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MAIN AND AUXILIARY PUMPS FOR IMPURE LIQUID

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Fig. 2.

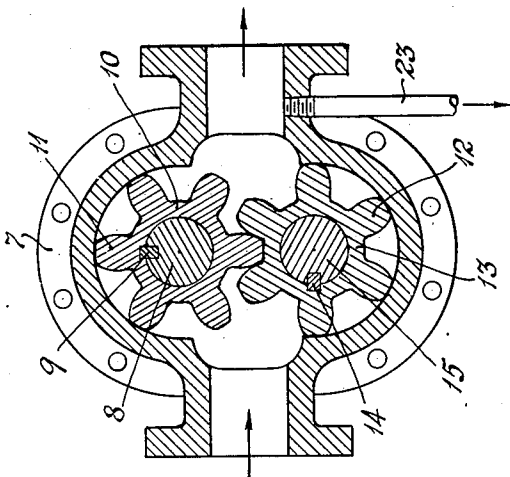
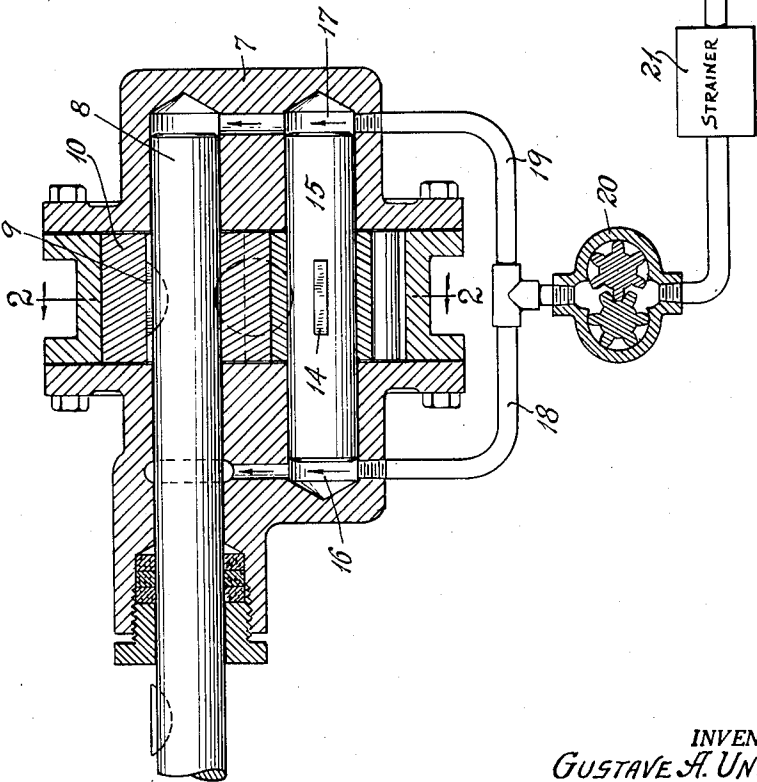


Fig. 1.



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Fig. 4.

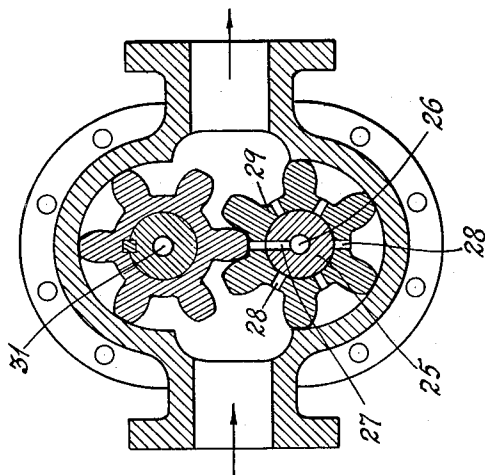
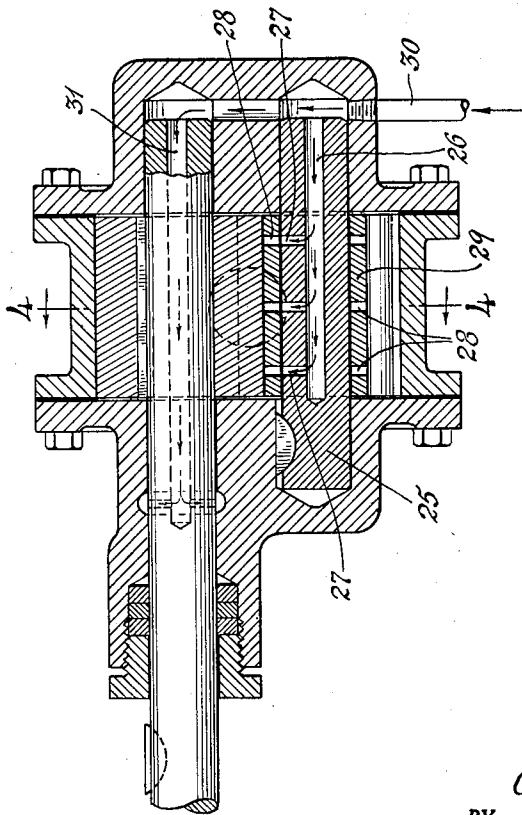


Fig. 3.



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Fig. 6.

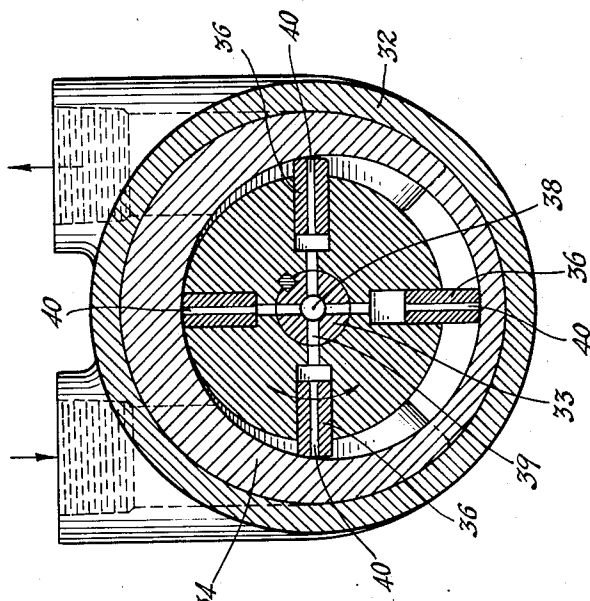
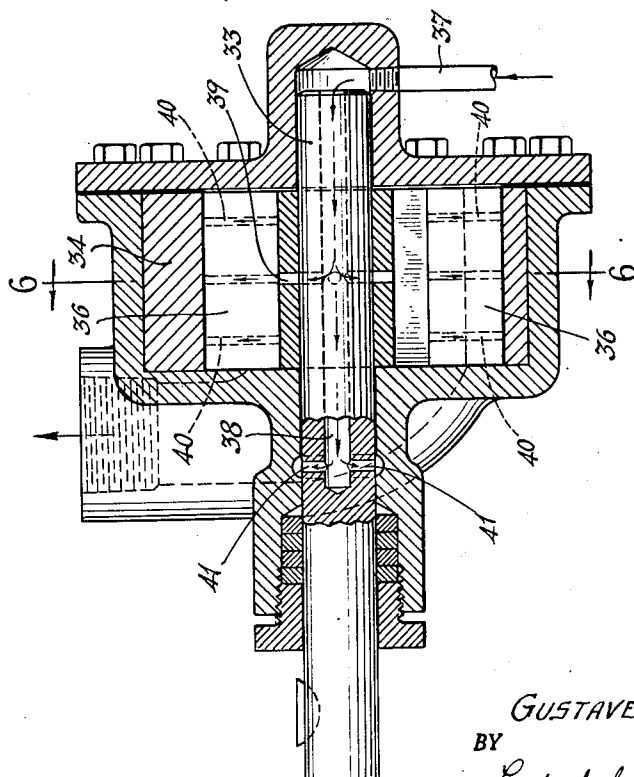


Fig. 5.



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MAIN AND AUXILIARY PUMPS FOR
IMPURE LIQUID

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1 Claim. (Cl. 103—126)

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The invention relates to a rotary pump and specifically to rotary pumps which are used for the pumping of impure liquids. By "impure liquids" I mean, for instance, Diesel oil which is drawn directly from storage tank and usually contains a good deal of foreign matter, for instance, sand or other abrasive material which passes through ordinary strainers.

Such foreign material, particularly sand or other abrasive material, seriously affects the volumetric performance of the pump. This, in turn, is caused by a reduction of the suction capacity caused by wear between the stationary and moving parts, such as the bearings, seals, side faces of the rotors and end covers, the rotor outside surfaces and housing, and between the mating rotors themselves. While the bearings may be protected from wear by impurities in the liquid being pumped, by separating such bearings with suitable shaft seals from the liquid, this expedient is not readily resorted to because of the mechanical complications involved such as the necessary increase in shaft length, resulting in additional size, weight, and excessive over-all cost of the pump.

My invention, in its broadest aspects, contemplates the provision of a rotary pump for impure liquids which, in its simplest form, provides for the protection of the bearings and roller side faces from the abrasive impurities by a system of scavenging the bearings, rotary side faces, and the mating areas of the rotors themselves. This scavenging system consists primarily in the supplying of clean liquid or oil to the main rotary pump, the clean liquid being led to the main pump by an auxiliary pressure pump in advance of which a strainer or purifier is positioned. The clean liquid thus pumped to the main rotary pump by the auxiliary pressure pump, at a pressure slightly higher than the discharge pressure of the main rotary pump, acts as a scavenging liquid.

In accordance with the various embodiments of my invention hereinafter described in conjunction with the illustrations in the accompanying drawings, showing the novel method of scavenging and the change in construction of rotary pump designed for the carrying out of such method, the amount of scavenging liquid required is comparatively small, depending upon the clearances, the degree of impurity content of the liquid being pumped, and the viscosity of such liquid. The slight additional power consumption which is required to pump the scavenging liquid through the auxiliary pump is amply compensated for by the increased efficiency of the main pump and the long life thereof which results from the greatly

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reduced wear of its component parts by the elimination of the impurities, such as sand or other abrasive materials, passing through the pump.

Specific embodiments of my invention are illustrated in the accompanying drawings, in which Fig. 1 is a vertical section through a rotary gear pump and auxiliary scavenging liquid pump, showing the application of my invention in its simplest form; Fig. 2 is a vertical section through the main pump along line 2—2 of Fig. 1; Fig. 3 shows, in vertical section, a slightly modified embodiment of my invention in which the scavenging liquid under pressure, in addition to being fed into the bearings and thence to the side faces of the rotors and endcovers, is also introduced through a preferably stationary shaft and registering passages in the shaft and in the gear hub to the lobe roots and thence into the gear meshing teeth themselves; Fig. 4 is a vertical section through this second embodiment of my invention along the line 4—4 of Fig. 3; and Figs. 5 and 6, the latter a section along the line 6—6 of Fig. 5, illustrate a third embodiment of my invention, showing the provision of pressure scavenging liquid to a radial vane type rotary pump.

It will be understood by those skilled in the art that the illustrations of the application of my novel system of scavenging of the second and third embodiments of my invention are not exclusive of the application of scavenging in the embodiment of Figs. 1 and 2, but that each illustrates the provision of additional pressure scavenging i. e. the supplying of scavenging liquid not only to the bearings and the rotor faces and covers, but, in the second embodiment also to the lobe roots and meshing gear teeth, and in the third embodiment also into the rotor slots of the vanes.

Referring more particularly to the drawings, in which similar reference characters identify similar parts in the several views, the reference character 7 designates generally the casing for the main rotary pump, within which is mounted the shaft 8 having secured thereto by key 9 the driving gear 10 having the teeth 11. Such teeth 11 are adapted to mesh with teeth 12 of a driven gear 13 mounted by means of a key 14 upon a shaft 15.

From the ends of the rotor bearings extend suitable passages 16 and 17 through which clean liquid is forced through the bearing clearances inwardly and then between the rotor end faces and the cover faces into the pump chambers for intermixing with the impure liquid, then being discharged with the impure liquid into the line.

The passages 16 and 17 receive their scavenging

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liquid from two conduits 18 and 19 connected to the pressure side of an auxiliary pressure pump 20 of conventional construction but of considerably smaller size than the main pump, and operated to deliver clean liquid at a pressure slightly higher than the discharge pressure of the main pump. This auxiliary pump 20 draws its liquid from a separate source of clean liquid, or from the main pump, preferably from its discharge side, passing it through a strainer or purifier 21. The intake conduit 22 of the auxiliary pump is connected to the discharge side of the main pump, as through the conduit 23.

In the thus illustrated and described simplest form of my rotary pump for impure liquids, the clean liquid under the higher pressure of the auxiliary pump washes or scavenges grit and abrasives away from between the rubbing surfaces and at the same time provides a clean bearing and sealing film for the main pump.

The amount of scavenging liquid required is comparatively small and it will depend upon the clearances, the degree of impurity content and the viscosity of the liquid being pumped. The slight additional power consumption to pump the scavenging liquid through the auxiliary pump 20 is amply compensated for by the increased efficiency of the main pump and by the greatly reduced wear thereof.

In the embodiment shown in Figs. 3 and 4, substantially the same general construction of main rotary pump is illustrated but in this embodiment, in addition to the scavenging liquid under pressure being fed into the bearings and thence to the side faces as in the embodiment of Figs. 1 and 2, the scavenging liquid is also introduced through the stationary shaft of the driven rotor and registering passages in the shaft and in the gear hub, to the lobe roots and thence into the gear meshing teeth.

This is accomplished by providing the stationary shaft 25 of the driven rotor with a central channel 26 having registering passages 27 in the shaft extending from said channel to meet with passages 28 in the gear hub 29.

The scavenging liquid under pressure is thus fed, as the gear hub 29 rotates, into the lobe roots and thence into the meshing gear teeth themselves.

The embodiment of my invention illustrated in Figs. 3 and 4 differs from the embodiment of Figs. 1 and 2 with respect to the scavenging of the bearings for the driving gear shaft, also in that a single conduit 30 is used for introducing the scavenging liquid, which conduit leads such liquid into the stationary shaft 25 and into the bearings of the rotating shaft of the driving gear through central channel 31 in such rotating shaft and thence, as shown by the arrows in Fig. 3, to the bearings of such rotating shaft.

In Figs. 5 and 6 is illustrated the provision of pressure scavenging applied to a radial vane type of rotary pump. In such embodiment, the pump comprises a main casing 32 through which extends the shaft 33. Eccentric with the center line of such shaft is the center line of a large cam 34, of conventional construction, the pump having four vanes 36.

The scavenging liquid is introduced through the conduit 37 into the rotor slots for the vanes. The liquid passes in the direction of the arrows

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shown in Fig. 5 through the central channel 38 of the shaft, through the radial slots 39 into the vanes and thence through the passages 40 in such vanes to the cam contact surfaces by means of the suitable holes 40 in the vanes to such contact surfaces of both the vanes and cams.

The channel 38 through the shaft 33, of course, extends a sufficient extent to provide the bearing scavenging slots 41 through which the scavenging liquid is fed into the bearings and the rotor and endcover faces.

The provision of pressure scavenging applied to the axial vane type of rotary pumps is similar to that for radial vane pumps and therefore requires no special illustration.

It will be understood that while I have described and illustrated specific embodiments of my invention as applied to rotary pumps, my novel method of scavenging impurities from bearing and other rotating contact surfaces in the operation of pumping impure liquids, is also applicable to centrifugal pumps and turbines, as well as to positive displacement hydraulic motors. Also, while I have described and illustrated specific embodiments of my invention, such embodiments are by way of illustration, rather than by way of limitation, as various changes therein may be made by those skilled in the art without departing from my invention.

I claim:

The combination with a main rotary pump for pumping impure liquids, said main pump having a rotating shaft with a gear secured on said shaft and a stationary shaft with a gear mounted for rotation on said stationary shaft, said gears having teeth and being mounted in meshing engagement, of an auxiliary pump for pumping clean liquid at a higher pressure than the main rotary pump, said stationary shaft having a central channel and radial passages, a conduit from said auxiliary pump to said central channel in said stationary shaft, radial passages in the gear leading from said radial passages in said stationary shaft to the roots of the teeth of the gear on said stationary shaft, whereby liquid from said auxiliary pump circulates as a continuous scavenging agent through said conduit, central channel and radial passages in said stationary shaft, radial passages in the gear, and thence into the meshing gear teeth of the main pump.

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