Feb. 24, 1931. I. H. WILSEY 1,793,577

ROTARY MACHINE

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Fig. 1

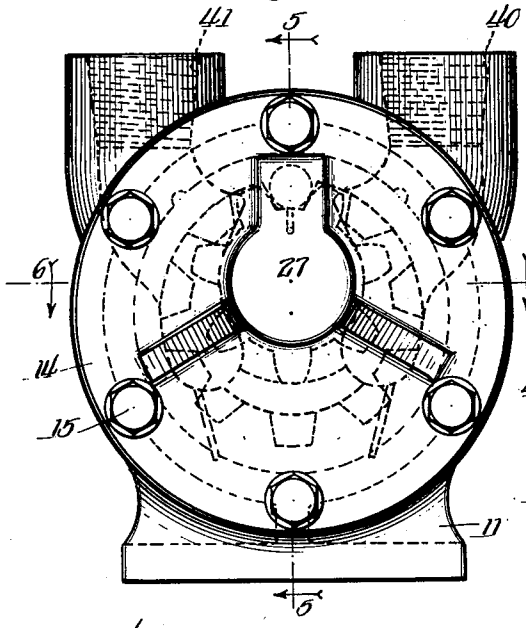


Fig. 2.

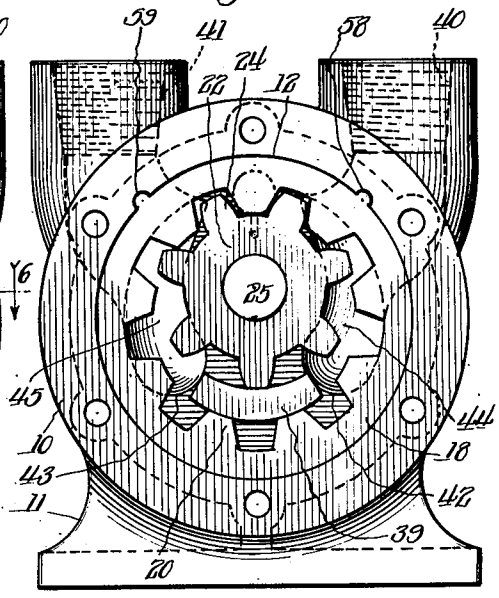


Fig. 4.

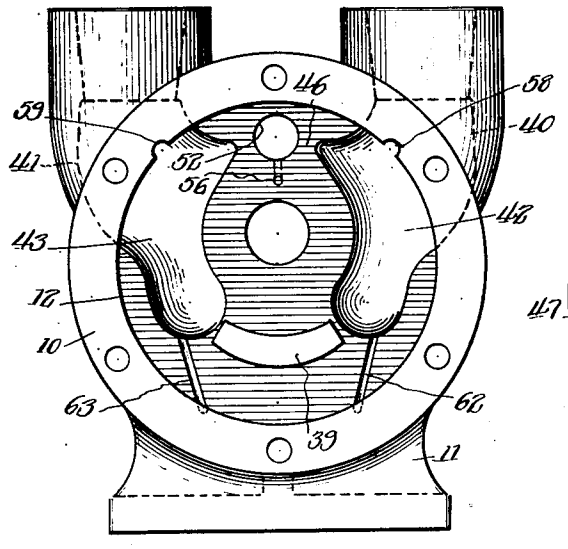
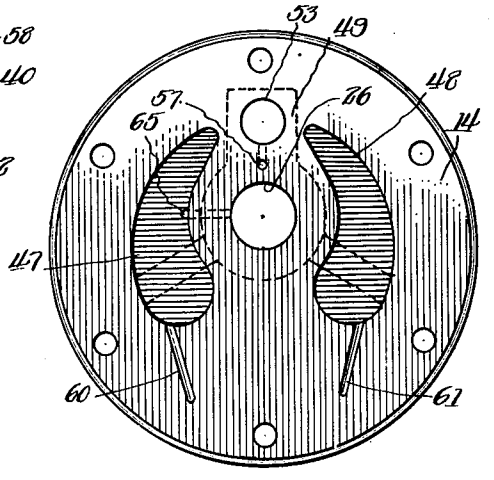


Fig. 3



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Fig. 5.

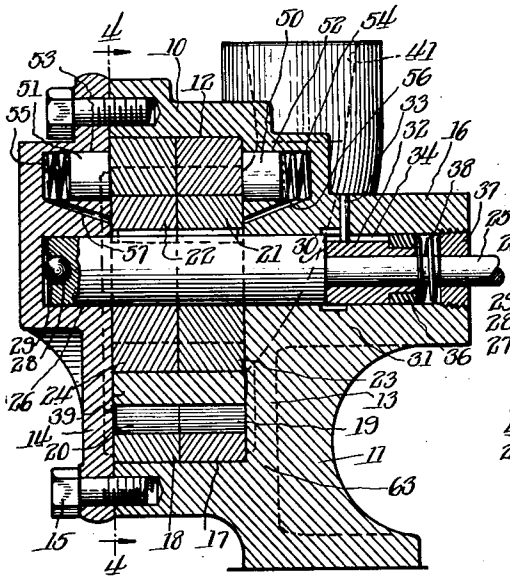


Fig. 6.

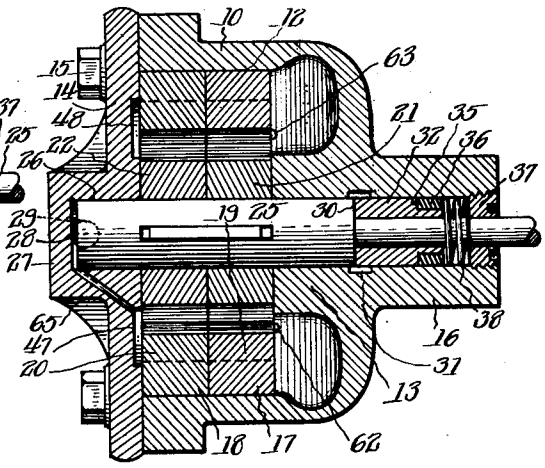


Fig. 7.

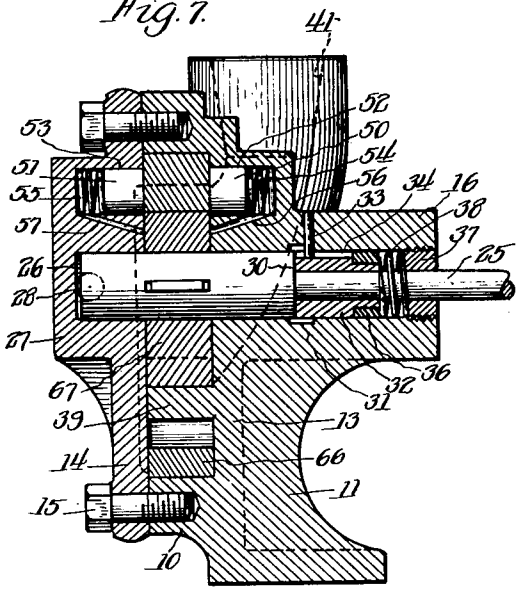
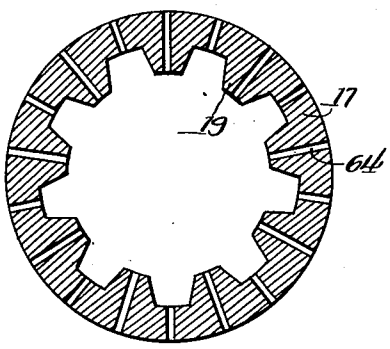


Fig. 8.



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Patented Feb. 24, 1931 1,793,577

UNITED STATES PATENT OFFICE

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ROTARY MACHINE

Application filed August 1, 1927. Serial No. 209,894.

My invention relates to improvements in rotary engines, particularly rotary pumps of the type in which a pinion is mounted in mesh with and eccentrically to an integral gear rotor, and a cut-off crescent-shaped partition is disposed between the pinion and the rotor.

The primary object of the present invention resides in the provision of a novel pump in which the rotor consists of a ring freely rotatable in the casing and meshing with an eccentrically related drive pinion.

A further object resides in the provision of a new and improved pump of the above character in which the floating rotor is substantially closed at its outer periphery so as to prevent evacuation of fluid from the interdental spaces by centrifugal force, and in which fluid is admitted to and discharged from one or both ends of the rotor so as to provide large inlet and discharge areas not interrupted by the rotor vanes and permitting ample time for fluid to pass to and from the rotor at any speed, thereby resulting in a pump which will operate efficiently over a wide range of speed and at high speed.

Another object resides in the provision in a novel pump of one or more of the following features: fluid inlet and discharge passages formed in the fixed head of the pump casing and having ports conforming in shape substantially to and opening to the ends of the fluid spaces in opposite sides of the rotor; supplemental ports similar in shape to said first mentioned ports and formed in the removable cover to open into the front ends of said spaces; and connecting passages between said ports.

Still another object resides in the provision of means for effecting the removal of foreign particles, such as abrasive material, which might find their way between the bearing surfaces between the casing and the rotor.

Further objects reside in the specific construction of the rotor, in the provision of means for balancing in the rotor, and in the provision of a partition formed integral with the fixed head of the casing.

Another object resides in the provision of a drive shaft journaled in both ends of the casing and of means for balancing said shaft against end pressure.

A further object resides in the provision in a pump of the above character of one or more movable end lands pressed yieldingly into engagement with one or both ends respectively of the rotor, and positioned diametrically opposite the crescent shaped partition and between the inlet and discharge passages, and of means for venting the back area of each land to the interior of the casing so as to back up the land with fluid to prevent chatter.

Another object resides in the provision of a new and improved packing for the shaft.

A general object resides in the provision of a novel pump which is inexpensive in construction, which is not subject to excessive wear, which can readily be assembled and disassembled, in which there is no addition of tolerances, and which is efficient in operation.

Further objects and advantages will become apparent as the description proceeds.

In the accompanying drawings:

Figure 1 is a left end view of a pump embodying the features of my invention.

Fig. 2 is a left end view of the pump with the cover removed.

Fig. 3 is an inside view of the cover.

Fig. 4 is an inside view of the pump casing taken along line 4—4 of Fig. 5.

Fig. 5 is a longitudinal sectional view taken along line 5—5 of Fig. 1.

Fig. 6 is a longitudinal sectional view taken along line 6—6 of Fig. 1.

Fig. 7 is a longitudinal sectional view similar to Fig. 5, but of a modified form.

Fig. 8 is a transverse sectional view of the rotor.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the draw-

ings, the exemplary embodiment of the invention consists of a pump casing 10 which is formed integral with a suitable base 11, and which preferably is cylindrical in shape. The interior of the casing 10, is formed with a cylindrical chamber 12, one end of which is closed by a fixed head 13, and the other end of which is closed by a removable cover or head 14 secured to the casing by any suitable means, such as a plurality of screw bolts 15. The fixed head 13 is formed integral with an axial outwardly projecting bearing hub 16.

Rotatably mounted in the cylindrical chamber 12 are a pair of rotors 17—18 which comprise two rings having internal gear teeth or vanes 19—20 respectively, and which abut end to end. The rotor 17 bears against the inner surface of the head 13 and the rotor 18 bears against the inner surface of the head 14. The outer ends of the interdental spaces between the vanes 19—20 are substantially closed against the passage of fluid peripherally therethrough.

Eccentrically related to the rotors 17—18 are two pinions 21—22 having vanes 23—24 respectively in mesh with the vanes 19—20. These pinions abut end to end and bear respectively against the opposite inner ends of the casing 10, and are mounted on a drive shaft 25. Of the shaft 25, the stub end is journaled in a bore 26 in a suitable bearing 27 formed in the cover 14, and the other end extends outwardly through the hub 16 and is adapted to be connected to a suitable source of power (not shown). A ball 28 is freely disposed in a depression or socket 29 in the stub end of the shaft 25, and bears against the inner end of the bore 26.

A suitable packing is provided for the shaft 25 in the hub 16. To this end the outer end of the shaft 25 is reduced in size to provide an annular shoulder 30. An annular groove 31 is formed in the inner surface of the hub 16 at a point about the shoulder 30. Slidably mounted on the reduced portion of the shaft 25 and bearing against the shoulder 30 is a suitable bushing 32 which is held against rotation preferably by means of a pin 33 extending from the hub 16 into a longitudinal groove 34 in the outer surface of the bushing and the outer end of which is reduced in size to provide a shoulder 35. Mounted on the reduced portion of the bushing 32 and abutting against the shoulder 35 is a ring 36 of resilient material, such as rubber. Secured in the outer end of the hub 16 is a suitable gland 37. A coil spring 38 is disposed about the reduced portion of the shaft 25, and abuts at its opposite ends against the ring 36 and the inner end of the gland 37. It will be evident that the spring 38 serves to hold the shaft 25 against the ball 28, and serves to compress the ring 36 so as to provide a tight fluid seal.

Disposed between the rotors 17—18 and the pinions 21—22 is a crescent-shaped projection or partition 39 which may be mounted in the casing in any suitable manner, and which in the present instance is formed integral with the fixed head 13. The partition 39 bears against the inner ends of the vanes 19—20 and against the outer ends of the vanes 23—24, and the inner and outer curved surfaces of the partition conform respectively to the curvatures of the rotors and the pinions. Preferably, the partition 39 is provided with blunt ends, as shown in Fig. 2.

Fluid is admitted to and discharged from one or both outer ends of the rotors 17—18. Formed in opposite sides of the fixed head 13 are fluid inlet and discharge passages 40—41 which are adapted to be connected in a suitable fluid line (not shown) and which terminate in parts 42—43 in the inner surface of the head and opening to the inner ends of the fluid inlet and discharge spaces 44—45 in opposite sides of the rotor 17. The ports 42—43 are curved to conform substantially in shape to the spaces 44—45, and are substantially coextensive in area therewith. The free upper ends of the ports 42—43, opposite the partition 39, are separated by a narrow cut-off area 46. Formed in the inner surface of the cover 14 is a pair of supplemental ports 47—48 similar to the ports 42—43, and opening to the front ends of the fluid spaces 44—45 in opposite sides of the rotor 18. The upper ends of the ports 47—48 are separated by a narrow cut-off area 49.

To prevent leakage past the cut-off areas 46—49, due to wear, suitable sealing lands 50—51 preferably are provided. These lands are slidably mounted in bores 52—53 in the heads 13—14, and respectively engage the remote ends of the rotors 17—18 and pinions 21—22. Coil springs 54—55 disposed in the closed ends of the bores 52—53 act against the back areas of the lands 50—51 to press the latter yieldingly against the pumping elements. Preferably, the inner ends of the bores 52—53 are vented through suitable passages 56—57 to the inside of the casing 10. These passages permit fluid from the casing to fill the inner ends of the bores with fluid, thereby serving to prevent chatter of the lands.

Means is provided for balancing the rotors 17—18. This means comprises a pair of longitudinal grooves 58—59 which are formed in the inner peripheral surface of the chamber 12 and at opposite sides of the cut-off areas 46—49, and which at their ends communicate respectively with the ports 42—47 and 43—48. Two grooves 60—61 are formed in the cover 14, and extend downwardly from the ports 47—48 to the bearing surfaces between the rotors 17—18 and the chamber 12. Thus, at these four spaced points, the pressures acting on the inner and outer peripheral surfaces of the rotors 17—18 are equal-

ized. By properly locating the grooves 58—59 and the grooves 60—61, the resultant forces acting on the rotors 17—18 can be held in balanced relation. Preferably, grooves 62—63, similar to the grooves 60—61, are also formed in the inner surface of the head 13. If desired, a plurality of small radial passages 64 may also be drilled through the rotors 17—18 at spaced points about their peripheries (see Fig. 8).

The grooves 58—59 serve to collect any foreign particles, such as abrasive material, which may enter between the peripheral bearing surfaces of the rotors 17—18 and the casing 12, and permit removal thereof by the rushing fluid. The notches 60 to 63 serve a similar purpose for the end bearing surfaces between the casing and the rotors.

The notches 58—59 may be enlarged as shown in Fig. 2 to constitute cross fluid passages between the opposed ports 42—47 and 43—48 in opposite ends of the casing 10 so as to permit the entry and discharge of fluid to and from the rotors at both ends of the casing.

To relieve pressure which might build up in the bore 26 through leakage past the ends of the rotor 18 and the pinion 22 and which might exert considerable end pressure on the shaft 25, the inner end of the bore is vented through a suitable passage 65 to the suction side of the pump.

In the modified form shown in Fig. 7, only one rotor 66 and one pinion 67 are provided. No grooves 62—63 are provided. In other respects, the construction of the pump is similar to that shown in the preceding figures.

In operation, assuming that the shaft 25 is driven in a clockwise direction as viewed in Fig. 1, fluid will enter the passage 40 and will pass through the port 42 into the suction space 44 of the rotors 17—18 to completely fill the latter. The fluid will flow through the space 44 to the port 47 so as to also provide a front entrance. Fluid may enter the port 47 by passing through the groove 58. The ports 42—47 provide large inlet areas which are uninterrupted by the vanes 19—20 thereby making it possible to build the pump of considerable length without lowering the efficiency of operation. Since the peripheries of the rotors 17—18 are closed by the casing 10, centrifugal force will be ineffectual to evacuate the interdental spaces between the vanes 19—20. Fluid from the suction space 44 of the pump is carried past the partition 39 to the discharge space 45 of the pump from where it passes through the ports 43—48 to the discharge passage 41. The rotors 17—18 are balanced to reduce wear and leakage. By forming the passages 40—41 in the fixed head 13, the cover 14 can be removed without disconnecting the piping, and the pump can be readily assembled and disassembled. By providing a pinion drive, the parts will run at a relatively low speed for a given motor. The pump is a uniflow pump, has large bearing surfaces to prevent leakage, and is simple and inexpensive in construction. Grit and other foreign materials are carried away by the fluid.

I claim as my invention:

1. A pump having, in combination, a casing having a hollow cylindrical chamber and having inlet and discharge passages opening to opposite sides of said chamber, an internal gear rotor mounted in said chamber, a pinion eccentrically related to said rotor and in mesh therewith, a partition disposed between said rotor and said pinion, a shaft for driving said pinion, bearings for said shaft in both ends of said casing, said shaft terminating in one of said bearings, and passage means formed in said casing connecting said last mentioned bearing continuously to the suction side of said chamber so as to exhaust any pressure tending to build up against said end of said shaft.

2. A pump having, in combination, a casing having a cylindrical chamber closed at one end by a fixed head, a removable cover closing the other end of said casing, an internal gear rotor freely disposed in said casing, inlet and discharge passages opening from opposite sides of said fixed head at the adjacent end of said rotor, a pinion disposed in eccentric relation to and in mesh with said rotor, a partition disposed between said pinion and said rotor, a shaft for rotating said pinion, said shaft being journalled in said head and said cover, an end thrust anti-friction bearing in said cover for said shaft, and spring means for pressing said shaft endwise against said bearing.

3. A pump having, in combination, a casing having inlet and discharge ports opening into one end thereof, a pair of internal gear rotors in said casing, a pair of pinions eccentrically related to and in mesh with said rotors, said rotors and also said pinions being in juxtaposition, partition means between said rotors and said pinions, and means for driving said pinions.

4. A pump having, in combination, a casing having a cylindrical chamber, a pair of rotors freely disposed in said chamber and bearing against the inner periphery thereof, inlet and discharge passages in one end of said casing and opening to opposite sides of said rotors, supplemental chambers in the other end of said casing, said chambers being directly opposite said passages and also opening to opposite sides of said rotors, a pair of pinions eccentrically related to and in mesh with said rotors, partition means between said rotors and said pinions, and means for driving said pinions.

5. A pump having, in combination, a casing having a cylindrical chamber, a rotor

freely disposed in said chamber and bearing against the inner periphery thereof, inlet and discharge passages in one end of said casing opening to opposite sides of said rotor, supplemental ports in the other end of said casing opening to opposite sides of said rotor, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, and means for driving said pinion.

6. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed in said chamber and bearing against the inner periphery thereof, inlet and discharge passages in one end of said casing opening to opposite sides of said rotor, supplemental ports in the other end of said casing opening to opposite sides of said rotor, passages in said casing connecting said first mentioned passages to said ports, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, and means for driving said pinion.

7. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed in said chamber, inlet and discharge passages opening through one end of said casing to opposite sides of said chamber, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, a pair of grooves in the inner periphery of said casing communicating respectively with said passages, and means for driving said pinion.

8. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed in said chamber, inlet and discharge passages opening through one end of said casing to opposite sides of said chamber, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, passages opening from the upper ends of said first mentioned passages to the peripheral bearing surfaces between said casing and said rotor, and means for driving said pinion.

9. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed in said chamber, inlet and discharge passages opening through one end of said casing to opposite sides of said chamber, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, grooves formed in the inner periphery of said casing and opening to said passages, grooves formed in one end of said casing and extending from the ends of the passage openings to the inner periphery of said casing, and means for driving said pinion.

10. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed in said chamber and bearing against the inner periphery thereof, inlet and discharge passages in one end of said casing opening to opposite sides of said rotor, supplemental ports in the other end of said casing opening to opposite sides of said rotor, connecting grooves in the inner periphery of said casing connecting said ports to said passages, venting grooves in one end of said casing extending from said ports to the inner periphery of said casing at points spaced from said connecting grooves, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, and means for driving said pinion.

11. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed in said chamber and bearing against the inner periphery thereof, inlet and discharge passages in one end of said casing opening to opposite sides of said rotor, supplemental ports in the other end of said casing opening to opposite sides of said rotor, spaced grooves in the inner periphery of said casing connecting said ports to said passages, venting grooves in the ends of said casing extending some from said ports, and some from said passages to the inner periphery of said casing at points spaced from said first mentioned grooves, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, and means for driving said pinion.

12. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed and fitting closely in said chamber, inlet and discharge passages opening to opposite sides of one end of said chamber, a pinion eccentrically related to and in mesh with said rotor, means for driving said pinion, a movable land disposed in said casing between said passages and bearing against the adjacent end of said rotor, and means for venting the back of said land to the interior of said casing.

13. A pump having, in combination, a casing having a cylindrical chamber, a rotor freely disposed and fitting closely in said chamber, inlet and discharge passages in one end of said casing opening to opposite sides of said rotor, spaced ports in the other end of said casing opening to opposite sides of said rotor, a pinion eccentrically related to and in mesh with said rotor, a partition between said rotor and said pinion, means for driving said pinion, a movable land between said passages engaging one end of said rotor, and a movable land between said ports engaging the other end of said rotor.

In testimony whereof, I have hereunto affixed my signature.

IRVEN H. WILSEY.