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OSCILLATING VANE ROTARY PUMP

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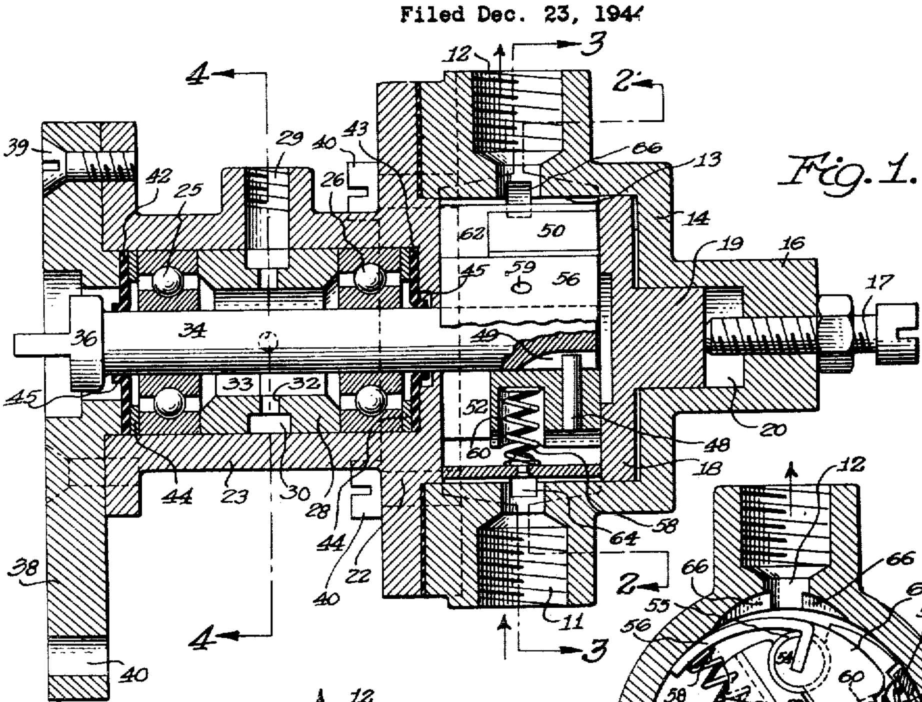

Fig. 1.

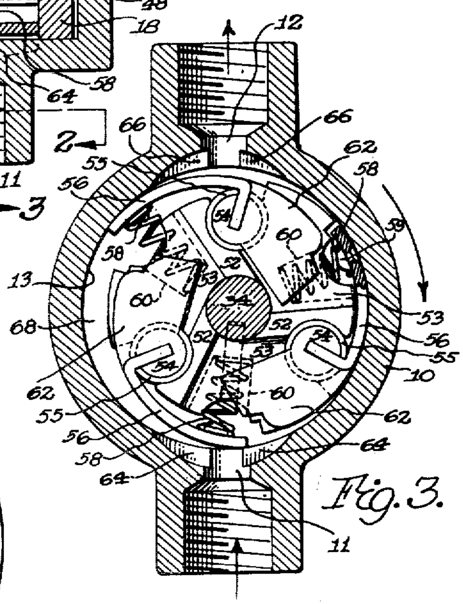

Fig. 3.

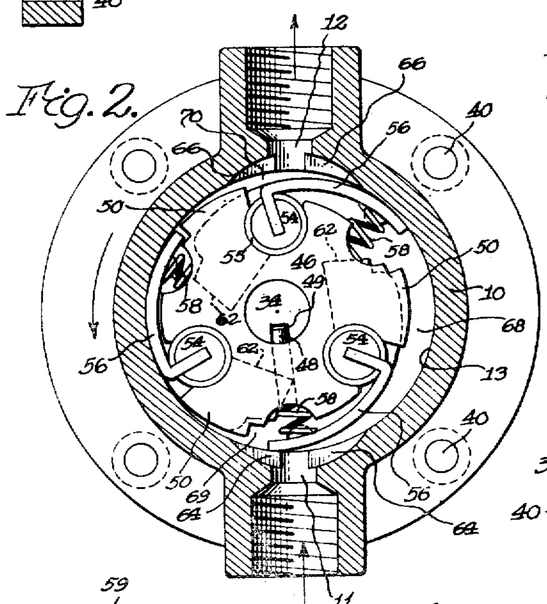

Fig. 2.

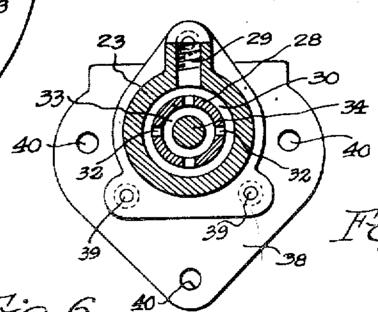

Fig. 4.

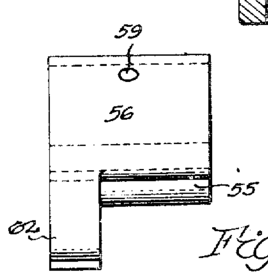

Fig. 5

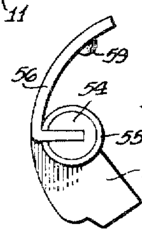

Fig. 6.

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OSCILLATING VANE ROTARY PUMP

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5 Claims. (Cl. 103—140)

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This invention relates to rotary pumps, and more particularly to a vane type pump adapted to pump gasoline, water, or other liquids.

An object of the invention is to provide a pump of such character as to be adapted for use in connection with automobiles, airplanes and the like, for pumping gasoline, coolant or other fluids used in the operation of the vehicle.

A further object of the invention is to provide a pump of simple and compact design, which is easy to manufacture and to maintain in use.

A further object is to provide a rotary pump adapted to be driven by an engine which operates at variable speed, the output pressure of the pump being maintained at predetermined value despite variations in the speed thereof.

A further object of the invention is to provide a pump having characteristics which particularly adapt it to the special requirements of the vehicle or other device with which it is to be used, so that the characteristics of the pump may be readily varied by slight changes in design, to provide the precise characteristics needed for a given installation.

A further object of the invention is to provide a rotary pump wherein the output pressure varies as a function of the speed of rotation, and which by simple changes in construction may be so varied that the output pressure increases with increase of speed, decreases with increase of speed, or remains constant despite variations in speed.

Further objects and advantages of the invention will be apparent from the following description, taken in connection with the appended drawings in which:

Fig. 1 is a longitudinal sectional view of a pump embodying the invention;

Fig. 2 is a transverse sectional view of the same, taken on the line 2—2 of Fig. 1;

Fig. 3 is a longitudinal transverse section taken on the line 3—3 of Fig. 1;

Fig. 4 is a transverse sectional view of a bearing, taken on the line 4—4 of Fig. 1; and

Figs. 5 and 6 are respectively front and side elevational views of one of the vanes forming part of the pump rotor.

The illustrated pump comprises a housing 10 which constitutes the stator of the pump, and which is provided with an inlet passage terminating in a port 11 and an outlet passage terminating in a port 12, both passages being threaded to receive conduits of the usual form. The housing 10 is formed with a cylindrical inner surface 13, and with an end wall 14 which

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terminates in a boss or hub 16 provided with a set screw 17. Within the housing adjacent wall 14 is mounted an adjustable disk 18, having a cylindrical extension 19 formed axially thereof and slidable within a cylindrical recess 20 in the hub 16. It will be seen that by adjustment of the set screw 17 the disk 18 may be maintained in contact with the rotor of the pump, described hereinafter.

The opposite end of the housing 10 is formed by the end wall 22 of a cylindrical casing 23, which is provided with anti-friction bearings 25, 26, separated from each other by means of a cylindrical spacing block 28. The casing 23 is provided with a nipple 29 adapted to receive a fitting of suitable type for the introduction of lubricant, which passes therethrough to an annular groove 30 formed in the periphery of block 28, thence through radial passages 32 to the bore 33 of the block, and thence to the bearings 25, 26.

A drive shaft 34 is mounted in bearings 25, 26, and is provided at one end with a coupling member 36 of any known type, to enable the shaft to be connected to any suitable source of power, such as the generator shaft of an automobile engine. A corresponding adapter flange 38 is provided adjacent the member 36, to permit the pump to be mounted in alignment with such shaft or other source of power. Flange 38 is connected to the casing 23 by means of screws 39, and is provided with bolt holes 40 for securing it in position relative to the source of power.

At opposite sides of the bearings 25, 26 are mounted flexible washers 42, 43, formed of synthetic rubber or other flexible material which is impervious to oil and gasoline, and held in place by metallic washers 44. Washers 42 and 43 are provided with central circular apertures of smaller diameter than the diameter of shaft 34, and when the shaft 34 is mounted in the assembly, the inner portions of the washers are outturned from the bearing as indicated at 45, thereby producing a relatively liquid-tight seal, which will function satisfactorily over a long period of time, since any wear upon the surface of the washer or the shaft will be compensated for by the tendency of the washers to return to their original disk shape.

The housing 10 is slightly eccentric relative to the axis of shaft 34, as indicated in Figs. 2 and 3. The rotor of the pump comprises a core 46 which is fixedly mounted upon the shaft through the medium of a key 48 engaging in a keyway 49 adjacent the end of the shaft. The core 46 is provided with spaced sectors 50 formed with cylindrical surfaces of the same curvature as that of the inner surface 13 of housing 10, so that the two surfaces will coincide at one point in the rotation of the rotor. The periphery of the core intermediate the sectors 50 is of lesser radius than the sectors 50, the left hand (Fig. 1) end of the rotor being provided with ridges 52 which extend from the shaft 34 to the periphery of the rotor and form intervening recesses 53.

A plurality of spaced longitudinal bores are formed in the core 46 adjacent the ridges 52, and receive therein cylindrical rocker shafts 54 which are provided with bearing surfaces 55 and have fixed thereto curved vanes 56. The vanes 56 have their outer surfaces formed as sectors of a cylinder of approximately the same radius as that of the inner surface 13 of the housing 10, while their inner ends are inturned to extend diametrally of the shafts 54. The vanes are urged outwardly into contact with the surface 13 by means of compression springs 58 which engage suitable retaining pins 59 on the inner surfaces of the vanes adjacent their free ends, the inner ends of the springs being seated in radial recesses 60 formed in the core 46 beyond the rocker shafts 54, the vanes 56 are continued to form counterweights 62, which are movable with the recesses 53, and are preferably cast integral with the vanes.

The counter-weights 62 are of such weight and shape as to have a predetermined moment of inertia relative to the moment of inertia of the vanes 56, so that the desired characteristics, as to output pressure of the pump as a function of speed, will result. Thus, if the pump is to be used in an installation wherein it is desired that the output pressure increase with increase in the speed of rotation, the counter-weights 62 may be designed to have small moment of inertia, or may be omitted altogether. In such a design, increase in the speed of rotation of the rotor will cause the vanes 56 to be urged outwardly against the inner wall 13 of housing 10 not only by the force of springs 58 but by the increasing centrifugal force of the vanes themselves, with the result that the vanes, will be held tightly against the wall and not much slippage or leakage of fluid will occur. If, on the other hand, it is desirable that the output pressure of the pump decrease with increase in speed, the counter-weights 62 will be made larger and of greater moment of inertia than the vanes 56. In such a pump, as the speed of rotation increases, the increasing centrifugal force of the vanes 56 will be more than compensated by the increasing centrifugal force of the counter-weight, with the result that at the higher speeds the counter-weights will tend to overcome the force of the springs 58, thereby decreasing the force by which the vanes are held against the inner wall of the housing, permitting more slippage, and decreasing the output pressure as the speed of rotation increases. In installations where it is desirable that the output pressure remain constant over a given range of speed, that result may be accomplished by designing the counter-weights 62 to have characteristics intermediate between the extremes just described, so that at higher speeds the centrifugal force of the vanes 56, and some portion of the force of springs 58, will be counteracted by the increased centrifugal force of the counter-weights, permitting such degree of slippage that the output pressure will remain constant.

Adjacent the inlet port 11, the housing 10 is provided with tapered grooves 64 leading to the passage 11, and similar grooves 66 are formed adjacent the outlet port 12, to provide for a gradual, rather than an abrupt, cutting off of the ports by the vanes 56.

In order to prepare the pump for operation, the flange 38 is secured in place, as to some suitable portion of an internal combustion engine, and the coupling 36 is coupled to a suitable source of power such as an engine driven shaft. The set screw 17 is adjusted so that the disk 18 has a running fit with the core 46, and the passages 11 and 12 are suitably connected in the fluid circuit to be maintained. If the shaft 34 is then caused to rotate in the counterclockwise direction as viewed in Fig. 2, it will be seen that the vanes 56, of which there are three in the illustrated embodiment, divide the space between housing 10 and the rotor into three chambers, one of which, designated 68, is of increasing volume, due to the eccentricity of the rotor, and therefore produces rarefaction within the chamber, tending to draw fuel thereto through port 11. In the position of the parts as shown in the drawings, chamber 68 has almost reached its maximum size, and its communication with the inlet port 11 is about to be cut off by the passage of vane 56 over the inlet port. The inlet port will then come into communication with a second chamber 69, which will increase in size until it assumes the shape of chamber 68.

The third chamber 70 is of decreasing size, hence rotation of the pump causes compression of the fluid therein, forcing the fluid out through the outlet port 12 under pressure. In the position of the parts shown, the chamber 70 has reached approximately its minimum size, and its communication with the outlet port is about to be cut off by the passage of the vane 56 over the outlet port. This will bring chamber 68 into communication with the outlet port, and chamber 68 will simultaneously become a chamber of decreasing size, discharging its contents under pressure through the outlet port 12.

Although the invention has been described with particular reference to a specific embodiment thereof, it is not limited to such embodiment, but may be modified in various ways within the skill of artisans in this art. The drawing and the descriptive terms used herein are therefore to be understood in an illustrative, rather than a definitive, sense, the scope of the invention being indicated only by the language of the following claims.

We claim:

1. A rotary pump comprising a cylindrical chamber having inlet and outlet ports, a rotary member mounted eccentrically within said chamber, vane members dividing the chamber into pumping chambers and each having a pivotal portion mounted in said rotary member and cooperating with said rotary member to seal said pumping chambers from each other, resilient means urging the vane members into contact with the curved wall of the cylindrical chamber, and centrifugally actuated weights of higher moment of inertia than said vane members fixed to said vane members and acting in opposition to said resilient means.

2. A rotary pump comprising walls forming a cylindrical chamber having inlet and outlet ports, a cylindrical drum eccentrically mounted in said chamber, vane members dividing the chamber into pumping compartments sealed from each other by the vane members and each having a cylindrical portion rotatably mounted in said drum, a counterweight fixed to each of said vane

members and extending on the opposite side of said cylindrical portion and having a higher moment of inertia than the vane, each of said counterweights being narrower than the vanes and thus having no vane function, and resilient means urging the vane members into contact with the cylindrical wall of said chamber.

3. A rotary pump comprising walls forming a cylindrical chamber having inlet and outlet ports, a cylindrical drum eccentrically mounted for rotation in said chamber, vane members extending throughout the length of said chamber and dividing the same into pumping compartments sealed from each other by the vane members and each having a pivot mounted in the drum, a counterweight fixed to each of said vane members and extending oppositely thereto relative to said pivot and having a higher moment of inertia than the vane whereby centrifugal force will tend to move the vane out of contact with the cylindrical wall of said chamber, and resilient means constantly urging the vane members into contact with said cylindrical wall.

4. A rotary pump comprising a housing forming a cylindrical chamber having inlet and outlet ports, a drum eccentrically mounted for rotation in said chamber, vanes having their inner edges pivoted to said drum and dividing said chamber into pumping compartments sealed from each other by the vanes, resilient means urging the vanes into contact with the cylindrical wall of said chamber, and centrifugally actuated counterweights of higher moment of inertia than said vanes fixed to said vanes, said counterweights acting in opposition to said resilient means to decrease the pressure of the vanes against said cylindrical wall as the speed of rotation of said drum increases.

5. A rotary pump comprising a housing forming a cylindrical chamber having inlet and outlet ports, a drum eccentrically mounted for rotation in said chamber, a plurality of vane members each having an inner edge pivotally mounted in a cylindrical recess in the drum and a curved portion normally contacting the cylindrical surface of said chamber and movable to a second recess in said drum, a centrifugally actuated counterweight fixed to each of said vane members and movable into and out of a third recess in said drum, each of said vane members preventing flow of fluid between said second and third recesses, and resilient means urging said curved portions into running contact with said cylindrical surface in opposition to said counterweights whereby the pressure of said curved portions against said cylindrical surface will be decreased as the rotary speed of the drum increases.

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