

[54] VANE TYPE FLUID MOTOR

3,473,478 10/1969 Little, Jr. 418/258

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[57] ABSTRACT

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[51] Int. Cl.² F04C 1/00

[58] Field of Search 418/223, 257, 258, 266, 418/267, 268, 269

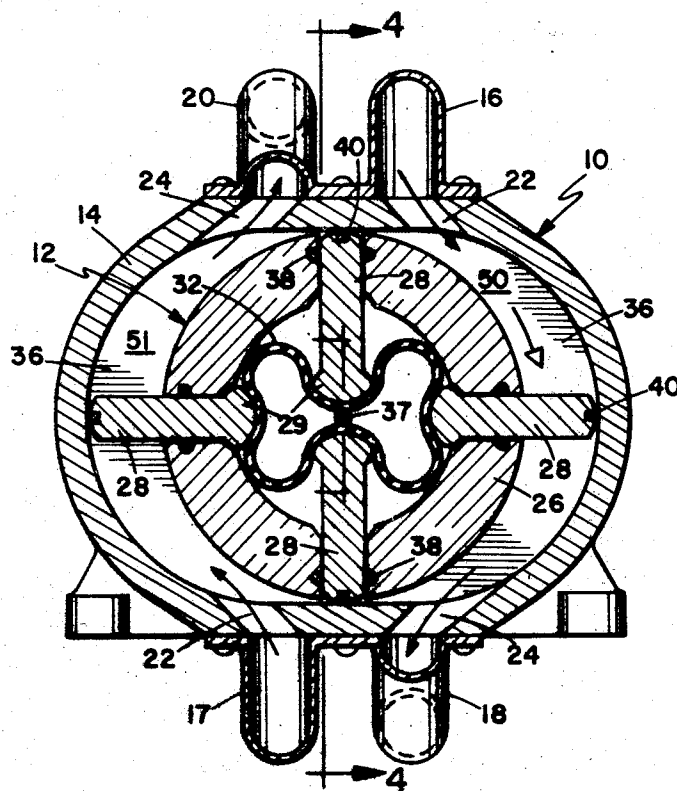
A motor for producing power from a pressurized fluid, incorporating an elongated stator housing with an interior surface against which the vanes seal. The vanes are mounted in a rotor housing and are biased into sealing contact with the walls of the stator housing by a pneumatic compensator. The pneumatic compensator incorporates a bladder which is pressurized to produce a radially outward bias, on the vanes. The net volume of the compensator is constant due to the opposite movement of adjacent pairs of vanes.

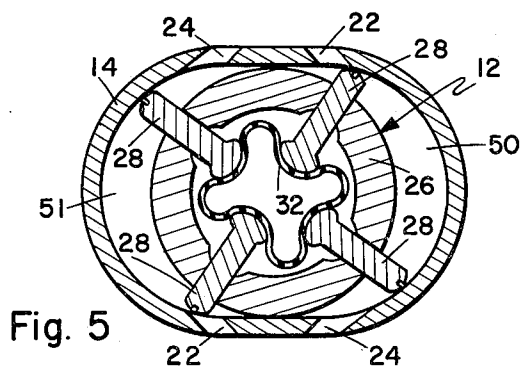
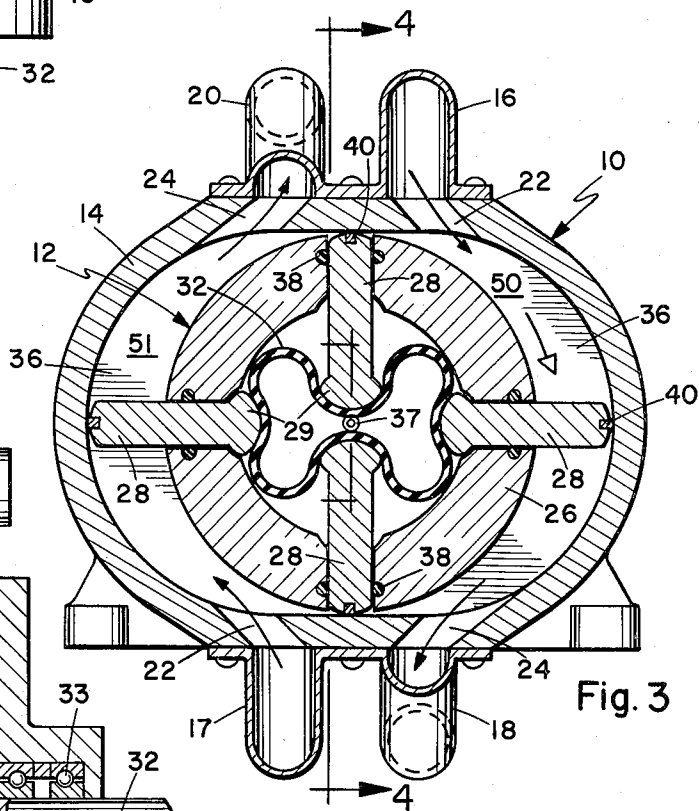
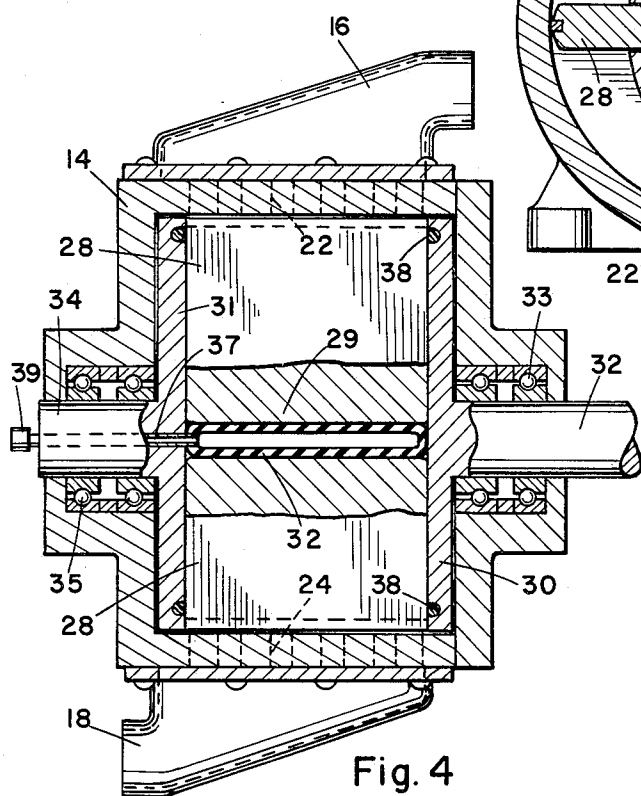
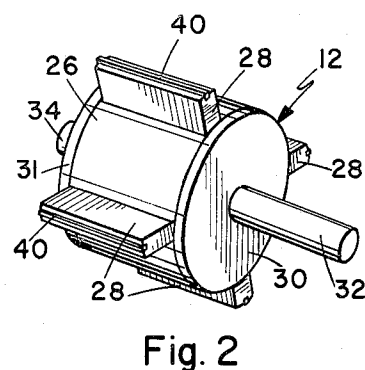
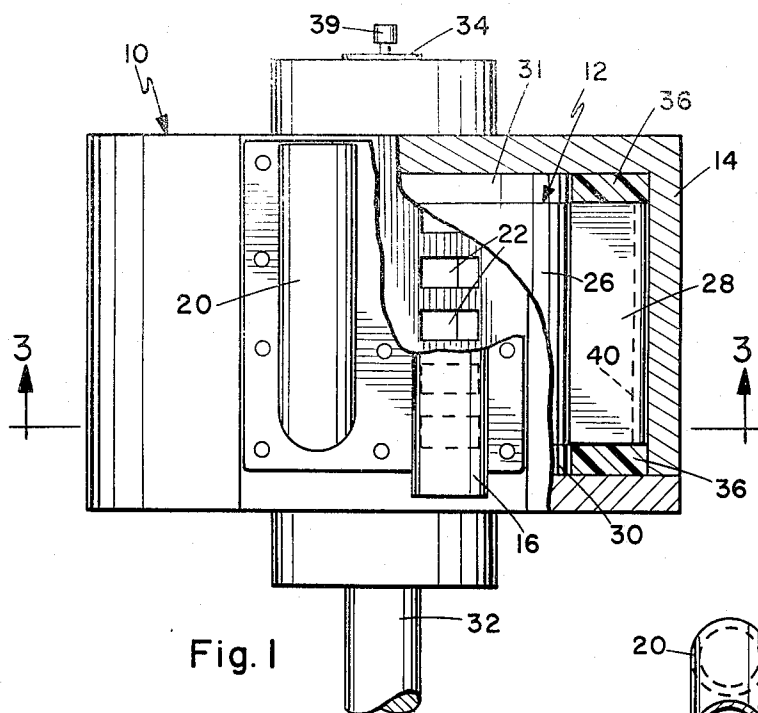
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8 Claims, 5 Drawing Figures





VANE TYPE FLUID MOTOR

BACKGROUND OF THE INVENTION

Rotary vane type motors and pumps have been known for some time. These devices have very desirable positive displacement characteristics, but have not seen wide application as motors, due in part to excessive seal wear and leakage. Further, the design of the stator to have compensating springs or other mechanisms to force the vanes into sealing contact with the walls of a stator housing have incorporated complex mechanical design resulting in an excessively bulky rotor housing high cost and undesirable wear characteristics.

In some prior art designs the vanes are made continuous through the rotor housing and therefore extend on opposite sides. This type of vane is useful only where the lobes of the stator housing are diametrically staggered and further requires elaborate provision for the intersection of vanes where more than a single pair of vanes is utilized.

It is therefore desirable to have a rotary vane type motor with provision for a compensating bias, to maintain the vanes in contact with the stator housing, and to accommodate wear of the vane seals and other variables. Such a motor is particularly desirable where the design does not necessitate complex structure in the rotor housing.

SUMMARY OF THE INVENTION

An exemplary embodiment of the invention incorporates a pneumatic compensator mounted within the rotor housing. The pneumatic compensator comprises a bladder which may be filled to a desired pressure with air or other pressurizing fluid. The bladder exerts a radially outward uniform pressure on the inward ends of the rotor vanes. The vanes are guided for reciprocating movement in and out of the rotor housing.

A stator housing is provided with two diametrically opposed lobes. The diametrically opposed lobes make it possible to use a relatively simplified manifold system whereby pressurized air is introduced at two points and exhaust air or other fluid medium is extracted at two points. Thus the bladder forces the diametrically opposed pairs of rotor vanes to their maximum radial extension, whereby contact is maintained with the walls of the rotor housing even in the maximum diameter portions of the housing. At the same time that the compensator is forcing the diametrically opposed vane pair to their maximum extension, the adjacent, 90° related, pair of vanes has been forced, by following the walls of the housing, to its maximum retraction within the stator housing. Thus one set of vanes results in an expansion of the other set of vanes results in a contraction of the volume of the pneumatic compensator, resulting in a zero net volume change.

The vanes are substantially rectangular in configuration with a tip seal along the outer end and with an enlarged portion at the inner end. The compensator bears against the enlarged inner end. The sides of the vanes are in contact with O-ring seal on rotor end plates. Sealing contact is also maintained between the vanes and half-moon sectors inserted in the large diameter lobe portions of the stator housing. The tip seal sweeps the smooth surface of the interior of the stator housing, porting and unporting the intake and exhaust ports, as

it sweeps over them. The exhaust ports are canted so as to minimize the force necessary to exhaust the fluid from the chamber.

It is therefore an object of the invention to provide a new and improved vane-type rotary motor.

It is another object of the invention to provide a new and improved vane-type rotary motor with improved sealing contact with the walls of the stator housing.

It is another object of the invention to provide a new and improved vane-type rotary motor which is relatively simple in construction.

It is another object of the invention to provide a new and improved vane-type rotary motor that is adjustable for seal wear.

It is another object of the invention to provide a new and improved vane type rotary motor which incorporates a relatively simple seal configuration.

It is another object of the invention to provide a new and improved vane type rotary motor with efficient fluid exhaust.

It is another object of the invention to provide a new and improved vane-type rotary motor which is relatively low in manufacturing cost.

It is another object of the invention to provide a new and improved vane-type rotary motor that does not require asymmetrical stator housing construction.

Other objects and many attendant advantages of the invention will become more apparent upon a reading of the following detailed description together with the drawings in which like reference numerals refer to like parts throughout, and in which:

FIG. 1 is a top plan view of the motor, partially cut away.

FIG. 2 is a perspective view of the rotor unit.

FIG. 3 is a sectional view taken on line 3—3 of FIG. 1.

FIG. 4 is a sectional view taken on line 4—4 of FIG. 3.

FIG. 5 is a diagrammatic sectional view showing the rotor in an intermediate position.

Referring now to the drawings, there is illustrated a vane-type rotary motor 10. The motor includes a rotor 12 and stator housing 14. The stator housing 14 is penetrated by intake ports 22 which receive pressurized fluid from intake manifolds 16 and 17 and exhaust ports 24 which discharge fluid into exhaust manifolds 18 and 20.

The rotor is comprised of cylindrical housing 26 which receives four rotor vanes 28 for reciprocating movement in and out of the cylindrical housing 26. The vanes 28 each have an inner end 29 which is enlarged to produce a large area of bearing contact with the pneumatic compensator 32. The outer end of the generally rectangular vanes have a longitudinally extending tip seal 40 for contacting the inner walls of the stator housing 14. The exterior diameter of the cylindrical rotor housing 26 is substantially equal to the minimum interior diameter of the stator housing to minimize leakage between the two chambers 50 and 51. The cylindrical rotor housing 26 terminates in end walls 30 and 31. End wall 30 includes an integral shaft 32 which would be utilized as a power take off point. The shaft is carried in bearings 33. End wall 31 mounts a stub shaft 34 which is carried in bearings 35. The shaft 34 has a bore through which the air filling extension 37 including the air receiving valve 39 of the pneumatic compensator 32 is received.

Sealing against the side walls of the reciprocating vanes 28 is completed for the half-moon chambers by sectors 36 which bear on their inner edges against the cylindrical rotor 26 and on their outer edges against the stator housing. A plurality of seals 38 inset in the rotor 26 seal against vanes 28 and prevent the pressure in the chambers from entering the interior of the rotor housing.

The rotor vane 28, rotor housing 26, and stator housing 14 are generally made of hardened steel to resist wearing. The bladder of pneumatic compensator 32 is made of a synthetic rubber with internal tire-type cords for reinforcement.

OPERATION

In use, the pneumatic compensator is inflated through the valve 34 to provide an adequate sealing pressure between the tip seals 40 on the rotor vanes 28 and the internal walls of the stator housing 14. This pressure may vary depending on the condition of the tip seals 40, the pressure of the driving fluids utilized, and other variables.

High pressure fluid such as air, steam, or other driving medium is delivered to the intake manifolds 16 and 17 and thus enters the motor 10 through the intake ports 22. From the position illustrated in FIG. 3, this pressure forces the rotor vanes clockwise. Thus the vanes extend from the rotor housing as they sweep through the chambers 50 and 51 to the maximum diameter portion of the stator housing 14 which, as illustrated, places the pair of vanes 28 in the generally horizontal orientation of FIG. 3. These vanes are at their maximum extension, whereas the 90° related pair of vanes 28 are fully retracted by contact with the minimum diameter portion of the stator housing 14.

During the next 90° of rotation the high pressure charge of fluid is allowed to be dissipated into the low pressure exhaust manifolds 18 and 20. To facilitate this discharge exhaust ports 24 are canted to reduce the amount of recompression necessary to exhaust the fluid. Thus exhausting starts as soon as the previous vane unports the first portion of the exhaust ports 24. A new charge and compression does not take place until approximately 40° of rotation later, when the same vane seals and closes off the intake port 22. This results in the delivery of the full pressure of the intake gases against the vane 28 and continues the driving rotation in the clockwise direction as in FIG. 5.

Having described my invention I now claim:

1. A rotary fluid driven motor comprising:
 - a stator housing,
 - a rotor mounted within said stator housing for relative rotation to said stator housing,
 - 5 said rotor comprising a rotor housing, a plurality of rotor vanes, and a pneumatic compensator means for maintaining a radially outward bias on said rotor vanes,
 - said rotor vanes being mounted for reciprocating radial movement and having an outer end including seal means for sealing against the inner walls of said stator housing during rotation of said rotor,
 - said pneumatic compensator means being mounted in said rotor housing and contacting the inner ends of said rotor vanes,
 - 15 said pneumatic compensator means comprising a bladder means for containing compressible fluid under pressure.
2. The rotary fluid driven motor according to claim 1 wherein said stator housing includes intake ports and exhaust ports, and
 - said exhaust ports having a greater angular extent along the walls of said stator housing than said intake ports.
3. The rotary fluid driven motor according to claim 1 wherein said bladder means comprises a flexible cord reinforced bladder with an air intake portion penetrating said stator housing.
4. The rotary fluid driven motor according to claim 30 1 wherein said stator housing comprises two diametrically opposed working chambers.
5. The rotary driven motor according to claim 4, wherein:
 - said stator housing includes intake ports and exhaust ports, and
 - 35 said exhaust ports are canted toward an associated working chamber and have a greater angular extent along the walls of said stator housing than said intake ports.
6. The rotary fluid driven motor according to claim 1 wherein said rotor includes substantially cylindrical end plates with integral shaft extensions.
7. The rotary fluid driven motor according to claim 6 wherein said vanes are sealed against said end plates.
8. The rotary fluid driven motor according to claim 45 6 wherein said vanes in the maximum diameter portions of said rotor housing sweep across substantially half-moon shaped inserts.

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