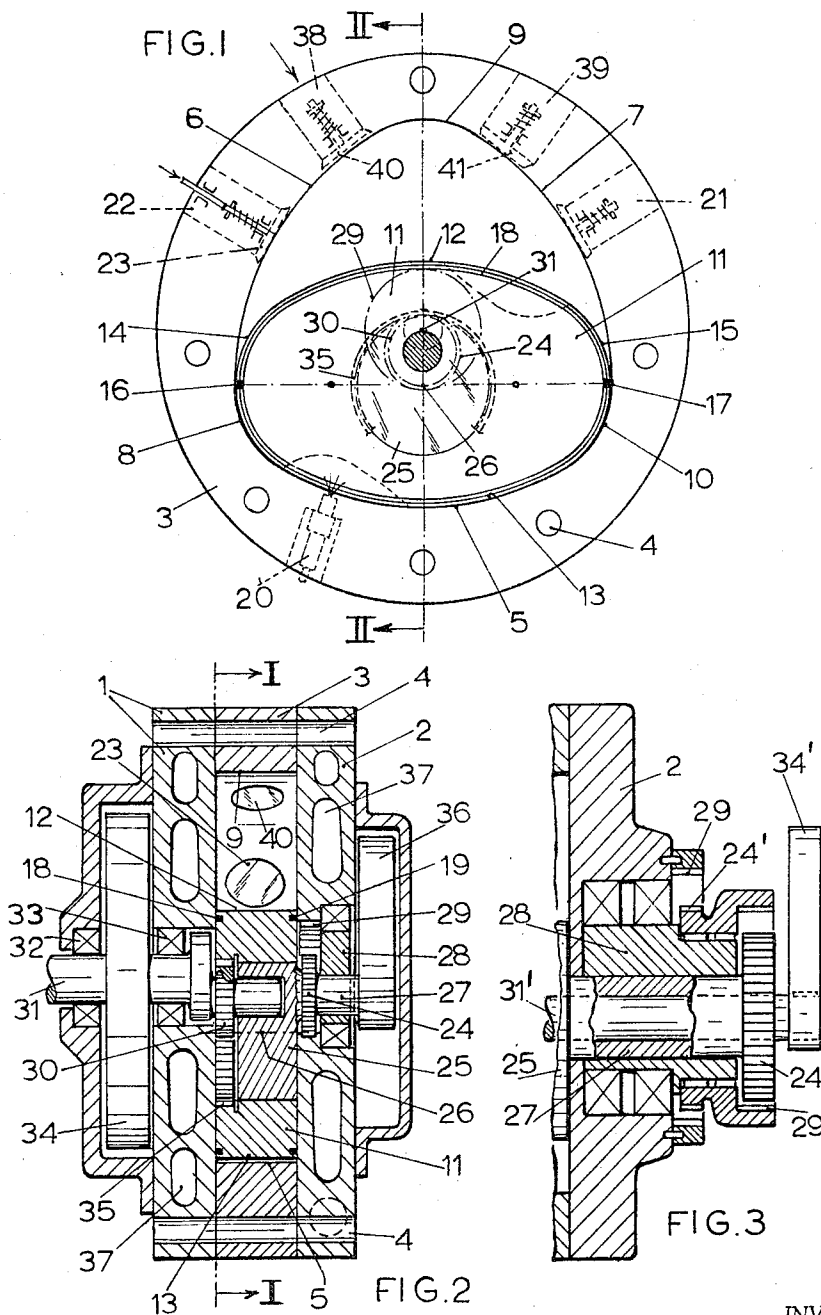


Nov. 15, 1966

C. DOYER
MOTOR, PUMP OR COMPRESSOR WITH A PISTON
ROTATABLE WITHIN A HOUSING
Filed July 9, 1964

3,285,189



INVENTOR

CORNELIS DOYER

BY

Smiley & Smiley
ATTORNEYS

1

3,285,189

MOTOR, PUMP OR COMPRESSOR WITH A PISTON ROTATABLE WITHIN A HOUSING

Cornelis Doyer, Wladimiriaan 6A, Bussum, Netherlands
Filed July 9, 1964, Ser. No. 381,484

Claims priority application Netherlands, July 15, 1963,
295,310

7 Claims. (Cl. 103—130)

The present invention relates to a motor, pump or compressor having a piston rotatable within a housing. Such motors, pumps or compressors generally have the advantage that no reciprocable parts are involved so that balancing is easier. In contrast, in the above mentioned machines of present construction the sealing and cooling of the piston cause great difficulties. The object of the invention is to provide a motor, pump or compressor of the type described which is distinguished from known constructions in respect of the disadvantages mentioned.

For this purpose, in accordance with the invention the housing is bounded by two parallel walls, and in the cross section this housing has the shape of an equi-angular triangle with convex outwardly curved sides which are connected by rounded parts, and the piston is formed by an oval disc located between the parallel walls, the shape of the long sides of the oval corresponding substantially to the shape of the sides of the triangle and the shape of the short sides of the oval corresponding substantially to the shape of the said rounded parts, so that upon movement of the piston from a position in which the piston abuts one side of the triangle to a succeeding position one end of the piston remains located in the associated rounded part and the other end passes along the opposite side of the triangle, and thereupon the other end of the piston remains located in a rounded part and the first mentioned end passes along the opposite side. Hence, in the positions referred to the piston has, at any time, a large part of its operative surface in contact with the coacting surface of the interior of the housing.

In accordance with the invention the sides of the triangle may be approximately circular arcs, and pass from one to another via circular arcs of greater curvature. Further, according to the invention the path of the centre of the piston may be a reduced hypocycloid. Such a path can easily be obtained, and the above described cooperation of the piston and the housing is then obtained.

In a preferred embodiment of the invention a pinion is eccentrically mounted in the piston in such manner that the centre of the piston lies within the pitch circle of the pinion, and the pinion is mounted eccentrically in a pin rotatable about the centre line of the housing in such manner that the pinion can roll along internal teeth arranged in the side wall of the housing, the pitch circle diameter of said internal teeth being $1\frac{1}{2}$ times as large as the diameter of the pinion, and a second pinion, the pitch circle of which passes through the centre line of the piston, is rotatably mounted in the piston coaxial with the first pinion, the second pinion being capable of rolling along internal teeth centrally arranged in the piston, the pitch circle diameter of the last mentioned internal teeth being twice as large as the pitch circle of the second pinion, which is eccentrically mounted on a shaft centrally and rotatably mounted in the housing.

Further, in accordance with the invention the pitch circles of the two pinions are advantageously in the ratio 9:8. The centre of the piston then describes a reduced hypocycloid the arcs of which may approximately be regarded as a circular arc.

The shaft for transmitting the power may be connected to one of the pinions.

In accordance with the invention the shaft is advantageously connected to the second pinion.

2

The invention will now be described in more detail with reference to the accompanying drawings, in which

FIG. 1 is a view in cross section of a motor according to the invention, on the line I—I of FIG. 2,

FIG. 2 is a longitudinal section on the line II—II of FIG. 1, and

FIG. 3 is a section, corresponding to the section shown in FIG. 2, of part of a motor constructed in accordance with another embodiment of the invention.

Referring to FIGS. 1 and 2, the housing of the motor illustrated comprises two end plates 1 and 2 with an annular part 3 between them. The parts 1, 2 and 3 are held together by bolts (not shown) passing through holes 4. In cross section the inner surface of the annular part 3 has convex sides 5, 6 and 7 which are interconnected by rounded parts 8, 9 and 10. Between the end plates 1 and 2 is located an oval piston 11, the shape of the long sides 12 and 13 of which corresponds to the shape of each of the sides 5, 6 and 7, whilst the shape of the short sides 14 and 15 corresponds to the shape of the rounded parts 8, 9 and 10 of the housing. In the short sides 14 and 15 of the piston 11 are arranged resilient seals 16 and 17 which upon rotation of the piston 11 rub along the sides 5, 8, 6, 9, 7 and 10 of the housing. On the sides of the piston there are provided oval sealing rings 18 and 19 which rub along the flat inner walls of the end plates 1 and 2, of the housing. In the housing there are also provided a spark plug 20, an inlet opening 21 for combustion air and fuel, and an opening 22 with a valve 23 operable to permit the discharge of the combustion gases.

In the long sides 12 and 13 of the piston recesses of desired form may be provided as ignition chamber cavities, as shown in broken lines. The piston rotates (FIG. 1) in clockwise sense. Upon movement of the piston from the position shown the short side 15 of the piston rests within the rounded part 10 of the housing, whilst the seal 16 rubs along the side 6 of the housing. Thereafter the short side 14 moves into and rotates in the rounded part 9 and the seal 17 rubs along the side 5. During this latter movement combustion air and fuel are drawn in through the opening 21, and is then compressed during rubbing of the seal 16 along the side 7 until the piston 11 has rotated through 180° from the position shown. The fuel and air mixture then being ignited by means of the spark plug 20, the piston will rotate to the right with the seal 17 rubbing along the side 6 in the manner described above in relation to the seal 16. At the end of this movement the outlet valve 23 is opened so that the combustion gases can escape through opening 22.

The control of the movement of the piston and the derivation of the work delivered by the piston take place in the following manner. A pinion 24 is eccentrically mounted in the piston 11 by means of a pin 25 in such manner that the centre line 26 of the piston 11 lies within the pitch circle of the pinion 24. The pinion 24 is mounted eccentrically, by means of a shaft 27 connected to it, in a pin 28 rotatable about the centre line of the housing, in such manner that the pinion 24 can roll along internal teeth 29 arranged in the end plate 2 of the housing. The pitch circle of the teeth 29 and of the pinion 24 are in the ratio 3:2.

A second pinion 30 is likewise rotatable in the pin 25 and coaxial with the pinion 24. The centre line of the piston passes through the pitch circle of the second pinion 30. This second pinion 30 is secured eccentrically on a shaft 31 which is centrally journaled in the housing by means of bearings 32 and 33. On the shaft 31 is arranged a flywheel 34. The pinion 30 can roll along internal teeth 35 in the piston 11, the pitch circle diameter of the teeth 35 being twice as large as the diameter of the second pinion 30. The pitch circles of the pinions 24 and 30 are

in the ratio 9:8. On the shaft 27 is also arranged a counter weight 36.

Since the centre line 26 of the piston 11 is somewhat within the pitch circle of the pinion 24, the centre of the piston describes a reduced hypocycloid. A point lying on the pitch circle of the pinion 24 describes a hypocycloid of Steiner. The arcs of the reduced hypocycloid described by the centre of the piston 11 may be regarded as approximately concentric circles in relation to the sides 5, 6 and 7 of the housing.

The cooperation of the teeth 35 with the pinion 30 provides that the piston 11 always takes up the correct position relative to the housing.

In the piston there are provided ducts (not shown) for the passage of a cooling liquid and oil for lubricating the piston. The end plates 1 and 2 have ducts 37 for the passage of the cooling liquid for cooling the cylinder walls.

To prevent air from being compressed behind the piston during the expansion stroke, and to prevent suction from being established behind the piston during the compression stroke, two openings 38 and 39 with spring loaded valves 40 and 41 respectively are provided.

The valve 40 opens upon the occurrence of suction, whilst the valve 39 prevents the occurrence of excess pressure. The compressed air drawn through the openings 38 and 39 may be used for providing further cooling.

In FIG. 3, parts corresponding to parts of FIG. 2 have been given the same reference numerals.

The pin 28 has been extended outwardly and carries an eccentrically mounted pinion 24', 29' the external teeth 24' of which cooperate with the internal teeth 29. The pinion 24 cooperates with internal teeth 29' of the intermediate wheel. The shaft 31 has been extended to the right by the part 31' and carries a counter weight 34'. The distance of the centre line of the housing from the centre of the pinion is the same as in FIG. 2. The diameter of the pinion 24 and of the teeth 29 however is much larger. In this way, better power transmission can take place.

What I claim is:

1. Motor, pump or compressor comprising a piston rotatable within a housing, said housing being bounded by two parallel side walls and in cross section having the shape of an equiangular triangle with convex outwardly curved sides which are connected by rounded apices, said piston being an oval disc located between the parallel walls and having long sides corresponding substantially to the shape of the sides of said triangle and short sides corresponding substantially to the shape of said rounded apices, sealing means disposed in the short sides of said piston substantially in the major axis thereof, and means for rotating the piston within the housing such that as the piston makes a complete revolution turning from a position in which one long side abuts a side of the housing triangle through subsequent positions in which each short side alternately passes along a side of the triangle while the opposite short side turns in the opposite rounded apex so as to slidably engage said sealing means against the triangle sides and apices substantially perpendicularly at all times during said complete rotation.

2. Motor, pump or compressor according to claim 1 wherein the sides of the triangle are substantially circular arcs and said apices are also circular arcs for smoothly merging said sides from one to another.

3. Motor, pump or compressor according to claim 1 wherein said means for rotating the piston controls the movement so that the path of the centre of the piston is a reduced hypocycloid.

4. Motor, pump or compressor according to Claim 1 wherein said means for rotating the piston comprises a first pinion eccentrically mounted in the piston in such manner that the centre of the piston is spaced inwardly of the pitch circle of the pinion, said pinion being mounted eccentrically in a pin rotatable about the center line of the housing in such manner that the pinion can roll along an internal toothed ring connected to one of said side walls of the housing, the pitch circle diameter of said ring being $1\frac{1}{2}$ times as large as the diameter of the pinion, a second pinion whose pitch circle passes through the center line of the piston being rotatably mounted in the piston coaxially with the first pinion, the second pinion being capable of rolling along internal teeth arranged centrally in the piston, the pitch circle diameter of the last mentioned internal teeth being twice as large as the pitch circle of the second pinion, and said second pinion being eccentrically mounted about a shaft mounted centrally and rotatably in the housing.

5. Motor, pump or compressor according to claim 4 wherein said tooth ring is eccentrically mounted on an extension of said pin mounting the first pinion, said intermediate wheel having external teeth adapted to roll along the internal teeth of said ring, the internal teeth of said ring having a pitch circle diameter $1\frac{1}{2}$ times as large as the diameter of the first pinion, the pitch circle diameter of said internal teeth in the piston being twice as large as the pitch circle of the second pinion.

6. Motor, pump or compressor according to claim 4 wherein the pitch circle diameter of the two pinions are in the ratio 9:8.

7. Motor, pump or compressor according to claim 4 wherein said shaft is connected to the second pinion for transmitting the power.

References Cited by the Examiner

UNITED STATES PATENTS

1,636,486	8/1927	Planche	103—130
3,033,180	5/1962	Bentele	91—56
3,117,561	1/1964	Bonavera	123—8
3,199,496	8/1965	Kell	123—8
3,221,664	12/1965	Jernaes	103—130

FOREIGN PATENTS

176,112	2/1922	Great Britain.
---------	--------	----------------

MARK NEWMAN, *Primary Examiner.*

SAMUEL LEVINE, *Examiner.*

W. L. FREEH, *Assistant Examiner.*