

April 5, 1955

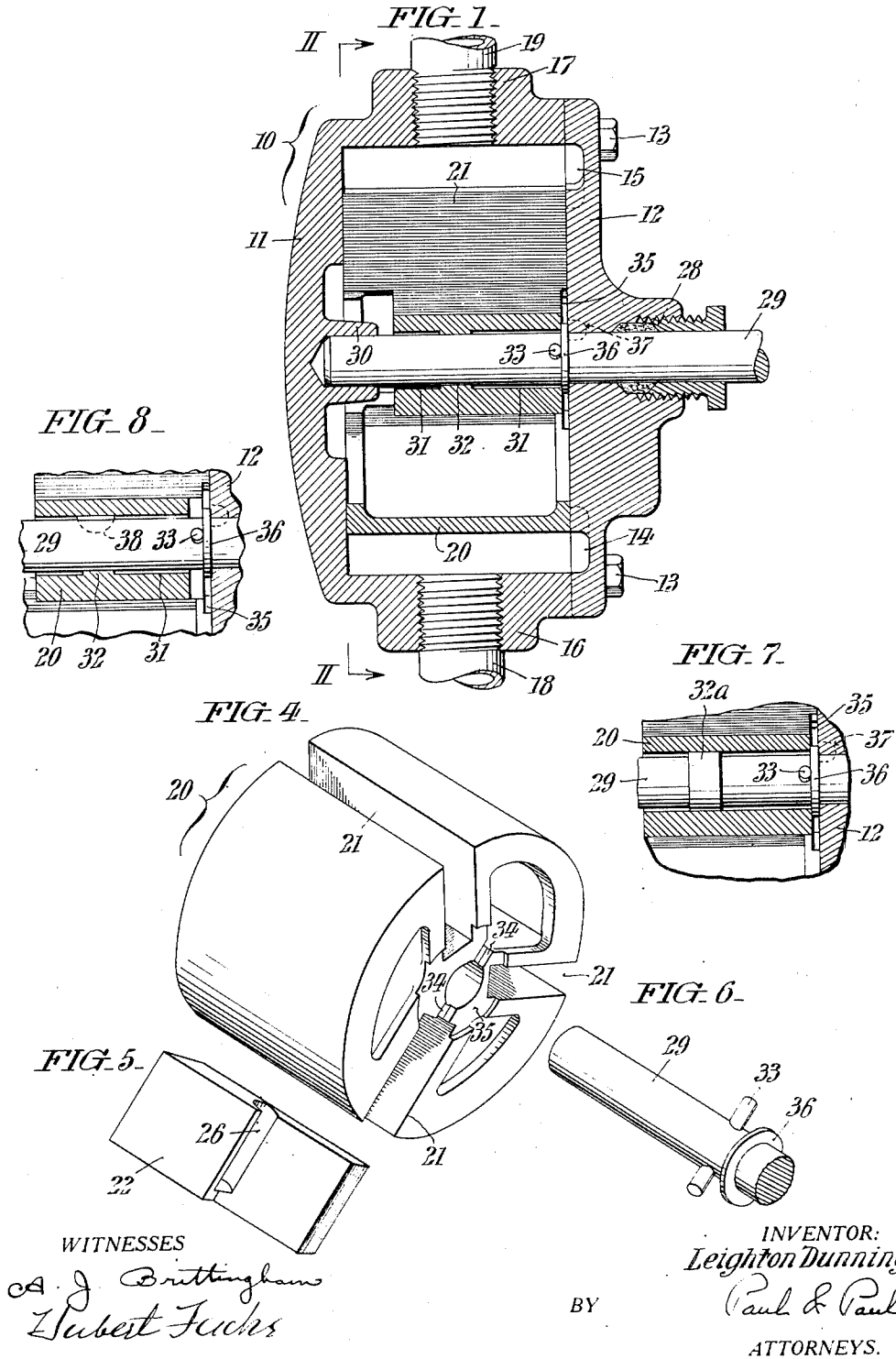
L. DUNNING

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Filed Nov. 9, 1950

2 Sheets-Sheet 1



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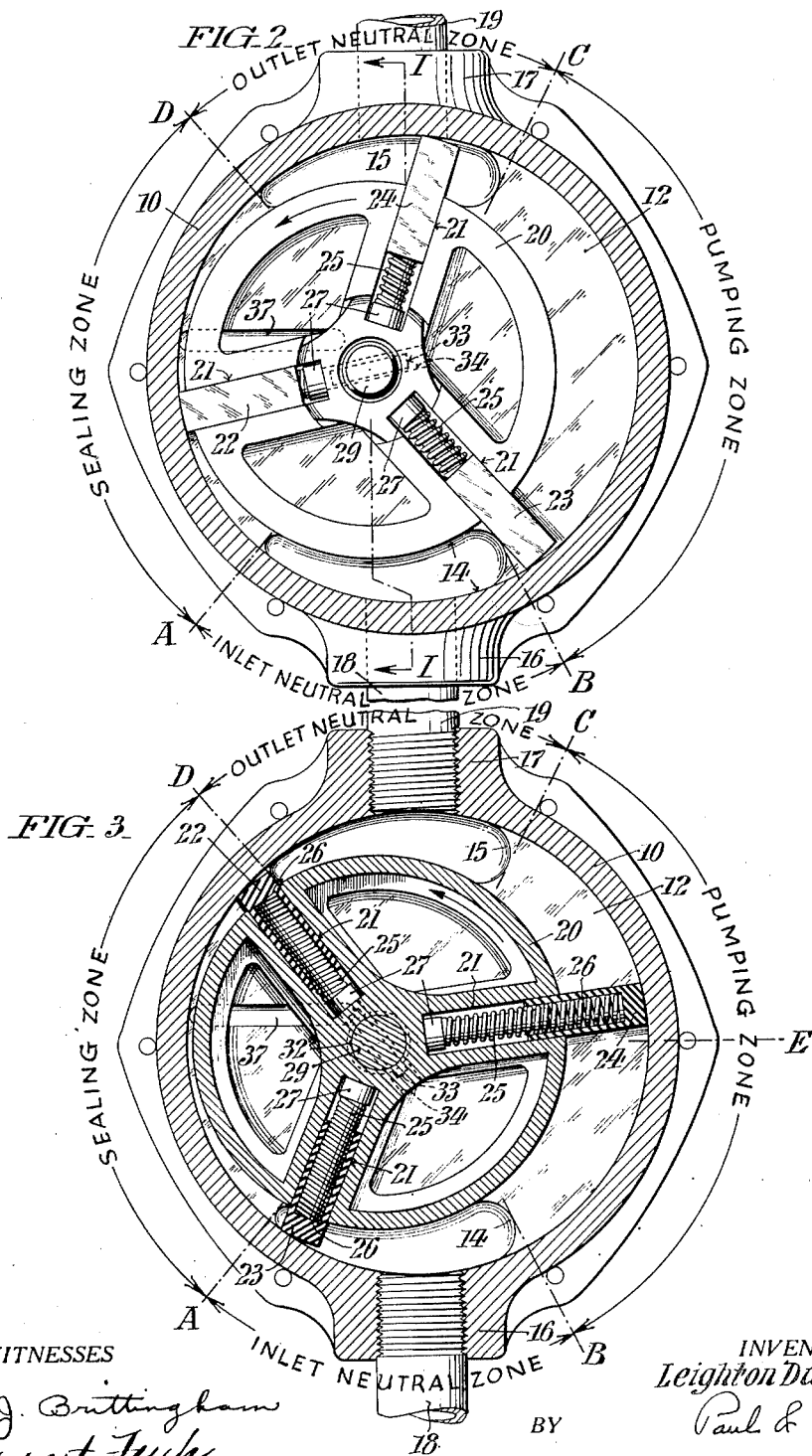
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3 Claims. (Cl. 103—136)

This invention relates to pumps. More specifically, it is concerned with rotary pumps of the type wherein fluid displacement is accomplished by vanes constrained to sliding movement in radial grooves of a rotor eccentrically disposed within a cylindric casing, and wherein the vanes are yieldingly urged outward of the rotor slots by spring pressure for maintenance of their distal edges in contact with the inner circumferential surface of said casing.

Often due to inaccuracies in machining and consequent failure of the component parts of such pumps to properly fit one into another, rapid wear takes place with consequent development of leakages between the parts and reduction in the operating efficiency of the pumps. Moreover, considerable power is required to overcome the friction between the mutually contacting surfaces of the relatively moving parts, particularly between the distal edges of the constantly spring pressed vanes and the internal circumferential surface of the casings during the operation of such pumps, which tends to reduce their efficiency.

My invention is directed more especially toward overcoming the above mentioned drawbacks. This desideratum is attained, as hereinafter more fully disclosed, through provision of means whereby the rotor and the vanes are interconnected in such a manner as to be free to adapt themselves to each other and to the casing, with their contiguous contacting surfaces in true meeting relation; and through the further provision of channelling by which some of the fluid being pumped is diverted to act with the springs as the vanes successively traverse the first half of the pumping zone within the casing, and to partially counteract the effect of the springs as the vanes are forced inward of their guide slots in the rotor by camming action with the casing in traversing the remaining half of the pumping zone, for easement of the friction during the latter phase.

Other objects and attendant advantages will appear from the following detailed description of the attached drawings, wherein

Fig. 1 is a view in longitudinal axial section of a rotary pump conveniently embodying my invention.

Fig. 2 is a view in cross section taken as indicated by the angled arrows II—II in Fig. 1.

Fig. 3 is a view corresponding to Fig. 2 with the moving parts of the pump differently positioned.

Fig. 4 is a perspective view of the pump rotor.

Fig. 5 is a broken out perspective view of one of the rotor vanes.

Fig. 6 shows the drive shaft of the pump in perspective; and

Figs. 7 and 8 are fragmentary views in section corresponding to Fig. 1 and showing two modifications.

As herein exemplified, my improved rotary pump has a cylindric casing 10 with one of its side walls 11 integrally formed, and the other side wall 12 removably secured by screw bolts 13. The side wall 12 has recesses 14 and 15 or ports in its inner face respectively in communication with diametrically-opposite inlets and outlets 16 and 17 into which flow pipes 18 and 19 are respectively screwed, each of said recesses or ports being, in this instance, approximately equal to a sextant in circumferential extent. Eccentrically disposed within the casing is a hollow spoked rotor 20 of smaller diameter with its opposite ends contacting the inner faces of the side walls 11 and 12; and slidable in full length radial

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slots 21 of the rotor are blades, whereof there are three in this instance, respectively designated 22, 23 and 24 and having a working fit between the side walls of the casing. Individual helical springs 25 yieldingly urge the blades 22—24 outwardly of the rotor slots 21 for maintenance of their distal ends in pressure engagement with the inner circumferential surface of the casing 10. As shown, each blade 22—24 has a centrally-located socket hole 26 to receive one end of the corresponding spring 25 with liberal circumferential clearance, the other end of the spring bearing against the head of an inserted pin 27 which latter bears in turn upon the bottom of the corresponding slot 21 of the rotor. It is to be noted that the shanks of pins 27 extend outward through the unsupported portions of the springs 25 beyond the inner ends of the blades. These pins thus serve as guides to prevent lateral flexure of the springs 25 as the blades move inwardly of the rotor slots. By reason of the construction just described, it will be seen that the blades 22—24 are free to adapt themselves to the interior surfaces of the casing 10 without imposition of any restraint to their movement, whereby rapid wear of the mutually contacting surfaces is effectively prevented.

Extending inwardly through a stuffed bearing 28 in the removable side wall 12 of the casing 10 is a drive shaft 29, whereof the inner end is rotatively supported in a bearing boss 30 on the opposite wall 11 of said casing. The shaft receiving bore of the rotor is enlarged at the ends as at 31 and has contact at the center only with the shaft 29 as at 32, said shaft being provided with diametral stud projections 33 which engage correspondingly located groove indentations 34 in the face of a small concentric recess 35 in one end of the rotor as shown in Figs. 1, 2 and 4. The rotor is thus positively connected to the shaft 29 with freedom to adapt itself positionally within the casing 10 so that friction of its ends with the inner faces of said casing is reduced to a minimum and rapid wear here also effectively counteracted. As shown, a spacing washer 36 surrounds the shaft 29 between the inner face of the wall 12 and the face of the recess 35 in the contiguous end of the rotor 20. By means of a substantially radial channel groove 37 in the inner face of the side wall 12 of casing 10, flow communication is maintained between the neutral and pumping zone of the pump as and for a purpose presently explained.

As alternatives, the bore of the rotor may be enlarged throughout as shown in Fig. 7, and the shaft 29 provided with a narrow circumferential enlargement 32a to fit within said bore and engage it only at the center; or, as shown in Fig. 8, a semi-circular (Woodruff) key 38 may be used to drive connect the rotor to the shaft in the region 32 and to hold it against shifting axially. In Fig. 8, the recess 35 in the end of the rotor is cut somewhat deeper and radial grooves such as shown at 34 in Fig. 4, are here omitted, the pin 33 thereby serving now only as a means to prevent the shaft 29 from being withdrawn. The effect of either of these alternative constructions will obviously be the same as that described in connection with Fig. 1.

Operation

As the rotor 20 is driven counterclockwise or in the direction of the arrows in Figs. 2, 3, fluid is constantly drawn in through the inlet 16 and discharged through the outlet 17 by passage of the vanes 22—24 through the pumping zone B—C between the recesses 14 and 15 to one side of the rotor in a manner characteristic of pumps of this type, said vanes being biased outward of the slots 21 by the springs 25 during their travel from the mid point of the sealing zone A—D to the mid point of said pumping zone, and being thereafter depressed until returned to the mid point of said sealing zone. Due to circumferential contact of the shaft 29 at 32 with the bore of the rotor at the center only, and to application of the spring pressure medially of the vanes 22—24 in accordance with my invention, said rotor and vanes are free to position and adapt themselves to the casing. As a consequence, the end faces of the rotor 20 and the side edges of the vanes will contact evenly over their

entire areas with the inner circumferential surface and side walls of the casing 10, to the advantage that the pump will operate smoothly, with avoidance of unequal wear between the mutually contacting surfaces, and with consequent assurance against the development of leak-ages.

In Fig. 3, the vane 22 has finished pumping, and passed through the outlet neutral zone C—D, and is just entering the sealing zone D—A between the recesses 14 and 15 and opposite the pumping zone B—C, and vane 23 has just left the sealing zone and is entering the inlet neutral zone A—B, while vane 24 has just passed the mid point E of of the pumping zone. At the stage just described, the sealing zone D—A is placed in communication with the inlet zone A—B, so that the interior of the rotor 20 is now under condition of suction due to communication established with said inlet zone by way of the groove 37. The suction thus set up, will tend to draw the vane 24 inward of the groove and thereby partially counteract the effect of the corresponding spring 25 as said vane is forced back by camming action with the internal circumferential wall of the casing in traversing the upper or second half of the pumping zone B—C. In Fig. 2, vane 24 has just moved into the outlet neutral zone C—D, and vane 22 passed the groove 37 with the result that the upper portion of the sealing zone A—D and the interior of the rotor 20 are now under condition of pressure, whereby vane 23, which has just entered the pumping zone, will be helped out against the circumferential wall of casing 10, and thus be maintained in more effective sealing contact with said wall until it again reaches the mid point of the pumping zone B—C.

From the foregoing it will thus be seen that I have provided a rotary pump which is simple in construction; which can be relied upon to operate smoothly and efficiently at all times, and which requires but a minimum of power to drive it.

Having thus described my invention, I claim:

1. In a rotary pump, a casing having inlet and outlet ports, parallel end surfaces, and a peripheral bore whereof the surface is normal to said end surfaces; a cylindrical rotor of smaller cross section than the casing bore rotatively supported in the casing and positioned relatively close to a portion of the casing bore lying between inlet and outlet ports and at a substantially greater distance from another portion of the bore also lying between inlet and outlet ports; a plurality of symmetrically spaced radial slots extending inwardly from the periphery of the rotor; slide vanes within the rotor slots having a working fit between the end surfaces of the casing; yielding means for urging the vanes outward of the rotor slots against the bore of the casing during rotor rotation; and means for alternately communicating fluid pressure existing in the outlet port and fluid pressure existing in the inlet port simultaneously to the inner ends of all the rotor slots, the last mentioned means including a small annular recess at one end of the rotor in communication with the bottoms of the vane slots, and a duct in one of the end walls of the casing extending from said recess to the narrow interval between the casing bore and the rotor substantially midway between the inlet and outlet ports.

2. In a rotary pump, a casing having inlet and outlet

ports, parallel end surfaces, and a peripheral bore whereof the surface is normal to said end surfaces; a cylindrical rotor of smaller cross section than the casing bore rotatively supported in the casing and positioned relatively close to a portion of the casing bore lying between inlet and outlet ports and at a substantially greater distance from another portion of the bore also lying between inlet and outlet ports; a plurality of symmetrically spaced radial slots extending inwardly from the periphery of the rotor; slide vanes in the rotor slots having a working fit between the end surfaces of the casing; spring means for urging the vanes outwardly of the rotor slots against the bore of the casing during rotor rotation; and means for alternately communicating fluid pressure existing in the outlet port and fluid pressure existing in the inlet port simultaneously to the inner ends of all the rotor slots, the last mentioned means including a small annular recess at one end of the rotor in communication with the bottoms of the vane slots, and a duct in one of the end walls of the casing extending from said recess to the narrow interval between the casing bore and the rotor substantially midway between the inlet and the outlet ports.

3. In a rotary pump, a casing having an inlet and an outlet port, parallel end walls, and a peripheral bore the surface of which is normal to said end walls; a rotor of smaller diameter than that of the casing bore having a small circular recess at one end thereof and a plurality of equally spaced slots in communication with said recess extending inwardly from its periphery and containing slide vanes, said rotor being offset so that it is relatively close to a portion of the bore lying between the inlet and outlet ports to establish, with the vanes, a sealing zone, and at a substantially greater distance from another portion of the bore to establish, with the vanes, a pumping zone also between the inlet and outlet ports; and a channel connecting the aforesaid recess in the rotor with the sealing zone at a point substantially midway between the inlet and outlet ports, whereby passage of the vanes during rotor rotation, causes the vanes in the rotor slots to be alternately subjected to the inlet and outlet pressures.

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