Dec. 16, 1941. A. J. GRANBERG 2,266,191

VARIABLE DISPLACEMENT PUMP

Filed June 5, 1939

Fig. 1.

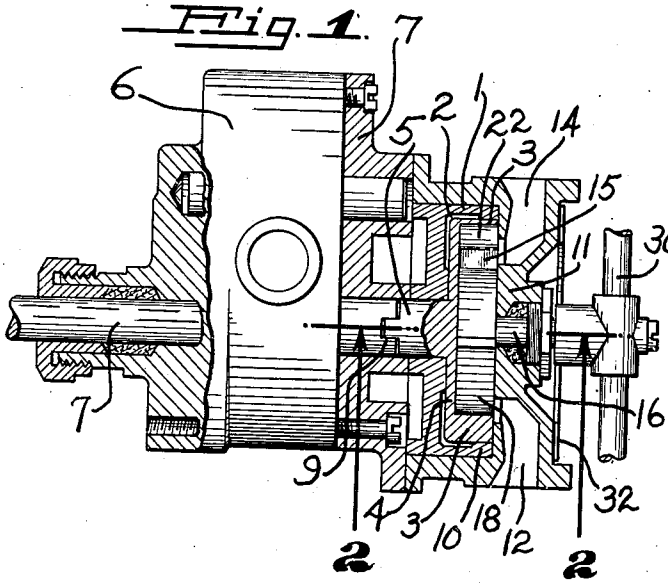


Fig. 2.

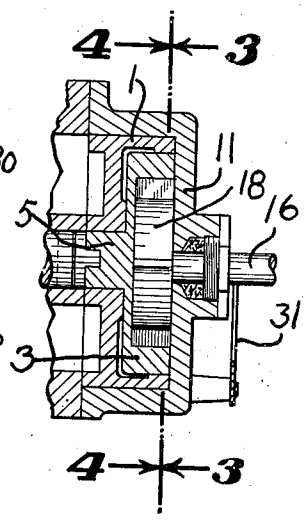


Fig. 3.

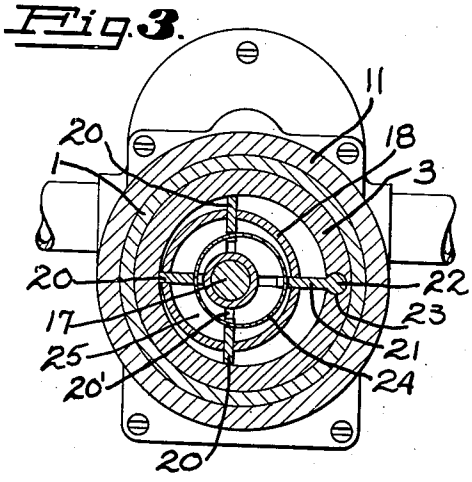


Fig. 4.

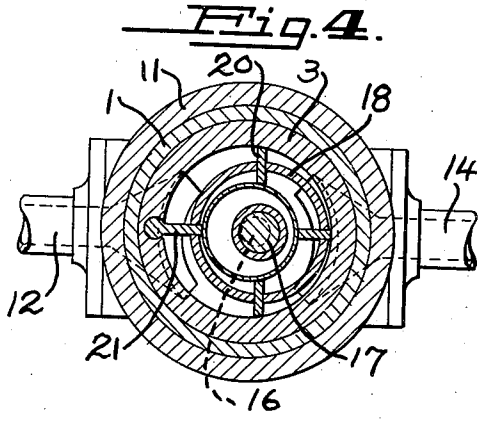


Fig. 5.

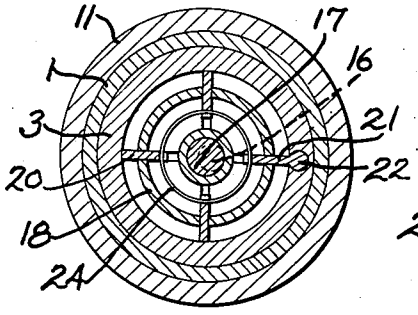
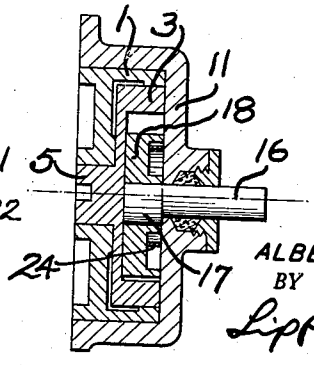


Fig. 6.



INVENTOR,
ALBERT J. GRANBERG.
BY
Lippincott & Metcalf
ATTORNEYS.

Patented Dec. 16, 1941

2,266,191

UNITED STATES PATENT OFFICE

2,266,191

VARIABLE DISPLACEMENT PUMP

Albert J. Granberg, Berkeley, Calif., assignor to Granberg Equipment, Inc., Emeryville, Calif., a corporation of California

Application June 5, 1939, Serial No. 277,394

5 Claims. (Cl. 103—120)

My invention relates to a variable displacement pump, and more particularly to a pump which can be adjusted even while running at a constant speed to give a variable output.

Among the objects of my invention are: To provide a variable displacement pump of simple construction; to provide a pump whose output capacity can be changed at will without change in speed of rotation; to provide a variable displacement pump having an output completely variable from zero to maximum while maintaining a uniform speed of rotation; to provide a variable displacement pump whose output can be changed while running; to provide a combination of pumps wherein a variable output is obtained; to provide a pump which is ideally adapted for the supply of fuel to oil burners or the like; and to provide a simple and efficient variable displacement pump.

Other objects of my invention will be apparent or will be specifically pointed out in the description forming a part of this specification, but I do not limit myself to the embodiment of the invention herein described, as various forms may be adopted within the scope of the claims.

Referring to the drawing:

Fig. 1 is a longitudinal sectional view of one form of variable displacement pump of my invention as attached to a main supply pump.

Fig. 2 is a sectional view, taken as indicated by the line 2—2 in Fig. 1.

Fig. 3 is a cross-sectional view, taken as indicated by the line 3—3 in Fig. 2.

Fig. 4 is a cross-sectional view, taken as indicated by the line 4—4 in Fig. 2.

Fig. 5 is a partial sectional view, similar to Fig. 4, showing the rotors in non-pumping position.

Fig. 6 is a partial longitudinal sectional view, showing the means for changing the output of the pump.

Referring directly to the drawing for a more detailed description of my invention, a casing 1 is provided with a cylindrical chamber 2 in which is mounted a cup-shaped rotor 3. The base plate 4 of this rotor is attached to a drive shaft 5.

In Fig. 1 I have shown the pump of my invention attached to a second pump 6, the end wall 7 of the second pump 6 being used as a mounting plate for the variable displacement pump. Pump 6 may be of any convenient type such as, for example, a gear pump driven by a shaft 7 and having a capacity at least equal to the maximum capacity of the attached variable displacement pump. The variable displacement pump is driven from main shaft 7 of the gear pump by means of coupling 9 interlocking main shaft 7 and variable displacement pump shaft 5. The use of the gear pump 6 will be explained later, and inasmuch as the exact mechanism of the gear pump is of no consequence to the present invention, no further reference to the detailed construction thereof will be made.

Returning, therefore, to the construction of the variable displacement pump, cup 3 is shaped to fit the inner surface of side walls 10 of the cup, and an oil seal is provided therebetween. End plate 11 of the variable displacement pump fits over casing 1 and may be used to hold the variable displacement pump against end wall 7 of the main pump. End plate 11 is provided with oppositely disposed inlet and outlet ports 12 and 14 opening into the pump chamber 15 in the cup 3.

Journaled on end plate 11 is a driven member shaft 16 extending toward pump chamber 15 to terminate therein as an eccentric 17. The axis of driven member shaft 16 is parallel to, but offset from, the axis of main shaft 5, but the eccentric 17, forming a prolongation of shaft 16 is so proportioned that when shaft 16 is turned to one position the eccentric end 17 will be coaxial with the shaft 5, and 180° therefrom is at maximum eccentricity with relation to shaft 5.

Mounted on eccentric 17, within chamber 15, is a driven cylinder 18 which extends from base plate 4 of the cup-shaped rotor 3 to end plate 11. The driven cylinder, however, is of lesser diameter than the diameter of pump chamber 15, so that pump chamber 15 is not completely filled. The diameter of driven cylinder 18, however, is such that when the driven member shaft 16 is turned to provide maximum eccentricity of eccentric 17 with relation to shaft 5, the periphery of driven cylinder 18 will closely approach the inner walls of cup 3, and when shaft 16 is turned so that the eccentric 17 is coaxial with shaft 5 the driven cylinder 18 will also be coaxial with shaft 5, with the width of the pump chamber the same all around the driven cylinder.

In order to provide a pumping action, driven cylinder 18 is provided with radially extending vanes 20 movable in slots 20' which are formed in the base plate 4 for the purpose. While I have shown four such vanes, it will be obvious to those skilled in the art that more or less may be used. One of the vanes, 21, known as the driving vane, differs from the remainder of the vanes in that it is provided with a semi-cylindrical end 22 which fits into a semi-cylindrical slot 23 cut

into the inner surface of the side walls of cup 3. Vanes 20 slide in slots 20' and are forced outwardly against the inner surface of the side walls of cup 3 by means of a single resilient ring 24 which presses outwardly against all of the vanes. Resilient ring 24 is positioned within a spring cavity 25 on the outer surface of driven cylinder 18. The driven cylinder 18 is therefore interlocked with cup 3 by means of the special vane 21, and thus when cup 3 is positively rotated, driven cylinder 18 will also be positively rotated.

In Figs. 3 and 4 I have shown the driven cylinder 18 positioned at maximum eccentricity from cup 3 by rotation of driven cylinder shaft 16 to provide maximum output. This position can be obtained by rotation of an outside handle 30 attached to shaft 16. Shaft 16 is provided with a pointer 31 operating over a scale 32 mounted on end plate 11 of the variable displacement pump. Under these conditions, as shaft 5 is rotated counter clockwise (Fig. 3), with maximum eccentricity of eccentric 17, it will be seen that the device acts as a pump, with maximum output, with inlet port 12 receiving fluid and the exhaust port 14 delivering fluid. When, however, shaft 16 is rotated 180° the condition shown in Fig. 5 is produced, where the driven cylinder 18 is concentric with cup 3, and no pumping will be accomplished.

All gradations of output may be obtained without changing the speed of rotation of shaft 5, from maximum to minimum displacement, by rotation of shaft 16 over 180°.

While the variable displacement pump of my invention may be utilized by itself, I have indicated one practical manner in which the pump may be utilized, and that is by attachment to a main flow pump giving a liquid flow of at least as large an amount as can be handled by the variable displacement pump. The customary manner of attaching the flow channels of one pump to the other will be immediately apparent to those skilled in the art. Mechanical connection has already been shown in Fig. 1.

Preferably, pump 6 is provided with a by-pass connection between inlet and outlet, so that excess liquid delivered by the outlet of pump 6 can be returned to the inlet. The outlet of pump 6 is then led to the inlet of the variable displacement pump. The variable displacement pump will then supply liquid in accordance with the relative position of cup and cylinder, this position being regulated by turning handle 30 and shaft 16. Such a dual pump is ideal for the supply of fuel to an oil burner, for example, where it is desired to regulate the strength of the flame.

Under these conditions, shaft 7 of pump 6 may be driven by a constant speed motor, and the amount of output from the combined pumps may be regulated at will and with ease, without shutdown.

I claim:

1. A variable displacement pump comprising a casing having end walls, a drive shaft entering said casing through one of said end walls, a cup shaped rotor having side walls and base fitting said casing and driven by said shaft, a second shaft entering the end of said casing which is opposite said drive shaft and having the axis thereof parallel and spaced from the axis of said first shaft, an eccentric mounted on said second shaft and extending into the chamber defined by said cup and one of said casing end walls, the axis of said eccentric being in one position coaxial with said first shaft, a cup-shaped driven member of smaller diameter than said rotor chamber mounted to rotate on said eccentric with the base of said driven member in contact with the base of said rotor, vanes radially mounted in said driven member and movable to bear on the inner surface of the side walls of said cup, one of said vanes interlocking with said side walls, resilient means within the hollow of said driven member forcing said vanes outwardly against said side walls, and inlet and outlet ports oppositely opening into the space between said side walls and said driven member.

2. A variable displacement pump comprising a casing having end walls, a drive shaft entering said casing through one of said end walls, a cup shaped rotor having side walls and base fitting said casing and driven by said shaft, a second shaft entering the end of said casing which is opposite said drive shaft and having the axis thereof parallel and spaced from the axis of said first shaft, an eccentric mounted on said second shaft and extending into the chamber defined by said cup and one of said casing end walls, the axis of said eccentric being in one position coaxial with said first shaft, a cup-shaped driven member of smaller diameter than said rotor chamber mounted to rotate on said eccentric with the base of said driven member in contact with the base of said rotor, vanes radially mounted in said driven member and movable to bear on the inner surface of the side walls of said cup, one of said vanes interlocking with said side walls, resilient means within the hollow of said driven member forcing said vanes outwardly against said side walls, inlet and outlet ports oppositely opening into the space between said side walls and said driven member, and means for rotating the second shaft over an arc to change the relative axial positions of said rotor and said driven member.

3. Apparatus in accordance with claim 2, wherein said resilient means is a resilient ring bearing on all of said vanes to force them outwardly, the outer edges of said ring, the side wall edges of said rotor, and the side wall edges of said driven member, bearing against said casing adjacent said second shaft entrance therethrough.

4. Apparatus in accordance with claim 1 wherein means are provided for rotating said second shaft over an arc of 180° to change the relative position of said rotor and said driven member from coaxial position of said eccentric to maximum eccentricity.

5. Apparatus in accordance with claim 2, wherein said casing is cup-shaped and wherein the cup-shaped rotor and cup-shaped driven member are inserted in said casing with the open ends of said rotor and said driven member bearing against the inner basal surface of the cup-shaped casing.

ALBERT J. GRANBERG.