position in the piston chambers.

2. A motor as claimed in claim 1, wherein the gear teeth ratio is twice the number of pistons.

3. A motor as claimed in claim 1 or claim 2, wherein the rotor includes a plurality of blocks (8) each including a plurality of pistons and piston chambers.

4. A motor as claimed in claim 3, wherein the piston chambers and the pistons are arranged in the blocks in pairs in opposition to one another.

5. A motor as claimed in any one of claims 1 to 4, further comprising a crank arm connected to the rotor, the piston rods being connected to respective ends of the crank arm.
6. A motor as claimed in claim 2, wherein each block includes a mounting plate rotatably supporting one end of the crankshafts of the pistons in that block, and a middle mounting plate disposed between adjacent blocks for rotatably supporting opposite ends of the crankshafts of the pistons in the adjacent blocks.
7. A motor as claimed in claim 6, wherein the casing of the valve members are secured to the mounting plates.
8. A motor as claimed in any one of claims 1 to 7, wherein each piston has a curved end corresponding in shape to the cylindrical casing.
9. A method of operating a rotary fluid motor including the steps of
 - providing a rotary fluid motor comprising
 - a fixed cylindrical casing
 - a rotor rotatably disposed in the casing, the rotor having
 - a rotatable output shaft extending within the casing,
 - the rotor including
 - a plurality of piston chambers,
 - a respective piston being reciprocally mounted in each of the piston chambers for radial movement relative to the axis of rotation of the output shaft,
 - and each piston having
 - a piston rod connected to a crankshaft connected to the output shaft,
 - the casing having
 - a respective fluid inlet port and
 - a respective fluid outlet port communicating with each of the piston chambers,

whereby operationally rotation of the rotor admits pressurised fluid through the inlet ports and discharges pressurised fluid from the outlet ports in a two stroke cycle,

a respective valve member surrounding each piston chamber to provide intermittent fluid communication between the piston chamber and the associated inlet and outlet ports as the rotor rotates and the valve member becomes aligned with one selected from the inlet port and the outlet port, each valve member being cylindrically shaped, and defining a curved end complementing the inner surface of the cylindrical casing to close said ports when that valve member is closed,

a drive train synchronising rotation of the crankshaft and the output shaft, the drive train including

an annular gear and

a piston gear with

a gear teeth ratio appropriate to engine efficiency,

and

the arrangement is such that the pistons undergo reciprocal movement in the piston chambers in synchronism so that the pistons all have the same stroke position in the piston chambers;

receiving pressurised fluid through an inlet port associated with a piston to exert pressure on the associated piston to rotate the crankshaft; and discharging the received pressurised fluid from the outlet port of the piston.

10. The method of claim 9, wherein the outlet port of the piston is in communication with fluid at a relatively lower pressure than the inlet port.
11. A method as claimed in claim 9 or 10, wherein the rotary fluid motor includes a plurality of rotors and associated piston chambers and pistons, and the method includes the steps of

receiving pressurised fluid into pistons associated with one rotor via their associated inlet ports to exert pressure on the associated pistons; while simultaneously discharging pressurised fluid from the outlet ports of pistons associated with another rotor.

12. The method of claim 11, wherein the pressure exerted on the pistons associated with one rotor is used to drive the pistons associated with another rotor to discharge pressurised fluid from their associated outlet ports.

13. A rotary fluid motor comprising
a fixed cylindrical casing
a rotor rotatably disposed in the casing, the rotor including
a rotatable output shaft extending within the casing, the rotor including
a plurality of piston chambers,
a piston associated with each piston chamber, each piston being reciprocally mounted in each of the piston chambers for radial movement relative to the axis of rotation of the output shaft, and each piston having
a piston rod connected to a crankshaft,
a rotatable output shaft coupled to the crankshaft of each piston to be driven thereby,
a respective valve member surrounding each piston chamber to provide intermittent fluid communication between the piston chamber and the associated inlet and outlet ports as the rotor rotates and the valve member becomes aligned with one selected from the inlet port and the outlet port, each valve member being cylindrically shaped, and defining
a curved end complementing the inner surface of the cylindrical casing to close said ports when that valve member is closed,
the casing having
at least one respective fluid inlet port and

at least one respective fluid outlet port communicating with each of the piston chambers,

whereby operationally rotation of the rotor admits pressurised fluid into a piston chamber through the inlet ports and discharges pressurised fluid from a piston chamber from the outlet ports in a two stroke cycle,

a drive train synchronising rotation of the crankshaft and the output shaft, the drive train including

an annular gear and

a piston gear with

a gear teeth ratio appropriate to engine efficiency, and

the arrangement is such that the pistons undergo reciprocal movement in the piston chambers in synchronism so that the pistons all have the same stroke position in the piston chambers.

14. A method of operating a rotary fluid motor including the steps of
providing rotary fluid motor comprising
a fixed cylindrical casing
a rotor rotatably disposed in the casing, the rotor including
a rotatable output shaft extending within the casing,
the rotor including
a plurality of piston chambers,
a piston associated with each piston chamber, each piston being reciprocally mounted in each of the piston chambers for radial movement relative to the axis of rotation of the output shaft, and each piston having
a piston rod connected to a crankshaft,
a rotatable output shaft coupled to the crankshaft of each piston to be driven thereby,
a respective valve member surrounding each piston chamber to provide intermittent fluid communication between the piston chamber and the associated inlet and outlet ports as the rotor rotates

and the valve member becomes aligned with one selected from the inlet port and the outlet port, each valve member being

cylindrically shaped, and defining
a curved end complementing the inner
surface of the cylindrical casing to close
said ports when that valve member is
closed,

the casing having

at least one respective fluid inlet port and
at least one respective fluid outlet port
communicating with each of the piston chambers,
whereby operationally rotation of the rotor admits
pressurised fluid into a piston chamber through the
inlet ports and discharges pressurised fluid from a
piston chamber from the outlet ports in a two stroke
cycle,

a drive train synchronising rotation of the crankshaft and the
output shaft, the drive train including

an annular gear and
a piston gear with
a gear teeth ratio appropriate to engine efficiency,
and

the arrangement is such that the pistons undergo
reciprocal movement in the piston chambers in
synchronism so that the pistons all have the same
stroke position in the piston chambers;

receiving pressurised fluid through an inlet port associated with a piston to
exert pressure on the associated piston to rotate the crankshaft; and
discharging the received pressurised fluid from the outlet port of the piston.