

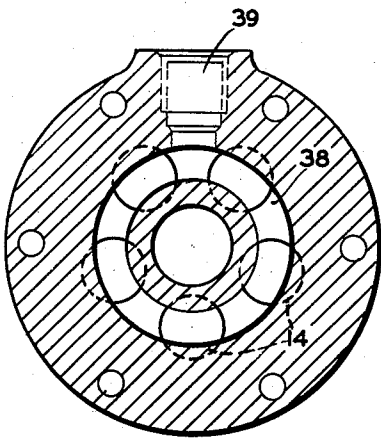
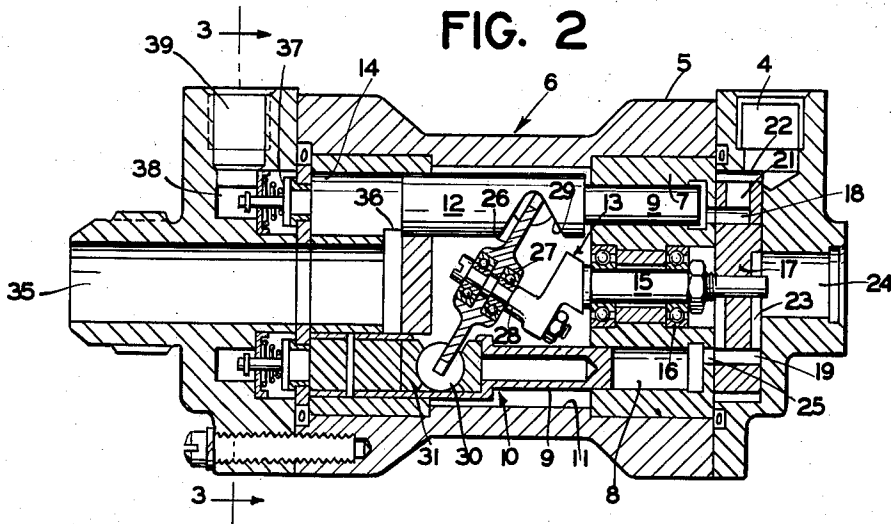
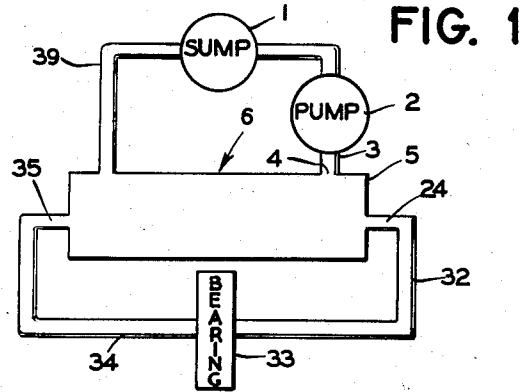
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SCAVENGE PUMP

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2,845,030

SCAVENGE PUMP

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This invention relates to new and useful improvements in scavenge pumps. It more particularly concerns a fluid scavenge pump of the piston type which is hydraulically operable by the fluid that it is designed to scavenge.

A general object of the invention is to provide a scavenge pump that functions, both to scavenge fluid from a circulatory system and to pump it back to its source.

A further object of the invention is to provide a scavenge pump of the above nature, wherein the fluid that drives the pump is also the fluid to be scavenged.

A still further object of the invention is to combine in a scavenging unit the functions of a motor and a scavenge pump, the motive energy of which is obtained from the fluid it is designed to scavenge.

The invention further lies in its particular construction, in the arrangement of its elements, and in their particular combinations and cooperative association with one another to effect the purpose intended.

The foregoing and other objects and advantages of this invention will appear more fully hereinafter from a consideration of the detailed description which follows, taken together with the accompanying drawings wherein an embodiment of the invention is illustrated. It is to be expressly understood, however, that the drawings are for purposes of illustration and description, and are not to be construed as defining the limits of the invention.

In the drawings:

Fig. 1 is a schematic view of a circulatory hydraulic system embodying the invention;

Fig. 2 is a longitudinal section through the pump; and

Fig. 3 is a cross section on line 3—3 of Fig. 2.

Referring to the drawings, there is disclosed an oil sump 1, which connects by a pressure lube pump 2 and a line 3 with an intake port 4 in the housing 5 of a combination motor and scavenge pump 6. In an end of the housing is fitted a block 7 having a plurality of cylinders 8, here five in number, arranged in a ring. In each cylinder reciprocates the driving end 9 of a double ended piston member, generally designated 10. Piston portion 9 reciprocates out of the inner end of the block into a chamber 11. The opposite end 12 of each piston member 10 is of a larger diameter and serves as a scavenge pump piston. The latter piston portions reciprocate in cylinders 14 at the opposite end of the housing.

A shaft end 15 of a crank member, generally designated 13, is axially supported for rotation in bearings 16 of cylinder block 7 and has an end projecting through the latter, on which end is carried a port plate 17. Opening out of the inner face of the latter is a pair of opposed semicircular or arcuate ports 18, 19. Port 18 communicates through a peripheral channel 21 with a surrounding annulus 22 that communicates with supply port 4. Port 19 communicates through plate 17 with a recess 23 in the opposite face of the plate, which recess is always in communication with a discharge port 24 leading out of the housing. As port plate 17 is rotated

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over the end face of piston block 7, the end port 25 of each cylinder is successively communicated, first with port 18 during the time that the latter progressively moves over the cylinder port, and is then similarly communicated with port 19. By this arrangement, as the cylinders 8 are communicated with port 18, the drive pistons 9 therein are progressively driven leftward as pressure fluid is progressively received in the cylinders through port 18. And as these cylinders are communicated with port 19, they are caused by the return action of the pistons 9 therein to progressively and successively discharge their contents into the discharge port 24.

Rotation of port plate 17 is effected through the actions of a nutating disc or plate 26. The latter is supported by suitable hub bearings 27 for rotation in chamber 11 on an eccentric angularly disposed crank pin end 28 of crank member 13. Each pump piston 12 opens through a notch 29 into chamber 11 and exposes a slotted ball 30 contained in a socket 31 of the pump piston. The marginal edge of the nutating plate extends into the slotted balls. The arrangement is such, that as the drive pistons 9 in cylinders 8 are communicated with the plate port 18 and driven successively and progressively leftward, the nutating plate is caused to rotate, its marginal edge passing through the slotted balls 30. The nutating plate rotates on the crank pin 28. As it rotates, it turns crank member 13 and, as a consequence, nutates as the latter turns. This action of the nutating plate causes the several piston units to successively reciprocate for the distance of a full piston stroke. Turning of crank member 13 causes rotation of the shaft end 15 thereof, whereupon port plate 17 is rotated in the manner previously described over the cylinder port holes 25 of piston block 7.

In the operation of the device, the fluid that has acted upon the driving pistons and is subsequently discharged through port 24, flows over line 32 and passes through the bearing 33 to lubricate the same. The lubricating fluid is then drawn over a scavenge line 34 into a passage 35 in the opposite end of the housing 5. Each of the several scavenge pump pistons 12 communicates by a separate passage 36 radially with the scavenge intake passage 35. Each pump piston acts, as it moves to the right, to uncover its passage 36 and to draw in through this passage scavenge fluid; and each pump piston acts, as it moves to the left on a compression stroke, to close over its passage 36 and to force the contents of its cylinder 14 through a check valve 37 into an annulus 38 that connects by a return conduit 39 to sump 1.

While an embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not limited thereto. Various changes can be made in the design and arrangement of the parts without departing from the spirit and scope of the invention, as the same will now be understood by those skilled in the art; and it is our intent, therefore, to claim the invention, not only as shown and described, but also in all such forms and modifications thereof as may be reasonably construed to be within the spirit of the invention and the scope of the appended claims.

What is claimed is:

1. A fluid motor-pump comprised of a plurality of pairs of interconnected axially aligned pistons, one piston of said pair being a driving piston and the other piston of said pair being a driven piston, block means having two rings of equally-spaced cylinders which reciprocally receive in alignment said pairs of driving and driven pistons to form a ring of driving cylinders and a ring of driven cylinders, a single axial intake passage with said ring of driven cylinders connected to the inner ends of the cylinders having the driven pistons therein, each of said pairs of pistons being interconnected by rigid struc-

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tures each of which includes a rotatively-mounted slotted ball, a circular nutating plate rotatively mounted on the inner end of an eccentric crank inwardly of said rigid structures and having the peripheral edge thereof reciprocally received in the slots in the balls of said structure, the outer end of said crank having an axially mounted shaft carrying rotary valve means for supplying and releasing fluid to and from the outer ends of said driving cylinders, said valve means being constructed to provide fluid from a peripheral annulus and to release fluid through a single axial flow path.

2. A fluid motor-pump comprised of a stationary piston cylinder block having two aligned rings of cylinders at each end of said block, one ring of said cylinders being motor cylinders and each having a single outer end port, the other ring of said cylinders being pumping cylinders having outer end outlets, a shaft rotatively mounted interiorly of said motor cylinders, pistons reciprocally mounted in each of said cylinders whereby aligned pairs of pistons result, each of said pairs of pistons being connected by rigid structures which include a rotatively mounted slotted ball, a circular nutating plate rotatively mounted radially inwardly of said rigid structures and having the peripheral edge thereof reciprocally received in the slots in said balls, crank means including a shaft rotatively supported axially of the piston block at the motor end thereof interiorly of said motor cylinders, said crank means having at the inner end thereof an eccentric pin journaled axially to said nutating plate, said shaft

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carrying at the outer end thereof a rotary annular valve plate, said valve plate having an arcuate inlet and diametrically positioned an arcuate outlet arranged to successively cooperate with said end ports of the motor cylinders so that fluid is admitted to drive pistons in the motor end and fluid is discharged upon the return of these pistons, a peripheral channel in said valve plate connecting said valve inlet to an annulus around said valve plate, a radial recess in said valve plate connecting said valve outlet to an axial discharge port, an axial intake passage interiorly of said pumping cylinders and extending to the inner ends of said pumping cylinders, said pumping cylinders having inlets at inner ends connected to said intake passage, an annulus at the outer ends of said pumping cylinders connected to said pumping cylinder outlets by check valves.

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